

## ABSTRACT

Title of Dissertation: **GEODESIGN AND THE EXPRESSION OF ENVIRONMENTAL VALUES: A MIXED METHODS EVALUTION**

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Doctor of Philosophy, 2020

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There is a stark contrast between professed environmental values and actual action taken to express those values. This ‘value-action gap’ limits the extent to which individuals enact both simple and collective actions to address critical and declining environmental trends ranging from global climate change to species loss and habitat degradation. While conceptual models positing individual and institutional approaches to overcome the value-action gap do exist, they minimize the complexity of socio-environmental challenges, on the one hand, or the importance of individual action, on the other. This dissertation evaluates an alternative approach to overcoming the value-action gap using a participatory form of environmental design and planning known as geodesign. Despite its apparent benefits, the geodesign approach remains under-theorized and largely unevaluated from the geographic perspective. Using a taxonomic review of geodesign practice and two case studies, this dissertation critically evaluates geodesign practice, identifies opportunities to improve its participatory characteristics, and positions the geodesign framework for use in participatory action research. The results show that the geographic concept of place and theory of place making can improve geodesign practice, account for its current limitations, and explain its hypothesized role in overcoming the value-action gap.

GEODESIGN AND THE EXPRESSION OF ENVIRONMENTAL VALUES:  
A MIXED METHODS EVALUATION

by

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Dissertation submitted to the Faculty of the Graduate School of the  
University of Maryland, College Park, in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy  
2020

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## Acknowledgements

Thank you to my committee, and, especially, to my advisor, Dr. Martha Geores, for your ongoing support throughout my PhD studies. I could not have completed this process without your willingness to see me through to the end despite the unexpected circumstances, unforeseen challenges and, thankfully, new opportunities at each step of the way.

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# Chapter 1: Evaluating Geodesign in Theory and Practice

## 1.1 Introduction

The "value-action gap" – the void between knowledge and actual measures taken in response to such knowledge – is a pervasive characteristic of contemporary environmental trends (Blake, 1999). Despite the demonstrated effectiveness of pro-environmental behaviors to confront issues from global climate change and biodiversity loss to individual choices regarding recycling, energy use, and consumption patterns, there is a stark contrast between professed environmental values and action taken to express those values (Dietz et al., 2009; Schultz, 2011). While environmental values and behaviors are the subjects of extensive research in multiple disciplines (Dietz et al., 2005), the pervasiveness of the value-action gap and the declining trajectory of many environmental trends highlight the need for further evaluation from alternative perspectives.

Blake's (1999) research on the value-action gap compared two approaches to understand and overcome the value-action gap in environmental issues: the 'information deficit model' and the 'institutional learning' approach (p. 261). The former suggests the gap can be overcome through information provision leading to corresponding action while the latter posits the need for structural change facilitated by institutional adaptation. Blake considered the 'information deficit model' to be aligned with rational choice and the theory of planned behavior (Stern et al., 1995; Stern et al., 1999) and the 'institutional

learning' approach to be aligned with the "dialectical understanding of the relations between individuals and social institutions" (Blake, 1999, p. 265). Yet he concluded that neither approach was sufficient to overcome the value-action gap. Neither approach addresses both the individual and structural barriers while also balancing the competing binaries necessary for participatory environmental action: "local vs. extra-local", "public/lay vs. expert", "community vs. individual", and "participation vs. representation" (p. 271-272). Instead, his analysis positioned the geographic concepts of scale, place and representation at the forefront of understanding and addressing the value-action gap. His observations, however, stopped short of articulating how a geographic approach could inform pragmatic solutions to overcome the value-action gap.

Amidst unprecedented global environmental change, this dissertation is motivated by the need for empirically, theoretically, and ethically robust approaches not only to understand but to overcome the value-action gap. This dissertation posits that the geographic theory of place and place-making combined with a novel participatory approach to environmental design and planning, known as geodesign, provides a place-based approach to understanding and overcoming the value-action gap. The hypothesized link between geodesign and the value-action gap, as well as the empirical and theoretical methods to evaluate that link, are introduced in this chapter and utilized throughout this dissertation to explain how geodesign facilitates the expression of environmental values to overcome the value-action gap.



## 1.2 Geodesign and the Value-Action Gap

While Blake's (1999) research on the value-action gap is among the few efforts to evaluate the value-action gap from a geographic perspective, the subject has received extensive attention in the fields of sociology, environmental and social psychology, and political science (Kollmuss & Agyeman, 2002; Dietz et al., 2005). In addition to the two models reviewed by Blake (1999), other value-action gap models have been proposed and evaluated in multiple disciplines. The "deliberative and inclusionary processes and procedures ('DIPS')" model suggests that public participation in environmental policy can overcome the value-action (Agyeman & Angus, 2003, p 345). The prosocial or similar 'environmentally significant behavior' models (e.g. Stern, 2000) suggest that the presence or absence of altruistic and relational values explains the value-action gap. Behavioral economic models, in contrast, explain why simple cost-benefit models alone cannot explain the value-action gap (Frederiks et al., 2015). And models based on "community-based social marketing" attempt to encourage behavior change through marketing and public information campaigns (McKenzie-Mohr, 2002). While these models have explanatory strength under certain circumstances, their focus on individual or consumer behavior minimizes their relevance for explaining and addressing environmental issues beyond the individual scale.

Many environmental values are not oriented exclusively towards individual action, but rather focus on collective outcomes associated with the characteristics of social ecological systems. Yet, with the exception of Blake (1999) and Agyeman & Angus (2003), the models described above do not assess the value-action gap beyond the individual scale. Instead, such models use proxy indicators and causal pathways to equate

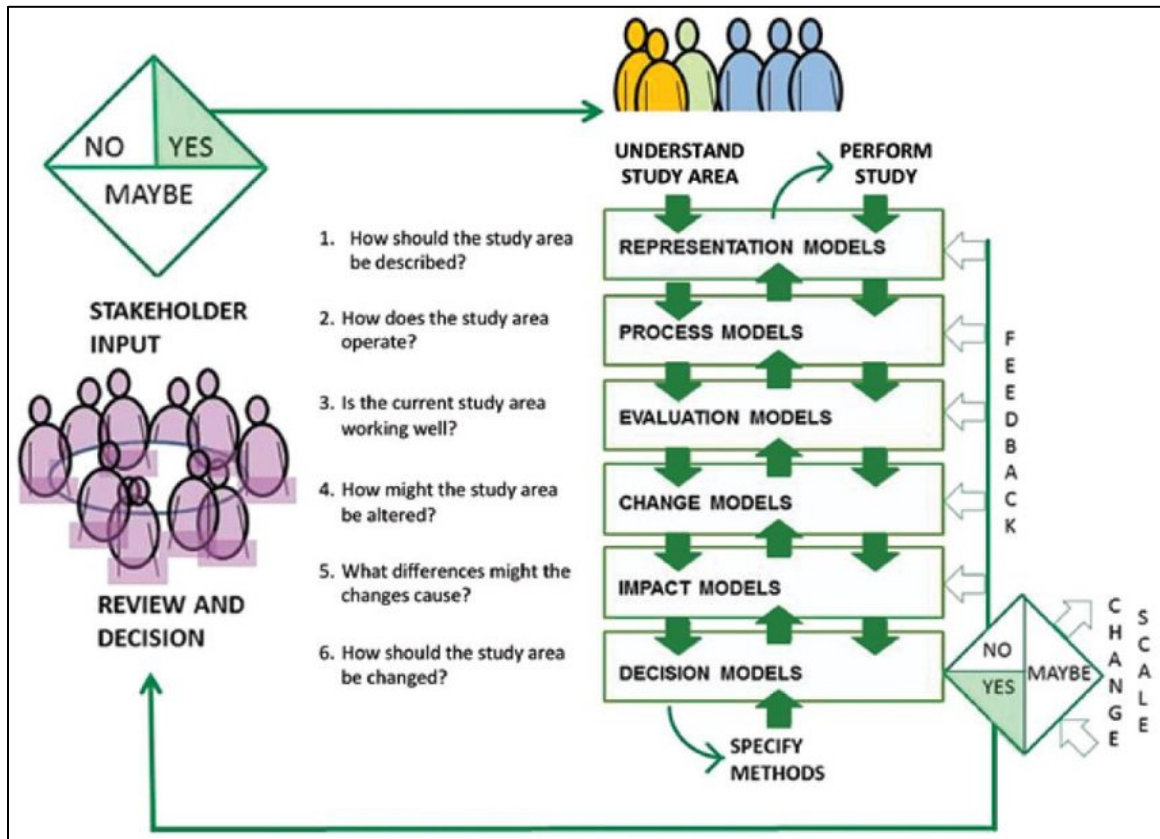
individual value orientations with intended or observed actions. They attempt to explain the value-action gap without explicitly addressing the relation between individual action and values oriented towards broader environment outcomes (c.f. Kollmuss & Agyeman, 2002). Assessing the value-action gap at the individual scale limits the utility of such research and prevents its use to facilitate collective action necessary to overcome environmental challenges beyond the individual scale. For this reason, this dissertation follows Blake (1999) and Agyeman & Angus (2003) in their efforts to explain the value-action gap applicable to issues beyond the individual scale.

While Agyeman & Angus (2003) emphasize the political and institutional factors associated with the value-action gap, their methods are unable to incorporate the diversity of place-based characteristics associated with complex socio-environmental problems. In contrast, Blake (1999) suggests that a place-based approach is fundamental to overcoming the value-action gap given its ability to frame not just political and institutional factors, but any characteristic of place associated with the values or actions in question. The explanatory strength of this approach is clear in the way it accounts for the multiplicity of factors omitted from other value-action gap models. Kollmuss & Agyeman (2002) reference, among other elements, the importance of demographic, institutional, economic, social, cultural, personal, informational, normative/value-based, attitudinal, emotional, and responsibility/agency-based factors for overcoming the value-action gap. While each of the above-referenced models account for some of these factors, they show limited ability to account for more than a selection of relevant factors at one time.

In contrast, the geographic concept of place and theory of place-making not only account for all factors associated with the value-action gap but provide a framework to understand their relationships and how they can be used for pragmatic place-making purposes (Sack, 2010). Pragmatic approaches to place-based environmental design and planning which account for the geographic concept of place and theories of place-making therefore offer an alternative means to overcome the value-action gap. Given this possibility, this dissertation evaluates whether one such approach to environmental design and planning, known as the “geodesign approach” (Steinitz, 2012, p. 184), shows potential as a pragmatic means to overcome the value-action gap through the application of geographic concepts of place and theory of place-making.

Geodesign is “a collaborative process, based on a set of questions and methods” that allows participants to “change geography by design” (Steinitz, 2012, p. 5). Originally proposed as “a framework for theory” (Steinitz, 1990), geodesign facilitates the identification and utilization of any theory, method or form of place-based knowledge necessary to address pragmatic environmental design challenges. In practice, the geodesign framework serves as a guide for participatory planning processes whereby participants utilize geospatial data, methods, and models combined with the creativity of the design professions to establish a plan to effect change in human-environment landscapes. Figure 1 illustrates the Steinitz (2012) geodesign framework, with emphasis on the iterative process through which participants answer a series of questions to “understand the study area,” “specify methods” to carry out the study, and then “perform the study” to achieve stakeholder objectives and overcome the design challenge (p. 25).

Figure 1.1: The Steinitz Geodesign Framework



(Steinitz, 2012, p. 25)

Each chapter of this dissertation will expand on this brief introduction to the geodesign framework and practice. Yet this summary provides the conceptual foundation for the overall argument advanced in this dissertation: geodesign provides a means to utilize the geographic concept of place and theory of place-making and therefore represents a geographic approach to overcome the value-action gap. This possibility, however, has not been evaluated in geographic or geodesign literature. While geodesign practice has been evaluated within landscape architecture and design literature (Foster, 2016; Tulloch, 2017; Hollstein, 2019), its conceptual structure and applied characteristics have received little attention from other perspectives. Even within the design professions, recent scholarship generally avoids substantive theoretical and conceptual evaluation of

the geodesign framework and practice (see Chapter 2). This dissertation therefore uses the geographic concept of place and theory of place-making to evaluate the geodesign framework and practice.

### 1.3 Literature Review: Human-Environment Geography and the Value-Action Gap

Three broad traditions of human-environment geography inform the theoretical and methodological approach taken to evaluate the geodesign framework and practice in this dissertation. Research on public participation geographic information systems (PPGIS) informs the dissertation's thematic and methodological evaluation of the participatory potential of geodesign practice. Literature and practice from the participatory action research (PAR) tradition suggests how geodesign practice could benefit from increased incorporation of the critical action and applied learning objectives of PAR. Most fundamentally, geographic literature on place and place-making provides the theoretical and methodological means to evaluate the relation between geodesign and the value-action gap. The following sections review these three bodies of literature to explain their importance for evaluating the relation between geodesign and the value-action gap.

#### *1.3.1 Geodesign and PPGIS*

The participatory intent of geodesign and its use of geographic information systems (GIS) shares similarities with the broad practice of public participation geographic information systems (PPGIS). Both geodesign and PPGIS seek to integrate GIS methods, models and data with the social, cultural, and subjective forms of knowledge produced through public participation. Both approaches attempt to reconcile

the appropriate use of increasingly sophisticated GIS within broader geographic theory and methods. Given the relative novelty of geodesign practice and the lack of rigorous evaluation of geodesign practice in geographic literature, PPGIS literature provides broad contours of critical research themes applicable to the nascent field of geodesign. The following review of PPGIS literature therefore shows how definitional questions regarding the nature of PPGIS, the social history of PPGIS practice, the forms of participation used in PPGIS, and the methods used for evaluating PPGIS practice provide conceptual and methodological tools to inform the evaluation of the geodesign approach in this dissertation.

In broad terms, PPGIS refers to “the use of GIS tools and techniques to solve a variety of community-oriented problems” (Ramasubramanian 2010; p. 26). Yet this characterization of PPGIS encompasses a diversity of practices and theoretical foundations and does little to increase the precision of PPGIS research. According to Brown (2012), the definition of PPGIS is “nebulous,” though that has not prevented many attempts to define and characterize PPGIS practice. Ramasubramanian (2010), for example, states that PPGIS activities should educate participants, enable them to engage in planning processes and decisions, incorporate their views in data and research production, and explain why their input matters (p. 33). Such definitional statements show the ontological importance of PPGIS methods and objectives: PPGIS seeks to ensure that the participatory use of GIS technology is coupled with the co-production of knowledge. Mukherjee (2015) further emphasizes these dual characteristics, describing PPGIS as “a vast area of research that focuses on providing marginalized populations equitable access to geographic information technologies and including their spatial

knowledge in decision making” (p. 384). While these definitions address the motivation behind PPGIS research, the ongoing debates regarding the definitional boundaries of PPGIS suggest the challenge of applying those motivations through consistent theory and practice. A similar discourse is apparent in geodesign literature and demonstrates the importance of ontological clarity necessary to evaluate the anticipated outcomes of geodesign practice (Goodchild, 2010; Wilson, 2015).

While the format of participatory and technological characteristics of PPGIS are highly varied, PPGIS literature consistently emphasizes the pedagogical opportunities associated with the creation of geospatial information. The objectives of PPGIS practice extend beyond the direct result of data production or participatory input in decision-making processes; PPGIS inclines towards substantive objectives of empowerment, social justice and representation. Indeed, Ramasubramanian (2010) states that the primary goal of PPGIS is to “enable the development of critical consciousness among participants” (p. 44) which results from the production and use of geographic knowledge. For this reason, PPGIS literature emphasizes the dual importance of process and objective; the process must be participatory, and the objective must encompass the pursuit of critical learning and action. In contrast, geodesign literature and practice currently lack such attention to its participatory characteristics or substantive outcomes regarding critical learning and action.

The social history of PPGIS literature and practice provides a further point of comparison with geodesign and explains the lack of attention to the objectives of critical learning and action in current geodesign practice. Sieber’s (2006) review of PPGIS literature and practice explains that PPGIS was first conceived in the early 1990’s during

several meetings convened by the National Center for Geographic Information and Analysis (NCGIA) to “empower less privileged groups in society” (NCGIA, 1996; in Sieber, 2006; p. 492). Early in its conceptual development, PPGIS focused on the participatory production of spatial data for policy-making and planning purposes. Obermeyer (1998) argues that PPGIS originated in the planning professions as practitioners began confronting concerns that the increasing quantitative orientation of GIS research could lead to inadvertent detriments to the planning practice. As will be shown in Chapter 2, the development of the geodesign framework and practice stems from similar social and disciplinary contexts. Both are reactions against the ascendancy of centralized, empirical, and positivist forms of knowledge and action, yet both attempt to harness the growing capacity of geospatial data and technology for applied purposes.

In the second decade after the origination of PPGIS research, critiques and contributions from geography and other disciplines led to a broadening of PPGIS practice and a sustained dialogue regarding the theoretical foundations of such practices. PPGIS literature and practice benefited from conceptual and methodological refinement through engagement with geographic theories and concepts of scale (Aitken, 2002; Ghose, 2007), power and empowerment (Elwood, 2002), participatory spaces (Lin, 2013), place (Zook & Graham, 2007; Brown & Weber, 2012), and public participation (Schlossberg & Shurford, 2005). At the same time, technological changes in GIS, resulting from the advent of crowdsourced data, web-2.0, volunteered geographic information, and participatory modeling, among other techniques, led to further conceptual development and refinement of PPGIS practice (Brown & Kyttä, 2014; Voinov & Kolagani, 2016). As such, Sieber (2006) characterizes PPGIS as a “coproduced concept composed of multiple



disciplinary approaches and actors, rapidly changing technologies, and numerous as well as occasionally transgressive goals” (p. 492). While subject to similar technological and social dynamics, geodesign literature and practice have not yet benefited from sustained engagement with the theoretical or conceptual critique from the perspective of human-environment geography.

Despite the theoretical and methodological advances gained through engagement with geographic concepts and methods, PPGIS literature generally lacks critical evaluation of the applied outcomes of participatory planning. Sieber’s (2006) review found that PPGIS literature largely avoids evaluating PPGIS outcomes and concludes that “few PPGIS researchers explore measures of PPGIS effectiveness. ... PPGIS research has yet to establish either a set of best practices or a technique to demonstrate whether or not PPGIS is a suitable approach for a given problem” (p. 503). In response, more recent literature has attempted such evaluation but has shown limited success. One approach modifies the methods used to evaluate spatial accuracy of remotely sensed data (Brown, 2012b; Brown and Kytä, 2014; Brown & Fagerholm, 2015) while others seek to evaluate the extent to which PPGIS can account for concepts of place (Brown & Weber, 2012; Huck et al., 2014). However, such research has not evaluated the overall outcomes of PPGIS practice. Indeed, multiple reviews of PPGIS literature arrive at the same conclusion (Ramasubramanian, 2010), leading one reviewer to state that after nearly twenty-five years “questions regarding effectiveness and sustainability of such participatory GIS initiatives remain unanswered” (Mukherjee, 2015, p. 385). As will be shown in Chapter 2, a similar research gap is evident in geodesign literature and practice.

The similarities between PPGIS and geodesign therefore suggest the need for critical evaluation of geodesign research and practice from the geographic perspective.

### *1.3.2 Geodesign and Participatory Action Research*

The integrative and multi-disciplinary nature of the geodesign framework poses multiple challenges for substantive evaluation of geodesign practice. Evaluation of substantive themes associated with participatory planning and design processes commonly attempts to isolate individual factors and identify discrete causal pathways associated with research hypotheses. This results in the proliferation of conceptual models with narrow applicability, as highlighted by the review of existing research on the value-action gap above. Rather than attempt to identify individual factors and causal pathways evident in geodesign practice, this dissertation draws on the geographic concept of place and theories of place-making to address the research questions holistically. While this theoretical focus can be addressed through a variety of methods, participatory action research (PAR) methods are particularly amendable to geodesign research.

Participatory action research encompasses a wide variety of methods and disciplinary perspectives and can account for the integrative, participatory and applied nature of geodesign practice. A brief review of the origin and current use of PAR methods shows their relevance to geodesign research. From community appraisal techniques in international community development (Chambers, 1994) to participatory research for the co-construction of knowledge (Hall, 2005), participatory techniques and research approaches are common in the social sciences. Within human geography alone, Pain's (2004) literature review finds at least five primary categories of participatory

research: participatory rural appraisal, participatory urban appraisal, participatory mapping, participatory action research, and participatory appraisal. Among the earliest forms of participatory research of relevance to geodesign is participatory rural appraisal (PRA). Chambers (1994) describes PRA as a “family of approaches and methods to enable local people to share, enhance and analyze their knowledge of life and conditions, to plan and to act” (p. 953). Given the critical learning and action objectives of PRA and its legacy of use in agricultural and natural resource management projects, this approach has been utilized in human-environment geography on themes ranging from evaluations of participatory methods for the design of rural development programs (Binns et al., 1997) to examining the gendered content of environmental education programs (Quigley et al., 2017) and encouraging participatory imagination to evaluate perceptions of land-use change (Johansson & Isgren, 2017). Such research, as well as its urban counterpart, “participatory urban appraisal” (Mitlin & Thompson, 1995; Moser & McIlwaine, 1999), demonstrate principles and practices which aid participatory learning and action objectives.

One such method is participatory mapping; it has become an established technique in multiple forms of participatory research and suggests the relevance of such techniques for geodesign practice (Chambers, 1994; Chambers, 2006). Participatory rural appraisal first incorporated the technique to use hand-drawn mapping to denote natural resources and community assets. Chambers (2006) states the broad scope and applicability of this mapping technique are now “innumerable” (p. 4), though perhaps most predominant in research associated with natural resource management. The breadth and diversity of approaches to participatory mapping have received significant attention in human-

environment geography research. The PPGIS tradition is itself a primary example of this attention, as it represents the “spontaneous merger” between the participatory research practices and GIS (Rambaldi et al., 2006, p. 2). As such, current PPGIS research seeks to identify new uses for increasingly sophisticated forms of participatory mapping and digital cartography (Caquard, 2014). Yet GIS-based methods are not the only mode of participatory mapping. Participatory research practices first used mapping activities involving sketching or “ephemeral maps” (e.g. “drawing maps on the ground” with any available material) (Rambaldi et al., 2006, p. 5), and extensive use of sketch mapping in participatory rural appraisal (Chambers, 2006) demonstrates the relevance of low-tech participatory mapping techniques.

Geographic scholarship has demonstrated the value of participatory mapping for research on themes ranging from critical evaluation of the scale of forced evictions (Allen et al., 2015) to participatory approaches to disaster risk assessment and management (Cadag & Gallard, 2012), among other applied purposes. Geographers have also fundamentally critiqued participatory mapping and associated techniques for reasons ranging from the validity of volunteered geographic information (Flanagin & Metzger, 2008), the nature of participation in digital mapping techniques (Tulloch, 2008), and the broader concerns of critical-GIS research (Elwood, 2006a). Research and practice involving participatory mapping techniques therefore provides a point of comparison for the nascent field of geodesign research and practice.

Participatory action research, however, consists of more than the use of individual participatory techniques. Pain’s (2004) review of participatory research distinguishes between research involving discrete participatory techniques in contrast to an overall

approach to the research process which involves participatory development of research objectives, methodologies and practices for applied action. This distinction is essential to understanding the applied potential of geodesign practice. Participatory Action Research has been characterized as a dynamic approach to research “in which researchers and participants decide on the research questions and methods, collect and analyze the data, and implement the research results in the community or group being studied” (Drahota et al, 2016, p. 166; c.f. Lewin, 1946). The broader approach to participatory action research has been used by geographers for research on a range of themes, including GIS and geography education (Elwood, 2009; Pain et al., 2013), gender relations and infectious disease transmission (Kesby, 2000), immigration (Cahill, 2010), and community economic identity (Cameron & Gibson, 2005), among others. Though most often employed in human geography, PAR has also been used for human-environment and physical geography themes, including watershed management to promote public health outcomes (Parkes & Panelli, 2001) and agricultural runoff (Whitman et al., 2015).

The similarities between geodesign and PAR literature and practice provide opportunities to develop geodesign practice in ways which promote its potential for applied learning and participatory action. The geodesign process exhibits PAR’s iterative process of action and reflection and represents an area of convergence between participatory research, action research, and participatory mapping techniques. In particular, geodesign shares PAR’s emphasis on participatory identification of problems, participatory establishment of research methods and approaches to applying research outcomes, and the use of place-based knowledge of relevance to research participants. These similarities provide sufficient reason to consider the use of geodesign through a

PAR approach, as proposed in Chapter 4. Despite these opportunities, however, current geodesign practice often reverts to the use of discrete participatory techniques, if any, as opposed to a broader approach to participatory research and action (Chapter 2).

### *1.3.3 Geodesign and Place*

The geographic concept of place and theories of place-making provide the foundation for the theoretical framework and methodological innovations used in this dissertation. As a concept, place is fundamental to the discipline of geography and represents one of geography's unique contributions to the social sciences; it is arguably the most important geographic concept (Cresswell, 2015), though also one of the most debated. While many scholars have addressed the concept in extensive manuscripts (Relph, 1976; Tuan, 1977; Buttimer & Seamon, 1980; Agnew, 1987; Low & Altman, 1992; Sack, 1992), place is not an unfamiliar term, but rather one with multiple meanings. Agnew's (1987) characterization of the term identifies three primary aspects of place: location (the "impact of the 'macro-order' in a place"), locale (the "structured 'micro-sociological' content of place"), and sense of place ("the subjective orientation that can be engendered by living in a place") (p. 5-6). These three aspects broadly account for the diversity of meanings associated with the term, though they represent one among many ways human geographers have conceptualized the diverse characteristics of place.

The geodesign framework shows similarities to the use of the geographic concept of place to frame place-based knowledge and facilitate applied action (Pierce et al., 2011). Williams & Patterson (1996), for example, demonstrate how place can frame

knowledge and improve applied research on ecosystem management. The authors show how the concept of place is "a framework for integrating environmental meanings into ecosystem management" (p. 509) which allows planners to account for the environmental values of relevance for applied ecosystem management and avoid potential conflicts due to fundamentally distinct place frames. Their use of place as a frame of inquiry provides the means to translate the social and cultural elements of place into forms of knowledge of relevance for ecosystem management. While their approach results in the "thinning" of deeper subjective understandings of place, it also improves the ecosystem management process by integrating values, interests and perspectives not otherwise incorporated in systematic or quantitative approaches to applied management (Williams & Patterson, 1996, p. 515). This example shows how the geographic concept of place can be applied to structure and interpret multiple forms of place-based knowledge and evaluate such knowledge for applied use. The utilization of place to frame place-based knowledge and thereby facilitate pragmatic action will be shown to be a central function of the geodesign framework throughout this dissertation.

The conceptualization of place as both an epistemic practice and framework for ontological evaluation (Cresswell, 2015, p. 23) suggests that the place-making process is a highly significant act. The concept of place does not just facilitate critical inquiry; its application in the place-making process facilitates critical action. Geographic scholarship therefore shows that the framing of place serves both empirical and applied purposes (e.g. Agnew, 1987; Sack 1992; Entrikin, 2002; Sack, 2010; Pierce et al., 2011). This dissertation follows Sack's (2010) framing of place and place-making shows how such a

framing can be used for both pragmatic action and conceptual research in relation to the geodesign framework and practice.

Sack's (2010) theory of place-making begins by identifying a more fundamental 'gap' than that described by Blake's reference to the 'value-action gap.' Sack argues that there is a gap between human reflection and natural causality, and accounting for this gap through a theory of place-making can address any aspect of social-ecological systems, from simple individual actions to global environmental challenges. Sacks' theory of place-making therefore accounts for any environmental challenge that could be addressed through the geodesign process. More importantly, it addresses the broad range of theoretical binaries accounted for in geographic scholarship which geodesign literature and practice have yet to explicitly acknowledge (e.g. human-environment, nature-society, place-space, male-female, agency-structure) (c.f. Cloke and Johnstone, 2005). In contrast, Sack shows that the gap between reflection and causality is "the most persistent and central problem of human nature" (p. 84) and that place-making is the foremost tool to address that gap. In this view, place-making is framed as "the activities involved in making, maintaining, using, and altering place of any scale" (p. 145), where place is defined as "an area of space that humans delineate, bound, and attempt to affect, influence, and control to a degree." (p. 146).

Sack's (2010) conceptualization of place and theory of place-making show how simple individual action can lead to environmentally significant impact beyond the individual scale. As will be shown throughout this dissertation, the geodesign framework also promises a means to increase the scale of individual action to address environmental challenges beyond any individual's understanding or control. Yet without the theoretical



foundation provided by the geographic concept of place and Sack's (2010) theory of place-making, this dissertation will show that the geodesign framework alone is unable to fulfill its promise and provide a means to overcome the value-action gap.

#### 1.4 Research Questions: Evaluating the Impact of Geodesign

The geographic concept of place and theory of place-making provides a coherent framework to address the extent to which the geodesign framework can be used to facilitate the expression of environmental values to overcome the value-action gap. The following sections describe each research question (RQ) with respect to the theoretical argument advanced throughout the dissertation.

***RQ1- Geodesign as Neutral Framework:*** Is geodesign able to facilitate the expression of diverse forms of place-based knowledge and environmental values?

If the geodesign framework can be used to overcome the value-action gap it must first be shown that the framework can account for the diversity of place-based values of relevance for addressing environmental challenges. As described above, the geodesign framework is intended to guide participants through a series of decisions and planning tasks without constraining participants to predetermined normative values, planning theories or methods. However, geodesign literature has yet to evaluate the assumption that geodesign practice facilitates the expression of diverse place-based knowledge and design objectives. Is the geodesign framework equally suited to the expression of diverse environmental values and normative objectives, and can it account for equally diverse theories and methods of relevance to the design challenge? Or is the framework

established with an implicit bias towards particular values, technologies and planning processes, thus restricting its utility for critical research and action? The dissertation's first line of inquiry evaluates this fundamental question by considering the diversity of place-based values expressed in current forms of geodesign practice.

***RQ2- Geodesign as Action Research:*** Can geodesign practice be used as a Participatory Action Research approach to critically evaluate and overcome the value-action gap?

The range of potential answers to RQ1 provokes corresponding questions regarding geodesign practice and its effect on participants' understanding of and ability to express their place-based environmental values. Whereas the first line of inquiry addresses the ontological nature of the geodesign framework and practice, the second line of inquiry evaluates the extent to which geodesign allows participants to achieve their critical learning and action objectives. Can participants in geodesign projects engage the factors necessary to overcome the value-action gap and express their environmental values? Does the geodesign process result in tangible outcomes aligned with the critical action objectives of participatory action research? Addressing this question will require a combined evaluation of the geodesign process and the factors associated with the value-action gap. By considering both the geodesign process and outcomes, this line of inquiry will evaluate the use of geodesign for critical research and pragmatic action to overcome the value-action gap.

***RQ3- Geodesign as Collective Action:*** Does geodesign increase the scale of environmental agency beyond the individual scale?

The third line of inquiry builds on the previous two questions and evaluates whether geodesign practice influences participants' beliefs regarding their environmental agency. Agency is defined as "the power to act," and, when applied to environmental issues, implies the power to act in environmentally significant ways (Hannigan, 2006, p. 34). Such actions may be simple or complex, direct or indirect, and can include everything from personal behavior to political action as forms of collective place-making. Among the assumed benefits of geodesign practice is the possibility for consensus building and participatory action at scales beyond the individual. Evaluating whether the geodesign process expands the scale of individual participants' perceived environmental agency could suggest ways the geodesign process can be used to mobilize collective action to overcome the value-action gap beyond the individual scale.

### *1.5 Geodesign Case Studies: Contexts for Change*

This dissertation evaluates the research questions based on the results of a taxonomic evaluation of current geodesign practice (Chapter 2) and two new geodesign case studies (Chapters 3 and 4). Given the limited generalizability of individual geodesign project results, the review of existing case study literature in Chapter 2 facilitates comparative assessment of the results of Chapters 3 and 4. The individual case studies, however, allow for greater analysis of substantive issues associated with the research questions and are the primary source of data for this dissertation.

The case studies conducted as part of this dissertation were selected using a purposeful selection technique. "Purposeful sampling" is a qualitative technique used to select case studies that satisfy research requirements and include thematic characteristics

to achieve the research objective (Cresswell, 2013, p. 100). The primary criteria guiding the selection of case studies in this dissertation include a.) feasibility for completing the research within the constraints of the dissertation timeline, b.) accessibility and proximity to the University of Maryland; c.) availability of willing research participants; and d.) intention to implement a participatory environmental planning process. The two case studies are briefly introduced below and further described in each respective chapter.

### *1.5.1 Edgewater Village Park, Harford County, MD*

Located in a suburban area in Harford County, Maryland, approximately 20 miles north-east of Baltimore, Edgewater Village Park is a small county park surrounding Serene Lake. The 575-acre case study site – which includes the park and parts of the surrounding communities and commercial zones in the unincorporated community of Edgewood – has been the target of ongoing actions by the local government to ‘improve’ and ‘develop’ the area. Most recently, the Harford County Department of Planning and Zoning partnered with the University of Maryland’s National Center for Smart Growth to complete a geodesign project as part of the county’s efforts to redevelop the park and promote community ‘ownership’ of the park.

The Department of Planning and Zoning, together with the Department of Parks and Recreation and the Department of Housing and Community Development, established the park and have sought to maintain it as a resource for the surrounding community. The county developed a proposal requesting assistance to address multiple park management issues through a participatory park planning process. The UMD’s National Center for Smart Growth selected the County’s proposal for support during the

fall 2018 semester and suggested a geodesign project to achieve their objective. The project met the case study selection criteria and was therefore incorporated into this dissertation as the first of two contrasting case studies.

### *1.5.2 Newtown Neck, St. Mary's County, MD*

Located approximately 100 miles south of Edgewater Village Park along the Chesapeake Bay, the second case study site encompasses an approximately 850-acre parcel on a peninsula of land surrounding the present location of the St. Francis Xavier Church in Leonardtown, Maryland (St. Mary's County). Still an active Parish within the Archdiocese of Washington, the St. Francis Xavier Church was founded in 1640 and is among the oldest Catholic churches from the original 13 colonies (St. Francis Xavier Church, 2018). Catholic affiliated entities owned the entire case study area until 2009 when the land surrounding the church was sold to the State of Maryland to develop a State Park. In contrast to the government-led park development process at Edgewater Village Park in the first case study, the parishioners and supporters of the catholic church are the active participants in the second case study. At the outset of the dissertation research phase, the parishioners of this church were attempting to preserve and promote the landscape and values of their catholic tradition; they expressed interest in conducting a participatory landscape and cultural heritage planning process to include their priorities in a buffer area management plan for the area surrounding the park. The site therefore provided a group of participants and problem for which a participatory geodesign process could be implemented.

The two case study sites were selected purposefully to provide contrasting characteristics to broaden the scope of the evaluation. The first case study site offers a diverse population and discrete planning challenge compared to the second case study site. Still, both address the theme of participatory land use planning and thereby provide a level of consistency between the evaluations. The case studies also differ regarding the role of the geodesign facilitator and the involvement of secular and religious institutions, both of which are important characteristics for evaluating the expression of environmental values for applied action. In the first case study, the geodesign process was instigated by Harford County government staff and facilitated by representatives of the University of Maryland's National Center for Smart Growth. In the second case study, the parishioners of the catholic church were actively promoting the project and were interested in partnering with external organizations or researchers in support of their preexisting design and historic preservation goals. The participants in both case studies were unfamiliar with the geodesign process at the start of each project, making the results of both case studies of relevance for critically evaluating the geodesign process without a predisposition towards its promised benefits.

### 1.6 Research Methods: Making Sense of Geodesign

Geodesign integrates theories, methods, and place-based themes from multiple disciplines and requires a mix of methods for critical evaluation. This dissertation therefore utilizes a variety of methods to address the primary research questions. The primary methods include taxonomic inventory, participant surveys, and participatory action research. While each chapter describes the applicable research method, those methods are briefly summarized here.

### *1.6.1 Taxonomic Inventory and Evaluation Methods*

The dissertation begins with a literature review and taxonomic inventory of current geodesign practice to evaluate the alignment between the geodesign framework and current practice. Taxonomies (or typologies – the more common term for conceptual classification in the social sciences) provide a structured approach to identify, organize, classify and compare distinct concepts or units (Bailey, 1994, p. 6). A taxonomic inventory of geodesign practice therefore offers a method to address ontological questions regarding the geodesign framework based on the characteristics of current geodesign practice. Is the geodesign framework, as currently used, able to accommodate diverse theories, methods and place-based knowledge? Or does geodesign practice inherently foster a particular technology, planning theory or environmental worldview? Answering this question is a prerequisite for the use of the geodesign framework for critical research and action to overcome the value-action gap. Taxonomic research methods provide the means to answer this question based on the evaluation of geodesign practice in Chapter 2.

### *1.6.2 Participant Survey Methods*

The second set of research methods used in this dissertation - participant survey methods - is used to demonstrate the limitations of current geodesign practice and the need for more substantive evaluations of geodesign project outcomes. Participant survey methods are a commonly used approach in PPGIS and related literature for evaluating participant expectations, characteristics, and satisfaction with GIS tools and participatory planning processes. They are indicative of the type of “analytic relationality” prominent

in much environmental psychology and sociological research (Seamon, 2018, p. 22). This dissertation's use of participant survey methods is intended both to utilize the survey methods common in participatory planning evaluation literature while also identifying the limitations of the status quo implementation of geodesign projects. The survey methods address substantive themes associated with the value-action gap. Chapter 3 uses survey data to assess participant satisfaction with the geodesign process and outcome, their expression of environmental values, and their beliefs regarding the scale of their environmental agency mediated through the geodesign process. The research uses a combination of new survey items and existing scales to measure environmental values, evaluate the impact of geodesign, and compare the extent to which geodesign affects environmental value constructs and value expression. Due to the small sample size, which was constrained by the extent of participation in the geodesign project itself and beyond the control of this research, data analysis used descriptive statistics and non-parametric methods suitable for small sample sizes.

### *1.6.3 Participatory Action Research Methods*

The third primary research method – participatory action – underlies the other data collection methods used in this dissertation and informs the interpretation of all research results. As described in the literature review above, participatory action research (PAR) is a method which includes research participants as co-researchers and utilizes an iterative approach to research design, implementation, analysis, and communication to achieve actionable results through participatory methods (Kindon, 2010). The participatory element in PAR can take many forms, ranging from surveys and interviews to storytelling, community art or political action (Kindon et al., 2007). The second case



study (Chapter 4) most fully demonstrates the use of geodesign as a participatory ‘technique,’ in the terminology of PAR and proposes an approach to geodesign referred to as geodesign-as-participatory action research (“geodesign-as-PAR”).

#### *1.6.4 Critical Realist Philosophy of Science*

The diversity of methods used to evaluate the results of the taxonomic inventory and case studies requires a coherent theoretical research framework and approach to science. While each respective method represents a distinct epistemology, this dissertation employs a critical realist approach to interpret the research results. Critical realism, as articulated by Bhaskar (1979) and applied variously within human-environment geography (e.g., Turner & Robbins, 2008; Yeung, 1997), rejects both the positivistic claims of empiricism and the relativistic claims of deconstructionism. Instead, critical realism takes a historicist approach to epistemology (Archer et al., 2016). Critical realism articulates an ontology and epistemology for the scientific process that values both the natural and social sciences and both quantitative and qualitative methods but does so within the constraints of metanarrative. In their interdisciplinary summary of critical realism, Archer et al. (2016) state:

*“Critical realism is not an empirical program; it is not a methodology; it is not even truly a theory, because it explains nothing. It is, rather, a meta-theoretical position: a reflexive philosophical stance concerned with providing a philosophically informed account of science and social science which can in turn inform our empirical investigations.”*

The three primary characteristics of the critical realist philosophy of science are: “ontological realism” – the belief in a reality independent of our ability to prove it; “epistemic relativism” – the utility of a diverse range of methodologies for producing knowledge; and “judgmental rationality” – the necessity of comparing knowledge claims produced by alternative epistemologies (Archer et al., 2016). Critical realism therefore encompasses a diversity of theories arising from a range of epistemological structures. The ontological realism and epistemological plurality accounted for in a critical realist philosophy of science provide a suitable philosophical foundation for the interdisciplinary nature of the geodesign framework. The critical realist philosophy of science is therefore used to structure the diverse methods and interpret the results of this dissertation as individual components of a coherent whole.

### 1.7 Dissertation Structure

The dissertation is structured to answer the fundamental research questions in three primary chapters. This introductory chapter has summarized the need and rationale for this research, established the research questions, and introduced the research context and methods. Each subsequent chapter is structured as a stand-alone article of relevance for the narrow focus of the chapter. Together with the introduction and conclusion, each chapter provides the content for the broader argument of the dissertation as a whole. Chapter two addresses the first research question regarding the ontological characteristics of geodesign; it uses a conceptual review of the geodesign framework and a taxonomic inventory of current geodesign practice to evaluate the assumed neutrality of the geodesign framework. Chapters three and four present the primary case studies evaluated in this dissertation. Chapter three describes the government-led geodesign project at

Edgewater Park, Harford County, MD and shows the deficiencies in uncritical implementation of the geodesign framework without sufficient attention to its participatory characteristics. Chapter four builds on lessons learned from Chapter three and presents the results of a geodesign-as-participatory action research case study of a participant-led land use planning processes at Newtown Neck, St. Mary's County, MD. By employing an alternative method, the second case study attempts to show how the geodesign framework can be used for critical learning and action to overcome the value-action gap. The concluding chapter summarizes the research results, compares the two cases, and explains how the geographic concept of place can be incorporated into geodesign practice to facilitate the expression of environmental values and overcome the value-action gap.

## Chapter 2: The Alignment Between the Geodesign Framework and Practice: A Taxonomic Evaluation of Geodesign Practice \*

### 2.1 Introduction

Geodesign is a dynamic, integrative, participatory approach to spatial design and planning (Steinitz, 2012). By integrating the analytical characteristics of the geospatial sciences with the creativity of the design professions, geodesign promises a uniquely effective design process. Its effectiveness is made possible, in part, by utilizing the analytic capacity of spatial decision support systems (SDSS) and planning support systems (PSS) and the participatory techniques of Public Participatory GIS (PPGIS). Yet geodesign is broader than any single SDSS or PSS tool; the premise for its distinctive effectiveness among design approaches is based on its integrative capacity to incorporate public participation and facilitate interdisciplinary collaboration throughout the design process.

As the geodesign framework finds greater use in planning and design practice, it must demonstrate the effectiveness of its integrative premise or face critiques common to other participatory design, planning and GIS practices (Sieber, 2006; c.f. Carton & Thissen, 2009; Brown, 2012; Pelzer et al., 2015; Rodela et al., 2017; Flacke et al., 2020). The benefits of increased public participation during the design process, especially methods involving complex spatial decision support or planning systems, must be justified in contrast to the financial and temporal cost (Carnes et al., 1998; Irvin &

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\* A version of this chapter was reviewed for publication in the journal *Environment and Planning B* and benefits from comments received from anonymous reviewers.

Stansbury, 2004). While geodesign literature to date emphasizes the technological promise of geodesign practice, there is a growing need for research evaluating the participatory aspects of geodesign practice and how the integration of its technological and participatory characteristics leads to enhanced outcomes in practice.

The objectives of this chapter are therefore to: i.) review the geodesign framework in relation to the technological and participatory capacity of SDSS, PSS and PPGIS; ii.) evaluate the extent to which current geodesign practice implements the breadth of technological and participatory characteristics of the geodesign framework and iii.) identify opportunities for comparative evaluation of geodesign outcomes based on the characteristics of specific cases of geodesign practice. To do so, the chapter first reviews the geodesign framework and its integration of PPGIS, SPSS, and PSS technologies and practices while identifying the basis for its claim to distinctive effectiveness. The chapter then presents the results of a taxonomic review of current geodesign practice to evaluate the alignment between geodesign practice and the integrative characteristics of the geodesign framework. The results of the taxonomic inventory point to a broadening range of geodesign practice, provide a resource for prospective geodesign practitioners, and facilitate comparative research evaluating the applied outcomes of geodesign practice.

## 2.2 Review

### *2.2.1 Geodesign in Theory*

The conceptual foundation for geodesign originates in the foundational work of landscape architects and planners such as Ian McHarg and later innovations in GIS for planning and design (Schwarz-von Raumer & Stokman, 2012). McHarg's approach to

landscape architecture in *Design with Nature* (1969) demonstrated the utility of layering thematic maps for visualization and design purposes, which some consider a conceptual harbinger of the capabilities now commonplace in modern GIS applications (Dangermond, 2010). The innovations in GIS mapping and modeling led practitioners in both the geographic and design disciplines to expect that this new technology would provide closer collaboration between these disciplines and result in new opportunities for spatially explicit design and modeling techniques. In retrospect, that reality did not immediately develop but is experiencing a resurgence of interest in multiple approaches to the planning and design process, including ‘geodesign’ (Wilson, 2015).

In *A Framework for Geodesign: Changing Geography by Design*, Carl Steinitz (2012) establishes geodesign as an integrative framework for landscape design and planning. Geodesign represents but one approach among many others to participatory design and planning (Hollstein, 2019), and the ‘Steinitz geodesign framework’ is but one articulation of a growing body of literature and practice described as geodesign (c.f. Artz, 2010; Schwarz-von Raumer & Stokman, 2012; Lee et al., 2014). Yet the Steinitz geodesign framework represents a robust articulation of geodesign as both a framework for theory and an approach to geodesign practice, thus accounting for geodesign’s conceptual and applied purposes (Steinitz, 1990, 1995, 2012, 2016; Rivero, 2015; Nyerges et al, 2016; Orland & Steinitz, 2019). Steinitz originally proposed geodesign as a “framework for theory” to help his students of landscape architecture “organize applicable knowledge – models – directed towards landscape change and to identify areas where contributions of theory are needed” (Steinitz, 1990, p. 136). The pragmatic intent of geodesign practice was therefore linked to its ability to facilitate the identification and

application of any theory, method, or source of data deemed necessary to overcome the design challenge by the participants in the design process. Steinitz thus advocated “that we cease our often narrow definitions of theory” (p. 136) and instead use a structured approach to frame the questions asked during the landscape design process.

To address this need, Steinitz proposed a set of six questions to guide the design process and facilitate the use of a wide variety of theories, methods and data from multiple disciplines. The Steinitz geodesign framework consists of six questions considered in three iterations. The questions and the models to address them are:

1. How should the study area be described in content, space and time?	-> Representation models
2. How does the study area operate?	-> Process models
3. Is the current study area working well?	-> Evaluation models
4. How might the study area be altered?	-> Change models
5. What differences might the changes cause?	-> Impact models
6. How should the study area be changed?	-> Decision models

(Steinitz, 2012)

Each question and corresponding model represent a distinct step in Steinitz's approach to the design process. In each step, participants identify the characteristics of each respective model; whether those models are sophisticated GIS models, hand-drawn sketches, or mental models is not a decisive factor in Steinitz’s articulation of the geodesign framework. This flexibility allows the design team to utilize diverse theory-driven methods and models from any discipline necessary to answer the questions posed in each step of the geodesign framework. As such, the geodesign framework provides a means to integrate, and, where possible, dynamically link, distinct models developed in

SDSS, PSS, and PPGIS contexts to equip participants with more robust and meaningful tools to address their design challenge.

The rapid advancement of geodesign software platforms, such as GeodesignHub.com, is increasing opportunities to dynamically link spatially explicit models originally developed as distinct forms of SDSS and PSS (Ballal, 2015; Pettit et al, 2019). Project-specific examples of geodesign research further emphasize this possibility. Yang et al. (2018a), for example, contrast Steinitz's geodesign framework with "traditional PSS" and propose a "geodesign method" to integrate multiple planning support system models in the geodesign process (p. 1376). Similarly, Yan et al (2018b) augment the Steinitz geodesign framework to account for increasingly sophisticated modeling technologies for urban planning, Dias et al. (2015) demonstrate the geodesign process to support land use planning in urban areas of the Netherlands, and Wu & Chiang (2018) demonstrate the potential use of 3D modeling using ESRI CityEngine in a geodesign process for flood resilience planning. Though these represent only a small sample of the burgeoning literature on geodesign modeling opportunities, they make the case that the geodesign framework is distinct from any single PSS or SDSS model and instead provides an integrative approach dynamically link such models and utilize them in applied participatory settings.

The participatory characteristics of the geodesign framework and the use of GIS technologies in geodesign practice suggest geodesign's similarity to many forms of PGIS and PPGIS. Whereas the emphasis of SDSS and PSS are most directly relevant to the geodesign evaluation, process and impact models, the geodesign process itself is arguable a robust form of applied PPGIS practice, with particular emphasis on the representation,



change and decision models (Slotterback et al., 2016; c.f. Arciniegas & Janssen, 2012). However, geodesign's distinction in comparison to individual SDSS and PSS, on the one hand, and general approaches to PPGIS, on the other, is the structured, iterative, participatory process provided by the geodesign framework.

The Steinitz geodesign framework proposes multiple iterations through the six questions, each involving varying amounts of input from the public, representatives from the geographic sciences, and representatives from the planning professions. The three iterations consist of:

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| <ol style="list-style-type: none"><li>1. Iteration 1: "Why questions" – rapid preliminary scoping questions</li><li>2. Iteration 2: "How questions" – the same six questions in the reverse order</li><li>3. Iteration 3: "What, where and when questions" – the same six questions asked during the implementation of the study</li></ol> |
|--|

(Steinitz, 2012)

The first iteration establishes the scope and purpose of the geodesign study and determines whether a geodesign process is suitable to meet that objective (Steinitz, 2012, p. 35). By asking 'why' questions, the process allows participants in the design team to express their expectations and motivations for the study. It is during this step that participants define what the study area is, what is of importance to know, how it can be known and represented, how it can be changed, and how it *should* be changed. The first iteration through the geodesign questions therefore allows participants to determine what form of place-based knowledge is of relevance for their current objectives and allows them to define the scope of the study accordingly. This facilitates the identification and

implementation of GIS technologies, including distinct SDSS or PSS, and participatory techniques that are fit for purpose to achieve participants' design objectives.

The second iteration through the questions seeks to define the methodology for the geodesign process. In this iteration, the six questions are asked in reverse order, starting with decision models and working backward to representation models. This ordering of the questions results in a decision-driven methodology rather than a data-driven methodology (Steinitz, 2012). By asking "how should the study area be changed" and establishing the decision model to make that determination, the geodesign process focuses only on themes and indicators of relevance for the specific issues at stake in the design process (p. 45). It is during this iteration that the methodology for each subsequent model is defined. This results in methods that are aligned with participant objectives and are suitable based on the participant's beliefs, values, and objectives.

The third iteration through the questions concerns the implementation of the methods proposed in the second iteration by asking the "what, where and when questions" (Steinitz, 2012, p. 83). The third iteration most closely resembles other spatial decision support processes and typically occurs during a 'geodesign workshop.' A significant distinction, however, is that the methods used in the geodesign process are determined with input from participants as part of the design process. The methods used and the geodesign workshop process itself are therefore more closely aligned with participants' beliefs, values, and expectations for the study. The result of the third iteration is 'the geodesign': the plan describing the agreed design, implementation modality, funding source, and other related matters.

The iterative and participatory structure of the geodesign process therefore goes beyond the use of individual PSS, SDSS or PPGIS techniques or technologies; it is a means to frame a participatory process which identifies and integrates whatever techniques, tools or data are necessary to achieve the pragmatic objective of the participants. As such, the geodesign process is said to integrate science and design, and in this respect is similar to other participatory technology-aided design processes. Foster (2016) reviews the integrative potential of the geodesign framework in comparison with other approaches to design. While the review identifies multiple similarities, Foster (2016) follows Shearer's (2012) view that geodesign is most distinctive with respect to "the design of the design" (p. 192) – the process whereby participants build consensus regarding the structure and content of the design process prior to carrying out the process itself. While other approaches recognize the importance of satisfying stakeholder expectations as a necessary result of the design process (Foster, 2016), geodesign prescribes a structured, iterative, and participatory process which involves all decision-making stakeholders at every stage of the design process.

In contrast to other participatory approaches to design, however, the geodesign framework seeks to foster a process in which diverse theories and normative perspectives can be expressed through the design and planning process. Literature in the planning and design traditions have reviewed the relation between geodesign and design theory (Foster, 2016; Hollstein, 2019), but with few exceptions (Wilson, 2015; Trouillet, 2019), this aspect has been largely unaccounted for from the geographic perspective. Yet the conceptual structure of the geodesign framework allows more than the integration of

discrete GIS technologies; it can also account for geographic theory and research methods such as the geographic concept of place and theory of place and place-making.

While the concept of place eludes simple definition in geographic literature, Agnew's (1987) characterization of the term identifies three primary aspects of place: location, locale and sense of place. Each of these aspects of place can be accounted for in the geodesign framework. Location, or the "impact of the 'macro-order' in a place" (Agnew, 1987, p. 5-6), represents the objective spatial characteristics of place incorporated into geospatial datasets, methods and software utilized in geodesign models. As will be shown in the second half of this chapter, location information is the predominant form of place-based knowledge incorporated into the geodesign process. Not all forms of place-based knowledge are reducible to quantitative spatial terms. Yet the geodesign framework is able to incorporate place-based aspects of locale (the "structured 'micro-sociological' content of place") and sense of place ("the subjective orientation that can be engendered by living in a place") (Agnew, 1987, p. 5-6) due to the range of questions and diversity of participants in the geodesign process. If fully implemented, the geodesign framework provides a structured process which allows participants to contribute their unique place-based knowledge and thereby contribute towards more effective communication and consensus-building during the design process.

While geodesign is not unique in its ability to frame place-based knowledge (Williams & Patterson, 1996; Sack, 2010; Pierce et al., 2011), nor in its use of SDSS and PSS technologies, it is distinct in its attempt to provide a structure participatory process to integrate these capacities to provide pragmatic opportunities for participants to achieve

their design objectives. Despite this conceptual possibility, geodesign's claim to distinction both among approaches to design and frameworks to apply place-based knowledge rests on the quality of geodesign practice and its applied effectiveness.

### *2.2.2 Geodesign in Practice*

Geodesign literature suggests that geodesign practice is uniquely effective compared to other forms of participatory planning and design support processes. McElvaney (2012) claims that geodesign can "enhance design quality and efficiency" (p. 8). Abukhater & Walker (2010) suggest that geodesign can "make it possible for the public to engage in the [planning] process and contribute in meaningful ways" (p. 28). Steinitz (2012) states that the objectives of the geodesign framework "are clear: to enable better designs and to improve communication towards decision making that supports a more adaptable and equitable future" (p. 201). Steiner & Shearer (2016) consider geodesign's "effectiveness" (p. 1) a sufficient reason to promote its use. In short, geodesign literature does not hesitate to highlight the promised benefits of geodesign practice despite a lack of evidence documenting such benefits in practice (Chapter 2).

Proponents suggest that the distinctive effectiveness of geodesign practice is due to the geodesign framework's integration of the geographic sciences, the subjective knowledge of the design team, and the place-based knowledge of public participants. The conceptual structure of the geodesign framework supports this integration. Ervin (2012) states that geodesign "enhances traditional environmental planning and design activities with the power of modern computing, communications, and collaboration technologies" (p. 1). Similarly, Flaxman (2010) emphasizes that geodesign allows the design team to

obtain better input and insight regarding participants' knowledge, interests and desires. The promised effectiveness of geodesign practice is therefore dependent on the balance between its technological and participatory characteristics and the extent to which they are fully implemented in practice.

Despite the conceptual prominence of geodesign's integrative capacity, geodesign scholarship specifically evaluating the effectiveness resulting from the integration of geodesign's technological and participatory characteristics is limited. A rapidly increasing body of literature describing geodesign practice ranges from broad comparative assessment (Orland & Steinitz, 2019) to detailed case studies of individual projects (e.g. McElvaney, 2012; Rivero et al., 2015; Janssen & Dias, 2017; Pettit et al., 2020). While several recent studies propose methods to increase the rigor and structure of geodesign practice evaluations (Orland & Steinitz, 2019; Foster, 2016) descriptive case studies continue to predominate the literature. To date, Tulloch's (2017) taxonomic inventory is the most comprehensive attempt to categorize and evaluate geodesign case study literature, given that previous compendiums of geodesign research (e.g. McElvaney, 2012; Lee et al., 2014) demonstrate the breadth of geodesign practice but were not intended for comparative evaluation. By identifying and categorizing 28 geodesign projects, Tulloch's inventory provided an essential step towards comparative research on geodesign practice but did not specifically evaluate the alignment between geodesign practice and the underlying characteristics of the geodesign framework. The remainder of this chapter therefore evaluates the extent to which geodesign practice implements the distinguishing characteristics of the geodesign framework, thereby

demonstrating the breadth of geodesign practice and facilitating comparative research to evaluate geodesign's claimed effectiveness.

### 2.3 Taxonomic Inventory of Geodesign Practice

#### *2.3.1 Methods*

A taxonomic inventory of geodesign practice was conducted to provide geodesign practitioners and researchers a source information to facilitate comparative assessment of the applied effectiveness and demonstrated outcomes of geodesign practice. A cut-off date of March 1, 2020 was established for the selection of projects included in this inventory. Project literature was identified through a search of major databases, including Web of Science, Google Scholar, Google Search, and Microsoft Academic Search, using the search term 'geodesign'. Projects not explicitly labeled as geodesign in corresponding literature were omitted; this ensured that the inventory results were based only on the assessment of projects explicitly defined as geodesign and their alignment with the conceptual structure and anticipated effectiveness of the geodesign framework described in geodesign literature. Project literature which lacked sufficient information to evaluate all taxonomic indicators were omitted. This resulted in the inclusion of more projects from peer-reviewed sources compared with projects described in less detail from other sources. The selection method was developed to provide an indicative inventory of general trends in geodesign practice rather than comprehensively account for all geodesign practice, including practice not documented in published literature and the diversity of geodesign research whose effectiveness has yet to be applied in practice.

Section 2.4 identifies such literature and describes its relevance for interpreting the inventory results.

All projects meeting the selection criteria were evaluated according to the taxonomic inventory classifications defined in *Table 2.1*. The terminology for each primary classification is adapted from the taxonomy proposed by Tulloch (2017). Additional secondary classifications were added to provide increased specificity regarding the participatory characteristics of geodesign. Additional classifications include project scale, purpose/objective, and form of public participation, and the role, medium, and duration of participation.

The project selection and evaluation methods were implemented to identify the indicative sample of geodesign projects listed in *Table 2.2*.

*Table 2.1: Taxonomic Inventory Classification Terms and Definitions*

<b>Primary Classifications</b> (Adapted from Tulloch, 2017)	
Public Participation	Direct – the participation of the ‘people of the place’ as individuals in their personal capacity. These may include residents of the geodesign study area, interested neighbors, or individuals participating based on their personal purposes and motivations
	Indirect – the participation of designated representatives of the ‘people of the place,’ including representatives from government agencies, the public sector or civil society organizations in the study area
Technology	Complex – the use of spatially explicit and dynamically integrated models within a single geodesign platform
	Simple – the use of a single model, or the use of multiple models of varying complexity which are not dynamically integrated within a single geodesign platform



Design Automation	Yes – the use of at least one geodesign model or system with automated design technologies
	No – the absence of automated design technologies in the geodesign models and/or systems utilized
<b>Secondary Classifications</b>	
Scale	A general classification of project study area size ranging from parcel, for projects limited to a single known parcel; sub-urban or urban, for projects larger than individual parcels and smaller than regions; and region, for projects with multiple urban and/or suburban areas within the project area
Application / Project Purpose	Implementation – projects in which the geodesign process is linked to the development and implementation of a resulting plan, policy or design
	Demonstration – projects in which the geodesign process is either hypothetical, demonstrative, or intended for educational, visioning, or scenario-building purposes with no explicit link to project implementation
Form of Participation	Collaborative – participation occurring at more than one stage of the geodesign process (e.g. project scoping and problem definition, methodology development, and/or collaboration during a geodesign workshop or design process)
	Contributory – participation limited to a single step in the geodesign process (e.g. during a geodesign workshop)
Medium of Participation	Digital – participation through an online or digital medium, such as interactive web map, survey, or feedback process
	In person – participation during meetings, workshops, site visits or other in-person activities
	Both – a combination of both digital and in-person participation
Duration of participation	One time – participatory activities that occur at one time (e.g. geodesign workshops), are not repeated and do not require ongoing participation
	Iterative – participatory activities that are repeated multiple times (e.g. weekly meetings), and may require ongoing participation

### 2.3.2 Results

A total of 23 geodesign projects meeting the inventory criteria, including nine from Tulloch's (2017) taxonomy, were identified and included in this inventory (*Table 2.2*). The inventory identified eight categories of geodesign practice based on the combination of the three primary technological and participatory characteristics. More than half of all geodesign projects identified utilize simple geodesign models without design automation (13 projects); this category can be further divided into those with direct public participation (7 projects) and those without such participation (6 projects). The use of complex, or dynamically linked, geodesign models is limited to seven projects, only two of which include any form of direct public participation. Results defined based solely on these primary characteristics are comparable to Tulloch's (2017) inventory and can be used to assess the trajectory of geodesign practice.

The inclusion of secondary characteristics on public participation provides further results previously unaccounted for in geodesign evaluation literature. The inventory found only two projects which link the geodesign process to any form of design implementation; the remainder were classified as demonstration projects given the lack of any description of applied outcomes or plans for design implementation. The inventory identified more diversity with respect to the scale of geodesign projects; thirteen were classified as regional projects while ten were classified as sub-regional (including parcel, urban and suburban). Similarly, indicators for the duration, role, medium of geodesign projects in available literature show a more equal split between contributory (13) and collaborative (10) projects when including projects with any form of public participation.

Of those projects with direct public participation, only two include collaborative forms of participation.

Table 2.2: Taxonomic Inventory of Geodesign Practice

“x” denotes classification for respective characteristic

Project	Primary Characteristics				Secondary Characteristics								Source Information	
	Public Participation		Technology		Scale		Objective/Purpose		Role of Participation		Medium of participation	Duration of Participation	Location	Reference
	Direct / People of Place	Indirect / Representatives	Model Complexity	Design Automation	Parcel, Sub-urban, or Urban	Region	Implementation	Demonstration	Collaborative	Contributory	Digital, In Person, Both or None	One time / Iterative		
Visioning Florida 2050	X		Complex	Yes		X		X	X		Both	Iterative	Central Florida, USA	McElvaney (2012, Ch. 7)
Seven Mile Creek Fuelshed Project	X		Complex	No		X		X		X	In person	Iterative	Southern Minnesota, USA	Slotterback et al., (2016)
Wind Turbine Placement	X		Simple	No		X		X		X	Both	One time	Saarland, Germany	Roth & Gruehn (2014).
Vital Landscape Project	X		Simple	No		X		X		X	Digital	One time	Southwest Hungary	Jombach et al. (2012)
Alluvial Fan Planning	X		Simple	No		X	X		X		Digital	Iterative	Southern California, USA	McElvaney (2012, Ch. 9)
Pictorial approach to planning	X		Simple	No		X	X			X	In person	One time	Lower Zambezi Valley, Mozambique	Janssen & Dias (2017).
Geodesign as an Educational Tool	X		Simple	No		X		X		X	In person	One time	South Cache Valley, Utah, USA	Warren-Kretzschmar,

														Lincoln, & Ballal, (2016)
Jakarta's "foot soldiers" of geodesign*	X		Simple	No	X			X		X	In person	Iterative	Jakarta, Indonesia	Rekittke, Paar, & Ninsalam, (2012)
Peat Meadow Planning	X		Simple	Yes	X			X		X	In person	One time	Friesland, Netherlands	Eikelboom, Janssen, & Stewart, (2015); Janssen et al. (2014)
Regional urban design scenarios		X	Complex	No			X	X		X	In person	One time	Limmattal Region, Switzerland	Hayek et al., (2016)
Yellowstone ecological forecasting*		X	Complex	No			X	X	X		In person	Iterative	Yellowstone National Park, USA	McElvaney (2012, Ch. 4)
Sustainable Urban Development in Singapore*		X	Complex	No	X			X	X		In person	Iterative	Singapore	McElvaney (2012, Ch. 5)
Kuwaiti Campus Planning and Design*		X	Complex	Yes	X		X		X		In person	Iterative	Sabah Al-Salem University City - Kuwait University	McElvaney (2012, Ch. 6)
Human-energy-water urban system		X	Complex	Yes	X			X		X	In person	One time	Shanghai, China	Yang, Chi, Wu & Quan (2018)
Alternative-Fuel station location		X	Simple	No			X	X		X	In person	One time	Southwestern USA	Kuby et al., (2018)
Development planning with geodesign and game theory		X	Simple	No			X	X	X		In person	One time	Liemers corridor, Netherlands	Lenferink et al., (2016)

Cape Cod climate scenarios*		X	Simple	No		X		X		X	In person	One time	Cape Cod, MA, USA	McElvaney (2012, Ch. 3)
Community Gardening on Brownfield Sites		X	Simple	No	X			X	X		In person	Iterative	Los Angeles, USA	McElvaney (2012, Ch. 8)
Coastal development scenarios		X	Simple	No		X		X	X		In person	One time	Chatham County, Georgia, USA	Rivero et al., (2015)
Geodesign for coastal cities		X	Simple	No	X			X		X	In person	One time	Wilmington, North Carolina, USA	Lee & Gamez, (2017)
Sustainable Urban Design Workshop		X	Simple	No	X			X	X		In person	One time	Washington State, USA	Nyerges et al. (2016)
Flood resilient cities		X	Simple	Yes	X			X		X	In person	One time	Tainan City, Taiwan	Wu & Chiang (2018)
South East Sydney Planning Scenarios		X	Simple	No	X			X	X		In person	Iterative	Sydney, Australia	Petitt et al. (2019)

## 2.4 Discussion

The inventory results provide an indicative summary of geodesign practice which demonstrates the breadth of characteristics included in the geodesign framework. This inventory provides practitioners a guide to identify comparable forms of geodesign practice aligned with the intended outcomes of projects in similar characteristics. Though the inventory results are not intended to capture innovative research on geodesign themes not yet been demonstrated in applied geodesign practice, the results contribute to the ongoing examination of the ontological structure and stability of the geodesign concept and the rapidly evolving trajectory of geodesign practice. In this respect, the results challenge two frequent claims regarding the integration of technological and participatory characteristics of geodesign practice: that the scale of geodesign project areas and the sophistication of geodesign models are inversely related to the feasibility of public participation. The results suggest that geodesign literature and practice currently overemphasize the technological characteristics of the geodesign framework at the expense of its participatory possibilities. While these findings highlight the difficulty of implementing geodesign's participatory characteristics, they also show the importance of describing and evaluating such characteristics in order to facilitate more effective geodesign project implementation in participatory settings. The following sections discuss each of these findings in turn.

### *2.4.1 Technological Orientation of Geodesign Practice*

The inventory results suggest that the trajectory of current geodesign practice and corresponding case study literature are trending towards increasingly technological forms

of geodesign practice. The technological trajectory of geodesign practice is evidenced by comparing the results of Tulloch's (2017) inventory with the inventory presented here. While both inventories use the same two primary classifications for the technological characteristics of geodesign practice (model complexity and design automation), the results are significantly different when projects lacking public participation are omitted.

Tulloch's (2017) inventory found that the level of design automation is the single most important characteristic for classifying geodesign practice; it divides the twenty-eight projects included in the taxonomy roughly in half. The literature review conducted for the present inventory identified similar attention to the technological aspects of geodesign practice but found few examples of such features in participatory geodesign practice. For example, Moura (2015) demonstrates a parametric modeling approach to visualize building regulations during geodesign projects. Kong and Sui (2017) demonstrate the use of cellular automata for developing scenarios and informing urban planning through geodesign. Hulse et al. (2016) apply agent-based modeling in a geodesign-like framework to assess forest fire-hazards and identify risk areas, and Perkl (2016) demonstrates the utility of geodesign for landscape planning of conservation corridors using a least cost path analysis to identify conservation corridors. While each study demonstrates an innovative use of automated technologies in the geodesign process, none incorporate any form of public participation described by the geodesign framework and were therefore omitted from the present inventory. When projects with no public participation are omitted, the level of design automation in geodesign project models, while important on a case by case basis, is not a distinguishing feature of



geodesign practice; only five projects in the taxonomy presented above have autonomous design features, and only two of those have direct public participation.

The technological trajectory of current geodesign practice is similarly evidenced by comparing the characteristics of substantive model complexity among projects included in Tulloch's (2017) inventory and the inventory presented above. The classification of 'substantive model' refers to the technologies used for the representation, process, evaluation, change, impact and decision models of the geodesign framework. Models which lack spatially explicit data and technology or those with distinct models for each thematic area of the geodesign study are characterized as simple models. Projects with multiple, integrated, spatially explicit models are classified as complex. Five projects in Tulloch's (2017) taxonomy have both public participation and 'complex' substantive models and are therefore included in the present inventory, as well as three additional projects identified which meet those criteria (Hayek et al., 2016; Slotterback et al., 2016; Yang et al., 2018). While the inventory presented above includes only eight projects with complex models, three of those include direct participation of the 'people of the place.' This shows the importance of dynamically integrated spatial models in geodesign practice and confirms that such approaches can be implemented in participatory settings.

Geodesign literature beyond the scope of this taxonomic inventory points to the recent speed and extent of technological development as one explanation for the overemphasis on geodesign technology in current practice (Hollstein, 2019). To date, technological innovation has been the most important driver of change in geodesign practice and research; new software and modeling methods have been at the forefront of

geodesign research (Batty, 2013). Li and Milburn (2016) describe the history of geodesign in terms of its "eras" of technological change: "the analogue era, the poor data era, the small data era, and the big data era" (p. 1). The current 'era' of geodesign research thus continues to demonstrate the close association between geodesign practice and advancing technology. Yet the pace of current technological development proceeds at the risk of overlooking the need to align such technologies with the participatory characteristics of the geodesign framework.

Though less prominent than other forms of technological development, there are noteworthy efforts to develop more advanced participatory design technologies and thereby address the divergence between the geodesign framework and current practice. Roth and Gruehn's (2014) successfully incorporated public input from ~600 online respondents in a visual landscape impact assessment, which they suggest could be utilized in a broader geodesign process. Similarly, Roderick (2017) recommends the use of "structured participation methods" for geodesign practice, such as CyberGIS Gateway or ChainBuilder, to offer opportunities for dynamic, asynchronous, and transparent participation, and Atzmanstorfer et al. (2014) demonstrates the use of an online "GeoCitizen Platform" for participatory design and collaboration outside the traditional planning or design context. These examples show the type of research and practice that will be necessary to accommodate the participatory characteristics of the geodesign framework amidst the increasing complexity of geodesign technologies. Existing scholarship has evaluated the performance of similar technologies for participatory planning processes in general (Slotterback, 2011; Cilliers and Timmermans, 2014; Tobias

et al., 2016; Jankowski et al., 2019), but with few exceptions (e.g. Slotterback et al., 2016; Petitt et al, 2019) has not evaluated these issues in geodesign practice.

The inventory presented above therefore points to a need for increased attention to participatory techniques within projects specifically denoted as geodesign in associated case study literature. The inventory suggests that geodesign case study literature provides limited evidence to evaluate the extent to which geodesign technology facilitates the integration of the participatory characteristics of the geodesign framework. The prominence of technological characteristics in current geodesign practice contrasts with the balanced role of technology in the Steinitz (2012) geodesign framework. Geospatial technology serves an important purpose in the geodesign process, but only to the extent required to facilitate a participatory, multi-disciplinary response to the questions posed in each iteration of the geodesign framework.

#### *2.4.2 Characteristics of Public Participation*

The inventory presented above includes additional taxonomic classifications regarding the participatory characteristics of geodesign practice and therefore allows comparative evaluation of the participatory techniques and outcomes in projects of similar scale and context. The taxonomy uses a dichotomous classification of whether public participation is direct or indirect, and the inventory results suggest that the form of public participation (direct/indirect) is the dichotomous characteristic accounting for the largest division in geodesign practice. While this numerical outcome is of little importance (14 projects with indirect participation, and 9 projects with direct participation) given the evolving breadth of geodesign practice, the inventory shows that

categorizing geodesign practice based on its participatory techniques provides a useful guide for practitioners and researchers seeking to identify comparable projects for inspiration or evaluation.

Of greater concern to the present research, however, the inventory results suggest multiple new avenues for comparative research. For example, the largest group of projects in the taxonomy include direct public participation in geodesign projects with simple substantive models (McElvaney, 2012, Ch 3, 6, and 8; Rivero et al., 2015; Lenferink et al., 2016; Nyerges et al., 2016; Lee and Gamez, 2017; Kuby et al., 2018). Examples such as Rekittke et al.'s (2012: 200) project integrating "grassroots GIS" in the geodesign process and Janssen & Dias's (2017: 144) use of a "pictorial approach to geodesign" both demonstrate 'low-tech' applications of the geodesign framework. These cases show the utility of the geodesign framework beyond a narrow technological focus and identify the need for further research and practice to evaluate the comparative outcomes of geodesign projects with relatively little technological complexity.

The inventory results also show the importance of evaluating the secondary characteristics of public participation. The inventory provides new insight regarding the form of public participation (collaborative or contributory), the medium of participation (digital or in-person), and duration of participation (one-time or iterative). With respect to form, the results show that contributory forms of participation are the most common in geodesign practice, accounting for thirteen of the projects included in the inventory. While some projects utilize participatory data (e.g., PPGIS or VGI data) or incorporate public feedback to evaluate or prioritize different design features, most projects involving contributory participation take the form of a single geodesign workshop. In contrast, ten

projects include collaborative participation, all of which are classified as indirect forms of public participation. This again suggests the increasing divergence between the geodesign framework's prioritization of direct, collaborative, public participation compared to the prevalence of indirect forms of contributory participation in current geodesign practice.

The medium of participation, either digital or in person, is another secondary characteristic of relevance for evaluating the alignment between technological and participatory characteristics of geodesign practice. Forms of digital participation range from websites which provide planning modules roughly accounting for each model of the geodesign framework (Jombach et al., 2012), a geodesign-inspired web portal providing land suitability evaluation tools and simulations (McElvaney, 2012, Ch. 9), to techniques combining digital and in-person forms of communication (McElvaney, 2012, Ch. 7; Roth & Gruehn, 2014). Projects with both digital and in-person forms of participation were found to provide the greatest possibilities for the direct participation of the 'people of the place.' Furthermore, as described below, this finding shows that the integration of geodesign technology and participatory characteristics can accommodate direct forms of collaborative participation at any scale.

Similarly, the inventory considers the duration of public participation as a further means to evaluate geodesign practice. Projects that involve a single form of participatory data collection, such as the participatory mapping effort conducted by Rekitke et al. (2012), are classified as a single participatory activity since the data is of relevance at one point in the geodesign process. Fifteen of the twenty-three inventoried projects involve a single participatory activity, ranging in duration from single meetings (Lenferink et al., 2016) to multi-day participatory geodesign workshops (Rivero et al., 2015). The

inventory results show that iterative and/or continuous engagement is less predominant and is generally equated with collaborative geodesign projects while one-time engagement can be equated with contributory projects. While this finding suggests the difficulty of implementing collaborative geodesign projects over longer durations of participation, it also suggests the need for research to evaluate the comparative effectiveness of different forms of participatory practice in similar contexts.

#### *2.4.3 Public Participation Compared to Scale and Complexity*

The increased range of taxonomic indicators accounted for in this inventory provides a means to evaluate two frequent claims regarding the relationship between the scale and complexity of geodesign practice and public participation. First, the inventory results do not support the assumption that the scale of geodesign projects is inversely related to the scale of meaningful public participation. The taxonomy accounts for the scale of geodesign practice at four levels: parcel, sub-urban, urban, and regional. Approximately half of all projects inventoried (14) were implemented at the regional scale, with the remainder accounting for parcel, suburban and urban projects. Regional projects included regional climate scenarios (McElvaney 2012, Ch. 3) and coastal development scenarios (Rivero et al., 2015) to regional scale evaluations identifying suitable locations for projects as varied as community gardening sites (McElvaney, 2012, Ch. 8) to alternative fuel stations (Kuby et al., 2018). The diversity of project scale confirms that the geodesign framework can be successfully implemented at the parcel to the regional scale but supports the assumption that projects beyond the parcel-scale benefit most from the geodesign approach.

The scale of geodesign projects, however, does not appear to limit the extent to which geodesign practice can implement the full scope of its technological and participatory characteristics at each scale. Projects employing both simple and complex substantive models and those with and without automated design technologies were implemented at the regional level. Similarly, projects at the regional scale include seven cases with the direct participation of the ‘people of the place’ and seven with indirect public participation. All projects included in the inventory which employ some form of digital participation occurred in projects at the regional scale. These projects utilized both complex substantive models and design automation, suggesting that direct public participation can be incorporated into any type of geodesign process. The inventory therefore shows that public participation in geodesign projects is possible at any scale and challenges the assumption that parcel-scale projects are more suited to public participation whereas regional-scale projects prevent effective public participation.

Similarly, the inventory results challenge the assumed inverse relation between the complexity of geodesign technology and the feasibility of public participation. The inventory shows that direct public participation does not preclude the use of complex substantive models or computer-as-designer technologies. The “Visioning Florida 2050” project (McElvaney, 2012, Ch. 7) most directly challenges both assumptions. The project incorporates the highest number of direct public participants among all projects inventoried while also utilizing computer-as-designer technologies and complex substantive models. The project directly involved 150,000 people through 150 public meetings and incorporated feedback from 7,319 people via an online poll (McElvaney, 2012, Ch. 7: 90). Though less extensive, the “Seven Mile Creek Fuelshed” project also

incorporated public participation and the use of complex substantive models (Slotterback et al., 2016). These examples demonstrate the possibility of combining technological innovation with similar innovations to account for the full extent of the geodesign framework's participatory characteristics.

#### *2.4.4 Extent of Applied Geodesign Practice*

In addition to the project-specific characteristics described above, the inventory results provide a means to evaluate the prevalence of applied versus conceptual forms of geodesign research. The results show that geodesign case study literature is skewed toward hypothetical, demonstrative, and conceptual implementation of the geodesign framework. Only three geodesign projects identified in this taxonomic review specifically demonstrate an applied use of the geodesign process. The “Kuwati Campus Planning and Design” project (McElvaney, 2012, Ch. 6) was implemented by a consortium of public and private sector developers in order to design an urban university campus. The “Alluvial Fan Planning” project resulted in the creation of a public website allowing users to evaluate land based on criteria of relevance for proposed developments (McElvaney, 2012, Ch. 9). And Janssen and Dias's (2017) “pictorial approach to planning” project was implemented as part of a larger planning process resulting in a legislated planning policy. The literature on each of these projects specifically shows how the geodesign process was linked to the implementation of the resulting plan, policy or project. All other projects either lacked a description of the applied purpose/objective or lacked an applied purpose or objective altogether.



This finding, however, is not indicative of the breadth of purposes for which the geodesign framework has been theoretically applied. The breadth of geodesign literature includes a growing diversity of project purposes. Three areas of active research include the use of geodesign for the purpose of policy development and implementation (Campagna & DiCesare, 2014; Sophronides et al., 2016; Moura, 2015; Campagna et al., 2019), natural resource and conservation planning (La Rosa, 2014; Perkl, 2016; Janssen & Dias, 2017), and for pedagogical activities in a variety of educational settings in multiple disciplines (Paradis et al., 2013; Tulloch & Walton, 2013; Muller & Flohr, 2016; Hayek et al., 2016; Lee & Gamez, 2017). These areas of research are indicative of the range of objectives for which the geodesign process could be applied and suggest opportunities to evaluate the effectiveness of these research themes in practice.

The limited number of applied case studies provides one explanation for the comparative lack of information in geodesign literature regarding the effectiveness of participatory characteristics in geodesign practice. Case studies conducted in controlled or hypothetical settings generally lack attention to how such practices can be implemented in applied and participatory settings. Of the few projects included in the inventory which evaluate geodesign process effectiveness, Pettit et al. (2019) show the potential ease and utility of such evaluating by reporting the results of satisfaction surveys completed digitally by all participants in the geodesign workshop, and Slotterback et al. (2016) show the insight derived from more robust research methods. The majority of geodesign practice literature, however, leaves many questions unresolved: How can automated design be integrated into applied and participatory forms of geodesign practice? How can the substantive models in the geodesign practice account

for more diverse forms of place-based knowledge? Which forms of public participation are suitable to meet the varying objectives of each stage of the geodesign process? How can technological innovation support the identification and participation of more diverse stakeholders? And how do the applied outcomes of geodesign practice differ from other approaches to participatory design? Explicitly accounting for the range of taxonomic factors accounted for in this inventory will facilitate more detailed evaluation of these and related questions in future geodesign literature and practice.

### 2.5 Conclusion

The taxonomic inventory results suggest an increasing divergence between the conceptual premise of geodesign as a ‘framework for theory’ and the trajectory of geodesign practice. While this does not represent a definitive evaluation of the geodesign concept or practitioners’ ability to implement geodesign in practice, it does point to the advantages of ontological clarity and ongoing assessment of the anticipated effectiveness of the geodesign framework in practice. The distinctiveness of the geodesign framework is premised on its ability to integrate diverse theories, methods, and thematic areas of relevance to meet the diverse objectives, motivations and perspectives of project participants. Yet the diversity of place-based knowledge necessary to answer the iterative series of questions upon which geodesign practice is structured is only possible through the active and iterative contribution of each of the four groups of key stakeholders described in the Steinitz geodesign framework (2012). The lack of public participation in geodesign practice therefore constrains the diversity of values, perspectives and objectives expressed through geodesign practice and limits the integrative potential afforded by geodesign technology and practice.

The divergence between the geodesign framework and practice also complicates research evaluating the conceptual and applied outcomes anticipated from geodesign practice. With respect to the objectives of this dissertation, the state of current geodesign practice limits the extent to which existing case study literature can be used to evaluate the utility of the geodesign framework to facilitate critical learning and action to overcome the value-action gap. Instead, the conceptual and taxonomic review in this chapter suggests that uncritical implementation of geodesign projects with minimal public participation can bias the results of geodesign practice. This limits its utility for overcoming the value-action gap for two reasons. Returning to Agnew's (1987) three-part characterization of place, the inventory shows that each aspect of place is conceptually accounted for in the geodesign framework but not equally expressed in geodesign practice. Without meaningful public participation, the alignment between locational aspects of place and the analytical/objective nature of current geodesign practice results in the prioritization of locational aspects of place. Contrary to the objectives of the geodesign framework, such practice may in fact hinder the expression of place-based values associated with other forms of place-based knowledge.

The extent to which geodesign practice can account for diverse forms of place-based knowledge and facilitate the expression of environmental values is therefore dependent, at least in part, on the full implementation of its participatory characteristics. The taxonomy proposed in this chapter provides a means for evaluating those characteristics, identifies examples of how they have been incorporated into previous geodesign research and practice, and suggests the need for additional primary research to address the research questions identified in this dissertation.

## Chapter 3: ‘Public Participation’ in a Single Day? A Geodesign Case Study of Edgewater Village Park Redevelopment Planning<sup>†</sup>

### 3.1 Introduction

The “geodesign approach” to landscape planning is intended to integrate the geographical sciences with design practice through a technology-enabled participatory design process (Steinitz, 2012). As a process, geodesign is said to allow participants to express their concerns, preferences and values as they seek to change their surroundings. As a technology, geodesign is assumed to enable individuals to understand, access and influence larger scales and more complex issues through dynamic social-ecological systems analysis and modeling. Regardless of the scale or context, the geodesign approach seeks to utilize empirical human-environment data to dynamically evaluate participatory design proposals and facilitate more efficient and effective planning and design outcomes (cf. Dangermond, 2010; Ervin, 2012; Flaxman, 2010; Goodchild, 2010; Steinitz, 2012).

Despite the conceptual promise of the geodesign framework, geodesign practice must be evaluated on its own merit on a case-by-case basis. This chapter therefore presents a case study of a day-long geodesign workshop convened to generate conceptual designs for the redevelopment of a municipal park in Harford County, Maryland. Literature evaluating geodesign practice has taken many forms, ranging from broad

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<sup>†</sup> A version of Chapter 3 has been accepted for publication in the 2020 volume of the *Journal of Digital Landscape Architecture* under the title ‘Evaluating Participatory and Technological Integration in Geodesign Practice.’

comparative assessment (Orland & Steinitz 2019) and taxonomic evaluation (Tulloch 2017) to case studies of individual projects (e.g. McElvaney 2012, Rivero et al. 2015, Janssen & Dias 2017). Several recent studies also suggest methods to increase the rigor and structure of geodesign practice evaluations (Orland & Steinitz 2019, Foster 2016). The case study evaluated in this chapter therefore utilizes a modified version of the descriptive case study format proposed by Foster (2016) complemented with survey and interview data analysis. The chapter adheres to the following structure: 1) project overview and purpose; 2) description of the process implemented; 3) summary of data and technology; 4) description of collaboration and participation; 5) evaluation of project outcomes; and 6) conclusion.

### 3.2 Geodesign Project Description

#### *3.2.1 Overview and Taxonomic Classification*

This case study concerns the scoping-stage participatory process used to develop design ideas for the redevelopment of Edgewater Village Park and surrounding communities in Harford County, Maryland (*Figure 3.1*). The park is located in a suburban area approximately 20 miles North-East of Baltimore, Maryland. The 86-acre park encompasses a runoff pond in the center of the park, baseball and softball fields, playgrounds and several trails connecting areas of the park to the surrounding neighborhoods. The Edgewood Recreation Center is adjacent to the park. Other amenities within a three-mile radius of the park, but beyond walking distance of the park area, include Edgewood Elementary, Middle and High School, LifeBridge Health Center, several places of worship, a Maryland Rail Commuter (MARC) station and the Aberdeen

Proving Ground, a military facility that is one of the main sources of employment in the County.

The Edgewater Village Park redevelopment project originated as a result of Harford County's participation in the University of Maryland (UMD)-affiliated Partnership for Action Learning in Sustainability (PALS) Program (PALS, 2019). The UMD-PALS program is an ongoing program run by the National Center for Smart Growth (NCSG) at the University of Maryland. Its mission is to "provide high-quality, low-cost assistance to local governments while creating an active and valuable real-world learning experience for UMD graduate and undergraduate students" (PALS, 2019). Each semester, the PALS program competitively selects proposals from local governments and supports them through applied research and collaboration from UMD students and faculty to address planning and sustainability-related challenges.

Figure 3.1: Geodesign Case Study Area: Harford County, MD

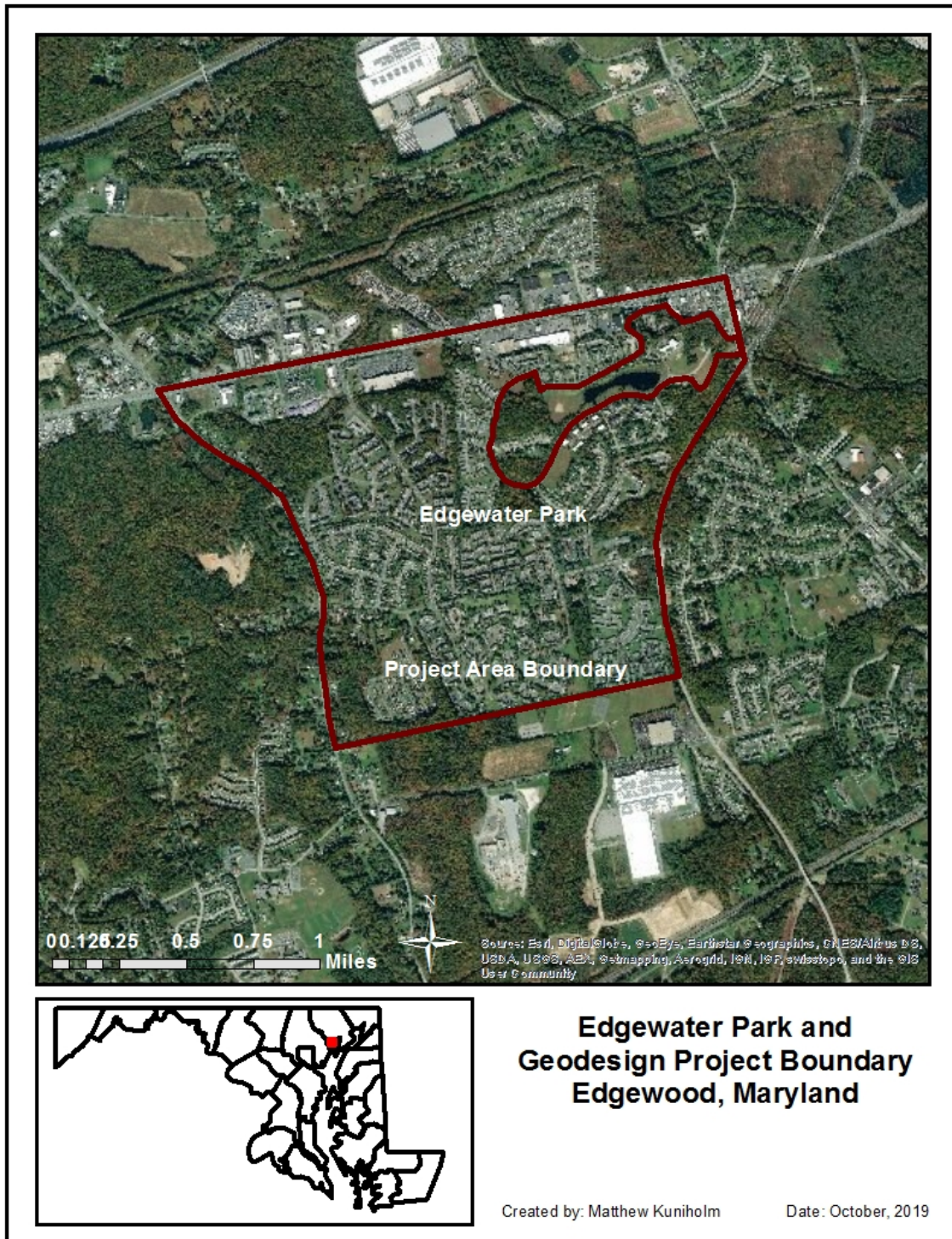


Figure 3.1 illustrates the boundaries of the geodesign project study area and the perimeter of the Edgewater Village Park, which is the priority of the geodesign project objective.

The Harford County Department of Planning and Zoning, Department of Parks and Recreation, and Department of Housing and Community Development share management responsibilities for Edgewater Village Park and surrounding areas. These departments submitted a combined request to the UMD-PALS program for assistance generating ideas for the redevelopment of Edgewater Village Park. Their application acknowledged that previous municipal efforts to increase visitation and foster a sense of “community ownership” of the park while reducing crime, littering, and loitering had not achieved the intended results (personal communication with county staff, 2018). Previous efforts to accomplish this goal had included repaving roads adjacent to the park, offering social and educational programming in and around the park, and establishing a farmer’s market next to the park, among other initiatives.

The county’s proposal to the PALS program requested assistance to address these issues through a participatory park redevelopment planning process. The PALS program selected the project for the fall 2018 semester and matched the project with the final-year design studio of the UMD Master of Landscape Architecture program. The PALS program suggested the geodesign framework to guide the park redevelopment process.

A geodesign project team was established to coordinate the logistical aspects of the project and discuss issues of relevance for answering the set of six questions in the first phase of the Steinitz (2012) geodesign framework. The project team was comprised of the Director of the NCSG-PALS program, the professor of Landscape Architecture leading the design studio course, a geodesign facilitator from GeodesignHub.com (the platform used for the geodesign workshop), and a representative from the Harford



County Department of Planning and Zoning, Department of Parks and Recreation, and Department of Housing and Community Development. The project team held several preparatory meetings during which the context of the study area, objectives for the geodesign process, and other logistical details were discussed, as described in the following section.

The taxonomic classification for this project is identified in Table 3.1.

*Table 3.1: Taxonomic Classification of Edgewater Village Park Geodesign Project*

Project	Primary Characteristics				Secondary Characteristics							
	Public Participation		Technology		Scale		Objective/Purpose		Role of Public		Medium	Duration
	Direct / People of Place	Indirect / Representatives	Model Complexity	Design Automation	Parcel, Sub-urban, or Urban	Region	Implementation	Demonstration	Collaborative	Contributory	Digital, In Person, Both or None	One time / Iterative
Edgewater Village Park Rehab		X	Simple	No	X			X		X	In-person	One time

While UMD facilitators advocated for alternate approaches to more fully implement the geodesign process, the Harford County officials were reluctant to prioritize public participation and therefore limited the extent to which the full scope of the geodesign framework could be implemented. The project timeline also constrained the potential duration of the participatory process. As described below, the project lacked direct participation of the ‘people of the place,’ lacked direct applied objectives, was pre-populated with data and models, and provided insufficient time for participants to learn

and meaningfully engage with the geodesign software used during the workshop. These characteristics are more fully described below.

### *3.2.2 Geodesign Process*

The geodesign project proceeded through three steps: (1) preparation – including program design, articulation of goals, and software and logistical set-up; (2) a geodesign workshop to involve representatives of park neighbors and county staff in the redevelopment process; and (3) design and presentation of park redevelopment concepts based on the results of the geodesign workshop subsequently prepared by students in the Master of Landscape Architecture design studio. Each phase is described below to provide context for the proceeding evaluation of the geodesign process used in this case.

#### *Phase 1: Planning and Preparation*

The planning and preparation phase sought to answer the questions posed in the first iteration through the set of six questions in Steinitz's (2012) geodesign framework. The first iteration through these questions establishes the design challenge to be addressed, determines whether a geodesign process is suitable to resolve the design challenge, and discusses the data and models necessary to do so. These questions, among others, were addressed by the geodesign planning team in advance of the public workshop and lacked direct public input.

The planning team convened a series of meetings and phone conferences to develop a 'Scope of Work' and 'Program of Change' for the geodesign process. The first meeting was held on July 27<sup>th</sup>, 2018, during which the team introduced themselves and discussed the purpose and proposed process for the geodesign project. A second meeting was held on August 31<sup>st</sup>, 2018, during which the team discussed the 'Program of

Change’, a statement of goals to be achieved by the geodesign process. A third meeting was held on October 19<sup>th</sup>, 2018, to coordinate with the student participants who would be completing follow-up work on park design features. The project team also conducted a site visit at the park on October 23<sup>rd</sup>, 2018.

The planning team developed the following objectives to guide the ‘Scope of Work’ and ‘Program of Change.’ The geodesign process sought to:

- *“Identify the county’s and residents’ aspirations for this area, including aging in place*
- *Integrate this area better with the surrounds to enable flow of people and traffic from areas nearby*
- *Identify opportunities for recreation for adults and young families, and expand upon existing community and recreational facilities*
- *Improve the area near Edgewater Lake for local community*
- *Identify additional parcels within the study area for potential redevelopment and/or alternative land uses (private and public parcels)”*

*Scope of Work, prepared by the project team*

Software and logistical set-up proceeded concurrently with preparatory meetings and articulation of goals. This work represents the second iteration through the set of geodesign questions. The geodesign process utilized the GeodesignHub.com (2018) online platform. GeodesignHub is a leading platform for open-source, dynamic, web-based applications to support the geodesign process. The platform has been used in multiple other geodesign projects (e.g. Rivero et al., 2015; Warren-Kretzschmar et al., 2016; Borges & Ballal, 2017). It attempts to digitize all steps in the Steinitz (2012) geodesign framework, including the representation, process, evaluation, change, impact and decision modeling tasks. By using the GeodesignHub platform, participants can interact with each other to understand, assess and integrate geographic data with their proposed design ideas for real-time evaluation and further consideration in subsequent design stages.

The GeodesignHub platform can be pre-loaded with base maps and relevant geospatial data for the representation, process and evaluation models. In more robust geodesign projects, the GeodesignHub platform and recommended process also accommodates participatory geosurveys, the use of crowdsourced data, or other non-traditional geo-referenced open source data (GeodesignHub.com, 2019). In this case, the GeodesignHub facilitator compiled data for the representation and process models and pre-loaded them in the GeodesignHub platform to populate the evaluation models, a key feature of the platform. The data for the change, impact and decision models were generated during the workshop by the participants using the GeodesignHub platform, as described below.

The characteristics of the geodesign process, project objective, substantive models, and geospatial data were pre-determined by the design team. Throughout these preparatory steps, UMD facilitators described the potential advantages of incorporating direct public involvement to make these fundamental determinations. Harford County staff, however, were reluctant to involve direct public participation, and the design team acknowledged that doing so would require more time and resources than were available for this geodesign project. The relevance of this decision on the structure of the geodesign process and project outcome are described in the evaluation section of this chapter.

### *Phase 2: Geodesign Workshop*

The geodesign workshop took place on November 9<sup>th</sup>, 2018, from 9 am-3 pm. Approximately 30 participants attended, including student-facilitators from the UMD Master of Landscape Architecture program, three UMD and NCSG faculty, and

approximately twenty participants from the Harford County government and neighborhoods surrounding Edgewater Village Park. Section 3.4 provides a description of participants and an evaluation of the participatory characteristics of the project.

The workshop began with a description of the design challenge and an introduction to the geodesign process. The GeodesignHub facilitator, who participated in the workshop remotely via phone and screen-share, introduced the concept of ‘geodesign’ and showed a brief video to demonstrate the key tasks for each step of the process. The general introduction was followed by a facilitated discussion during which participants described their goals for attending the workshop and provided feedback on the problem statement. Participants expressed diverse motivations for participating, ranging from neighborhood residents interested in the park redevelopment process to business owners wanting to contribute to the development of the neighborhood and county government officials who were required to attend the workshop.

Following the introductory presentations and discussion, each participant was provided a laptop for use during the workshop. The GeodesignHub facilitator demonstrated how to log in to the GeodesignHub project site and sketch design interventions on the project basemap in the GeodesignHub platform. Some participants initially struggled to log in and begin to use the GeodesignHub site while others intuitively utilized the platform shortly after the introduction and video. The student-facilitators were crucial at this stage; they individually assisted many participants until everyone was able to complete the initial task of sketching and adding design elements.

Once all participants had successfully logged in and learned how to utilize the GeodesignHub platform, the workshop progressed to the first step of the design process:

each participant was to develop 5-7 design interventions, sketch them digitally on the project area basemap, and submit them to the GeodesignHub project site. This was easily accomplished by most participants, though the level of detail in each design varied greatly by participant. The participant-generated design interventions ranged from proposals for sidewalks and crosswalks to policy and zoning interventions, environmental protection or recreation features such as playgrounds, pavilions or sports fields, and new zoning and economic development policies (policies were denoted in the basemap by polygons covering the affected areas). Each participant's design interventions became visible on the GeodesignHub platform as soon as they were complete. The GeodesignHub project site was projected in a large format for viewing by all participants.

Participants were then divided into groups representing three primary stakeholder interests identified by the geodesign project planning team: County government, local businesses and developers, and community residents. There was little time during the workshop for discussion of the actual interests of these stakeholder groups or the extent to which workshop participants agreed that these groups represented the actual groups most interested in the redevelopment of Edgewater Village Park. Nevertheless, workshop participants engaged in the 'role-play' aspect of this step as instructed.

A facilitator instructed each of the three groups to review the available design interventions and agree to a park redevelopment plan which fulfilled the assumed interests of their respective stakeholder group. The municipal government group prioritized design interventions with the least cost and need for maintenance. The business community group prioritized transportation, accessibility, and security. The neighborhood community group did not consider the cost of interventions (though they

anticipated that lower cost interventions had more likelihood of support) and focused on recreation, aesthetic value and park accessibility.

Following a lunch break, each group presented their initial designs to all participants. The group presentations were approximately 5 minutes each and focused on each group's chosen design interventions and their underlying rationale for including each design element. In the final step of the workshop, the groups were instructed to negotiate between their respective designs and develop a single consensus design. The two groups with the most similar designs began the negotiation. The first two groups identified the design interventions not supported in both plans, discussed each design element, and chose to eliminate, combine or revise design elements. Following negotiation between the first two groups, participation of the third group representing the 'government' stakeholders was decisive in forcing all groups to consider the logistical implications regarding funding, maintenance, and management of each proposed design.

By this time in the workshop, some participants were visibly tired. Approximately ten participants had left by this point in the workshop. The facilitator suggested ways to shorten the negotiation phase. By the end of the negotiation phase, only eight participants and eight student and faculty facilitators from the University of Maryland were present. All remaining participants agreed that the process had achieved a consensus on the final plan to satisfy the objectives of their respective stakeholder groups. One of the UMD facilitators then provided a brief summary of the day and described how the results of the geodesign planning process could be incorporated into subsequent proposals for design interventions at the park. The date for the presentation of the conceptual design plans to be prepared by UMD students was provided and the workshop concluded.

### *Phase 3: Proposed Design Interventions*

The team of student facilitators from the geodesign workshop developed conceptual designs for various aspects of the park redevelopment process in the weeks following the workshop. Not all design interventions included in the final design negotiated during the geodesign workshop were incorporated into student designs. Student designers were free to utilize the results of the geodesign process to inform their design but were not obligated to utilize only those design elements resulting from the geodesign process.

The design proposals were presented at a public open-house event on December 6<sup>th</sup>, 2018, in the same location the geodesign workshop had been held. Visitors walked through open-house stations where each student-designer presented their park redevelopment concept. Participants were primarily county government staff who had participated in the geodesign workshop, though several individuals who had not participated in the geodesign workshop also attended the open house. Each design had a unifying concept ranging from plans to use Edgewater Village Park as an ‘energy park’ where neighbors could ‘burn energy’ on outdoor exercise equipment and recreational fields, to plans highlighting the pond as a central aesthetic feature with added pavilions and observation decks, to concepts which made minimal structural modifications and added natural elements such as meadow plantings or other landscaping.

#### *3.2.3 Data and Technology*

The scope of data and technology necessary for the geodesign process depends on individual project objectives and participant input. The goals of this workshop were to



prioritize efficiency and facilitate scoping-phase idea generation during a single, day-long workshop. The time allotted for the workshop would not have been sufficient for the participatory definition and development of the geodesign models. The project team therefore chose to use the GeodesignHub.com platform due to its ease of use, pre-set models, and suitability for public workshops. Data for the first three models were generated by the GeodesignHub facilitator while the data for the change, impact and decision models were contributed by participants during the workshop. Annex A of this dissertation describes each model and shows indicative screenshots of each step in the process, for reference.

The GeodesignHub.com platform accounts for all six models proposed in the Steinitz (2012) geodesign framework. The platform also provides multiple features that were not utilized in this case study, including comment features, counts of design element frequency, budgeting and cost estimate tools, plug-ins, and version history and control functions (GeodesignHub, 2019). In addition to facilitating real-time collaboration between workshop participants and allowing for greater direct use of geospatial data, the GeodesignHub.com platform can provide data outputs in a variety of geospatial data formats and APIs. This feature has the potential to facilitate data sharing and promote collaboration between project teams that utilize different geospatial tools or systems and require data in different formats. The technical and procedural parameters of the GeodesignHub.com platform have been described extensively elsewhere (Ballal, 2015; Warren-Kretzschmar et al., 2016; Borges & Ballal, 2017). Yet as Steinitz (2012) and others have suggested, implementing the geodesign framework is not dependent on the use of any single tool or technology.

### *3.2.4 Collaboration and Participation*

Geodesign is an integrative process that requires support and collaboration from the geographic sciences, design professions, information technologists, and the “people of the place” (Steinitz 2012, p. 4). Each of these groups was represented in this case study. County government staff responsible for managing the Edgewater Village Park initiated and participated in the planning team and workshop. Students and faculty from the UMD Master of Landscape Architecture program facilitated the process. The project team drew on the geographical sciences for GIS models, data and evaluation. And individual community residents participated in the geodesign workshop.

Despite the participation of each primary stakeholder group, the participatory characteristics of this project were constrained by the way the project was implemented. During preparatory meetings, county government representatives described the social dynamics in the study area as comprising of distinct communities associated with several public housing developments, a townhouse community, and small group of homeless residents living adjacent to the park. It was noted that individuals from each of these groups would likely have distinct interests in the park redevelopment process. While the UMD project facilitators encouraged county staff to ensure that representatives of these groups were invited to participate in the geodesign process, the county government was ultimately responsible for sending invitations and coordinating the logistics of the workshop. No members of these groups were present at the geodesign workshop.

As shown in Chapter 2, public participation in the geodesign process can also be evaluated based on the scale and boundary of the study area. The geodesign framework is often described as most suitable for design challenges at the “mid-level regional scale”

between the traditional focus of the design professions at the “local” scale, but not as broad as the focus of the geographic sciences at the “global” scale (Steinitz, 2012, p. 19). The manner in which “scale matters” (Steinitz, 2012, p. 19) remains an area requiring further comparative research regarding the structure of public participation in the geodesign process (see Chapter 2).

In this case, the boundary of the study area was discussed by the planning team in advance of the geodesign workshop. Several different boundaries were proposed. County representatives considered it important to align the boundaries of the geodesign study area within the boundaries of a recently declared ‘economic opportunity zone.’ This designation stems from the U.S. Tax Cut and Jobs Act (2017) which utilizes Opportunity Zones to provide “federal tax incentives for investment in distressed communities over the next 10 years” (Dept. of Housing and Community Development, 2018). County representatives also noted that the county is a large property owner in the area and could sell property in response to potential developer interest. The opportunity zone designation influenced the selection of the geodesign project boundaries and showed the influence of economic and political processes from beyond the study area.

The nature of public participation in the geodesign process can also be evaluated by considering who determines the nature of the ‘design challenge’ and how that challenge is articulated. Both determinations are in part dependent on the participants and their goals for the process, the scale of the study area and the project team’s understanding of ‘public participation.’ The Steinitz geodesign framework (2012) recommends defining the design challenge as one of the first steps in the process. The design challenge for this project was articulated by the geodesign planning team and the

geodesign workshop began with a review of the problem statement and the premise for using the geodesign process. While further discussion during the workshop or an iterative process to articulate the ‘design challenge’ with public input prior to the workshop would have helped align all participants’ expectations and facilitated greater collaboration towards achieving a shared objective, neither approach was implemented in this project.

Public participation in this geodesign process was therefore considered indirect, the workshop represented a single instance of contributory participation, and the project failed to communicate how the geodesign workshop results were going to be implemented by local municipal authorities. As such, the project did not offer participants the opportunity hypothesized to facilitate the expression of environmental values, interests and objectives to overcome the value-action gap.

### 3.3 Evaluation of Outcome

If evaluated only on proximate outcomes, the geodesign process documented here had at least three results: 1.) participants in the geodesign workshop reached a hypothetical consensus on priority design elements for park redevelopment; 2.) six park redevelopment concept designs were subsequently developed and presented by the landscape architecture student-facilitators; and 3.) student-facilitators and participants learned more about the geodesign framework, the GeodesignHub.com software, and the general characteristics of Edgewater Village Park. Yet these outcomes are of limited explanatory value for answering the substantive research questions posed by this dissertation.

The following section therefore evaluates the project using data gathered from interviews, observation and participant survey methods to address the following substantive research questions:

*RQ3.1- Does the geodesign process satisfy participant expectations regarding factors associated with value-action gap?*

*RQ3.2 - Does the geodesign process affect and/or facilitate the expression of participants' environmental beliefs and values?*

*RQ3.3- Can geodesign increase the scale of environmental agency beyond the individual scale?*

These questions focus on factors associated with the value-action gap described in literature reviewed in Chapter 1, with emphasis on participant learning, collaboration, value expression and perceived environmental agency. The questions are indicative of the substantive research on geodesign project outcomes advocated for in Chapter 2, which go beyond the narrow emphasis on the immediate outputs of the geodesign process reported in geodesign literature.

### *3.3.1 Methods*

Prominent methods for evaluating participatory processes in spatial design and planning include satisfaction surveys (e.g Brown & Chin, 2013), interviews (e.g. Zolkafli et al., 2017), controlled experiments in laboratory settings (e.g. Salter et al., 2009; Arciniegas et al. 2013), field experiments (Jankowski and Nyerges, 2001), and case studies in which the practitioner or researcher offers their own evaluation of the process

through case studies. Case study literature, however, is the most common form of research in geodesign evaluation, as shown in Chapter 2 (e.g., Steinitz, 2012; McElvaney, 2012; Cocco et al., 2015; Rivero et al., 2015; Janssen & Dias, 2017; Tulloch, 2017). While case studies demonstrate the diversity of contexts and approaches to geodesign practice, recent reviews of geodesign literature suggest a need for additional rigor and structure to evaluate geodesign practice (Orland & Steinitz 2019, Foster 2016). This evaluation therefore utilizes additional methods designed to answer the primary research questions in this chapter.

The evaluation methods included a pre-and post-workshop survey, follow-up interviews, and researcher observation and participation in the geodesign project. *Table 3.2* summarizes the data collection sources and activities used in this case study.

*Table 3.2 Data Sources and Activities: Edgewater Village Park*

<i>Date</i>	<i>Source/Activity</i>	<i>Summary</i>
July 27, 2018 Aug 31, 2018  Oct 19, 2018  Oct 23, 2018	Project Planning Meetings	<ul style="list-style-type: none"> <li>• Project team introductions and discussion</li> <li>• Discussion of project scope and ‘program of change’</li> <li>• Discussion and training for student facilitators</li> <li>• Project team site visit to project location</li> </ul>
Nov 9, 2018	Pre-Workshop Survey	<ul style="list-style-type: none"> <li>• Three-part survey administered (n=22) immediately prior to geodesign workshop. Survey themes included participant objectives/satisfaction, environmental values, and scale of perceived environmental agency.</li> </ul>
Nov 9, 2018	Geodesign Workshop	<ul style="list-style-type: none"> <li>• Participation and observation in the geodesign workshop allowed researcher to record notes and observations regarding research themes.</li> </ul>

Nov 9, 2018	Post-Workshop Survey	<ul style="list-style-type: none"> <li>• Three-part survey administered (n=16) immediately following the geodesign workshop. Survey themes included participant objectives/satisfaction, environmental values, and scale of perceived environmental agency.</li> </ul>
Nov 9, 2018	Post-Workshop Qualitative Response	<ul style="list-style-type: none"> <li>• Open-ended questions included in the post-workshop survey allowed participants to provide feedback on the geodesign tool/data and their satisfaction with the geodesign workshop.</li> </ul>
Dec 6, 2018	Design charrette participation and observation	<ul style="list-style-type: none"> <li>• Participation and observation in the student presentation of their proposed design interventions allowed researcher to assess the role of the geodesign workshop in the resulting designs and to discuss the process with student participants.</li> </ul>
Dec 6, 2018 – Feb, 2019	Follow-Up Interviews	<ul style="list-style-type: none"> <li>• Semi-structured interviews (n=4) with consenting workshop participants using the interview protocol in Annex A3.</li> </ul>

Survey data was collected through a pre-and post-survey during the geodesign workshop. Eligibility to participate in the survey research component of the project was separate from general participation in the geodesign process. The survey research component was introduced at the start of the workshop and workshop participants meeting the eligibility criteria were invited to participate. To meet the eligibility criteria for the survey, participants had to: a.) be an adult over the age of 18, b.) who would participate in the geodesign meetings or workshop; and c.) voluntarily agree to participate in the surveys or interviews as demonstrated by a signed consent form. The consent form was distributed and explained prior to the workshop, along with confirmation that the

methodology was approved by the UMD Institutional Review Board. All participants in the evaluation research signed a consent form.

The analysis of survey data used for this research required a matched pair of pre- and post-survey responses from individual participants. Only survey responses received from individuals who participated in both the workshop and the follow-up meeting were included. Each survey was administered during the workshop to minimize additional time required from workshop participants; the pre-workshop survey was administered immediately following a brief introduction to the workshop and the evaluation research. The post-workshop survey was completed as the final activity of the workshop (see Annex A3 for data collection instruments and procedures).

Out of 30 workshop participants, twenty-two completed the pre-workshop survey and sixteen completed the post-workshop survey. One of the post-workshop surveys was completed by a late-arriving participant who did not complete a pre-workshop survey. Fifteen matched pair pre- and post- surveys were used in this analysis. The fifteen complete matched pair survey responses encompass student facilitators, government representatives and local resident participants, though the sample accounts only for participants who stayed until the end of the workshop. The reasons for participant attrition and the impact it has on the results are discussed in the conclusion of this chapter. The small sample size required the use of non-parametric data analysis methods. Both the sample size and methods used here are similar to the approach taken in other studies evaluating participatory planning processes with small sample sizes (Meng & Malczewski, 2009; Arciniegas et al., 2013; Warren-Kretzschmar, 2016; Zolakafi et al.,



2017) as opposed to hypothetical or experimental approaches where researchers have greater control over the research context.

The survey instrument collected data on three primary themes corresponding to the three research questions: participant satisfaction with the geodesign process, the expression of environmental values, and the scale of perceived environmental agency as mediated through the geodesign process. Survey items, research results and analysis for each survey theme are described separately below, though they were integrated into a single survey instrument.

### *3.3.2 Participant Satisfaction Survey*

One way of evaluating the utility of the geodesign process for critical research and action is through analysis of participant objectives and satisfaction with specific geodesign projects. Previous evaluations and reviews of participatory planning and design have yet to identify a single indicator or survey item suitable to measure participant satisfaction in participatory planning processes (c.f. Crossland et al., 1995; Carnes et al., 1998; Jankowski & Nyerges, 2001; Burby, 2003; Rowe & Frewer, 2004; Sieber, 2006; Hartmann, 2012; Boroushaki & Malczewski, 2010; Slotterback et al., 2016; Warren-Kretzschmar et al., 2016; te Brommelstroet, 2017; Zolkafli et al., 2017). Given the range of potential indicators and the lack of agreement on the most important factors of satisfaction, this research uses a pluralistic approach to measure participant satisfaction through a range of process and outcome indicators. For the purpose of this research, the ‘effectiveness’ of public participation in geodesign is understood to be *the extent to which the geodesign process satisfies participant objectives*. The two primary concepts in this

definition are participant satisfaction and participant objectives. Each of these concepts encompasses a range of indicators derived from a review of the literature described above. The participant objective indicators used in this research correspond to the hypothesized factors associated with the individual barriers and themes of relevance for overcoming the value-action gap (Kollmuss & Agyeman, 2002). The process satisfaction indicators are based on the hypothesized elements of the geodesign framework of relevance for facilitating value expression to overcome the value-action gap.

*Table 3.3* lists the themes included in the survey and the survey questions used for each indicator. Each survey question uses a five item Likert-scale. An interview guide was developed and used to gather feedback on the themes in the table below during the semi-structured interviews.

*Table 3.3: Satisfaction Survey Instrument*

<b>Theme</b>	<b>Survey Item</b>
Process Satisfaction:	“Please rate your agreement with the following statements based on your experience during the geodesign process:
1. Understandable	<ul style="list-style-type: none"> <li>• The process was easy to understand.</li> </ul>
2. Respect ideas	<ul style="list-style-type: none"> <li>• My ideas and opinions were respected.</li> </ul>
3. Sufficient time	<ul style="list-style-type: none"> <li>• There was enough time for everyone to participate.</li> </ul>
4. Representative participation	<ul style="list-style-type: none"> <li>• The right people were present to participate.</li> </ul>
5. Consensus	<ul style="list-style-type: none"> <li>• In the end, we all agreed on the final plan.</li> </ul>
6. Influence in design	<ul style="list-style-type: none"> <li>• I could see how my ideas influenced the design process.</li> </ul>
7. Respect time (good use of time)	<ul style="list-style-type: none"> <li>• The geodesign process was a good use of my time.”</li> </ul>
Participant Objectives / Result satisfaction	“You may be participating in this workshop for a variety of reasons. Please rate how

	important the following objectives are for your participation in this workshop:
1. Learning about issues	<ul style="list-style-type: none"> <li>To learn about issues affecting the area.</li> </ul>
2. Teach others	<ul style="list-style-type: none"> <li>To teach others about the issues affecting the area.</li> </ul>
3. Evaluate	<ul style="list-style-type: none"> <li>To analyze and evaluate issues affecting the area.</li> </ul>
4. Input for decision makers	<ul style="list-style-type: none"> <li>To help decision-makers improve their plans for the area.</li> </ul>
5. Learning from others	<ul style="list-style-type: none"> <li>To hear from others about issues affecting the area.</li> </ul>
6. Express values	<ul style="list-style-type: none"> <li>To express your environmental values.</li> </ul>
7. Decision-making and consensus	<ul style="list-style-type: none"> <li>To make decisions and collaborate with others to address issues affecting the area.”</li> </ul>
Process Satisfaction	“How satisfied were you with your experience participating in the geodesign process?”
Result Satisfaction	“How satisfied are you with the result of the geodesign process?”

### *Results*

The matched pair data sets from each individual’s pre- and post-workshop survey were analyzed using the Wilcoxon signed rank statistic to test the following hypothesis:

*H1- The geodesign process meets participant objectives for characteristics of participatory design process.* The Wilcoxon signed rank statistic is a non-parametric test suitable for small datasets to test whether variation in the pre- and post-workshop survey responses is significant (Wilcoxon, 1945). Participants ranked the importance of all objectives surveyed in the pre-survey highly; the average response for all but two objectives surveyed prior to the workshop were “important” (4) or “very important” (5). Participants considered the objectives “teach others” and “express values” as somewhat

important, with average responses of 3.95 and 3.41, respectively. The workshop did not exceed participant objectives on any aspect of participant satisfaction surveyed.

Comparison of the mean response in pre- and post-workshop questions shows a gap ranging from -0.12 (“hear from others”) to -0.96 (“provide input”) for all objectives. Despite this gap, comparison of matched-pair responses using the Wilcoxon-signed rank statistic indicated that the gap was insignificant ( $p$  values  $>$  significance level  $\alpha = 0.05$ ) for all but one objective surveyed: the workshop failed to satisfy participant’s objective to “provide input for decision-makers” ( $p = 0.005$ ). Therefore, apart from providing input for decision-makers, there is no evidence to reject the null hypothesis; the data suggest that *the geodesign workshop meets participant objectives for all characteristics of participatory design process except contribution of meaningful information to decision-makers.*

Survey results were also examined to compare participant satisfaction with the participatory process of geodesign versus the outcome of the process. This was achieved by comparing responses to two questions in the post-workshop survey: one regarding participant satisfaction with the geodesign process and one regarding participant satisfaction with the result of the geodesign process. The same Likert-scale was used for both questions, ranging from “Not at all Satisfied” (1) to “Very Satisfied” (5). The mean response to the process and result question were compared to assess the following hypothesis: H2- *Participant satisfaction with the participatory geodesign process is the same as participant satisfaction with the result of the geodesign workshop.*

Average satisfaction among all participants regarding the participatory process of the geodesign workshop was 4.125, indicating that participants were “satisfied.” The

average satisfaction with the results of the workshop (3.625) was less, but still within the “moderately satisfied” range of the 5-point Likert-scale. Therefore, due to the slightly lower mean satisfaction with the geodesign result compared with the geodesign process, there is insufficient evidence to confirm H2, meaning *participant satisfaction with the participatory process and the result of the geodesign workshop are distinct; participants were more satisfied with the process than the result.*

In addition to the single indicators of process and outcome satisfaction, a set of additional indicators was also tested. Seven indicators for geodesign process satisfaction were identified based on the literature review and included in the post-workshop survey. Respondents were asked to state their level of agreement with the following indicators of satisfaction based on their experience in the workshop: “the process was easy to understand,” “my ideas and opinions were respected,” “there was enough time for everyone to participate,” “in the end, we all agreed on the final plan,” “I could see how my ideas influenced the design process,” and “the geodesign process was a good use of my time.” A Likert-scale ranging from “highly disagree” (1) to “highly agree” (5) was used for each question. Responses were analyzed to identify the average response to these questions.

Two forms of factor analysis were used to assess the relation and validity of indicators of process and outcome satisfaction. Principle component analysis was used to evaluate possible reductions in the number of variables associated with process and outcome satisfaction. Factor analysis was used to identify the structure of the dataset. The evaluation is described in Annex A2 Section 2.1. The principal component analysis of all satisfaction variables and the exploratory factor analysis of the specific satisfaction

variables found no evidence to confirm that general indicators of participant satisfaction are indicative of the successful achievement of specific participant objectives in the geodesign process. Thus, *there is no evidence of association between achieving participant objectives and overall indicators of their satisfaction with the process or outcome.*

The satisfaction data was also tested to identify differences in responses from expert and non-expert participants in the geodesign workshop. ‘Expert’ participants were defined as student-facilitators or faculty in the University of Maryland-sponsored PALS program. All other participants were considered public/non-expert. A non-parametric Mann Whitney U statistic was used to compare the sample data from experts with non-experts to test the following two hypotheses: *H3- There is no difference between public (non-expert) and expert participant satisfaction with the participatory process in the geodesign project; and H4-There is no difference between public (non-expert) and expert participant satisfaction with the outcome of the geodesign project.*

The scales for workshop satisfaction, decision-making satisfaction, and representation satisfaction were used to compare expert and non-expert satisfaction. P-values for workshop satisfaction ( $p=0.984$ ), decision-making satisfaction ( $p=0.907$ ), and representation satisfaction ( $p=0.931$ ) were all above the significance level ( $\alpha = 0.05$ ) indicating insufficient evidence to reject the null hypothesis. The results show *no difference between public (non-expert) and expert participant satisfaction with the participatory process (workshop satisfaction) (H3) or outcome (decision-making satisfaction) (H4).*

### 3.3.3 *Environmental Values Survey*

A second means to evaluate the utility of the geodesign process for critical research and action is the association between the geodesign process and the hypothesized factors for overcoming the value-action gap. This research looks at one such factor, knowledge acquisition and resulting value change among participants, due to its relevance for the purposes of this chapter and the overall research questions for this dissertation. The second theme addressed in the pre- and post-workshop survey instrument was therefore participant's stated environmental values. Along with indicators regarding participant satisfaction with the educational value of the geodesign process, assessing value change is a means of assessing the critical learning and reflection on environmental values facilitated by the geodesign process.

The survey instrument uses Klain et al.'s (2017) survey which was developed to account for intrinsic, instrumental, relational and metaphoric value constructs. The survey instrument incorporates the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000), a commonly used survey instrument to characterize environmental beliefs, attitudes and values (Shephard et al., 2015; Harraway et al., 2012; Shephard et al., 2009). It also includes survey items for other value constructs of relevance to the value-action gap, including relational, intrinsic, instrumental and metaphoric value constructs, which correspond to different forms of place-based knowledge and values. No modifications were made to the Klain et al. (2017) survey instrument such that survey results can provide direct comparison and facilitate further research on the utility of the survey instrument. Each survey item is shown in Table 3.4; the same items were used on both

the pre- and post-survey. All questions used the same Likert-scale, ranging from 1 (highly disagree) to 5 (highly agree).

*Table 3.4: Environmental Values Survey Instrument*

Survey Item	Value Construct
1. There are landscapes that say something about who we are as a community, a people.	Relational
2. My health or the health of my family is related one way or another to the natural environment.	
3. I have strong feelings about nature (including all plants, animals, the land, etc.); these views are part of who I am and how I live my life.	
4. Plants and animals, as part of the interdependent web of life, are like 'kin' or family to me, so how we treat them matters.	
5. How I manage the land, both for plants and animals and for future people, reflects my sense of responsibility to and so stewardship of the land.	
6. I often think of some wild places whose fate I care about and strive to protect, even though I may never see them myself.	
7. Humans have a responsibility to account for our own impacts to the environment because they can harm other people.	
8. Humans are severely abusing the environment.	NEP
9. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	
10. If things continue on their present course, we will soon experience a major ecological catastrophe.	
11. The so-called "ecological crisis" facing humankind has been greatly exaggerated.	
12. The earth is like a spaceship with very limited room and resources.	
13. Humans have the right to use nature to meet our needs, even if this includes impacts that will take a decade or more to recover.	Intrinsic



14. Humans have the right to use nature any way we want.	
15. Natural resource extraction is necessary for countries to develop.	Instrumental
16. It is important to protect nature so we have clean air and water.	
17. We can lose forests and wetlands, as long as we are keeping enough for the environment to function.	
18. I think about the forest/ocean and the plants and animals in it like:	Metaphor
a. Something I identify with so strongly that it makes me, me.	
b. A family of which I am very much a part.	
c. A world we must care for so that any damage doesn't also negatively affect humans who depend on it elsewhere.	
d. Beings to which we owe responsible citizenship and care.	

(Klain et al., 2017)

### Results

Data from the pre-survey allowed the characterization of participants' environmental values. Data from the post-survey allowed the comparison with pre-survey values to evaluate the potential impact of the geodesign process on participants' environmental values. The non-parametric Wilcoxon signed-rank statistic was used to evaluate changes in each item of the NEP scale for each pre-post survey respondent in order to test the hypothesis: *H5- participation in the geodesign process increases participant support for pro-environmental values.*

The Cronbach's alpha score, a common measure of the reliability of survey data, was calculated for the entire dataset and for each sub-factor (instrumental, intrinsic, NEP,

relational and metaphoric value constructs). The results show that the survey data is reliable for the chosen methods (*Table 3.5*), though the instrumental value construct alone is not suitable for reliable analysis. Thus, the non-parametric methods used to evaluate the data are appropriate.

*Table 3.5: Reliability of Survey Data - Cronbach's alpha*

<b>Value Construct</b>	<b>Pre- Survey</b>	<b>Post-Survey</b>
Total	0.953	0.924
NEP	0.866	0.726
Intrinsic	0.866	0.951
Instrumental	0.541	0.556
Relational	0.917	0.896
Metaphoric	0.852	0.936

Results from the pre-survey showed slight variation between the environmental value constructs supported by participants in the geodesign workshop. The relational value construct had the highest level of support among workshop participants both before ( $x = 4.210$ ) and after the workshop ( $x = 4.181$ ); the Cronbach alpha measure of internal consistency for the relational construct was also the highest for any sub-factor (0.917) in the pre-workshop survey and was well above the common threshold of 0.8 for reliable data in the post-survey (0.896).

Results show that participant support for all but one of the environmental value constructs decreased between the pre- and post-workshop surveys. The difference was minor, ranging from -0.06% for relational constructs to -8.73% for the NEP construct. The mean response for the metaphoric construct was the only construct with increasing support between the pre- and post-workshop surveys (+3.59%).

*Table 3.6: Change in support for environmental value constructs*

	<b>Before</b>	<b>After</b>	<b>Difference</b>	<b>% Difference</b>
Total	3.866	3.660	-0.206	-5.33%
Metaphor	3.685	3.817	0.132	3.59%
Relational	4.210	4.181	-0.029	-0.68%
Intrinsic	3.967	3.733	-0.233	-5.88%
Instrumental	3.573	3.511	-0.062	-1.73%
NEP	3.667	3.347	-.320	-8.73%

To test the significance of changes in support for environmental value constructs, each individual survey item and the sub-set of questions representing each value construct were evaluated using the Wilcoxon signed-rank statistic. The hypothesis was tested at the 0.05 and 0.1 significance level. The results of the Wilcoxon signed rank statistic are illustrated in Annex A2, Figure 4. The analysis found that variation in pre- and post-workshop survey data for all but two survey items was insufficient to reject the null hypothesis, meaning any change was insignificant. Based on the Wilcoxon signed-rank statistic p-values, the change in pre- and post- survey responses were insignificant for all but two items. The difference in pre- and post-workshop survey responses was significant at the 0.05 significance level for the “Ecological catastrophe” item ( $p = 0.025$ ). The “Clean air and water” item ( $p = 0.059$ ) was significant at the 0.1 significance level. The ecological catastrophe item represents an NEP value construct. The “Clean air and water” item represents an instrumental value construct. Therefore, while support for the majority of individual environmental value constructs remained stable in the post-workshop survey, there was a minor increase in support for two environmental value survey items.

The same method was used to compare pre- and post-workshop survey results for the mean responses for each set of items representing a distinct value construct. The difference between pre- and post- survey results was found to be insignificant for all value constructs (intrinsic, instrumental, NEP, metaphor and relational) based on the Wilcoxon signed-rank statistic at the 0.05 significance level. Thus, there is no justification to reject the null hypothesis. Evidence that participation in the geodesign workshop in this case study increased participant support for pro-environmental values was limited to two individual survey items; thus, *there is insufficient support for the hypothesis (H5) that participation in the geodesign process increases participant support for pro-environmental values.*

#### *3.3.4 Scale of Environmental Agency Survey*

A third means to evaluate the utility of the geodesign process for critical research and action to overcome the value-action gap is by considering the relation between geodesign project scale and the scale of each participant's perceived environmental agency. Survey items pertaining to the scale of participants' perceived environmental agency were developed specifically for this research in order to evaluate the alignment between the scale of participant's perceived environmental agency and the scale of the geodesign process. The survey items relate to the responsibility/agency factor hypothesized to be of relevance for overcoming the value-action gap (Kollmuss & Agyeman, 2002).

Environmental agency is understood as “the power to act” in environmentally significant ways (Hannigan, 2006, p. 34). Lacking an objective measure for ‘the power

to act’, the survey measured participants’ beliefs regarding their perceived agency at multiple scales as well as the perceived utility of the geodesign project for addressing environmental challenges across a similar range of scales. The survey data was used to evaluate the alignment and change in participants’ beliefs regarding their perceived environmental agency as mediated by the geodesign process. The items used in the pre- and post-workshop surveys are shown in Table 3.7. Each set of questions used the same Likert-scale, ranging from 1 (no influence at all) to 5 (very influential).

*Table 3.7: Scale of Environmental Agency Survey Instrument*

<b>Theme</b>	<b>Survey Item</b>
Scale of perceived environmental agency: pre-survey	<p>Please rate how much you believe acting in the following ways allows you to influence your environment:</p> <ul style="list-style-type: none"> <li>a. Through my personal behavior at home</li> <li>b. Through the way I treat the land I use</li> <li>c. Through my relationships with friends and neighbors</li> <li>d. Through my participation at a community organization, church or association</li> <li>e. Through my involvement in government programs, policies or decisions</li> </ul>
Scale of perceived utility of geodesign process: post-survey	<p>I believe the geodesign process helps me influence the environment:</p> <ul style="list-style-type: none"> <li>a. Through my personal behavior at home</li> <li>b. Through the ways I treat the land I use</li> <li>c. Through my relationships with friends and neighbors</li> <li>d. Through my participation at a community organization, church or association</li> <li>e. Through my involvement in government programs, policies or decisions</li> </ul>

## *Results*

The scale of participants' perceived environmental agency was first assessed using the set of questions from the pre-survey. Descriptive statistics of the dataset provided a baseline from which to compare the perceived scale of participant environmental agency during the geodesign process. The post-workshop survey used the same set of questions to assess the scale of participants' perceived environmental agency while participating in the geodesign workshop. Data from both the pre- and post-workshop survey were then compared to assess the alignment between the scale of individual environmental agency and the scale of environmental agency of the geodesign process. The non-parametric Wilcoxon signed-rank statistic (Wilcoxon, 1945) was used to evaluate the significance of any differences between each individual's pre- and post-workshop survey responses to test the hypothesis: *H6- participation in the geodesign process increases the scale of perceived environmental agency.*

Results from the pre-workshop survey indicate that survey respondents perceive their environmental agency to have the greatest influence at the scale of their individual land use decisions and their participation in government programs, policies or decision-making processes. Environmental agency was ranked lowest at the scale of individual household behaviors and influence through civil society organizations. However, the differences between the perceived environmental agency at each scale were minor, and participants considered the influence of their environmental agency to be at least "moderately important," "important" or "very important" at all scales evaluated (*Table 3.8*).

*Table 3.8: Perceived Significance of Environmental Agency - Comparison of Scale*

	<b>Behavior at Home</b>	<b>Land use</b>	<b>Social Network</b>	<b>Civil Society</b>	<b>Public Sector</b>
Pre	3.800	4.267	4.133	3.800	4.267
Post	2.533	2.800	2.800	3.000	3.467
Difference	-1.267	-1.467	-1.333	-0.800	-0.800
% Difference	-33.3%	-34.4%	-32.3%	-21.1%	-18.8%

When compared to the pre-workshop survey, the results of the post-workshop survey indicate a decrease in the perceived influence of personal environmental agency at each scale. The gap between the pre- and post- survey perceptions of environmental agency was greatest at the scale of individual land use (-1.47), influence through personal social networks (-1.33) and personal behavior at home (-1.27). The gap between pre- and post-survey perceptions of environmental agency was lowest at scales requiring the greatest degree of structured collaboration: civil society and public sector participation. The scale with the highest perceived environmental agency in the pre-survey and the smallest gap in the post-survey was participation in the public sector.

Data from the pre- and post-workshop survey also allowed an indicative evaluation of the association between participation in the geodesign process and changes in the perceived scale of participants' environmental agency. Responses for each item on the pre- and post- surveys were evaluated using the Wilcoxon signed-rank statistic. The p-value for each item was computed and compared at the 0.05 significance level. P-values below the significance level suggest that the null hypothesis of no difference between pre-and post-survey data should be rejected.

The p-values for survey items corresponding to each of the five scales of perceived environmental agency were below the significance level; the null hypothesis

should be rejected in each case (Annex A2, Figure 5). However, in contrast to the hypothesized direction of change, the survey results indicate that the proposed alternate hypothesis that participation in the geodesign process increases the scale of perceived environmental agency should also be rejected. Survey data suggest that the geodesign process either limits the perceived influence of individual environmental agency or is not aligned with participants' expectations regarding the significance of their environmental agency through the geodesign process. Regardless of interpretation, the null hypothesis that there is no difference between perceived environmental agency in the pre- and post-survey must be rejected. *The results suggest that participants perceive the scale of their individual agency to be greater than the scale of their collective agency through the geodesign project.*

### *3.3.5 Open-Ended Responses and Follow-up Interviews*

Open-ended survey responses and follow-up interviews were used to complement and expand on survey data results. The post-workshop survey included two open-ended questions: one to allow respondents to identify any themes omitted from the geodesign workshop of relevance to participants and one to provide suggestions or feedback on the geodesign process. Similarly, the follow-up interviews sought feedback on the three survey themes described above as well as open-ended feedback regarding the geodesign process and outcome.

Open-ended survey results identified several themes which participants considered absent from the geodesign map and pre-populated data: crime, safety, and finance. These themes accord with the interests of municipal government representatives



in the project team, though anonymized data collection prevented the identification of respondents. In contrast, one respondent answered this question by stating that “low-income homeowners [were] not included in the participants,” thereby calling attention to the lack of representative participation and the impact this has on the quality of data used and produced in the geodesign process. In addition to recommending additional data and themes for geodesign maps, some survey respondents made general comments regarding geodesign technology. These ranged from ambiguous comments such as “better tech” to specific recommendations such as “make the map for the drawing a bigger area on the screen.”

Open-ended feedback in the post-workshop survey generally highlighted various levels of participant satisfaction with logistical characteristics of the geodesign workshop. The most common theme in survey responses concerned the duration of the geodesign workshop. While some participants stated “we just needed more time,” “more time to learn/practice software,” or “more time to design,” others said “9-4 was way too long. If you want stakeholders to come and stay – condense the schedule. My attention span was done by lunchtime.” However, others stated simply “2 ½ days” suggesting that much more time was needed to fully complete the process. These observations suggest that most participants felt a single day-long workshop was insufficient to fully complete the objective but that shorter periods of interaction would have produced more focused participation. One participant’s comment that the “process worked well [but] it’s important to be flexible with timing” was indicative of the need to adapt the workshop schedule based on participant objectives and capabilities.

A second reoccurring theme was the need for better instructions and orientation regarding the purpose of the geodesign process. Three different respondents requested “instructions on paper,” a “better explanation of the ultimate outcomes,” and a need for “repeating instructions,” respectively. Others noted that the “invitation was very intimidating as no one knew what geodesign was.” These responses suggest that more attention was necessary to provide contextual information and orientation through invitations or advance notice, while also providing clear instructions to reiterate the purpose of participant input at each step of the geodesign process.

Information from follow-up interviews was less prominent than anticipated. Nine workshop participants consented to participate in follow-up interviews and only four eventually made themselves available for interviews. Two interview participants were student facilitators, one was a local resident and one was a local government employee. Despite the small sample, the interview data supports and expands the findings of both the questionnaire data and open-ended survey responses. Prominent themes in the interview responses included duration and logistics of the geodesign workshop, the representativeness of participation, the overall objective and explanation of the purpose of the geodesign process, and the use of pre-populated data in the geodesign platform.

Interview participants made clear that the geodesign process implemented in the workshop was constrained by the available time: participants “needed more time” and “were busy” during the workshop. Another stated that “it was a long day and everyone was tired” while another noted that “there were a lot of things going on during the day... It took a lot of energy. We were all so busy.” Yet despite the general view that more time was needed, some respondents also suggested that it was unlikely for participants to

return for a multi-day workshop, with one suggesting it would not be worth the time: “I have to justify my time” ... “If I was invited back I wouldn’t attend because I couldn’t justify it” as a good use of time.

Despite the time constraints, interview respondents also noted several positive aspects regarding the geodesign process and workshop. One interviewee stated that the geodesign process “helped people learn from each other and recognize each other’s views”. Another confirmed: “there was a lot of interaction.” Comparing the geodesign workshop to other forms of public participation, one interviewee stated that the geodesign workshop was a “simple way to communicate with people’s ideas. Most of these meetings are serious, but here we actually talked as humans, not just the blah blah blah.” Yet when asked what they learned from other participants, the interviewee stated, “well that’s the thing, I wanted to hear what the neighbors had to say” suggesting the process did not afford opportunities to hear from local residents. Thus when questioned, several of these positive reflections gave rise to critique. When asked specifically about the representativeness of participation, one respondent stated that “most of the people don’t even live in that area,” suggesting that the focus on specific design ideas for the park was not well suited to the process as implemented or the actual participants. When asked how the process could achieve the goals as presented, the respondent stated that “I would start with who is there and what do they want in their community,” but “I feel like there are a bunch of steps in there that we just skipped over.”

Similar to open-ended survey responses, multiple interview respondents identified a need for more orientation and instruction during the geodesign workshop and a clearer description of the overall purpose and intended outcomes for the process. One stated: “I

liked the information that was presented, but honestly, I wasn't really sure what the purpose of it was. Even after I left, I wasn't sure what the purpose of it was." Another suggested the need for more robust description of the underlying data and technology. When asked about the quality of the data pre-populated in the geodesign software, the interviewee stated that "the [geodesign] systems should have been the main focus, not just glazed over. We should have known more detail. We needed to know how you came up with the systems... We need better information about the systems."

A final set of observations relate to the purpose of participatory planning in general rather than the geodesign process in particular. One of the government employee respondents stated: "I don't feel like there was enough pre-determined parameters" for the design process; this individual suggested that the participatory design process was too broad to result in any specific ideas the county could implement. The respondent wanted the geodesign process to focus on specific design ideas within pre-determined project parameters rather than brainstorming ideas that would not be feasible within the existing municipal development plan and budget. Other respondents addressed the purpose of participatory planning in different ways. One stated simply that "that's the thing with planners, they'll do what they're gonna do." One of the student facilitators responsible for using the geodesign process to inform their design proposals explained this view in more detail: "It was helpful for people to contribute their ideas. As designers, it was very helpful," suggesting that the participatory process was intended as an aid for the professional tasks of detailed design and planning.

### 3.4 Discussion

The results of the mixed-methods evaluation of the Edgewater Village Park geodesign project confirm the importance of participatory characteristics of geodesign but do so by identifying the deficiencies of participation in this project and the impact those deficiencies have on the outcome of the process. The results provide negative confirmation for each research question addressed in this chapter and show that the deficiencies in public participation prevented the expression of participant values and the possibility for effective collective action to overcome the value-action gap. The Edgewater Village Park geodesign project did not: meaningfully satisfy participant expectations regarding factors associated with the value-action gap, affect or facilitate the expression of participant's environmental beliefs or values, or increase the scale of environmental agency beyond the individual scale. Thus the geodesign project implemented here did not provide the 'people of the place' a means of overcoming the value-action gap. The following paragraphs interpret these results and their relevance for the overall research questions of this dissertation.

The results confirmed that the project met all but one category of participant satisfaction, but evaluation of all available data suggests that this finding does not indicate the implementation of the participatory characteristics of the geodesign framework and associated possibilities to overcome the value-action gap. The only category of satisfaction which the process did not satisfy, input to decision-makers, was the factor assumed to be of direct relevance to overcoming the value-action gap at scales beyond the individual level. Similarly, the indicator associated with value change and

expression showed no evidence that participants meaningfully engaged with or expressed their environmental values in anything but a cursory way.

Not only do these findings exemplify the value-action gap, they suggest that participants in the geodesign process are accustomed to the value-action gap. They were satisfied by a process which fails to overcome the value-action gap at the individual level and yet expressed concern that local government representatives did not appear likely to use the results of the process to implement the resulting plans. The geodesign process, as implemented in this project, reinforced participants' reliance on local government authorities to address the environmental challenges on which the process focused and did not facilitate critical learning or reconsideration of participants' existing values, beliefs or behaviors. Furthermore, the process assumed the accuracy and relevance of pre-populated maps, models and data. Yet it did not account for the place-based knowledge of the people of the place in the preparatory steps of project development.

Qualitative data from observation and participant interviews confirm the results of the hypothesis tests and suggest a causal explanation associated with the quality of the participatory process. Eleven of the sixteen completed post- surveys included responses to open-ended questions and four follow-up interviews were completed. None of the written responses to open-ended survey questions suggested that participants considered the process to have expressed their environmental values, beliefs or objectives, nor did any participant consider the geodesign process to have expanded their perceived environmental agency. Follow-up interviews provided similar information. One interviewee confirmed that the geodesign process "did not go that deep," explaining that participants were focused on completing the immediate tasks at hand and learning the

new technology rather than attempting to understand or express their environmental values. Other respondents suggested that while the geodesign process *could* be a suitable means to facilitate environmental value expression, participants were not cognizant of that possibility until asked during the interview and would not have suggested so otherwise. Instead, the most frequent observation from participants suggested the duration, format, and purpose of the geodesign process were too constrained for meaningful results.

Comparing the Edgewater Village Park geodesign project with the taxonomic characteristics of the geodesign framework described in Chapter 2 explains why these deficiencies in public participation resulted in the negative substantive outcomes with respect to research questions 3.1, 3.2 and 3.3. Public participation in this project was indirect, relying on unaccountable representatives of neighboring residents and park users. Furthermore, indirect participation by stakeholder representatives was limited to a single opportunity at one step of the geodesign process, as opposed to the continuous and collaborative role of the ‘people of the place’ envisioned by the geodesign framework. The geodesign workshop was the only opportunity for public participation, and, based on exit interviews and researcher observation, participants were primarily focused on learning to use the geodesign technology and how to participate in the highly structured process. These characteristics prevented participants from engaging at a deeper level to advocate for their own interests, express their own values, and take advantage of the pedagogical opportunity or reconsider preexisting beliefs regarding their environmental agency.

The lack of clarity on the applied purpose of the project was another major deficiency in this project and prevented participants from meaningfully engaging with place-based knowledge or values because they were not invested in the process or results. While the geodesign workshop did achieve the goal of facilitating stakeholder consensus on a conceptual design for the redevelopment of the park, the outcome is considered hypothetical. This was compounded by uncertainty among workshop participants regarding the extent to which the design concepts would be utilized by the county. The use of hypothetical interests during group work was not a weakness in the workshop process itself; dividing participants into hypothetical stakeholder groups allows participants to freely brainstorm and empathize with perspectives they may not share. The benefits of the participatory activities, however, were counteracted by the lack of representation among participants, the lack of an applied purpose, and the limitation of public participation to a single phase in the geodesign workshop.

County representatives did not inform workshop participants regarding how the outcomes of the geodesign process would be used to inform the actual park redevelopment process. This diminished the potential continuity between the scoping-phase of the design process completed during the geodesign workshop and subsequent phases of detailed design and project implementation. This also appeared to reduce stakeholder satisfaction with the project outcome given their uncertainty regarding whether their time was well-spent and whether their views would lead to tangible action by the county. While the GeodesignHub platform includes tools to help project planners budget and schedule for project implementation, thereby resolving these concerns, it was



unclear if or how county planners were interested in these tools or their willingness to utilize them in the future.

### 3.5 Conclusion

This project achieved several basic outcomes expected of geodesign projects: it resulted in proposed concepts for potential park redevelopment planning, facilitated public participation in the design process, and introduced participants to the geodesign process. Perhaps its greatest positive outcome was its utility as an educational experience for UMD student-facilitators and county planners on the design team. Yet based on all other outcomes evaluating the expression of place-based values to overcome the value-action gap, this project failed. There was no increase in the scale of participants' perceived environmental agency, no discernable engagement or expression of place-based values, and minimal evidence of satisfaction with elements of participatory geodesign hypothesized to overcome the value-action gap. The case study presented in this chapter is therefore instructive in that it shows how deficiencies in the participatory characteristics of geodesign practice prevent critical learning and action outcomes and limit the applied benefits of the geodesign framework for overcoming the value-action gap.

Though the overall conclusion of this individual project overwhelmingly confirms the lack of meaningful public participation and the resulting outcomes, it also suggests ways to improve geodesign practice to make such critical research and action possible. Indeed, the case study provides provisional support for the theoretical possibilities of the geodesign framework for participatory action research and collective action, though those possibilities were not realized in this case. With respect to the scale of participants'

environmental agency, comparison of the pre- and post-workshop surveys indicate a decrease in the perceived influence of personal environmental agency at each scale, suggesting a mismatch between participants' perceived environmental agency and the suitability of the geodesign process to express that environmental agency at varying scales. However, the scale with the highest perceived environmental agency in the pre-survey and the smallest gap in the post-survey was participation in the public sector, suggesting that the geodesign process is most suited for design challenges requiring collaborative planning beyond the control of individual behavior. If deficiencies in the public participation process in this geodesign project were improved by ensuring collaborative, continuous, and direct participation of the people of the place, coupled with a clear pathway to achieve the applied objective, more significant applied outcomes could have been realized, leading to larger impact beyond the individual scale.

With respect to the expression of environmental values, comparison of pre- and post-workshop survey data found a significant increase in support for two environmental value items, though support for other environmental value items and constructs remained unchanged. The environmental value construct with the highest support among geodesign participants was the relational construct for environmental values, giving reason to consider the importance of relational aspects of sense-of-place values in geodesign practice. Reliance only on instrumental environmental values in the geodesign process or evaluation models, for example, could limit the suitability of the geodesign framework in contexts where participants identify with other constructs of environmental values. It could also imply that geodesign practice is more amenable to the expression of some value constructs over others. Yet the participatory characteristics of the geodesign

framework, if fully implemented, would overcome this deficiency by allowing participants to identify their own objectives, assemble the necessary data, determine the most appropriate models and decision-making methods, and conduct the geodesign process accordingly.

These conclusions are explained by the constraints on public participation throughout the process. The participatory characteristics of the geodesign framework of relevance for overcoming the value-action gap were not present in this project. Participants were not meaningfully included in each iteration of the geodesign questions. The duration of participation was limited. The input from participants had no direct application beyond the hypothetical workshop setting. And the indirect form of representation limited substantive engagement between the design process and the values, objectives and perspectives of the ‘people of the place.’ While the deficiencies in the participatory characteristics of this geodesign project explain why this individual case failed to show geodesign’s utility for overcoming the value-action gap, the deficiencies were due to project implementation rather than the geodesign framework itself. Geodesign practice with more robust participatory characteristics could therefore offer different results. To continue to evaluate these research questions, the next chapter provides a second case study in which the role of the ‘people of the place’ is greatly expanded and the project is evaluated through participatory research methods.

## Chapter 4: Geodesign as Participatory Action Research

### 4.1 Introduction

As both a process and a framework, geodesign emphasizes the need for iterative public participation in environmental design and planning (Steinitz, 2012). As shown in Chapters 1 and 2, the geodesign framework's participatory and integrative structure is the primary means through which geodesign facilitates the identification and incorporation of diverse theories, methods and place-based knowledge necessary to address participants' design objectives. Yet the results of each preceding chapter indicate that current geodesign practice often lacks the reflexivity and public participation envisioned by the geodesign framework. These deficiencies explain the inconsistent participatory outcomes of current geodesign practice and limit the extent to which the geodesign framework can be used to overcome the value-action gap (Chapter 3). By evaluating these deficiencies, the preceding chapters identify multiple opportunities to increase the alignment between the geodesign framework and current practice and thereby seek the development of 'a more critical geodesign' (Wilson, 2015).

Given that the aim of critical evaluation is to improve practice, this chapter builds on the results of the preceding chapters and proposes an approach to geodesign practice more fully aligned with the geodesign framework's participatory characteristics. This approach, referred to as geodesign-as-Participatory Action Research (geodesign-as-PAR), redoubles the participatory characteristics of the first phase of geodesign practice by critically evaluating place-based themes of relevance for structuring the subsequent stages of the participatory planning processes. A case study concerning the development

of a buffer area management plan around an 850-acre State Park along the Chesapeake Bay in St. Mary's County, MD, shows how the approach achieves these participatory objectives.

The chapter is structured not only to propose and describe the geodesign-as-PAR approach but to test and evaluate that method in an applied geodesign case study. Following a brief review of the participatory characteristics of the geodesign framework, the first section explains how participatory action research methods can improve the participatory characteristics of the first phase of the geodesign process. The second section introduces the case study and the 'geodesign-as-PAR' research method used in this chapter. The third section describes the results of the iterative reflection and action phases of the geodesign-as-PAR case study, and the concluding sections discuss the case study research findings and their significance for future application of the geodesign-as-PAR method.

## 4.2 Review

### *4.2.1 Participatory Geodesign- Concepts and Structure*

Scholarship on the geodesign framework and current practice suggests that geodesign's distinctiveness compared to other design approaches is due primarily to: i.) its dynamic integration of the geographical sciences with creative design practices, and ii.) the iterative participatory structure which accounts for the diversity of theories, methods and place-based knowledge contributed by participants in the design process (Foster, 2016; cf. Ch 2). Geodesign proponents argue that these distinctions also make geodesign practice uniquely effective (e.g. Abukhater & Walker, 2010; McElvaney, 2012; Steinitz, 2012). Yet, despite the emphasis on geodesign's integrative technological

capacity, geodesign literature has shown minimal attention to the distinctive participatory characteristics of the geodesign framework and their contribution to geodesign's promised effectiveness (Chapter 2).

As previous chapters show, a primary reason for the inconsistent participatory outcomes of current geodesign practice is the constrained nature of public participation in the first phase of the geodesign process. The objective of the first iteration through the Steinitz (2012) geodesign framework is to “answer the why questions” (p. 35) regarding the purpose and scope of the geodesign process. During this phase, participants work together to articulate the design challenge, establish the project boundaries, determine the administrative parameters of the design process, and prioritize the thematic content to include in the representation model and associated questions in the geodesign framework. The answers to these questions all depend on ‘why’ participants are seeking to conduct the planning process in the first place. As such, *Table 4.1* lists a sample of geographic issues accounted for by the Steinitz geodesign framework associated with each question and model.

Participants consider these geographic issues in their reflection on each question, though not necessarily in a linear sequence, during the scoping phase. The diversity of geographic themes accounted for during this scoping phase facilitates consideration of a range of theories, methods and place-based knowledge of relevance for the design process. A lack of public participation in the first phase of the geodesign process would therefore constrain the effectiveness of public participation in each successive phase as well. Without opportunities for participatory input in the first phase of the geodesign process, participants have no means to ensure the structure and methodology for the

design process are aligned with their place-based knowledge, values and design objectives.

*Table 4.1: Geographic Themes in Geodesign Framework Questions*

1.How should the study area be described in content, space and time?	-> Representation models
<ul style="list-style-type: none"> <li>• What is the area’s physical, economic, and social geography?</li> <li>• What is its physical, economic, and social history?</li> </ul>	
2.How does the study area operate?	-> Process models
<ul style="list-style-type: none"> <li>• What are the area’s major physical, ecological and human geographical processes?</li> <li>• How are they linked to each other?</li> </ul>	
3.Is the current study area working well?	-> Evaluation models
<ul style="list-style-type: none"> <li>• Are there current environmental and other “problems” in the area?</li> <li>• Are there groups with differing views on these questions?</li> </ul>	
4.How might the study area be altered?	-> Change models
<ul style="list-style-type: none"> <li>• What major changes are foreseen for the region?</li> <li>• Are the pressures for change coming from the inside or outside?</li> </ul>	
5.What differences might the changes cause?	-> Impact models
<ul style="list-style-type: none"> <li>• In which ways are foreseen changes seen as beneficial or harmful?</li> <li>• Are these impacts seen as serious? As irreversible?</li> </ul>	
6.How should the study area be changed?	-> Decision models
<ul style="list-style-type: none"> <li>• Who are the major stakeholders? Are they from the public or private sector?</li> <li>• Are peoples’ “positions” known? Are they in conflict?</li> </ul>	

(Steinitz, 2012, p. 36-39)

The geodesign framework describes the importance of public participation in each stage of the design process. Steinitz states that “collaboration among the participants is a key and fundamental characteristic of a geodesign study, and it must be coordinated from the beginning” (2012, p. 35). Despite the geodesign framework’s emphasis on early-stage participatory input, geodesign literature has largely overlooked the need for methodological and conceptual approaches to implementing the full scope of the geodesign framework’s participatory characteristics. As a result, public participation,

especially in the first phase of the geodesign process, appears to be constrained by financial, administrative, logistical, and political factors, among others, leading to the imposed steps of the design process (see Chapter 3).

The structural constraints to participatory geodesign practice are compounded by the typical mode of geodesign project development and implementation. Under the predominant approach to project implementation, a convening entity, typically a government agency or research institution, hires a design team to facilitate the design process. The convening entity identifies a design problem to be addressed through a geodesign approach and is responsible for funding the project and determining its administrative parameters. The design team, in coordination with the client, identifies the relevant community stakeholders and decision-makers, determines their role in the geodesign process, and proceeds to establish the structure and methods for the geodesign study. The convening entity (e.g., the ‘client’) then works with the design team to achieve the stated goals of the design process within predetermined administrative parameters.

The relationships between the client, community, and design team in this common mode of geodesign practice deviates from the participatory assumptions of the geodesign framework; it presents a contrast between design ‘done by’ and design ‘done for’ the ‘people of the place’ (Schwarz-von Raumer & Stokman (2012)). In contrast to the participatory structure of the Steinitz (2012) geodesign framework, the convening entity and design team often complete the first phase of the geodesign process with minimal input from the ‘people of the place’. This mode of geodesign practice often defaults to a predetermined structure using data and methods which may not account for community participants’ environmental values and design objectives. While this form of practice is



often viewed as necessary in larger projects (cf. Ch 2), such practice jeopardizes the distinctive participatory characteristics and promised effectiveness of geodesign practice.

An alternative to the standard mode of geodesign practice would seek the full implementation of the geodesign framework's participatory characteristics, beginning in the scoping phase. This would inevitably extend the duration of the scoping phase and would require different relationships between client, community and design team. Yet the approach would show greater alignment with the participatory intent of the geodesign framework and have a higher likelihood of achieving the promised effectiveness of geodesign practice. More importantly, such an approach would require all participants to commit to the participatory development of the design process without the ability to control the process or default to predetermined design methodologies. Despite calls for 'a more critical geodesign' (Wilson, 2015) which implements the participatory principles in the Steinitz (2012) geodesign framework, current scholarship has yet to demonstrate or evaluate the feasibility of such an approach.

#### *4.2.2 Principles for a More Critical Geodesign*

Given the need for a more participatory approach to geodesign practice, and the lack of research evaluating participatory geodesign in practice, the following section considers how the use of participatory action research principles during the first phase of the geodesign process could facilitate a more critical approach to geodesign practice. Geodesign literature has considered the relation between the geodesign framework and design theory (Foster, 2016; Hollstein, 2019), human-environment systems (Gu et al., 2018), critical geography (Wilson, 2015; Trouillet, 2019), and new directions in geodesign practice (Ervin, 2016). Considering the relation between the participatory

action research tradition and the participatory characteristics of the geodesign framework provides a similar means to improve the participatory characteristics of geodesign practice.

Participatory action research (PAR) is:

*research which involves all relevant parties in actively examining together current action (which they experience as problematic) in order to change and improve it. They do this by critically reflecting on the historical, political, cultural, economic, geographic and other contexts which make sense of it (Wadsworth, 1998).*

There is conceptual alignment between multiple aspects of the participatory structure of the geodesign framework and the participatory characteristics of PAR, yet current geodesign would benefit from the incorporation of PAR methods in practice. PAR and geodesign both involve iterative processes to identify and structure knowledge for applied purposes. The two approaches rely on the participation of relevant stakeholders rather than defer to external researchers or decision-makers, and both approaches encourage consideration of opposing views and diverse forms of knowledge. In contrast to participatory geodesign practice, however, PAR methods are field-tested and have been applied in human geography research on topics such as participatory GIS and environmental management (e.g., Elwood, 2006), GIS and geography education (Elwood, 2009; Pain et al., 2013), gender relations and infectious disease transmission (Kesby, 2000), immigration (Cahill, 2010), and community economic identity (Cameron & Gibson, 2005), among others. Accounting for these features of PAR in geodesign practice represents a potential source of innovation to more fully achieve the geodesign framework's participatory potential.

In addition to implementing the full scope of the participatory characteristics of the geodesign framework, ‘a more critical geodesign’ also requires reflexivity and critical examination of the geodesign process (cf. Rose, 1997; Kobayashi, 2003). The combination of geodesign and participatory action research provides a means to do so. PAR techniques emphasize reflexivity as a primary means by which participants evaluate and apply knowledge gained through participatory research. Kindon et al. (2007) emphasize that “reflexivity and self-change” are essential characteristics of participatory action research (p. 13). The geodesign framework, if fully implemented, implicitly shares these characteristics but expands the scope of reflexive consideration. It encompasses the coupled human-environment context of the study area and the process through which the design study is conducted. The iterative steps of the geodesign framework prompt participants to reflexively consider the study area and provides a frame through which participants can reflect on the place-based aspects of environmental challenges to identify appropriate ways to structure the design process. These participatory possibilities, however, are often overlooked during the standard scoping phase of current geodesign practice. They can be incorporated using the geodesign-as-PAR method proposed below.

#### *4.2.3 Geodesign-as-PAR*

In contrast to current models of geodesign practice, the geodesign-as-PAR approach uses the principles and methods of participatory action research to implement the participatory characteristics of the first phase of the geodesign framework. The approach uses these participatory methods to critically evaluate themes of relevance for answering the scoping phase geodesign questions and determining the structure of the subsequent steps of the geodesign process. The approach applies to the first phase of the

geodesign process in recognition of public participation in the scoping phase of the geodesign framework. The geodesign-as-PAR approach is therefore: i.) collaborative, considering the people of the place as co-instigators, collaborators and participants in the design process; ii.) applied, considering not only pragmatic design challenges but also actions to address structural constraints necessary for implementing the design process; and iii) reflexive, considering the diversity of theories, methods, and place-based knowledge through which participants address the design challenge.

While geodesign-as-PAR uses the Steinitz (2012) geodesign framework and reinforces its participatory characteristics, it differs from current geodesign practice in its iterative pattern of reflection and action between the first and second phases of the standard geodesign process. The scoping phase allows participants to reflect on any theme of relevance for the design process using the geodesign questions to frame their critical reflection. Based on this reflection, the approach then facilitates an action step during which participants determine the structure for the subsequent phases of the geodesign process in accordance with their place-based knowledge, values and design objectives. The geodesign-as-PAR approach draws on the reflexivity and action-research principles of PAR to facilitate this critical reflection and action during the scoping phase of the geodesign process.

Once this action step of the first stage of the geodesign-as-PAR process is complete, the second and third phases of the geodesign process proceed according to the standard model of participatory geodesign practice. Representatives of the geographic sciences, design professions, technologists and ‘the people of the place’ collaborate iteratively over the course of the geodesign project to specify the design models and

methods and implement the design process. The geodesign-as-PAR approach therefore proceeds as described by Steinitz (2012) geodesign framework while ensuring the full scope of its participatory characteristics is implemented in practice.

### 4.3 Methods

A participatory geodesign project was initiated and subsequently evaluated using the geodesign-as-PAR approach. The methods section is divided in two parts to contrast the initial stage of current forms of geodesign practice with the geodesign-as-PAR approach proposed in this Chapter. Similarly, the case study results are described in two parts: the first concerning initial stage of the geodesign process and the second concerning the restructuring of that process using the geodesign-as-PAR method described below.

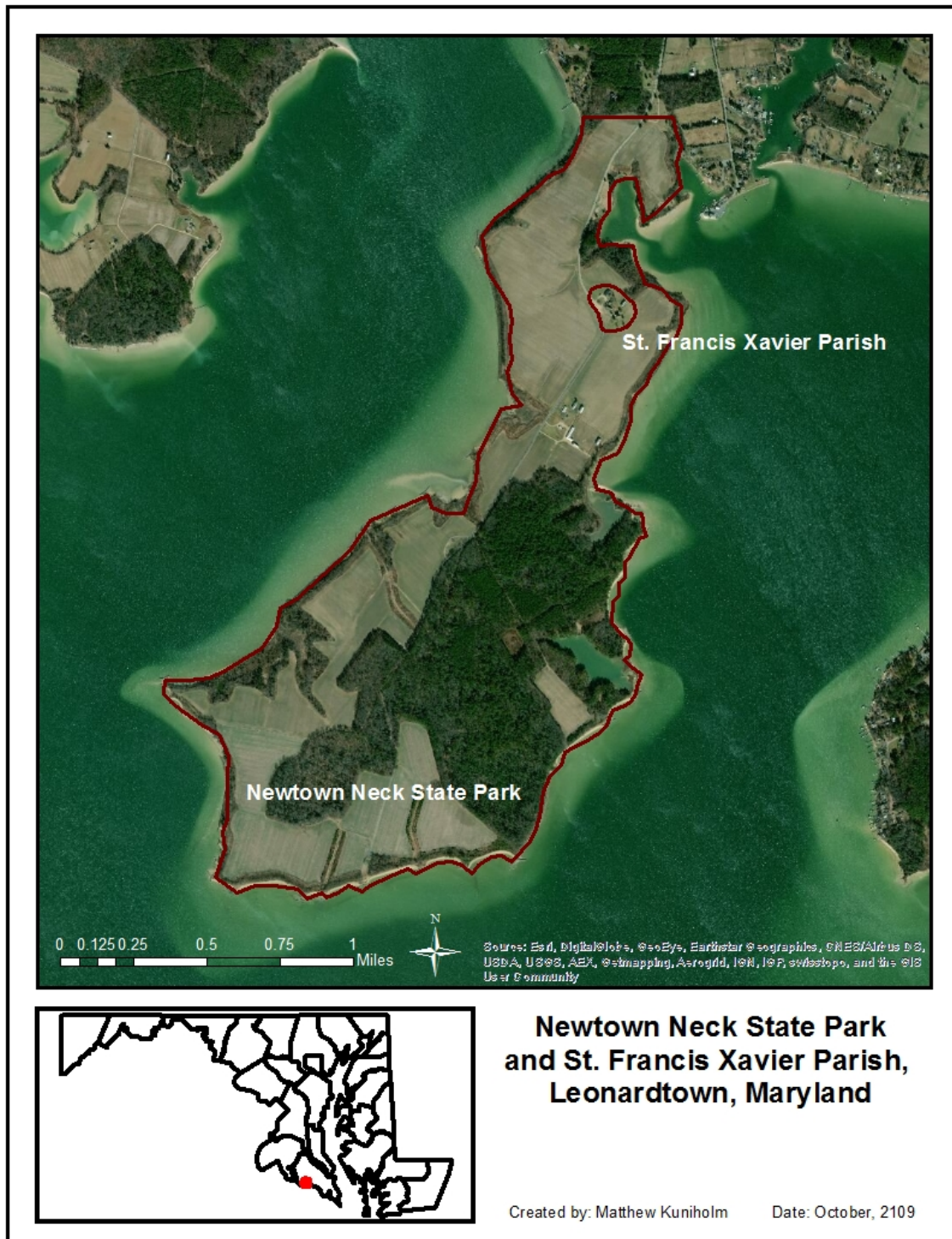
#### *4.3.1 Case Study Part 1 – Site Selection and Preparation*

The case study concerned the development of the 850-acre Newtown Neck State Park and buffer area surrounding St. Francis Xavier Church in St. Mary's County, MD (*Figure 4.1*). The case study site was identified through a year-long process of background research, site investigations, and discussions with potential project participants. The site was purposefully selected (Cresswell, 2013, p. 100) using the following criteria: a.) feasibility for completing the geodesign project within the constraints of the dissertation timeline, b.) accessibility and proximity to the University of Maryland; c.) availability of willing research participants actively seeking to participate in collaborative land-management; d.) intention to implement a participatory environmental planning process; and e.) community willingness to work with the

GoodLands organization, a recently formed non-profit organization which uses the geodesign approach to assist Catholic-owned properties increase the environmental and social benefits of their resources through participatory planning (Goodlands, 2018).

These criteria were necessary to identify a project site and stakeholders willing to implement a geodesign process using a participatory alternative to the standard form of geodesign practice described above.

Figure 4.1: Geodesign Case Study 2: Newtown Neck, St. Mary's County, MD. The geodesign project study area, encompassing the entire park, is designated in red.



The selected site encompasses land surrounding the present location of the St. Francis Xavier Church in Leonardtown, Maryland, which has been used to develop the Newtown Neck State Park (Figure 4.1). Still an active Parish within the Archdiocese of Washington, the St. Francis Xavier Church was founded in 1640 and is among the oldest Catholic churches founded among the 13 colonies (St. Francis Xavier Church, 2018). Catholic-affiliated entities owned the entire parcel until 2009, when the land surrounding the church was sold to the State of Maryland to develop Newtown Neck State Park (Maryland Park Service, 2016). The park was designated in 2014 and the Maryland Department of Natural Resources conducted an initial park planning process in 2016 to establish an administrative and environmental management plan (Maryland Park Service, 2016). The plan identified the need to develop an additional ‘buffer area management plan’ in partnership with the St. Francis Xavier Parish to resolve ongoing disagreements regarding the use and management of the area between the church property and the park.

Meanwhile, a land and facilities management committee of St. Francis Xavier Church, known as the Manor House Committee, was exploring opportunities to use the parish-owned land encompassed by the park for environmental management, cultural and historic preservation. At the start of this research project, the Manor House Committee was considering the need for a participatory planning process to establish the buffer area management plan and achieve their design objectives for the area between the church property and the park. The site met all the case study selection criteria and appeared to be a suitable context for a participatory geodesign project in collaboration with the GoodLand organization, the ‘Manor House Committee,’ and the Maryland Park Service.



Several guiding principles were established to structure the project and facilitate initial participation. Prior to starting the project, individual community representatives were identified and consulted to confirm their interest in pursuing this project. The research project also received approval from relevant authorities from St. Francis Xavier Church, without whose endorsement the project would not have been possible, and the methods were approved by the University of Maryland Institutional Review Board. At the outset, it was also evident that the potential duration of the project could be constrained by the anticipated timeline of the Ph.D. research program; the involved participants understood this constraint and decided to undertake the project regardless of how it might fit into the dissertation research timeline. These guiding principles were essential for establishing commitment and rapport among project collaborators.

#### 4.3.2 Case Study Part 2 – Geodesign-as-PAR

The geodesign-as-PAR method was applied to the participatory geodesign case study described above. The method proceeded according to the principles introduced in *Section 4.2.3*. Data was collected through meetings, workshops, and interviews conducted during the activities associated with the Case Study - Part 1 (*Table 4.2*). Social activities unrelated to the project were also helpful to build relationships between project collaborators but are not listed as formal scoping activities.

*Table 4.2: Data Sources and Activities- Newtown Neck*

<b>Date</b>	<b>Source/Activity</b>	<b>Summary</b>
Apr - May, 2016	Introduction and follow-up emails and phone calls with GoodLands organization	<ul style="list-style-type: none"> <li>• Introduced research interest and discussed partnership opportunities for participatory geodesign project</li> <li>• Agreed to search of potential participatory geodesign project sites</li> </ul>

July 15, 2016	Meeting with GoodLands organization	<ul style="list-style-type: none"> <li>• Meeting to discuss participatory research and geodesign project opportunities</li> <li>• Shared a draft research proposal</li> </ul>
Aug 15, 2016	Correspondence with Goodlands organization	<ul style="list-style-type: none"> <li>• Email and telephone call exchange to discuss changing priorities and availability of Goodlands organization; emphasis on developing a pipeline of projects and creating a software platform for future project use</li> </ul>
Sept – Oct, 2016	Search for participatory geodesign project site	<ul style="list-style-type: none"> <li>• Search included internet, newspaper and literature review; site visit to potential project location at Newtown Neck State Park; discussions with key informants; and proposal of Newtown Neck site to GoodLands organization</li> <li>• Confirmed Goodlands organization’s willingness to facilitate potential participatory geodesign project at Newtown Neck State Park if participants were interested</li> </ul>
Nov 4, 2017	Interview with Priest 1 – from neighboring parish	<ul style="list-style-type: none"> <li>• Context of Catholic Church in Southern Maryland</li> <li>• Environmental management and conservation issues on Catholic property in Southern Maryland</li> <li>• Summary of local parishes and priests, including interest in environmental conservation and planning</li> </ul>
Nov 5, 2017	Introduction with Priest 2 – from St. Francis Xavier	<ul style="list-style-type: none"> <li>• Informal introduction with Priest at St. Francis Xavier; established mutual interest in discussion more about the research project and potential collaboration</li> </ul>
Nov 15, 2017	Phone interview with Priest 2 – from St. Francis Xavier	<ul style="list-style-type: none"> <li>• Scheduled interview with Priest at St. Francis Xavier to explain research interest and consider opportunities for participatory environmental planning / geodesign project</li> </ul>
Jan – May, 2018	Background research on Newtown Neck State Park	<ul style="list-style-type: none"> <li>• Background research included literature review, site visits to Newtown Neck State Park and surrounding areas, and identification of key informants.</li> </ul>
Apr 18, 2018	Email correspondence with Priest 2 – from St. Francis Xavier	<ul style="list-style-type: none"> <li>• Confirmed the Goodlands organization’s willingness to participate as geodesign project facilitator (see attached project summary brochure shared Apr 18, 2017)</li> </ul>
June 6, 2018	Meeting with Priest 2 – at St. Francis Xavier parish office	<ul style="list-style-type: none"> <li>• Reviewed project goals and potential role of Goodlands organization’s as geodesign project facilitator</li> <li>• Received approval to begin working with Manor House Committee as primary contacts for the project</li> <li>• Priest 2 provided contact information for committee members.</li> </ul>

June 11, 2018	Meeting with Goodlands organization staff	<ul style="list-style-type: none"> <li>• Discussed geodesign project opportunity at Newtown Neck State Park/ St. Francis Xavier Church</li> <li>• Reviewed proposed research and facilitation methodology</li> </ul>
Aug 3, 2018	Interview with Manor House Committee chairman	<ul style="list-style-type: none"> <li>• Introduction and summary of research interests</li> <li>• Introduction to the Manor House Committee (objective, membership, history, current and future activities, etc)</li> <li>• Detailed conversation of history of Newtown Neck and St. Francis Xavier Church</li> <li>• Received contact information for more key informants involved in the Manor House Committee</li> </ul>
Sept 27, 2018	Manor House Committee Meeting	<ul style="list-style-type: none"> <li>• Participated in monthly Manor House Committee meeting to introduce research interest, meet committee members, and discuss interest in participatory planning / geodesign project</li> <li>• Confirmed committee's willingness for my participation and research as part of committee's ongoing work</li> </ul>
Nov 29, 2018	Manor House Committee Meeting	<ul style="list-style-type: none"> <li>• Participated in monthly Manor House Committee; agenda included regular business of the committee such as planning fundraising activities, sharing updates on parish and Archdiocese of Washington D.C. planning initiatives, and planning future events</li> </ul>
Dec 5, 2018	Manor House Committee Meeting	<ul style="list-style-type: none"> <li>• Participated in manor house committee meeting which included the following agenda items, among others: opportunity for participatory planning process led by an architectural firm appointed by Archdiocese of Washington D.C.,</li> </ul>
Jan 24, 2019	Maryland Province Archives research (Georgetown University Library)	<ul style="list-style-type: none"> <li>• Visited Maryland Province Archives to review 'Newtown Ledger' – a collection of day-books kept by Jesuit residents of Newtown Neck</li> </ul>
Feb 9, 2019	Design Charrette	<ul style="list-style-type: none"> <li>• Participated in design charrette led by the architectural firm's team hired by the Archdiocese of Washington D.C. and facilitated by the Manor House Committee</li> <li>• Agenda of the workshop included: introduction to project and workshop; presentation of Newtown Neck/St. Francis Xavier History (provided by the chairman of the Manor House Committee); presentation regarding historic preservation and applicable design regulations; instruction to and completion of participatory design activities (group brainstorming, idea presentation, discussion); summary of workshop outcomes and next steps</li> </ul>

Feb 24, 2019	Manor House Committee presentation “From Georgetown to Newtown”	<ul style="list-style-type: none"> <li>• Attended Manor House Committee presentation, part of a speaker series commemorating the 350th anniversary of St. Francis Xavier</li> <li>• Title of the talk was “From Newtown to Georgetown: Connections and Legacies,” which focused on the contested history of St. Francis Xavier and slavery in the colonial Catholic church in Southern Maryland</li> </ul>
Feb 25, 2019	Manor House Committee meeting	<ul style="list-style-type: none"> <li>• Participated in manor house committee meeting which included the following agenda items, among others: participant perceptions of the design charrette, next steps in design process, fundraising opportunities to support design and project implementation</li> <li>• The committee began to prioritize activity on the manor house preservation within their control (site maintenance, house maintenance) due to uncertain outcome of the participatory design process and funding availability</li> </ul>
June 9, 2019	Manor House Committee Meeting	<ul style="list-style-type: none"> <li>• Committee meeting in which a proposal for a second design charrette was discussed and ultimately rejected (or at least postponed at the time of this writing) because the level of support from the Archdiocese of Washington was not known, previous participants felt they had shared all they could without positive response, and the committee was still waiting for the design report from the first charrette.</li> </ul>

#### 4.4 Case Study Results

The following sections describe the results of Parts 1 and 2 of the participatory geodesign project. The results of the ‘action’ and ‘reflection’ components of the iterative geodesign-as-PAR process are described in separate subsections. The results of the geodesign case study (Part 1) are described in the first sub-section; these results represent the ‘proximate outcomes’ of participatory geodesign discussed fully in *Section 4.5* while also representing the first ‘action step’ of the geodesign-as-PAR process (Part 2). The results of three examples of the reflection stage of the geodesign-as-PAR process are then provided; each subsection reflects on participant’s experience in three previous participatory planning processes and explain how such reflection contributes to effective

participation during the geodesign process. The final section describes the results of the action stage which concludes the geodesign-as-PAR process and identifies the participatory characteristics necessary for successful implementation of the remaining phases of the geodesign process.

#### *4.4.1 Part 1 Results – Geodesign Project Initiation*

The scoping phase of the participatory geodesign project began in 2017, a year after the Newtown Neck Park Plan was established and approximately a year after initiating the participatory aspects of project set-up. Following the lengthy process of establishing relationships and determining the project’s guiding principles, the project proceeded to address the geodesign scoping phase questions (*Table 4.1*). Participant responses indicated contrasting views between the primary stakeholder groups. The ‘people of the place’ were interested in pursuing a design process to conserve the historical and cultural value of the place while also accommodating environmental management and park administration objectives. The community participants defined the study area boundaries to encompass the buffer area between the park and the church, but with emphasis on the areas within the jurisdiction of the Archdiocese of Washington DC. Most importantly, community participants emphasized the historical and cultural significance of the land and buildings at the site and the need to incorporate these themes in the planning process and resulting design proposal.

In contrast, representatives of the Archdiocese of Washington D.C. and the Maryland Park Service expressed thematic interests in pragmatic management concerns. The Archdiocese of Washington D.C. stressed the importance of reducing maintenance costs and financial liability of church facilities, with little interest in the environmental or

historic themes prioritized by community members. For their part, the Maryland Park Service emphasized the need to balance environmental, recreational, and cultural uses for the park and buffer area but were unable to facilitate a design process in which the project boundaries were exclusively focused on church land or facilities.

Diverging interests between stakeholder groups is to be expected throughout the planning process. Yet the active participation of the ‘people of the place’ during the scoping phase identified a complicating factor which jeopardized the participatory process from the start: neither the St. Francis Xavier Parish nor the Manor House Committee had permission from the Archdiocese of Washington D.C. to conduct a geodesign process or the authority to implement any resulting design. Scoping phase questions regarding the geodesign ‘decision model’ were therefore the most problematic for the ‘people of the place’ during the first phase of this geodesign process given the perception that their contribution would ultimately be futile. Thus while members of the Manor House Committee were interested in the geodesign process and potential support from the GoodLands organization, they were hesitant to implement the subsequent phases of the geodesign project due to the lack of support from the Archdiocese of Washington D.C. and the likelihood that the process would ultimately be unsatisfying.

Given that the current model of participatory geodesign practice offers no methods to address structural factors that prevent the implementation of effective geodesign projects, the ‘people of the place’ defaulted to an alternative form of standard design practice. Instead of conducting the subsequent phases of the geodesign process, the St. Francis Xavier Church and Manor House Committee sought to incorporate their design objectives into an ongoing project supported and controlled by the Archdiocese of

Washington D.C. to develop an architectural feasibility plan for the preservation and management of the Manor House and surrounding land. Rather than risk complicating this effort with a separate land management and geodesign project, the project collaborators agreed that it would be more feasible to focus on a single process and attempt to integrate any environmental or land management concerns into that process. The geodesign process was therefore suspended and the participants attempted to address their environmental design objectives through the diocesan-led architectural study.

#### *4.4.2 Part 2 Results – Geodesign-as-PAR*

The following sections reframe the Newtown Neck State Park participatory geodesign case study as an iterative example of the geodesign-as-PAR approach. While the geodesign-as-PAR approach can account for any thematic area of relevance to the ‘people of the place,’ this section focuses on a single thematic element of place-based knowledge prioritized by the people of the place: the expression of environmental values in participatory design processes. This theme was identified by participants in Part 1 of the geodesign case described above, but neither the standard mode of geodesign practice nor the attempted participatory process described above sufficiently accounted for its relevance in the design process. The following subsections are therefore considered Part 2 of the geodesign project introduced above.

The geodesign-as-PAR case study format differs from standard geodesign case studies due to its thematic rather than procedural and technological focus. The format uses the questions in the first iteration of the geodesign framework to structure the critical evaluation of place-based themes of relevance for the design process. The first section describes the historical context necessary to understand the thematic focus on

environmental value expression evaluated in this geodesign-as-PAR process. The three subsequent sections show how the geodesign-as-PAR approach facilitates critical evaluation of this theme and its relevance for achieving the design objectives of the ‘people of the place’ in subsequent phases of the geodesign process.

#### *4.4.2 Reflection 1: Place-Based Knowledge of Environmental Value Expression*

Places such as Newtown Neck State Park, where this case study is located, are connected in time and space to a broader and deeper context than typically considered in geodesign projects (cf. Kolen et al., 2014). Human geography research on participatory planning, however, shows the importance of ‘thick’ descriptions of both time and place (e.g., Williams & Patterson, 1996; Boland & Zhu, 2012; McMichael & Katonivualiku, 2020). The geodesign-as-PAR approach therefore recognizes that the success of contemporary place-making efforts among the ‘people of the place’ are dependent in part on their perception of the relation between current and historic characteristics of the place. The following paragraphs therefore introduce the place-based themes in the history of Newtown Neck State Park of relevance for understanding how those themes are reflected in participatory design and planning processes described in subsequent sections of this chapter.

Among the themes of most relevance for a thick description of place-based knowledge in the study are the religious values of the Catholic Church and the historical legacy of residents’ natural resource management decisions. The area now known as Newtown Neck State Park, and the State of Maryland in general, has been influenced by the Catholic Church since its founding as a colony. Cecil Calvert, who obtained the



charter for the colony from King Charles I of Great Britain in 1632, was Catholic, as were approximately 150 of the 200 individuals aboard the first two ships to formally disembark and form the colony from England (Grubber, 2015; Peck, 2012; Maryland State Archives, 2017). Throughout its early history, the colony wavered between religious tolerance and religious conflict as Puritan, Catholic, and Anglican colonists mirrored the turmoil affecting the political climate in Great Britain. These political and religious dynamics led to diminishing power for Catholic colonists. Yet significant tracts of land continued to be held by the Catholic Church and individual Catholics representing Catholic affiliations in Maryland, as evidenced by the enduring Jesuit ownership of the land at the case study site from colonial times through 2009, when it was sold to the State of Maryland to develop Newtown Neck State Park.

The work of Curran (2014) and Cushner (2002) describe the history of the Jesuit arrival in the American colonies. Less well studied, but of importance to the present research, is the influence of the Catholic Church on the environmental history of Maryland. As a result of Catholic involvement in the settling of the colony, large tracts of land were held by Jesuits and other individual land-owners affiliated with the Catholic church, ranging in size from small farms to parcels of 24,500 acres or more (Georgetown University Library Exhibition, 1976). The extent to which Catholic land ownership facilitated the involvement of Catholic interests in land management, and by extension, the environmental history of the State of Maryland, is under-explored, though its influence can still be observed in contemporary environmental management issues and the use of agricultural lease-hold farming within Newtown Neck State Park. According to data collected by the GoodLands organization analyzing the patterns of current Catholic

land ownership throughout the United States, one of the primary areas of Catholic land ownership in the United States is the mid-Atlantic region, centered around Maryland (Goodlands, 2017).

Edwin Beitzell, author of “The Jesuit Missions of St. Mary’s County” (1959) wrote a short history of St. Francis Xavier Church as part of the church’s 300<sup>th</sup> anniversary in 1962. According to that history, the Jesuit mission of Newtown Manor began in the years following the colonial charter in 1632 and the arrival of the first colonists to Maryland in 1634. By 1640, the land roughly corresponding to what is now known as Newtown Neck State Park was deeded by Lord Baltimore (Cecil Calvert) to William Bretton, who provided a home for the Jesuit mission. At the time Catholics were not permitted to build church buildings (Beitzell, 1962, p. 11). It was not until 1662 that the first church building for St. Francis Xavier Church was constructed on the site. The Society of Jesus established the church as part of their mission to the colony, constructing a wood frame church in 1662 and a larger church in 1731, which is still in use today (Grubber, 2015). The original manor house and surrounding land were sold to the Jesuits in 1668 (Beitzell, 1962, p. 15); the deeds for Bretton’s original 750-acre tract and the additional 100-acre parcel later acquired by the Jesuits are available in the Jesuit Archives-Maryland Province (Beitzell, 1962, p. 17). In the interim between the Jesuit purchase of the land and the original deed to William Bretton, the Jesuits used the Bretton Manor house as a base for their missionary efforts, starting a school on the site in 1652 and visiting surrounding areas for missionary activities (Beitzell, 1962, p. 11). The Society of Jesus later built the Newtown Manor House adjacent to the church in 1789,

which is also still present at the site, but is now in disrepair and is the subject of the St. Francis Xavier Church Manor House Committee's restoration efforts.

From the perspective of the earliest Jesuits in the area, Beitzell (1962) notes the importance of the geographic location and landscape value of the area where the church was founded. The leader of the Jesuit mission is described in archival documents as gathering "his flock 'at the head of the bay'" (p. 10) and that his land "was then, and still is, a beautiful rich neck of farm land which reaches out into the Potomac River between Breton Bay and St. Clements Bay" (p. 10). Beitzell's description also portrays the socio-economic characteristics of the working landscape: "along the shores could be seen the cabins and huts of the freemen, while in scattered clearings stood the more pretentious brick homes of the planters...[and] at the port anchorage the great square-rigged ships of England loaded hogsheads of tobacco, corn, and furs to be exchanged for products needed by the colonists" (p. 11). Archival research conducted for this project indicates that the Jesuit priests living at the Newtown Mission took part in such trading. Goods traded ranged from tobacco, corn, wine and spirits, to the necessities of clothing, candles and horses, as recorded by the Jesuits in their "day-books", an annual accounting journal of their transactions. However, Beitzell (1962) curiously notes that in later years the Jesuit superiors responsible for managing the property at Newtown Neck were

"very wise men and they learned many years ago that one of Satan's close relatives was the 'farming devil' whose particular trick was to give the parish priest a passion for farming and then, in order to hinder the sons of St. Ignatius in their efforts to become good missionaries, he would try to make them bad farmers .... But the superiors soon caught on to this trick and very early in the history of the Manor of Little Bretton they hired an Overseer and let tenants farm the land" (p. 41).

The recorded environmental history of the Jesuit's Newtown Mission therefore focuses primarily on the capacity of the natural resources and agricultural activities to provide financial support for the Jesuit's missionary and educational work. The current chair of the St. Francis Xavier Manor House Committee and a collaborator in this project, notes that the Jesuits used a variety of methods to manage the agriculture assets of the property (personal interview). Their primary focus, however, was to use these forms of land management to support their missionary activities (from presentation at St. Francis Xavier Manor House Committee). Their approach to land use and management relied on the freehold, indentured servant, enslaved, and, later, leasehold/tenant forms of agriculture. The Jesuit's reliance on slave labor to support their missionary activities and educational service, including financial support to Georgetown University gained from the sale of all slaves owned by the Maryland Jesuits in 1838, has recently provoked increased scrutiny and research attention (Georgetown University, 2016; Swarns, 2016). The current practice of lease-hold framing, therefore, is a manifestation of the contentious tradition that has provided financial support to the Jesuit Mission in Maryland since colonial times.

Despite the political, economic, religious and cultural changes from the 1660s to the present, the land cover and agricultural uses of the land at Newtown Neck State Park have remained surprisingly stable. The area is thought to have been occupied by the Piscataway tribe of American Indians, who also used the land for growing maize, beans and tobacco (Maryland Park Service, 2016). Yet these agricultural uses never encompassed the entire site; 150 acres of mature hardwood forest remains relatively undisturbed (Maryland Park Service, 2016). In addition to the enduring natural landscape,

the parish of St. Francis Xavier Church has continued to operate continuously since it was founded, though the church building was reconstructed and the location moved within the property several times. As of 2009, there were approximately 300 parishioners (Maryland Park Service, 2016, p. 9). Therefore, in their 350+ years of stewarding the land on Newtown Neck, “the Jesuits have otherwise left remarkably few traces on the landscape, except for a recent, extensive project to stabilize the shoreline,” as noted in a local newspaper (Lutz, 2014).

Given the historical influence of the Catholic Church in Maryland, the case study site at Newtown Neck State park offers a window into the relation between Catholic environmental values and applied issues of environmental management. While it may be argued that the Catholic Church’s influence on environmental issues in Maryland is inconsequential when compared to the full extent of competing factors associated with environmental issues, the enduring involvement of the Catholic Church has shaped the current landscape at Newtown Neck State Park and the environmental values expressed by the ‘people of the place’ who continue to draw on their Jesuit tradition. Others may argue that such ‘thick’ descriptions of place-based history are of little applied relevance to contemporary planning and design processes. Yet, as the remainder of this case demonstrates, approaches to participatory planning and design which seek to achieve participants’ design objectives must be attentive to diverse forms of place-based knowledge given participants’ frequent expectation that such knowledge will find a voice through the planning process.

#### 4.4.3 Reflection 2: Land Transaction

The first major contemporary land use transition at the case study site, and the first to be considered using the geodesign-as-PAR approach, concerns the decision by the Catholic Church to sell the land at Newtown Neck to the State of Maryland. The geodesign-as-PAR approach uses the questions in the geodesign framework to evaluate the place-based values expressed in previous land use and planning decisions to understand how those values continue to influence place-based and participatory planning processes at the site. The retroactive application of the geodesign framework requires the use of secondary sources and discussions with key informants and co-collaborators familiar with the land ownership transition at Newtown Neck. Yet there is little public information regarding the transaction between the State of Maryland and the Corporation of Roman Catholic Clergyman, the Jesuit-affiliated entity that held legal ownership of land at Newtown Neck. The evaluation therefore relies primarily on first-hand knowledge shared by project participants, with reference to available secondary sources wherever possible.

According to the Maryland Park Service (2016), “the purchase of the ‘Maryland Province Properties’ was a unique opportunity to acquire a large undeveloped and ecologically significant lands [*sic*] that had been in continuous ownership by the Society of Jesus since the early 1600s” (p. 9). Yet according to local residents and co-collaborators in this project, the events leading up to that ‘unique opportunity’ are still the subject of speculation and concern, including uncertain political and financial priorities on both sides of the transaction. At the most basic level, the land management ‘challenge,’ to use the terminology of the geodesign framework, which triggered the land

management transition reflects the ongoing reduction of Jesuit investment in anything that detracts from their current institutional focus on education. Thus it can be assumed that the declining income to asset ratio derived from the Jesuit's ~4,500 acre land assets in Southern Maryland prompted a reconsideration of the long term value of their land ownership position.

Rather than simply reconstruct the events leading to the sale of the 'Maryland Province Properties' in 2009 using historical methods, the geodesign-as-PAR approach seeks instead to critically evaluate the competing environmental beliefs and values expressed by participants in the land use transition. This facilitates reflection on the underlying aspects of place that continue to affect land use decision-making at the site. The use of the geodesign framework *frames* the evaluation by considering participant's environmental beliefs and values associated with each question posed during the geodesign process. While the decision-makers in the transaction did not use the geodesign framework to guide the sale of the Catholic-owned property to the State of Maryland, its use in the geodesign-as-PAR facilitates critical evaluation of the characteristics of previous land use management decisions and the extent to which current land use decisions are informed by the historic aspects of place.

The two primary participants in the 2009 land transaction were the State of Maryland Department of Natural Resources and the Corporation of Roman Catholic Clergyman. To a lesser extent, the process also included support and advocacy from various environmental organizations, including the Conservation Fund (which brokered the deal), and the Friends of the John Smith Trail (now known as the Chesapeake Conservancy) (The Examiner, 2009; Lutz, 2014). Yet there was no indication that the

‘people of the place’ participated in the 2009 land transaction or decision-making process in any way.

*Table 4.2* uses the geodesign questions to evaluate the environmental beliefs and values expressed by each respective group of participants in the land use transition. In the absence of documentation on the land transaction decision-making process, the geodesign framework was used to frame available knowledge provided by co-collaborators in this project to describe the values, beliefs, and actions represented in the decision to sell the catholic-owned parcel in 2009. While the results of this evaluation are based on information gathered during the project, they do not represent the official views of either the Catholic Church, St. Francis Xavier parish, or the MD Department of Natural Resources; they are the results of the geodesign-as-PAR approach intended to facilitate understanding among project collaborators regarding the expression of place-based values of relevance to current land management decisions.



Table 4.2: Environmental Values Expressed During Land Transaction

Question	Key Themes by Participant		
	Society of Jesus; Archdiocese of Washington D.C.	MD Dept. of Natural Resources; Environmental NGO's	People of the place: Leasehold farmers (LF), St. Francis Xavier Church, respectively (SFX)
How should the study area be described in content, space and time?	<ul style="list-style-type: none"> <li><i>In terms of legal ownership; financial cost/benefit</i></li> </ul>	<ul style="list-style-type: none"> <li><i>In terms of critical habitat; woodland, wetland, streams</i></li> </ul>	<ul style="list-style-type: none"> <li><i>As a source of agricultural income; (LF)</i></li> <li><i>In terms of historic and cultural value (SFX)</i></li> </ul>
How does the study area operate?	<ul style="list-style-type: none"> <li><i>Annual income from agricultural lease; home of St. Francis Xavier Church</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Biophysical, ecological and socio-economic system</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Agricultural labor (LF)</i></li> <li><i>Living history (SFX)</i></li> </ul>
Is the current study area working well?	<ul style="list-style-type: none"> <li><i>Negative returns; financial liability;</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Stable land use since 1660's, includes critical habitat and agricultural area</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Profitable agricultural enterprise (LF)</i></li> <li><i>Lack of funds for historic preservation, risk of land development (SFX)</i></li> </ul>
How might the study area be altered?	<ul style="list-style-type: none"> <li><i>Sell property; reinvest assets in other Jesuit priorities</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Maintain current agricultural and critical habitat areas</i></li> <li><i>Add recreation and public use features</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Increase agricultural area or decrease access costs (LF)</i></li> <li><i>Secure funding for historic preservation, restore manor house, and maintain heritage landscape (SFX)</i></li> </ul>
What differences might the changes cause?	<ul style="list-style-type: none"> <li><i>Better deployment of assets aligned with current mission</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Long term protection of critical habitat; Increased public access and recreational enjoyment</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Increased agricultural profit (LF)</i></li> <li><i>Maintain communities historical and cultural heritage (SFX)</i></li> </ul>
How should the study area be changed?	<ul style="list-style-type: none"> <li><i>Sell property</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Buy Property</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Maintain Property</i></li> </ul>

The use of the geodesign framework to evaluate the decision to sell the Catholic-owned property to the State of Maryland suggests several enduring elements of land-use decision making at the study site. Following negotiations between the State of Maryland and the Corporation of Roman Catholic Clergyman, the ‘Maryland Properties’ were purchased for \$57 million with funding from the State of Maryland’s ‘Program Open Space’ (The Examiner, 2009). One newspaper article suggested that the Jesuits sold the land “to help support the retirement and care of their aging members” (The Examiner, 2009). Representatives of the Maryland Department of Natural Resources hailed the deal, later stating that “when it was offered, it looked like a really attractive property” and represented “a real overlay of significant resources” (Lutz, 2014). Similarly, the lead broker from the Conservation Fund considered the deal a “once and forever opportunity” (The Examiner, 2009). Fundamental to each of these observations is the monetary value of the site and the financial priorities and constraints of the primary decision-makers.

Stakeholders without a financial stake in the transaction had minimal influence or representation in the decision-making process. The DNR, based on the pursuit of its mission towards “securing a sustainable future for our environment, society, and economy by preserving, protecting, restoring, and enhancing the State’s natural resources” (Maryland DNR, 2019) could be seen as an indirect representative of all residents in the State of Maryland. Yet the use of the geodesign framework to critically evaluate DNR’s participation in the decision shows clear differences when compared with the interests of the ‘people of the place.’ There is no indication that the representatives of either the State of Maryland or the various environmental organizations advising the transaction acted in the interest of the ‘people of the place’ or considered

their views. The views of those with the closest connections to the place, with its rich and living history, culture and environment, did not participate in the decision because they lacked the financial resources to exert their interests.

Unsurprisingly, the values and objectives of the primary participants in the land transaction were those best represented in the outcome of the decision. Both sides of the deal achieved their respective goals because both were empowered by their financial stake in the decision. Participatory forms of decision-making do not guarantee that environmental values of those most affected by land use decision making will be respected. While direct participation by the ‘people of the place’ may have provided a platform to advocate for their interests, the financial constraints and opportunities of the parties to the land transaction were determinative of the outcome of this land management transition. The geodesign-as-PAR approach resulted in this observation becoming part of the narrative of the ‘people of the place’ in Newtown Neck, as further demonstrated in the next two land management decisions.

#### *4.4.4 Reflection 3: Park Development*

In contrast to the sale of the Jesuit property to the State of Maryland, a second land transition at the case study site involved extensive public participation and was well documented. The development of the management plan for Newtown Neck State Park involved an 18-month process and a 25-member committee composed of the Maryland Department of Natural Resources staff and community stakeholders (Maryland Park Service, 2016). The committee planned two informational open houses, a design charrette, an online survey, and two meetings with St. Francis Xavier Church. The Park

Service approved the Newtown Neck State Park Master Plan in 2016, including three phases of 5-year planning objectives for recreation, agriculture, wildlife, and restoration objectives (Maryland Park Service, 2016).

The process to develop the park management plan was intended as a participatory process involving three stakeholder groups: the Maryland Department of Natural Resources (DNR) and representatives of other local government agencies; non-governmental and community-based organizations; and the ‘people of the place,’ including both the leasehold farmers operating on the parcel and parishioners of St. Francis Xavier Church. The DNR staff initiated, structured and implemented the planning process. Representatives from several other State and local government offices participated as well, including Historic St. Mary’s City, St. Mary’s Historic Preservation Committee, and the Maryland Department of Recreation and Parks, Department of Economic and Community Development, and Commission of Indian Affairs.

The second category of participants were representatives of non-governmental and community organizations. Individual representatives from each of the following organizations participated in the committee: Maryland Waterfowl Association, St. Mary’s College, Southern Maryland Audubon Society, Friends of Point Lookout Lighthouse, Sailing Center Chesapeake, Newtown Neck Heritage Alliance, Western Shore Boy Scouts of America, St. Mary’s Riding Club, Newtown Walkers, Lookout Lighthouse Preservation Society, Chesapeake Paddlers Association, National Wild Turkey Federation, Southern Maryland Audubon Society, and Ducks Unlimited (Maryland Park Service, 2016). Representatives from these organizations were invited to participate in

the process based on their knowledge of thematic areas of relevance to the park management plan.

The third category of participants had the least representation in the park planning process. Only one representative of the ‘people of the place’ was included in the 25-member planning committee: the chair of the St. Francis Xavier Church Manor House Committee and parishioner of St. Francis Xavier Church. Two other citizens also participated: an archaeologist and a local resident. Neither the Catholic Archdiocese of Washington D.C. nor the Society of Jesus formally participated. Similarly, there is no record that the lease-hold farmer managing the agricultural land at Newtown Neck was consulted or participated.

According to the Master Plan (Maryland Park Service, 2016), the participatory process gave participants the opportunity to provide “recommendations to elected officials” (p. 10), answer questions “about desired uses and amenities at the park,” “provide information to DNR staff about the community and historic use of the property,” and “evaluate concept plans and provide an opportunity for participants to select their preferred plan” (p. 11). Ultimately, the process was said to have resulted in a consensus-based park plan that would “ensure that the property is permanently protected from development and that natural and cultural resources are conserved and enhanced” (p. 40). However, the geodesign-as-PAR approach facilitates critical evaluation of these outcomes and allows participants to reframe the process to understand what forms of place-based knowledge were most clearly expressed.

The respective environmental values, beliefs and objectives expressed by each group of participants in the park planning process are summarized in *Table 4.3* using the

geodesign framework questions. The assessment of the values, beliefs and objectives is based on information gathered during the geodesign-as-PAR project but are not representative of the official views of the Catholic Church or Maryland Department of Natural resources.

*Table 4.3: Environmental Values Expressed During Planning Process*

Question	Participant		
	MD Dept. of Natural Resources;	Representative NGO's	People of the place: Leasehold farmers (LF), St. Francis Xavier Church, respectively (SFX)
How should the study area be described in content, space and time?	<ul style="list-style-type: none"> <li><i>In terms of critical habitat; woodland, wetland, streams, soils, wildlife, cultural resources</i></li> </ul>	<ul style="list-style-type: none"> <li><i>In terms of NGO interests, including archaeology, birding, history of American Indians; history of Chesapeake Bay, historic preservation; Newtown Neck heritage, recreation, sailing/boating, &amp; waterfowl</i></li> </ul>	<ul style="list-style-type: none"> <li><i>As a source of agricultural income; (LF)</i></li> <li><i>In terms of historic and cultural value (SFX)</i></li> </ul>
How does the study area operate?	<ul style="list-style-type: none"> <li><i>As a biophysical, ecological and socio-economic system</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Contains resources of value to each respective NGO</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Through agricultural labor (LF);</i></li> <li><i>Living history (SFX)</i></li> </ul>
Is the current study area working well?	<ul style="list-style-type: none"> <li><i>Stable land use since 1660's, includes critical habitat and agricultural area</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Currently offers only restricted access to resources of interest</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Profitable agricultural enterprise (LF)</i></li> <li><i>Lack of funds for historic preservation, risk of land development (SFX)</i></li> </ul>
How might the study area be altered?	<ul style="list-style-type: none"> <li><i>Maintain current agricultural and critical habitat areas</i></li> <li><i>Add recreation and public use features</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Increase access to resources of interest</i></li> <li><i>Collect, utilize, maintain, preserve or expand resource of interest (depending on resource)</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Increase agricultural area or decrease access costs (LF)</i></li> <li><i>Secure funding for historic preservation, restore manor house, and maintain heritage landscape (SFX)</i></li> </ul>

What differences might the changes cause?	<ul style="list-style-type: none"> <li>• <i>Long term protection of critical habitat; Increased public access and recreational enjoyment</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Increased ability to fulfill organizational goals</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Increased agricultural profit (LF)</i></li> <li>• <i>Maintain communities historical and cultural heritage (SFX)</i></li> </ul>
How should the study area be changed?	<ul style="list-style-type: none"> <li>• <i>Implement park management plan</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Advocate for resources of interest in park management plan</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Advocate for resources of interest in park management plan: Maintain agricultural area (LF); preserve and maintain living history (SFX)</i></li> </ul>

Using the geodesign framework to critically evaluate the planning process facilitates a deeper understanding of how the environmental values and beliefs of each participant were expressed or constrained by the participatory process. Comparing *Table 4.2* and *4.3* shows that the values and beliefs of the Maryland Department of Natural Resources remained unchanged compared to the land transaction process and park planning process. While it is unsurprising that the DNR’s mandated values and beliefs, as articulated in DNR’s mission statement, remained unchanged, it is notable that the outcome of both the land transaction process and the park planning process fully met the goals of the DNR Park Service. This suggests that the DNR’s role in structuring the participatory process and establishing the Master Plan was determinative of the outcome; the values and beliefs of the Maryland Park Service were to be expressed and integrated in the Master Plan regardless of the outcome of the participatory process. As a result, the planning process achieved the Maryland Park Service’s (2016) goal by establishing a plan “for the protection, conservation, and effective management of this ecologically and cultural significant property for the use and enjoyment of future generations” (p. 6).

In contrast to the Maryland DNR's satisfaction with the results of the planning process, the 'people of the place' described the process as a series of unproductive meetings. One participant characterized the entire process as "death by democracy," suggesting that the plan failed to meet anyone's interests while managing to disappoint everyone through unproductive and ultimately unsatisfying participation. The park service manager responsible for the project no longer holds that position, which participants referenced as evidence of a failed process. Yet the conflicting interests and disappointing results are only hinted at in the Master Plan: an operational goal in the plan notes that "the Newtown Neck community has expressed a strong interest in plans for the park, and efforts will be made to develop partnerships to facilitate volunteer support for implementation for the goals for the park" (Maryland Park Service, 2016, p. 61). The process thus deferred the values, beliefs and interests of the people of the place to an unspecified and uncertain future partnership.

The geodesign-as-PAR approach reframes the results of the park planning process and shows that the values and beliefs of the participant with the most control over the participatory process – the Maryland DNR – were most clearly expressed throughout the process and in the resulting plan. While the participatory process involved a series of 11 committee meetings, mixed-media consultation, and direct and indirect participation, the process did not equally express the values or interests of all participants and likely would have reached the same result without a full participatory process. The 'people of the place' felt their only influence was to counteract the influence of external stakeholders advocating for alternative land use proposals, rather than expressing their own design objectives. While the process was intended to facilitate collaborative decision-making, it



ultimately increased the antagonistic role of ‘the people of the place’ due the constrained opportunities for meaningful expression of environmental values and objectives.

Reframing the results of the park planning process employed by the Maryland Park Service also provides a point of comparison with the land transaction discussed above. Whereas the sale of land did not involve public participation, the park planning process was overtly participatory, though it could be categorized as “consultation” or, perhaps more accurately, “placation,” according to Arnstein’s (1969) typology of participation. This form of consultation not only fails to meet the expectations of stakeholders. It can be counterproductive in many circumstances (Hurlbert & Gupta, 2015). In this case, members of St. Francis Xavier Church sent a list of concerns to the Maryland Park Service requesting their consideration during the park planning process. The parishioners’ concerns ranged from the potential visual impacts and site security risks to their desire to be meaningfully included in the park planning and management process (St. Francis Xavier Church, 2016). The park planning process, however, did not resolve these issues. Instead, it proposed the subsequent development of a buffer area management plan to address these and other concerns regarding the area between the park and the church; the plan was to be completed within five years from establishing the park. Despite the use of a more robust participatory process, the concerns of the ‘people of the place’ were therefore deprioritized and addressed only through potential ‘follow-up’ actions subject to future funding and management decisions.

Applying the geodesign framework retroactively to each of the previous two land management decisions at Newtown Neck State Park facilitates critical evaluation of the participatory characteristics of those decisions. Whereas the first example shows how

monetary interests and opportunities excluded the need for public participation, the second example shows how the structure of public participation and the convening role of government entities constrained the results of the participatory process itself. Critical examination of place-based values expressed in previous land use and planning decisions allows participants to structure the geodesign process to more meaningfully express their values, interest and objectives.

#### *4.4.5 Action Step: Geodesigning the Design Process?*

The geodesign-as-PAR approach reframes participants' place-based knowledge in ways they can directly apply through the structure of subsequent phases of the geodesign process. Having demonstrated the reflection stages of the geodesign-as-PAR approach above, the following section describes the action step which concludes the scoping phase of the geodesign process. The results of this concluding action step propose ways to restructure the subsequent phases of the geodesign project introduced in Part 1 based on the critical reflections described above.

The participatory geodesign project briefly described above began in 2017, a year after the Newtown Neck Park Plan was established. At the start of the project there was an expressed need among the key stakeholders, namely St. Francis Xavier Church and Newtown Neck State Park, to develop a management plan for the buffer area between the church and the park. Yet the process used to establish the Master Plan for Newtown Neck State Park (see Reflection 3, above) had not facilitated a meaningful resolution of the conflicts of interests between members of the St. Francis Xavier Parish and the State Park and was therefore unlikely to result in success if replicated for the buffer area management plan. It was in this context that the St. Francis Xavier Manor House

Committee agreed to collaborate on the geodesign project to address their desire to design a buffer area between the church and the park, while also preserving the Manor House and cultural heritage of the site.

Initial conversations with the Manor House Committee indicated that it was unlikely that the Maryland Park Service would be willing to utilize the geodesign process to respond to the project participants' interest in planning the buffer area management plan and preserving the cultural history of the church and Manor House. It appeared more likely that the GoodLands organization, with its clear environmental stewardship goals informed by Catholic theology and its experience using the geodesign process, would be a credible facilitator for the environmental management planning process. Furthermore, the GoodLands organization's objective and expertise in geodesign are aligned with the characteristics of critical and participatory geodesign practice, making their participation amendable to the principles in which this project was structured.

Following the lengthy attempt to proceed through the scoping phase of the geodesign project described above (*Section 4.2.1*), the participants decided to pursue their design objectives through the ongoing architectural feasibility study administered by the Archdiocese of Washington D.C. An architectural firm was selected by the Archdiocese of Washington D.C. to assist the Parish to establish a preservation and restoration plan for the manor house and to consider possibilities for land management enhancements in the surrounding area, including the buffer area between the church and the park. As noted above, the Manor House is a priority asset for the parish due to its unique architecture and role in the history of the Jesuits in St. Mary's county and the Newtown Jesuit Mission. The Manor House Committee itself was formed by volunteers from the parish to

raise money and advocate for the restoration and appropriate use of the manor house, which demonstrates their emphasis on financial leverage as a result of lessons learned from previous land management decisions.

The architect's scope of work was developed without obvious input from the Manor House Committee. The objective was the participatory development of a feasibility study identifying steps necessary to stabilize the current deterioration of the manor house and propose options for its preservation or restoration. The scope of work included an introductory meeting between the architect and the manor house committee, a design charrette to collect input, and a second charrette to gather feedback on the proposed options. The proposed process closely resembled the park planning process despite the unsatisfactory results of that process and the committee's attempts to restructure the architectural firm's contract and scope of work.

The first design charrette was held on February 9<sup>th</sup>, a Saturday morning, from 8 am-12 pm. The meeting began with introductions of the roughly 35 participants and an overview presentation from the lead architect. The chair of the Manor House Committee gave an informative presentation regarding the history of Newtown Manor, emphasizing its cultural, religious and architectural history. The presentation included several historic and current maps and aerial images of the site, findings from the committee's archival research and oral history projects, personal stories and perspectives regarding the area, and other relevant information unavailable from other sources. A member of the architectural team then gave a presentation regarding the applicable laws and permitting implications for the possible preservation and restoration of the manor house. The remainder of the charrette was spent in two participatory activities: a small group

‘brainstorming’ discussion to discuss ideas for the manor house and surrounding landscape, followed by group presentations and a concluding discussion.

Participants offered a wide variety of ideas to resolve the design challenge. Each group proposed ways to restore the manor house and make it accessible for at least limited public use. The proposed uses ranged from a facility for church events, to a public museum for Jesuit history in southern Maryland. Other ideas focused on income generation, ranging from using the manor house for short term rentals (e.g., AirBnB) to use for weddings, receptions, or other events. Most groups clearly stated what they did not want to leave the manor house in its current deteriorated condition, close the manor house to the St. Francis Xavier Church community, or take on any additional preservation easements that restrict the use or increase the cost of restoration. The most well-defined views expressed during the workshop were antagonistic rather than creative; participants clearly expressed what they would *not* accept, though there was less agreement or clarity on what the desired end goal should be. Some participants discussed the broader landscape and environmental setting, rather than a singular focus on the manor house. These included the use of the buffer area with the park for historic interpretation or possible nature trails and historic demonstration gardens.

The architect’s team took notes and intended to refine the set of ideas generated during the first charrette to subsequently share their suggested design options at a second charrette (still pending at the time of this writing). The participants were not entirely certain what format the design options would come in, but it was later understood that the architect would prepare a brief report and PowerPoint presentation. At the time of this writing, the manor house committee and workshop participants were waiting for the

proposal from the architect and planned to evaluate the proposed options in the second charrette. During subsequent monthly meetings, the Manor House Committee began to address the challenge of fundraising. While neither the Parish nor the Manor House Committee have the authority to make financial decisions regarding parish assets, they are responsible for funding any project they propose.

The results of the first design charrette suggest that the outcome of the preliminary phase of the manor house restoration project will be inconclusive. The architectural team will provide a summary document and presentation of possible options. Each proposal will likely exceed the available budget, yet the Archdiocese of Washington D.C. is unlikely to fund the proposal and the manor house committee will require significant financial support from external donors. Even if the Manor House Committee were successful in raising the necessary funding, the implementation of the proposed design would be subject to the approval and management oversight from the Archdiocese of Washington D.C.

Similar to previous steps in the geodesign-as-PAR process, *Table 4.4* summarizes the results of the geodesign-as-PAR evaluation of the attempted initiation of the geodesign project described in Part 1 of the case study, above (Section 4.2.1) and proposes an action step for the continuation of the geodesign process. The results indicate the need to reframe subsequent phases of the geodesign to facilitate the expression of the environmental values and design objectives of the people of the place.

Table 4.4: Evaluation of Participatory Geodesign Project

Question	Geodesign Reflection to Action Stage
How should the participatory process be described in content, space and time?	<ul style="list-style-type: none"> <li>• <i>Participatory processes are an expression of values through the individual action of participation and the collective creation of an intended action represented by the structure of the design process. The former is an end in itself; the latter is a means to an end. The participatory process will be unsatisfying until the former is aligned with the latter.</i></li> </ul>
How does the participatory process operate?	
Is the current participatory process working well?	<ul style="list-style-type: none"> <li>• <i>The participatory process for land management in the study area is not working: the first transition did not include participatory process and the second transition did not satisfy participant desires to express individual values.</i></li> <li>• <i>Modeling subsequent phases of the geodesign project on the same tendencies is unlikely to achieve the intended results.</i></li> <li>• <i>Participatory processes with predetermined structures and/or dominated by financial interests are not satisfactory to the 'people of the place'. 'Participatory processes' following this model will be repeated out of necessity because existing power dynamics are not addressed.</i></li> </ul>
How might the participatory process be altered?	<ul style="list-style-type: none"> <li>• <i>Implement the full scope of participatory geodesign without predetermining methods, structure or data sources; when necessary, consider third party facilitators to ensure participants are aware of the full scope of the geodesign framework and are able to make use of the breadth of its participatory characteristics.</i></li> </ul>
What differences might the changes cause?	<ul style="list-style-type: none"> <li>• <i>Higher likelihood of satisfying expectations of the people of the place regarding the action of participation, and the intended action of the resulting plan;</i></li> </ul>
How should the participatory geodesign process be changed?	<p><i>The critical evaluation using the geodesign-as-PAR approach identified the following actionable results to facilitate subsequent phases of the geodesign project:</i></p> <ul style="list-style-type: none"> <li>• <i>Use the second planned charrette in the architectural feasibility study process to propose larger decision-making process using the geodesign framework;</i></li> <li>• <i>Invite the GoodLands organization to implement the second and third phases of a geodesign process, specifying that the decision-making process and the characteristics of the participatory process will be determined as part of the geodesign process itself;</i></li> <li>• <i>Incorporate PPGIS and PAR methods to account for environmental values and living history of Newtown Neck and St. Francis Xavier Church community;</i></li> <li>• <i>Use the geodesign process to establish a concept plan which integrates the selected option for the restoration of the manor house in the larger context of the Newtown Neck landscape; and</i></li> <li>• <i>Use the concept plan (e.g. the geodesign) to negotiate support from relevant authorities, donors or other funding sources in order to implement the plan.</i></li> </ul>

The result of this project would be unsatisfactory if measured based on the objectives of a standard participatory geodesign project. However, because the objective of geodesign-as-PAR is to facilitate critical research and action, the result of the project is not constrained by the factors which prevented the establishment or implementation of plan. The geodesign-as-PAR approach provides a clearer understanding among project participants regarding the characteristics of participatory decision-making which constrain the expression of environmental values, beliefs and intended behaviors. This facilitates the critical action outcomes intended by the geodesign-as-PAR approach: using the geodesign framework itself as means to restructure future participatory processes to more meaningfully express and achieve participants place-based values and objectives.

#### 4.5 Discussion

The contrasting results of Parts 1 and 2 of this case study show the importance of public participation in the scoping phase of the geodesign process. Whereas the proximate results of Part 1, meaning directly observable results based on immediate outcomes, highlight the limitations of current approaches to geodesign implementation, the results of Part 2, particularly the opportunities for restructured participation identified through the geodesign-as-PAR process, represent a successful outcome despite the lack of traditional indicators of successful participatory design. The significance of each outcome is discussed below.

##### *4.5.1 Immediate Outcome of Participatory Geodesign Scoping Phase*

The results of the scoping phase of this geodesign project show the challenges associated with the participatory characteristics of the initial steps of the geodesign



process. Given that the current model of participatory geodesign practice offers no methods to address structural factors that prevent the implementation of effective geodesign projects, the ‘people of the place’ defaulted to a standard design practice in which their objectives were not fully met. If measured by typical indicators of geodesign project success, the result of this project would be unsatisfactory. Following more than a year of participatory project setup, the participants determined only that the geodesign process was not amenable to their decision-making context, despite their perception that geodesign would offer a helpful way to structure the design process. However, as shown in Part 2 of this case study (*Section 4.4.2*), the Manor House Committee’s decision to use the architectural feasibility study as a means to accomplish the objectives of the geodesign process also failed to achieve their design objectives and express their environmental values.

More importantly, however, the case shows that structural constraints to participatory planning must be identified and overcome if participatory geodesign is to achieve the participatory outcomes anticipated by the geodesign framework. Despite the active participation of the ‘people of the place,’ their design objectives and participatory intentions were not suitable for expression through the geodesign process because the structure of the design process was constrained by the political and financial interests of the convening entities. The lack of political and financial capital among the ‘people of the place’ limits their influence and undermines the viability of standard approaches to participatory geodesign practice. Despite the geodesign framework’s emphasis on public participation and the integration of diverse theories, models and place-based knowledge, geodesign literature has yet to demonstrate an effective means through which participants

can reframe the design process to address structural constraints preventing them from expressing and achieving their design objectives.

The proximate results of this project suggest that geodesign practice, even in projects attempting to implement the full extent of the geodesign's participatory characteristics, will be constrained by structural factors which prevent meaningful public participation in the first phase of the geodesign process. In contrast, the results of the geodesign-as-PAR process show how these structural factors can be accounted for in the design of the participatory process itself, as described below.

#### *4.5.2 Substantive Results of Geodesign-as-PAR*

The geodesign-as-PAR evaluation of the expression of environmental values in previous land management transitions facilitated clearer understanding among the people of the place regarding their highest priority 'design challenge.' The greatest challenge was not how to improve the management plan but rather how to improve the participatory process used in future land management decisions. The geodesign-as-PAR evaluation showed that the outcomes of the two previous land management decisions in the case study site were determined by the convening entity or stakeholders with: i.) financial resources, and ii.) control over the structure of the participatory design and decision-making process. Given the lack of these resources among the 'people of the place', traditional forms of design practice, with standard relationships between client and design team, were not feasible means through which to achieve their design objectives.

The results above explain why the Manor House Committee attempted to exert their interests using similar means at the start of the geodesign process, but also shows why their decision not to continue the geodesign-as-PAR process did not achieve their

intended results. The Manor House Committee was formed to raise funds and use those funds to influence the planning process. This strategy resulted in partial success; by raising money and advocating for the Manor House restoration project, the Archdiocese approved the architectural feasibility planning project. However, the ‘people of the place’ were unsuccessful in their attempt to assume leadership for the participatory decision-making process. Though the Manor House Committee assumed responsibility for raising funds for the design and implementation of the project, they were not authorized to structure the decision-making process and were subject to the interests of external decision makers.

Rather than continue the pattern of unsuccessful and unsatisfying participatory processes, the geodesign-as-PAR approach facilitates critical evaluation of the challenges in the participatory characteristics of land use and planning decisions. In this case, it identified ways the constraining structural characteristics could be changed. While none of the environmental values of the project collaborators were fundamentally altered, the geodesign-as-PAR allows project collaborators to reconsider the means through which they express their values and consider new approaches to participatory decision-making. Recommendations for how the participants could restructure the participatory characteristics of subsequent phases of the geodesign process are included in the final row of *Table 4.4*. Their implementation would not only facilitate a meaningful geodesign process to address the specific design objective. It would also facilitate critical action to restructure the role of the ‘people of the place’ in future decision-making processes, thus giving voice to the diversity of their place-based knowledge.

#### 4.6 Conclusions

The geodesign-as-PAR approach identifies new opportunities for critical geodesign practice and contributes to answering the primary research questions of this dissertation. This chapter shows that geodesign can be a participatory process, but that to be successful, it must be structured with active participation and critical reflection from the ‘people of the place’ in each phase of the geodesign process. Like other ‘participatory processes,’ geodesign practice risks devolving into a “tyranny of participation” (Cooke & Kothari, 2001; quoted in Kindon, 2010, p. 272) or form of placation (Arnstein, 1969). If the outcome is predetermined or the process is constrained, as was the case in each land management transition described in this chapter, participation is unsatisfying and potentially detrimental to the ‘people of the place’. Geodesign-as-PAR avoids these risks by facilitating iterations between action and critical reflection in each phase of the geodesign process.

Increased public participation in the geodesign scoping phase provides a pragmatic opportunity for participants to advocate for the inclusion of participatory methods in subsequent phases. This will likely increase the demand for more participatory forms of geodesign technology and practice and offers a means to include participatory techniques developed in PGIS, PPGIS and participatory action research. Geodesign models need not be technologically robust, and can account for creative expressions of participation in a variety of formats (Janssen & Dias, 2016; c.f. Balug, 2019). The proposed geodesign-as-PAR method provides direct opportunities to incorporate participatory GIS techniques in the geodesign representation and process models (e.g. Lin, 2013; Zook & Graham, 2007; Brown & Weber, 2012; Schlossberg &

Shurford, 2005). New forms of participatory modeling (Voinov et al., 2016) and the increasing use of volunteered geographic information (e.g. Brown & Kytta, 2014) are likely to extend these opportunities in geodesign practice, as demonstrated in a small number of geodesign projects to date (Roth & Gruehn, 2014; Slotterback, 2016; Roderick, 2017). Given its emphasis on restructuring the geodesign decision model to address structural issues which constrain participatory design, the geodesign-as-PAR approach also provides opportunities for participants to advocate for the factors of good governance in the structure of the design process itself (McCall & Dunn, 2012). Despite these opportunities, the extent to which participatory GIS content can be integrated or dynamically linked to other geodesign models remains a key challenge.

The geodesign-as-PAR approach shows that the first phase of participatory geodesign is an actionable end in itself; determining the structure of the geodesign process requires active participation from the people of the place in collaboration with other decision-makers and members of the design team. Each stage of the geodesign process should then proceed through the participatory process structured during the first phase of the geodesign process, including the determination of methods, collection of data, and implementation of the geodesign workshop. The critical evaluation of themes necessary to structure the geodesign process itself is therefore the primary contribution of the geodesign-as-PAR approach. Without this step, participants have little recourse to address structural factors associated with funding, institutional barriers, and the constraints of socio-political contexts, among others, which limit their ability to achieve their design objectives through the geodesign process.

The innovations accounted for in the geodesign-as-PAR suggest how geodesign practice can facilitate the expression of environmental values to overcome the value-action gap. The participatory action and critical research facilitated by the geodesign-as-PAR approach provide the means to identify, understand and overcome the barriers to value expression, thus confirming the hypothesized relation between geodesign and the objectives of participatory action research. Geodesign-as-PAR is, as Wadsworth's (1999) definition of participatory action research implies, a form of "research which involves all relevant parties in actively examining together current action (which they experience as problematic) in order to change and improve it" (p. 18). The combination of reflection and action accounted for in the geodesign-as-PAR approach provides the means to restructure participatory planning processes to express participants' environmental values and overcome the value-action gap.

## Chapter 5: Geodesign as a Place-based Model to Overcome the Value-Action Gap

### 5.1 Introduction

The geographic concept of place and theory of place-making provide an interpretive framework to evaluate the dissertation's research findings and explain the relation between geodesign and the value-action gap. This concluding chapter first evaluates the results of the two case studies in comparison to the promised benefits of the geodesign framework. It then addresses each respective research question and shows how the results challenge current assumptions regarding the geodesign framework while also identifying opportunities to improve the participatory characteristics of geodesign practice. The final section concludes by explaining how the geographic concept of place and theories of place-making position geodesign as an alternative approach to understanding and overcoming the value-action gap.

### 5.2 Comparative Evaluation

#### *5.2.1 Geodesign's Promised Effectiveness*

The taxonomic inventory of geodesign practice in Chapter 2 identified a gap between the promised effectiveness of geodesign described in conceptual literature (e.g. Flaxman, 2010; Abukater and Walter, 2010; Ervin, 2012; McElvaney, 2012; Steiner and Shearer, 2016) compared to the limited extent of research evaluating the outcomes of geodesign in practice. This dissertation contributes towards addressing that gap by

evaluating the anticipated benefits of the integration between geodesign's participatory and technological characteristics. Fundamental to that evaluation is the assessment of the ontological structure of geodesign and the alignment between the geodesign framework and current practice and the implementation of case studies seeking to improve geodesign practice and evaluation. By identifying and categorizing the primary and secondary characteristics of geodesign practice, the taxonomic evaluation in Chapter 2 shows that current geodesign practice does not fully implement the participatory potential of the geodesign framework and therefore limits the promised benefits of geodesign practice. The case studies, in turn, each utilize a broader implementation of the geodesign framework and evaluate the applied outcomes using a mix of methods.

This concluding section extends the taxonomic evaluation by incorporating the examples of geodesign practice described in this dissertation (Edgewater Village Park, Newtown Neck State Park - Part 1, and Newtown Neck Geodesign-as-PAR - Part 2). The evaluation shows how each successive case study builds on the findings of previous studies to improve the participatory characteristics of geodesign practice in alignment with the geodesign framework. Evaluating each case study against the taxonomic characteristics from Chapter 2 not only explains the differences between the case study results but shows why constraints to public participation limit the promised effectiveness of geodesign practice.

### *5.2.2 Comparison of Case Studies*

The revised taxonomy in Chapter 2 evaluates geodesign practice based on three primary characteristics: the complexity of geodesign models (simple/complex), the use of



automated design technology (yes/no), and the nature of public participation (direct/indirect and secondary characteristics of scale, purpose, role of public, format and duration of participation). The taxonomic categories of geodesign practice correspond with the characteristics hypothesized to account for its unique effectiveness: technological integration and participatory collaboration. *Table 5.1* summarizes the taxonomic characteristics of each case study and shows the differences between each project and their respective outcomes and perceived effectiveness.

Table 5.1: Taxonomic Classification of Case Studies

Project	Primary Characteristics				Secondary Characteristics								Outcome / Effectiveness
	Public Participation		Technology		Scale		Objective/Purpose		Role of Public		Medium	Duration	
	Direct / People of Place	Indirect / Representatives	Model Complexity	Design Automation	Parcel, Sub-urban, or Urban	Region	Implementation	Demonstration	Collaborative	Contributory	Digital, In Person, Both or None	One time / Iterative	
Edgewater Village Park Rehab		X	Simple	No	X			X		X	In-person	One time	<ul style="list-style-type: none"> <li>Perceived effectiveness among participants</li> <li>No demonstrable improvement in design quality or implementation outcomes compared to previous design processes at the park</li> </ul>
Newtown Neck State Park (Part 1)	X		NA	No	X		X		X		In-person	Iterative	<ul style="list-style-type: none"> <li>Perceived ineffectiveness among participants</li> <li>Did not overcome preference for traditional design approach</li> <li>Geodesign scoping did not address structural constraints for meaningful public participation</li> </ul>
Newtown Neck State Park (Part 2-Geodesign-as-PAR)	X		Complex	No	X		X		X		In-person	Iterative	<ul style="list-style-type: none"> <li>Geodesign-as-PAR scoping phase identified changes necessary for improved public participation</li> <li>Proposed process accounted for participant values and objectives and showed higher chance of effectiveness compared to alternative approaches</li> </ul>

The three examples of geodesign practice differ in both technological and participatory characteristics. Given that none of the case studies incorporated automated design technologies, the distinguishing technological characteristic is geodesign model complexity. The Edgewater Village Park geodesign project utilized GeodesignHub.com, an online platform for interactive geodesign projects. The project used only the most basic features of the platform due to the limited time available during the workshop. While the platform can incorporate dynamically linked models, it was only used in this case to overlay thematic data, incorporate participant design inputs, and calculate evaluations regarding the area and estimated costs of proposed designs. The complexity of the geodesign models in the first case study is therefore considered ‘simple.’

In contrast, Part 1 of the second case study did not use geodesign technology as commonly described in geodesign scholarship. Participants determined that a traditional design process in which a design team conducted a design charrette and subsequently presented design concepts was more suitable to their decision-making process. The geodesign-as-PAR approach in Part 2 of the second case study, however, evades obvious categorization as either simple or complex. The geodesign-as-PAR approach did not use digital modeling, yet in many ways the models used in the second case study were more complex than those used in the first case study. Using the geodesign-as-PAR approach, participants in the second case study iteratively considered how participants’ environmental values, interests and objectives were expressed in successive environmental planning and land use transitions at the site. Addressing each geodesign scoping question using the geodesign-as-PAR approach required complex cognitive

models and encouraged participants to reflect on historical and contemporary aspects of place. Such models allowed participants to iteratively evaluate the relation between multiple aspects of place-based knowledge, the structure of the design process, and the design objective. Existing geodesign technology has yet to demonstrate the capacity to dynamically link all place-based characteristics of interest to public participants during each phase of the participatory geodesign process. In contrast, the findings from Part 2 of the second case study suggest that geodesign model complexity is not limited to technological complexity, but rather depends on the cognitive and conceptual complexity of place-based factors incorporated into the design process.

Comparing the complexity of geodesign models with the project outcomes in each case study shows that technological sophistication is less important than the incorporation of place-based knowledge contributed through public participation. The first case study used a technologically robust modeling platform but showed no substantive outcomes in support of the promised effectiveness of geodesign practice. Part 1 of the second case study showed that geodesign technology is not required in the scoping phase of geodesign practice. Instead, the results indicate that the extent to which place-based knowledge is accounted for in the geodesign scoping phase can be determinative of project outcomes. Part 2 of the second case study confirmed these findings and showed that the iterative use of cognitive models in the geodesign-as-PAR approach can achieve effective outcomes in contexts that would otherwise constrain the effectiveness of standard approaches to participatory design processes. Public participation in the scoping phase provides opportunities to restructure environmental design and planning processes in ways aligned with participant objectives. These findings confirm the importance of the

geographic concept of place for explaining the results of each case study and their relation to the promised effectiveness of geodesign practice.

Evaluating the outcomes of each case study against the participatory characteristics of geodesign practice identified in the taxonomic inventory provides further confirmation of the importance of the geographic concept of place. The two case studies differ in the primary participatory characteristic (direct/indirect) and three of the five sub-characteristics of public participation (purpose, role, and duration). The projects are similar with respect to scale (parcel) and format (in-person). The first case study was implemented with indirect participation from the ‘people of the place,’ while the second case study involved their direct participation. Participants in the first case study were selected by local government authorities and did not include individual residents of surrounding neighborhoods. Only a small number of external stakeholders participated and there was no expectation that participants would represent their community or stakeholder group in any formal capacity. Representatives of public housing communities, schools, churches, and homeless squatters near the park were not invited, while business owners and staff of municipal offices and services were included as primary participants. The lack of local representation hindered the geodesign project’s ability to facilitate community participation in the planning process and did not support the intended project objective of increasing ‘community ownership’ of the park. While the first case study can be categorized as a form of representative participation, the nature of representation was informal and ad hoc and showed no benefit compared to expert-led approaches to design.

The forms of public participation evaluated in Parts 1 and 2 of the second case study, in contrast, are categorized as direct representation. The participatory decision-making process in Part 1 was initiated in direct collaboration with the ‘people of the place.’ The ‘people of the place’ had been excluded from previous land management decision-making processes but then advocated for and achieved a role in the final land use transition described in the second case study (Part 2). The geodesign-as-PAR approach identified opportunities for the ‘people of the place’ to collaborate with the primary stakeholders in the geodesign process: officials from the Archdiocese of Washington D.C., representatives of the State of Maryland Department of Natural Resources and interested non-governmental organizations. This direct participation among the ‘people of the place’ increased the extent to which the geodesign process in the second case study accounted for diverse place-based knowledge.

Similarly, the secondary characteristics of public participation in each case study provide further evidence that successful project outcomes are associated with factors that increase the integration of diverse place-based knowledge through robust forms of public participation. The expression of place-based values and design objectives is constrained in hypothetical projects and those in which public participation is limited to contributory input at a single point in the geodesign process. This explains why the effectiveness of the first case study was significantly constrained: it failed to include representatives of ‘the people of the place,’ it limited their input to a single point in the geodesign process, it provided insufficient time to achieve the objectives of the geodesign workshop, and it failed to articulate a means to implement the resulting geodesign plan. Geodesign

projects which lack public participation are unlikely to achieve the promised effectiveness of geodesign practice.

Public participation, however, is not a panacea. Other approaches to participatory planning, including those used for the participatory park planning process in the second case study, emphasize the importance of public participation but cannot guarantee meaningful results. Despite the merit of public participation as a primary objective of the planning process, participatory activities are often found unsatisfactory or counterproductive by the very participants they were intended to benefit (Coglianese, 2002; Irvin & Stansbury, 2004; Bailey & Grossardt, 2010). Indeed, the advent of PPGIS was intended to balance the analytical and objective aspects of GIS research and enable its use for critical learning and action. Yet, as the literature review in Chapter 1 shows, the effectiveness of PPGIS methods for achieving its critical action goals has been difficult to evaluate or confirm (Sieber, 2006; Ramasubramanian, 2010; Mukherjee, 2015). Geodesign practice must confront similar challenges to demonstrate the assumed benefits of its participatory characteristics.

Part 1 of the second case study exhibits these challenges and shows the need for integration between geodesign's technological and participatory characteristics. Awareness of place-based aspects of the design challenge and opportunities for public participation can be insufficient to achieve participants' objectives. Participants must be able to structure the design process in ways that account for their place-based knowledge and objectives. This is a key objective of the scoping phase of the geodesign framework and its importance was shown in the contrasting outcomes of Parts 1 and 2 of the second case study. Public participation in the scoping phase increases the likelihood that the

secondary characteristics of public participation applicable in the second and third phase of the geodesign process will be aligned with participant expectations. This finding explains why the geodesign-as-PAR project was the most effective in achieving the promised effectiveness of geodesign practice without the use of standard geodesign technologies.

The results of the taxonomic evaluation and comparison of case studies included in this dissertation have identified multiple opportunities to improve geodesign practice. Each chapter provides detailed recommendations. Chapter 2 proposes improved methods to evaluate the alignment between the geodesign framework and practice and thereby encourage implementation of the full scope of the geodesign framework. Chapter 3 shows that participatory geodesign requires increased opportunities for two-way communication and collaboration during each phase of the geodesign process. Chapter 4 shows how geodesign can benefit from the participatory action research tradition through the geodesign-as-PAR approach. These findings identify opportunities to improve geodesign practice and thereby increase the applied benefits of the geodesign framework.

### 5.3 Interpretation of Research Questions

The combined research results from each chapter provide evidence to answer the dissertation's primary research questions on the relation between geodesign, the value-action gap, and the geographic concept of place and theory of place-making. The following sections discuss the research findings regarding each question, as summarized in *Table 5.2*.



Table 5.2: Research Question Results

<p><i>RQ1: Is geodesign able to facilitate the expression of diverse forms of place-based knowledge and environmental values?</i></p>	<p>The geodesign framework is premised on the theoretical assumptions of rational and analytic planning traditions. Current geodesign practice adheres to these theoretical assumptions and limits its relevance for overcoming the value-action gap. However, if geodesign is practiced reflexively using the full extent of its participatory characteristics, it can be used to facilitate the expression of diverse environmental values, interests and objectives.</p>
<p><i>RQ2: Can geodesign practice be used as a Participatory Action Research approach to critically evaluate and overcome the value-action gap?</i></p>	<p>Geodesign-as-PAR allows for critical reflection on the values expressed and embedded within participatory planning processes. Actively reflecting on these characteristics allows participants to utilize participatory geodesign practice to express their values, beliefs and objectives in communicative formats indicative of applied action to overcome the value-action gap.</p>
<p><i>RQ3: Does geodesign increase the scale of environmental agency beyond the individual scale?</i></p>	<p>Participatory geodesign can be successfully implemented at multiple scales; Geodesign-as-PAR facilitates reflexive consideration of place, allowing participants to expand their understanding of their environmental agency and the role of collective action for achieving their objectives.</p>

5.3.1 Geodesign for Environmental Value Expression

The Steinitz (2012) geodesign framework seeks to facilitate the identification and utilization of diverse theories, methods and forms of place-based knowledge necessary to address pragmatic environmental design challenges. The results of the taxonomic review in Chapter 2 and the case studies in Chapters 3 and 4, however, challenge the assumption that current geodesign practice effectively expresses diverse forms of place-based

knowledge and values. The taxonomic review of geodesign practice shows an increasing tendency towards technological sophistication at the expense of geodesign's participatory characteristics. Technological complexity does not preclude the incorporation of diverse forms of knowledge, but the predominant form of current geodesign practice limits the range of theories, methods and place-based knowledge incorporated into the design process and limits geodesign's ability to express diverse environmental values. While it is possible this overemphasis on certain forms of technology is a reflection of geodesign literature and not geodesign practice, consideration of geodesign's conceptual foundation suggests otherwise.

Recent scholarship addressing the geodesign framework calls attention to the similarities between the geodesign framework, systems analysis, and rational-choice decision theory (Wilson, 2015; Hollstein, 2019). Hollstein suggests that the geodesign framework is indebted to a "planning and decision theory which saw decision-making in planning as requiring a synthesis of the rational planning normative model with objective, behavioralist methods" (p. 57). Hollstein emphasizes that the geodesign framework was intended to balance the objective and subjective elements of the design process. The findings of this dissertation, however, indicate that geodesign practice continues to prioritize the theoretical premise of analytic forms of planned decision-making at the expense of subjective aspects of place-based knowledge and desired action. Despite the intended balance between objective and subjective elements of the geodesign framework, the case study results in this dissertation support Wilson's (2015) critique of the assumed neutrality of the geodesign framework to provide equal expression to diverse theories, methods and place-based knowledge. Instead, the geodesign framework's theoretical

association with rational-choice theory, deference to quantitative aspects of systems analysis, and resulting emphasis on spatial data suitable for analytical geospatial methods help explain the current trajectory of geodesign practice.

The geodesign framework's affinity for analytical, objective and quantitative forms of knowledge limits the extent to which diverse forms of place-based knowledge can be expressed through geodesign practice but does not preclude that possibility entirely. While the evaluation of outcomes in the first case study finds no significant evidence that participation in the geodesign process facilitates the expression of participant's environmental values, beliefs or subjective place-based knowledge, the second case study shows contrasting outcomes in Parts 1 and 2 of the project. The participatory planning processes evaluated in Part 1 of the second case study showed similar results to the first case study; none of the participatory processes satisfied the 'people of the place' or achieved their design objectives. Yet the geodesign-as-PAR approach in Part 2 of the second case study shows how the geodesign framework can be applied reflexively by implementing the full scope of its participatory characteristics.

The geodesign-as-PAR approach accounts for the underlying theoretical biases by reflexively using the geodesign framework to reflect on diverse aspects of place and the way place-based knowledge affects current participatory land use and management practices. It recognizes that any action is biased and thereby seeks to reflexively account for that bias while using the geodesign process to achieve the intended result. By using the geodesign framework reflexively, the geodesign-as-PAR approach accounts for the theoretical premise of the geodesign framework while also identifying how it can be used to achieve critical action objectives. The combined results of each chapter therefore

suggest that current geodesign practice adheres to the underlying theoretical assumptions of the geodesign framework and limits its relevance for overcoming the value-action gap. However, if geodesign is practiced reflexively using the full extent of its participatory characteristics, it can be used to facilitate the expression of diverse environmental values, interests and objectives.

### 5.3.2 Geodesign for Participatory Action Research

The dissertation's second primary research question addresses geodesign's potential use as a participatory action research approach to understand and overcome the value-action gap. The introductory chapter hypothesized that the reflexive, iterative, and integrative characteristics of the geodesign framework would allow for its use within participatory action research. The results of the taxonomic review and the success of the geodesign-as-PAR approach confirm this hypothesis in contrasting ways. The taxonomic review and first case study show that the geodesign framework includes participatory characteristics to account for diverse public input but that project outcomes are dependent on the extent to which place-based knowledge is incorporated into geodesign's participatory and technological characteristics. The results of Chapters 2 and 3 show that geodesign practice does not currently align with the principles of participatory action research due to the constraints on public participation in most geodesign projects. For this reason, the first case study found no evidence that participants considered the geodesign process to facilitate critical learning and action outcomes.

In contrast, the second case study shows that alternate forms of geodesign practice, such as geodesign-as-PAR, provide opportunities to achieve a 'more critical'

practice of geodesign aligned with the principles of participatory action research. Collaborative geodesign which directly involves the ‘people of the place’ in meaningful participation at each stage of geodesign projects over extended durations is more likely to result in stakeholder consensus on the resulting geodesign plan. Projects with participatory establishment of shared objectives leading to applied project outcomes are also more likely to satisfy participant expectations for successful geodesign project implementation. These findings suggest that the participatory characteristics associated with successful geodesign practice are also those most closely associated with the principles and methods of participatory action research.

While the geodesign framework was originally established to facilitate both pedagogical and applied objectives, the extent to which geodesign practice has achieved applied learning objectives has varied since the first publication of Steinitz’s (1990) “framework for theory.” Hollstein (2019) reviews the evolution of the participatory characteristics of the geodesign framework and shows the utility of geodesign as an educational tool, primarily for landscape architecture and planning at the university level (Rekittke & Paar 2011; Rekittke et al., 2012; Tulloch & Walton, 2013; Warren-Kretzschmar et al., 2016; Muller & Flohr, 2016). The geodesign-as-PAR methods continues the evolution of geodesign’s participatory implementation and shows how it can be used to achieve critical learning and action objectives.

In addition to improving the participatory outcomes of geodesign practice, the use of the geodesign framework through a participatory action research approach, such as geodesign-as-PAR, explains its relevance for overcoming the value-action gap. The geodesign-as-PAR helps participants understand the relation between environmental

values and the place-making process and provides a platform through which to express their values. This can be seen in the contrasting results of Part 1 and Part 2 of the second case study. If evaluated based on the typical indicators of successful geodesign practice (e.g., consensus and implementation of a geodesign plan) the results of both the originally intended geodesign project (Part 1) and the geodesign-as-PAR (Part 2) would be unsuccessful. Neither resulted in the implementation of a 'geodesign' plan which expressed participant values in ways to overcome the value-action gap. Yet the geodesign-as-PAR approach in the second case study shows that public participation in the geodesign process achieves a critical learning and action objective and represents an environmentally significant outcome.

The geodesign-as-PAR approach facilitates actions which overcome the value-action gap by providing participants the means to: a.) critically engage with diverse forms of place-based knowledge; b.) understand how such knowledge has been accounted for and expressed in previous land use and planning decisions in the study area; and c.) use that knowledge to restructure the participatory planning process to more meaningfully account for and express diverse forms of place-based knowledge. This provides participants in the geodesign-as-PAR process an opportunity to express their environmental values and structure the design process accordingly. If the geodesign process successfully results in the creation of a design proposal which is subsequently implemented, the scale of the environmentally significant participatory action can be magnified, as discussed with reference to the third and final research question below. The geodesign-as-PAR process therefore provides a means for individuals to understand and

overcome the value-action gap through the simple action of participating in the design process, regardless of whether the resulting plan is implemented.

### 5.3.3 Geodesign for Collective Action

Conceptual models attempting to explain and overcome the value-action gap are often limited to the individual scale and emphasize individual actions associated with consumer behaviors (Chapter 1). Yet environmental problems addressed through the geodesign process are not limited to the individual scale, nor are most environmental values limited solely to individual behavior. The dissertation's final research question therefore considers whether participatory forms of geodesign can increase the scale of environmental agency beyond the individual scale, thereby extending the scope of geodesign's potential relevance for overcoming the value-action gap.

Geodesign's ability to increase the scale of environmental agency to overcome the value-action gap beyond the individual scale depends on the extent to which its participatory and technological characteristics connect the simple action of participation with the implementation of the resulting 'geodesign.' This can be accomplished in two ways based on the dual finding that: a.) individual participation in the geodesign process represents a simple action leading to broader consequences associated with the implementation of the geodesign; and b.) that participatory forms of geodesign can be implemented at the parcel to regional scale, thereby increasing the impact of individual action beyond the individuals direct control.

As noted above, the simple action of participation can provide individuals the opportunity to express their environmental values in environmentally significant ways.

The significance of those actions, however, is dependent on the extent to which the geodesign process contributes to broader collective action associated with those values. The research findings suggest that geodesign magnifies the significance of this participatory action in at least two ways. First, the geodesign framework allows participants to address environmental and social factors beyond their direct control. Existing models attempting to explain and overcome the value-action gap are largely unable to account for both the individual and structural constraints to implementing environmentally significant action (Blake, 1999). By involving representatives of four primary stakeholder groups and working within, but not acquiescing to, existing decision-making structures, the geodesign process increases participants' ability to restructure the design process and achieve their design objectives.

Second, the geodesign framework allows participants to address environmental and social factors beyond their individual understanding. As shown in Chapter 1, the geodesign framework accounts for all the factors associated with the value-action gap, including the interrelationships between those factors and the individual and institutional barriers that could constrain the results of environmental action (Blake, 1999). The geodesign process allows participants to better understand, evaluate and propose changes in factors associated with overcoming the value-action gap including, among others, demographic, institutional, economic, social, cultural, personal, informational, normative/value-based, attitudinal, emotional and responsibility/agency-based factors (Kollmuss & Agyeman, 2002). The critical learning outcomes of the geodesign process allow participants to understand these factors in new ways and thereby facilitate



alternative approaches to addressing design challenges and expressing their environmental values and objectives.

The extent to which geodesign increases participants' perceived environmental agency by facilitating the critical learning and action objectives described above, however, is also dependent on the applicability of geodesign practice at varying scales. The results of the taxonomic evaluation show that the geodesign framework is suitable for projects at a variety of geographic scales, but that achieving the full scope of its participatory characteristics is more difficult at smaller scales. The geodesign approach is most commonly applied in projects at the regional or urban scale. Addressing complex environmental and social challenges at this scale benefits from the technological and analytic input of the geographic sciences. While geodesign literature typically assumes an inverse relation between scale and participatory potential, the review of technological innovations in Chapter 2 identified multiple methods to facilitate digital forms of participation in the geodesign process at any scale (e.g. ReKittke et al., 2012; Lee & Gamez, 2017; McElvaney, 2012, Ch. 7). These results show that the technological and logistical characteristics of geodesign practice can be structured to facilitate collaboration despite the challenge of doing so at the regional scale. Doing so increases the benefits of geodesign's applied learning and action objectives and explains the geodesign framework's potential to magnify the significance of individual action to overcome the value-action gap beyond the individual scale.

#### 5.4 Conclusion: Geodesign, Place and the Value-Action Gap

The geographic concept of place and theory of place-making explain the research results, account for the limitations in current geodesign practice and show the relation between the geodesign framework and the value-action gap. Scholarship on place in human geography conceptualizes place as both a frame for knowledge (Williams & Patterson, 1996; Martin, 2003) and a process for place-making (Elwood, 2006b; Pierce et al., 2011). Though the geodesign framework is intended as both a process for applied environmental planning and a frame for structuring place-based knowledge, the geographic concept of place and theory of place-making underly both characteristics and explain the research results. The geographic concept of place and theory of place-making can be used to evaluate the geodesign framework and practice, indicating that geodesign is dependent on geographic theory and practice while also providing a means to implement these fundamental geographic concepts in practice.

This argument is sustained by the results of each chapter. Chapters 1 and 2 show geodesign's conceptual capacity to account for diverse forms of place-based knowledge encompassed by the geographic concept of place. The three primary aspects of Agnew's (1987) concept of place (location, locale, and sense of place) can be incorporated into the six geodesign models and three phases of geodesign project development. Yet the dissertation research shows that geodesign practice favors locational aspects of place and therefore provides one way of explaining the differentiated case study results. The first case study was pre-populated with maps, models, and methods. This resulted in the uncritical representation and use of spatial data which did not fully account for local differentiation and place-based knowledge. In contrast, the geodesign-as-PAR project

allowed participants to use complex cognitive models based on their intimate place-based knowledge. Yet this knowledge was not accessible to State Park planners or decision-makers within the Archdiocese of Washington D.C. Neither project, therefore, accounted for the full range of place-based knowledge necessary to achieve participants' design objectives.

The participatory characteristics of geodesign practice bridge the divide between locational aspects of place accounted for in spatial systems, process and models and sense of place aspects contributed by public participation. Without accounting for sense of place – “the subjective orientation that can be engendered by living in a place” (Agnew, 1987, p. 6) – geodesign is unable to account for place-based knowledge and values. The extent to which geodesign projects incorporate sense of place through public participation therefore provides a second way of explaining the differentiated project outcomes. Participants in the first case study were not provided an opportunity to collaborate in the first two stages of the geodesign process and were hindered from fully expressing their place-based knowledge and values. In contrast, participants in the geodesign-as-PAR project were able to critically evaluate previous participatory processes and identify opportunities to restructure future processes to provide more meaningful participation. The dissertation therefore shows that while the geodesign framework provides a conceptual means to balance the influence of locational and sense-of-place forms of place-based knowledge, that balance is dependent on the quality of the participatory characteristics of geodesign practice.

The case study results described above show the extent to which the geodesign framework and practice accounts for and expresses locational and sense-of-place aspects

of the geographic concept of place associated with the value-action gap. Yet it is the third aspect of Agnew's (1987) concept of place – locale – that explains the crucial link between geodesign practice and the value-action gap and differentiates it from other models evaluating the value-action gap. As a bounded place-making process, geodesign practice must account for its own locale. It is through their experiential participation in the geodesign process that participants have the opportunity to understand and overcome the value-action gap. The geodesign process begins with an empty project space (Entrikin, 2002, p. 21). Through the iterative stages of project scoping, development of project methods and models, and the completion of the geodesign study, participants collaborate to determine the substance and subject of their newly created space. The participatory process of structuring the geodesign process and determining how to implement the geodesign plan is thus a new place: a temporary representation of a desired future requiring collaborative input and commitment to implement the design through collective action.

As a bounded place-making process, geodesign must not only account for the subject and substance of the study area but also account for the boundaries and practices of the place-making process itself. In this way, evaluations of the geodesign framework and practice are dependent on the geographic theory of place-making. According to Sack's (2010) geographic theory of place-making, all places are a result of simple actions which overcome the 'gap' between reason and causal action. As noted in Chapter 1, Sack's reference to the 'gap' is more fundamental than the value-action gap in that it accounts for all causal action. Instead, it acknowledges that place-making is a fundamental tool to enacting beliefs, values and objectives through "the activities

involved in making, maintaining, using, and altering place of any scale” (Sack, 2010, p. 145). Sack’s geographic theory of place-making shows how simple actions at the individual level achieve enduring results beyond the individual scale. This theory accounts for the relation between place, the ‘gap’ and characteristics of ‘the social,’ including identity, power, relationship, knowledge, and conflict (Sack, 2010, p. 179). These features of the geographic concept of place explain its ability to integrate the diversity of factors associated with the value-action gap while also confronting structural constraints which limit the applicability of other models explaining the value-action gap.

For geodesign to achieve its critical learning and action objectives and facilitate participants' ability to overcome the value-action gap, participants in the geodesign process must have the opportunity to determine the objective and methods for the geodesign process. Decisions regarding the structure and participatory process of geodesign practice is as much a part of geodesign as the subject and substance of the models. While geodesign is often noted for the consensus-building and collaborative characteristics of the workshop, those outcomes are not guaranteed and depend on the parameters of the place-making process established in the first and second stages of the geodesign process. As such, the first and second phases of the geodesign process are critical steps in determining the characteristics of geodesign as a place of participatory planning.

If the geodesign process begins as an empty project space, it is a “dilemmatic space” where difference and diversity, rather than idealized unity or structurally determined outcomes, can be held in dynamic tension (Entrikin, 2002, p. 20). The geodesign process seeks to productively manage this tension by balancing the objective

and subjective aspects of place-based knowledge through participatory place-making. The participatory establishment of 'ground rules' for each geodesign project therefore accords with Entrikin's (2002) articulation of "democratic place-making" (p. 24) able to sustain multi-culturalism through consensus-based rule-making. By attending to these structural elements of the place-making process, geodesign accounts for the final aspect of Agnew's characterization of place. Geodesign, if practiced reflexively with the full implementation of its participatory characteristics, can account for the lived experience of participants, the constraints of their daily life, and the nature of their participation in the geodesign process. Geodesign's locale is thus the place where participants encounter the geodesign process and have the opportunity to engage in the place-making process.

As both a process and a framework, geodesign can serve as an alternative means to understand and overcome the value-action gap. While other models account for a selection of factors or barriers associated with the value-action gap, geodesign can account for the full diversity of place-based factors necessary to overcome the value-action gap. Its capacity to account for and express locational and sense-of-place aspects of place-based knowledge enables participants to critically evaluate the geodesign process as place of participatory planning and experience the process as a unique locale for environmental value expression. The success or failure of the geodesign process therefore depends on the simple action of participation through which participants establish the geodesign process as a place for participatory planning. By accounting for the geographic concept of place and theory of place-making, geodesign provides a place for participatory planning through which participants can express environmental values and overcome the value-action gap.

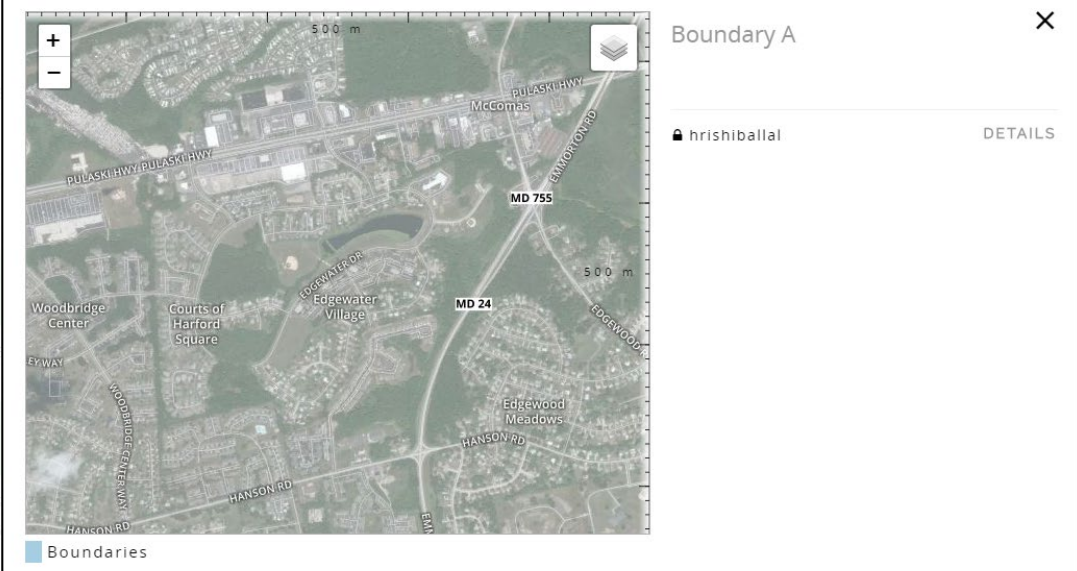
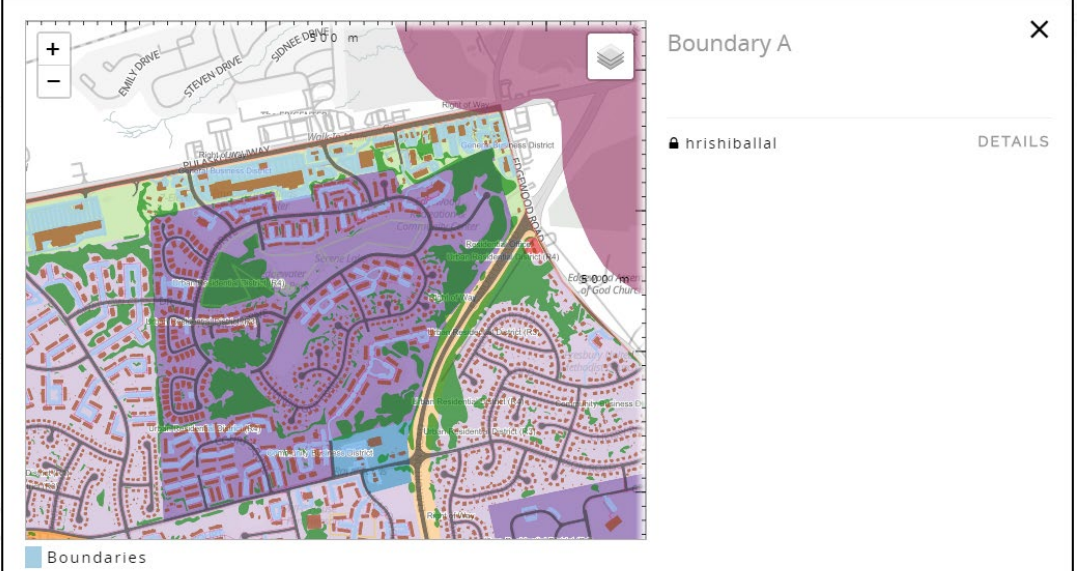
## Annexes

*Annex A1 – Edgewater Village Park Geodesign Project Models (Case Study 1)*

*Annex A2 – Analysis of Case Study 1 Survey data*

*Annex A3 – Data collection instruments and procedures*

**Annex A1: Edgewater Village Park Geodesign Project Models.** Each row in the following table explain and illustrate each step in the geodesign project workshop in the first case study. All screenshots are from GeodesignHub.com and are narrated in the column at right.

<p><b>Representation model:</b> data for the representation model was limited to publicly available basemaps and satellite imagery, as well as thematic layers derived from those basemaps.</p>	 <p>Boundary A</p> <p>hrishiballal DETAILS</p> <p>Boundaries</p>
<p><b>Process model:</b> data requirements for <b>process</b> models depend on the scope and complexity of the intended evaluation models. The process models were derived from the representation models by the GeodesignHub facilitator according to the themes described in the evaluation models.</p>	 <p>Boundary A</p> <p>hrishiballal DETAILS</p> <p>Boundaries</p>



Evaluation model: Evaluation models are a key feature in the GeodesignHub workflow. In this case, the platform included ten evaluation themes. Data from the representation and process models are compiled into an evaluation layer for each theme (see Rivero et al., 2015 for methodological detail). Each respective evaluation layer is presented separately on the GeodesignHub platform to facilitate visual evaluation when adding design elements and considering impacts. The project planning team selected the following themes for the evaluation models: recreation (PREC), green infrastructure (GI), blue infrastructure (BI), educational infrastructure (EI), transportation (TRANS), agriculture (AG), mixed-use (MIS), industrial (IND), low-density housing (LDH), and high-density housing or community institutions (INST).



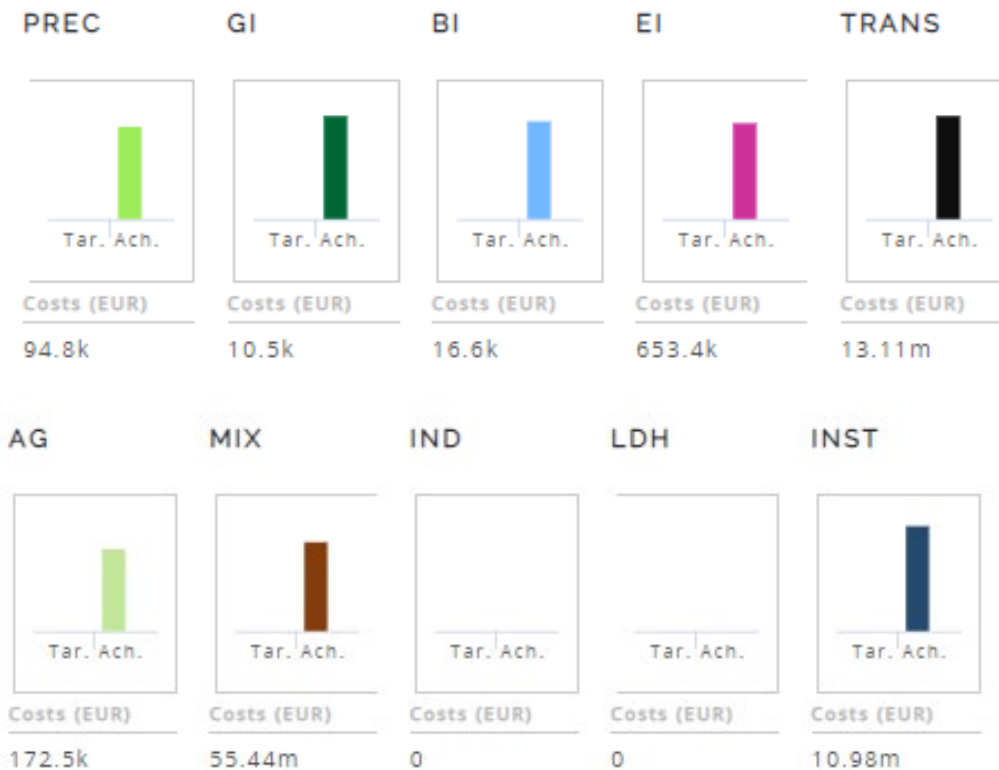
Change model: Participants in the geodesign workshop contribute their ideas for changes in the study area using the sketch function within the GeodesignHub platform. The sketch function allows users to add points, line, polygons, and annotations. The design interventions are categorized according to theme. In this case, participants were able to add interventions in each of the ten evaluation model themes. As shown in the diagram below, the categories with the most design interventions were recreation, transportation, and low-density housing. Designs interventions for educational infrastructure, agriculture, green infrastructure, and high-density housing attracted only one or two design proposals from workshop participants.

The GeodesignHub platform supports dynamic collaboration between workshop participants. As each participant develops their individual designs, the designs become visible to all participants. The participants can then compile multiple design features into their conceptual design regardless of who created the individual design feature. This enhances group collaboration during the workshop. The platform has multiple visualization features to compare individual design elements, concepts, and plans developed by each participant or group. All design elements and conceptual designs are visible by

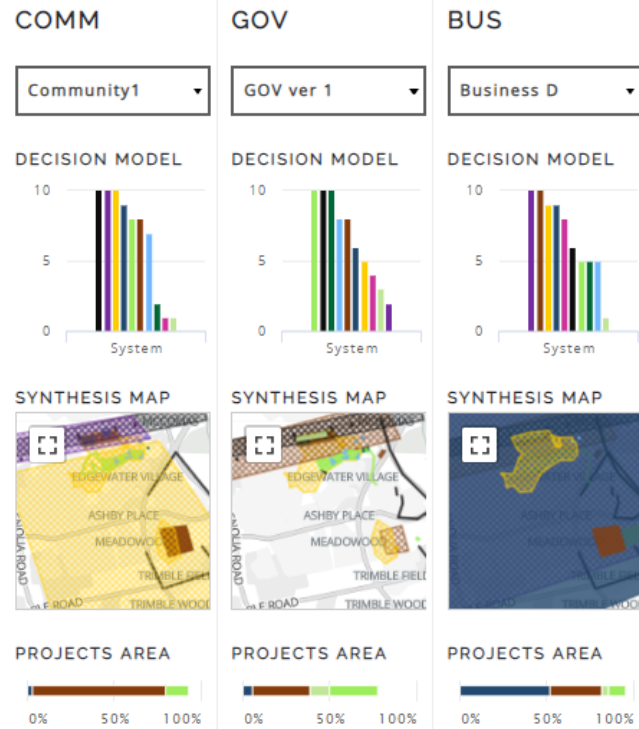


turning them on or off as layers in the GeodesignHub platform.

Impact model: As soon as participants add design interventions to their conceptual design, the GeodesignHub platform automatically calculates the 'impact' of the intervention. The user can toggle to see the impact of one or multiple interventions. For this case, the impact model was simplified to evaluate the total area encompassed by interventions in each theme. For example, if users had specific goals regarding the amount of recreational space, they could easily gauge whether their conceptual design had achieved that goal throughout the design process. The GeodesignHub platform can accommodate dynamic impact models such as those utilized in stand-alone planning support systems, but these were not necessary to achieve the goals of this case study.



Decision model: the final step in the workflow requires participants to compare possible design interventions or plans and negotiate to reach a final decision. The decision model facilitates this process. The GeodesignHub platform allows workshop participants to modify their designs in real time, thereby facilitating negotiation and group decision-making as the teams accommodate alternative ideas and evaluate potential impacts. The decisions model used in this case quantified the area added under each evaluation theme (e.g. housing, recreation) and illustrated the comparative total in a bar chart for each of the three group's composite designs (see figure). Like the change and impact models, the decision models are dynamic and update automatically whenever participants adjust the design elements throughout the workshop. More advanced decision models can be added to the GeodesignHub platform, but only the basic elements of the decision model were necessary for the purposes of this case study.



*A2- Survey Data Figures. All figures below created by the author using R and XLstat software based on pre- and post-workshop survey data from case study one.*

### *A2.1 Factor Analysis*

Two forms of factor analysis were used to assess whether the difference between process satisfaction and outcome satisfaction was significant. Principle component analysis was used to evaluate possible reductions in the number of variables associated with process and outcome satisfaction to increase the precision of the evaluation. Factor analysis was used to identify the structure of the resulting dataset.

Eigenvalues were calculated for all dimensions of the principal component analysis and a scree plot was used to identify dimensions suggested to be retained. Components with eigenvalues  $> 1$  are typically retained (Kaiser, 1960). The three primary dimensions account for 71.58% of cumulative variance. The relation between variables and dimensions were plotted on a variable correlation plot. The results of the principal component analysis suggest two to three primary dimensions in the survey results regarding factors of participant satisfaction in the geodesign workshop. However, the results do not suggest a significant difference between process and outcome satisfaction. Instead, the principal component analysis indicates that ‘influence,’ ‘respect,’ ‘results’ and ‘process’ variables are associated in a single dimension, suggesting there are other ways to categorize participant satisfaction than a single indicator of process and outcome satisfaction. The scree plot and variable correlation plot are illustrated in Annex A2, Figure 1.

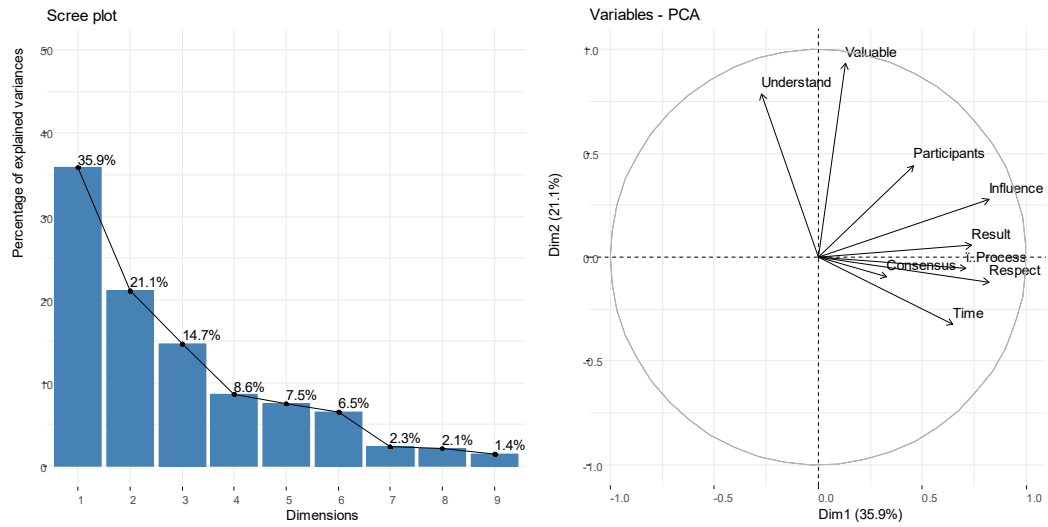
The relation between each variable and the retained dimensions was tested in two ways: the quality of representation of each variable was illustrated using the  $\cos^2$  (square cosine, squared coordinates) function in FactoMineR package of R and a bar chart of the contribution of

each variable to each dimension (Lê et al., 2008). The results of the principal component analysis suggest that the survey variables could be reduced into three scaled variables. Annex A2, Figure 2 illustrates the results of the principal component analysis of process and outcome satisfaction variables.

Exploratory factor analysis was conducted on the specific satisfaction variables; the general variables for process and outcome were not retained due to their possible lack of precision and subjectivity among survey respondents. Eigenvalues were calculated and a scree plot was used to identify the number of retained dimensions. Using three factors, exploratory factor analysis with varimax orthogonal rotation resulted in a p-value of 0.84 with the structure shown in Annex A2, Figure 4.

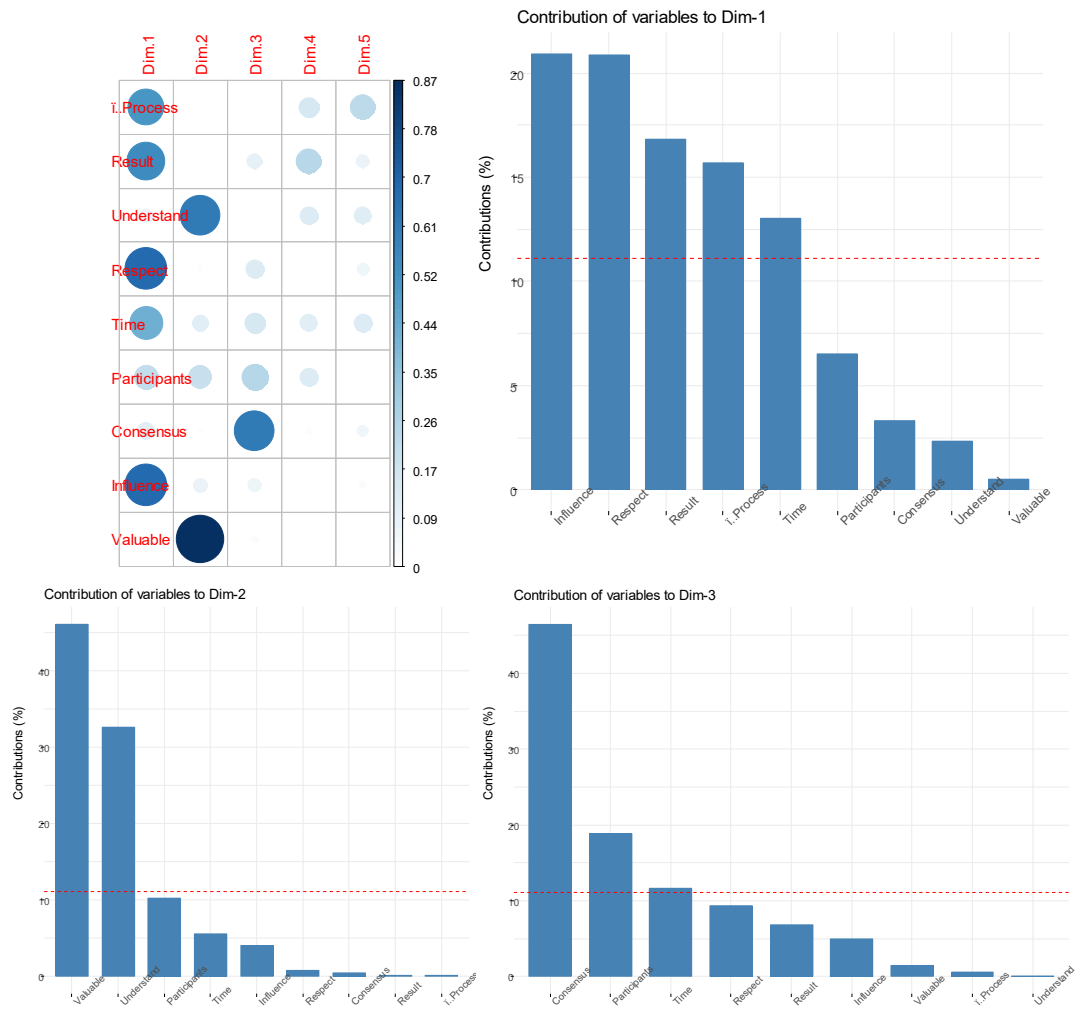
Factor loadings were calculated for all variables and are shown for all factor loadings > 0.3 in the table below. The three retained factors account for 67% of total variance and each of the three factors has a difference in proportional variance of no more than 0.06. Factor 1, which could be labeled as an indicator of decision-making satisfaction, includes the respect, influence and consensus items. Factor 2, which could be labeled an indicator of the workshop satisfaction, includes the ease of understanding, valuable use of time, and sufficient time for the workshop item. Factor 3 is a single item factor which could be labeled as an indicator of representativeness.

Annex A2, Figure 1: Principle Component Analysis of Process and Outcome Satisfaction



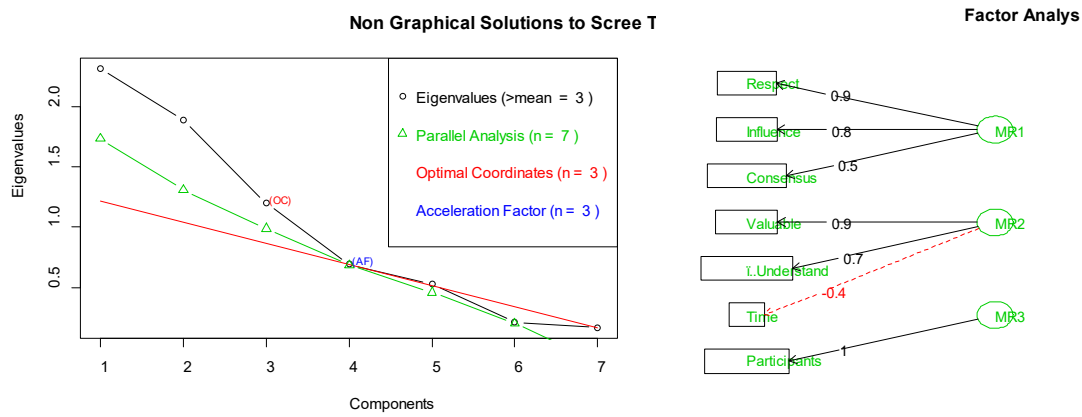
	<i>Eigenvalue</i>	<i>Variance (%)</i>	<i>Cumulative Variance (%)</i>
<i>Dim.1</i>	3.23	35.85	35.85
<i>Dim.2</i>	1.90	21.06	56.91
<i>Dim.3</i>	1.32	14.67	71.58
<i>Dim.4</i>	0.77	8.56	80.14
<i>Dim.5</i>	0.68	7.54	87.68
<i>Dim.6</i>	0.58	6.46	94.14
<i>Dim.7</i>	0.21	2.32	96.46
<i>Dim.8</i>	0.19	2.14	98.60
<i>Dim.9</i>	0.13	1.40	100.00

Annex A2, Figure 2: Contribution of Variables in Principle Component Analysis of Process and Outcome Satisfaction



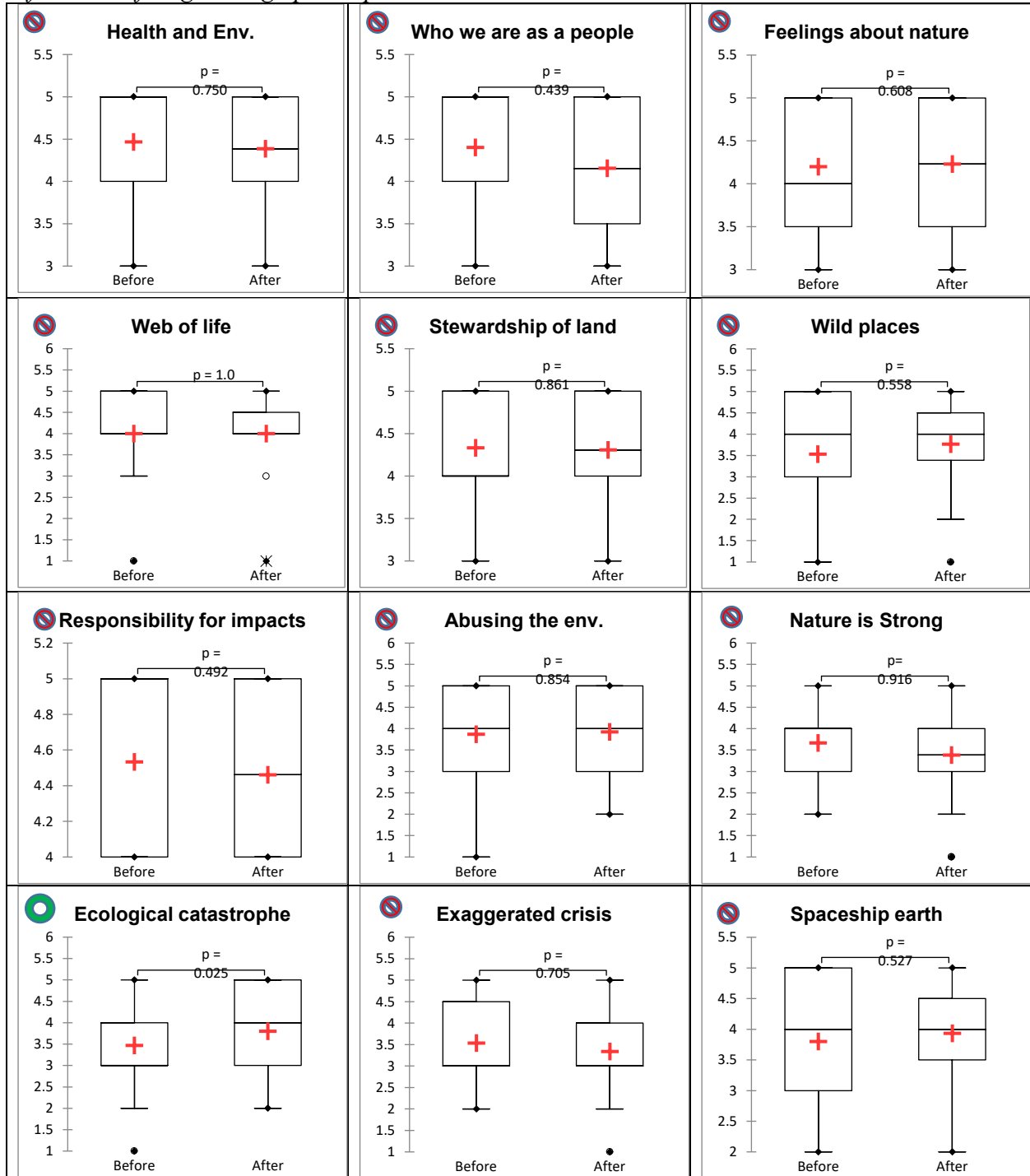


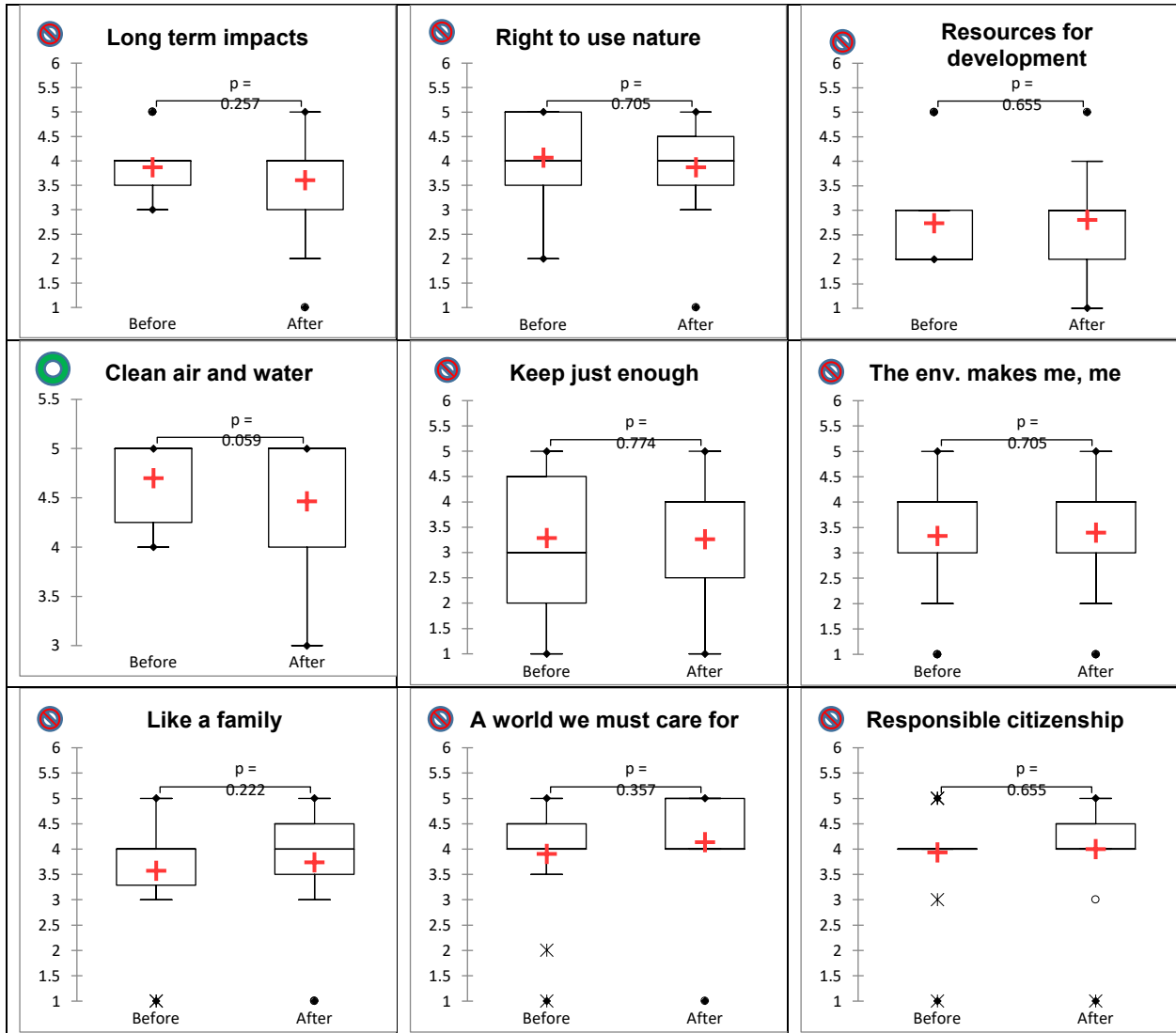
Annex A2, Figure 3: Exploratory Factor Analysis Showing Structure of Participant Satisfaction



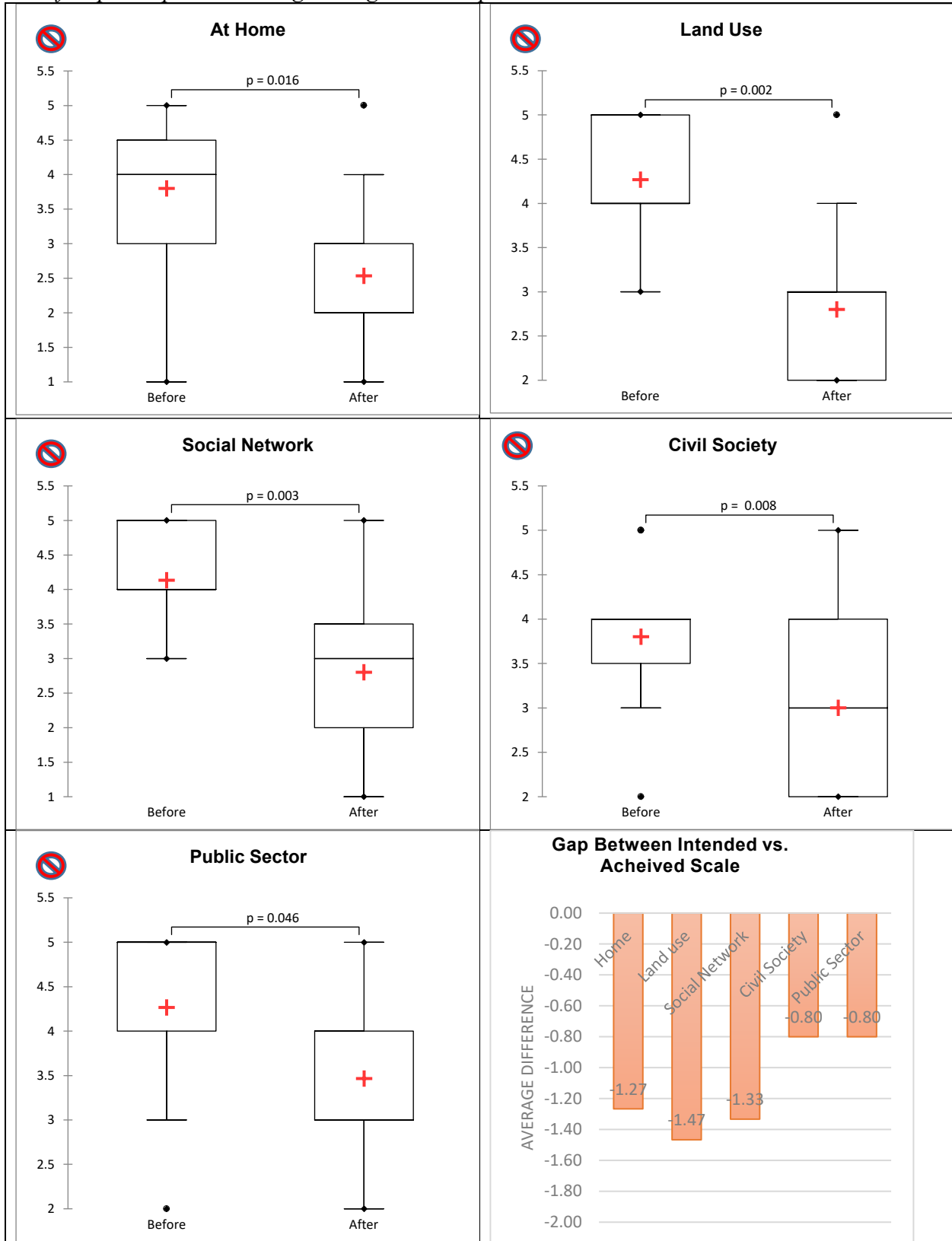
	Factor 1	Factor 2	Factor 3
Respect	0.92		
Influence	0.75		
Understand		0.74	
Valuable		0.88	
Participants			1.00
Time		-0.46	
Consensus	0.48		
SS Loadings	1.77	1.62	1.32
Proportional Variance	0.25	0.23	0.19
Cumulative Variance	0.25	0.48	0.67

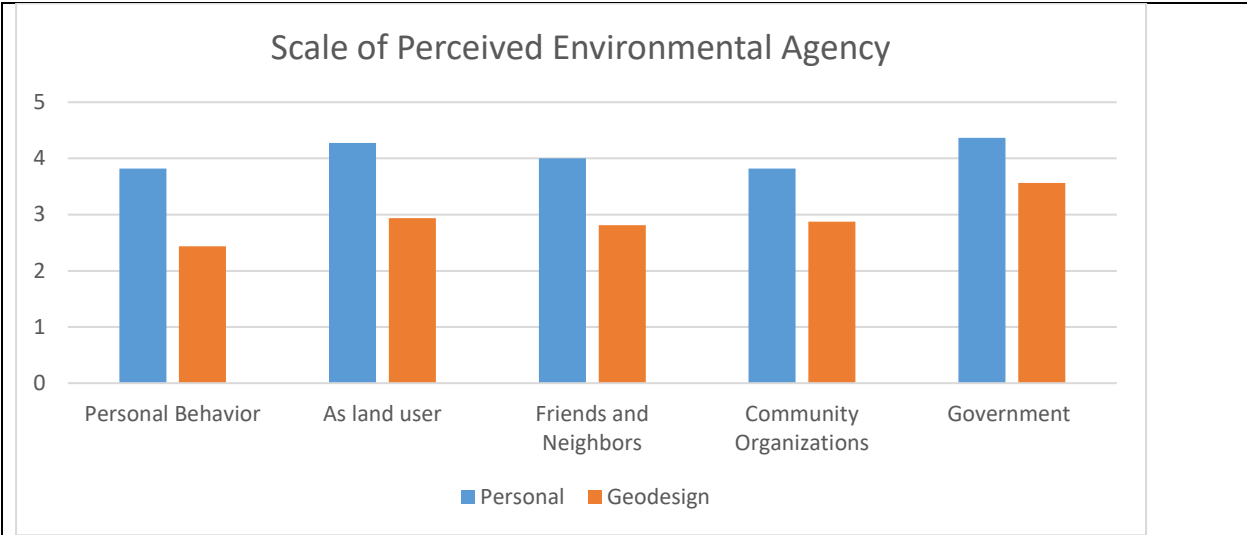
Annex A2, Figure 4: Wilcoxon Signed Rank Statistic Comparison of environmental values before and after geodesign participation





Annex A2, Figure 5: Comparison of perceived environmental agency at varying scales before and after participation in the geodesign workshop





*(p-values based on Wilcoxon signed-rank statistic at 0.05 significance level).*

### CONSENT TO PARTICIPATE

<b>Project Title</b>	<b>Expressing Environmental Values through Geodesign</b>
<b>Purpose of the Study</b>	<i>This research is being conducted by Matthew Kuniholm at the University of Maryland, College Park. We are inviting you to participate in the geodesign evaluation research project to provide data to help us understand the impact and effectiveness of the planning process. The purpose of this research is to understand how people in geodesign projects understand, express or modify their environmental values, and their satisfaction with the geodesign process overall.</i>
<b>Procedures</b>	<i>You have the opportunity to participate in a ~10 minute survey which you can complete by filling out a paper survey during both the first and last project workshops, and a separate 20-30 minute interview to discuss your feedback in further detail with the principal researcher any time after the final geodesign workshop. Your interview will be recoded using a digital recorder so your feedback can be fully assessed. You will have an opportunity to schedule the interview at a time and place suitable for you. You can choose to participate in the survey, the interview, neither the survey or the interview, or both the survey and the interview.</i>
<b>Potential Risks and Discomforts</b>	<i>While completing both the survey and interview you will be asked questions regarding your values and attitudes regarding the environment. This may be challenging or uncomfortable if you have not considered these issues before, but no further risks or discomforts are likely. You may choose not to answer any question, and can ask for clarification or stop the interview or survey at any time for any reason.</i>
<b>Potential Benefits</b>	<i>There are no direct benefits from participating in this research. However, you may benefit from a greater appreciation of your environmental values and attitudes by participating in this research. We also hope that, in the future, other people might benefit from this study through improved understanding of how geodesign projects allow people to express their environmental values.</i>
<b>Confidentiality</b>	<i>Only the principal researcher will have access to the survey and interview data. Any potential loss of confidentiality in survey data will be minimized by storing data in a secure location and/or password protected computer and will be destroyed after the research is complete.  <i>If we write a report or article about this research project, your identity will be protected to the maximum extent possible. We won't attribute any information you share with us or use your name or other identifiable information. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities only if you or someone else is in danger or if we are required to do so by law.</i></i>

<b>Right to Withdraw and Questions</b>	<p><i>Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.</i></p> <p><i>If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:</i></p> <p style="text-align: center;"><i>Matthew Kuniholm, 2134 Lefrak Hall, University of Maryland, College Park, MD 20740 Email: <a href="mailto:Matk@umd.edu">Matk@umd.edu</a>; Telephone: 202-297-0183</i></p>	
<b>Participant Rights</b>	<p><i>If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:</i></p> <p style="text-align: center;">University of Maryland College Park Institutional Review Board Office 1204 Marie Mount Hall College Park, Maryland, 20742 E-mail: <a href="mailto:irb@umd.edu">irb@umd.edu</a> Telephone: 301-405-0678</p> <p><i>This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</i></p>	
<b>Statement of Consent</b>	<p><i>Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.</i></p> <p><i>Please select the box below if you agree to participate in the survey and/or the interview and sign your name below.</i></p> <p><b>Survey</b>                    <input type="checkbox"/></p> <p><b>Interview</b>                <input type="checkbox"/></p>	
<b>Signature and Date</b>	<b>NAME OF PARTICIPANT</b> [Please Print]	
	<b>SIGNATURE OF PARTICIPANT</b>	
	<b>DATE</b>	

*Semi-Structured Interview Protocol*  
*Project: Expressing Environmental Values through Geodesign*  
*Matt Kuniholm – Principle Investigator, University of Maryland, Department of Geographical Sciences*

Time of interview:

Date:

Place:

Interviewer:

Interviewee:

Position/Affiliation of Interviewee:

Questions:

1. How did you become involved in this project/meeting/group?
2. How effective do you think the participatory planning (geodesign) process was?
3. Did the participatory planning (geodesign) process help you to communicate your interests, values and ideas with other participants?
4. Did the participatory planning (geodesign) process help you collaborate with other participants to agree on the proposed design?
5. Are you satisfied with the results of the participatory planning (geodesign) process?
6. What did you learn through the participatory planning (geodesign) process?
7. Where you able to express your interests, ideas and beliefs through the participatory planning (geodesign) process?
8. How could the geodesign process be improved to increase your satisfaction with the process and result?



*Pre and Post Workshop Survey*  
*Project: Expressing Environmental Values through Geodesign*  
*Matt Kuniholm – Principle Investigator, University of Maryland, Department of Geographical Sciences*

**Part I:**

**--- Pre-workshop survey---**

1. You may be participating in this workshop for a variety of reasons. Please rate how important the following objectives are for your participation in this workshop:
  - a. To learn about issues affecting the area  
1- not important at all      2-      3-      4-      5-very important
  - b. To teach others about the issues affecting the area  
1- not important at all      2-      3-      4-      5-very important
  - c. To analyze and evaluate issues affecting the area  
1- not important at all      2-      3-      4-      5-very important
  - d. To help decision-makers improve their plans for the area  
1- not important at all      2-      3-      4-      5-very important
  - e. To hear from others about issues affecting the area  
1- not important at all      2-      3-      4-      5-very important
  - f. To express your environmental values  
1- not effective at all      2-      3-      4-      5-very effective
  - g. To make decisions and collaborate with others to address issues affecting the area  
1- not important at all      2-      3-      4-      5-very important
  
2. Please rate how much you believe acting in the following ways allows you to influence your environment:
  - a. In my personal behavior at home  
1- no influence at all      2-      3-      4-      5-very influential
  - b. In the ways I manage the land I own or use  
1- no influence at all      2-      3-      4-      5-very influential
  - c. Through my influence among my friends and neighbors  
1- no influence at all      2-      3-      4-      5-very influential
  - d. Through my participation at a community organization, church or association  
1- no influence at all      2-      3-      4-      5-very influential
  - e. Through my involvement in government programs, policies or initiatives  
1- no influence at all      2-      3-      4-      5-very influential

----- **Post-workshop Survey** -----

1. Please rate your agreement with the following statements based on your experience during the geodesign process:

- a. The process was easy to understand:  
1- I don't agree at all      2-      3-      4-      5- I strongly agree
- b. My ideas and opinions were respected:  
1- I don't agree at all      2-      3-      4-      5- I strongly agree
- c. There was enough time for everyone to participate:  
1- I don't agree at all      2-      3-      4-      5- I strongly agree
- d. The right people were present to participate:  
1- I don't agree at all      2-      3-      4-      5- I strongly agree
- e. In the end, we all agreed on the final plan:  
1- I don't agree at all      2-      3-      4-      5- I strongly agree
- f. I could see how my ideas influenced the design process:  
1- I don't agree at all      2-      3-      4-      5- I strongly agree
- g. The geodesign process was a good use of my time:  
1- I don't agree at all      2-      3-      4-      5- I strongly agree

2. Please rate how effective you feel the geodesign process was to enable you to:

- a. To learn about issues affecting the area  
1- not effective at all      2-      3-      4-      5-very effective
- b. To teach others about the issues affecting the area  
1- not effective at all      2-      3-      4-      5-very effective
- c. To analyze and evaluate issues affecting the area  
1- not effective at all      2-      3-      4-      5-very effective
- d. To help decision-makers improve their plans for the area  
1- not effective at all      2-      3-      4-      5-very effective
- e. To hear from others about issues affecting the area  
1- not effective at all      2-      3-      4-      5-very effective
- f. To express your environmental values  
1- not effective at all      2-      3-      4-      5-very effective
- g. To make decisions and come to agreement with others to address issues affecting the area  
1- not effective at all      2-      3-      4-      5-very effective

3. Please rate how much you agree with the following statements:

I believe the geodesign process helps me influence the environment:

- a. In my personal behavior at home  
1- no influence at all      2-      3-      4-      5-very influential
- b. In the ways I manage the land I own  
1- no influence at all      2-      3-      4-      5-very influential
- c. In the ways I work together with friends and neighbors  
1- no influence at all      2-      3-      4-      5-very influential
- d. In the ways I influence decision-makers responsible for managing land  
1- no influence at all      2-      3-      4-      5-very influential
- e. In the ways I participate in school, church or other community organizations  
1- no influence at all      2-      3-      4-      5-very influential
- f. In the ways I participate in government programs, policies or initiatives  
1- no influence at all      2-      3-      4-      5-very influential

4. In your opinion, were there any themes that should have been included in the maps or geodesign tool that were not included? If so, please describe.

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5. How satisfied were you with your experience participating in the geodesign process?  
1- not satisfied at all      2-      3-      4-      5-very satisfied

6. How satisfied are you with the result of the geodesign process?  
1- not satisfied at all      2-      3-      4-      5-very satisfied

7. Do you have any suggests for how to improve the process?

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**Part II: Environmental Views (both pre and post workshop survey)**

*Please state the extent to which you agree with the following statements. For each statement, please state whether you Highly Disagree, Disagree, Neither Agree nor Disagree, Agree, or Highly Agree.*

	Highly Disagree	Disagree	Neither Agree nor Disagree	Agree	Highly Agree
19. There are landscapes that say something about who we are as a community, a people.					
20. My health or the health of my family is related one way or another to the natural environment.					
21. I have strong feelings about nature (including all plants, animals, the land, etc.); these views are part of who I am and how I live my life.					
22. Plants and animals, as part of the interdependent web of life, are like 'kin' or family to me, so how we treat them matters.					
23. How I manage the land, both for plants and animals and for future people, reflects my sense of responsibility to and so stewardship of the land.					
24. I often think of some wild places whose fate I care about and strive to protect, even though I may never see them myself.					
25. Humans have a responsibility to account for our own impacts to the environment because they can harm other people.					
26. Humans are severely abusing the environment.					
27. The balance of nature is strong enough to cope with the impacts of modern industrial nations.					
28. If things continue on their present course, we will soon experience a major ecological catastrophe.					

29. The so-called "ecological crisis" facing humankind has been greatly exaggerated.					
30. The earth is like a spaceship with very limited room and resources.					
31. Humans have the right to use nature to meet our needs, even if this includes impacts that will take a decade or more to recover.					
32. Humans have the right to use nature any way we want.					
33. I think about the forest/ocean and the plants and animals in it like:					
a. Something I identify with so strongly that it makes me, me.					
b. A family of which I am very much a part.					
c. A world we must care for so that any damage doesn't also negatively affect humans who depend on it elsewhere.					
d. Beings to which we owe responsible citizenship and care.					
34. Natural resource extraction is necessary for countries to develop.					
35. It is important to protect nature so we have clean air and water.					
36. We can lose forests and wetlands, as long as we are keeping enough for the environment to function.					

(Source: Klain et al 2017).

## Bibliography

- Abukhater, A. & Walker, D. (2010). Making smart growth smarter with GeoDesign. In *Changing Geography by Design: selected reading in geodesign*. ESRI, Redlands, CA.
- Agnew, J. (1987). *Place and politics : The geographical mediation of state and society*. Boston: Allen & Unwin.
- Agyeman, J., & Angus, B. (2003). The role of civic environmentalism in the pursuit of sustainable communities. *Journal of Environmental Planning and Management*, 46(3), 345-363.
- Aitken, S. (2002). Public participation, technological discourses and the scale of GIS. *Community participation and geographic information systems*, 357-66.
- Allen, A., Lambert, R., Apsan Frediani, A., & Ome, T. (2015). Can participatory mapping activate spatial and political practices? Mapping popular resistance and dwelling practices in Bogotá eastern hills. *Area*, 47(3), 261-271.
- Archer, M., Decoteau, C., Gorski, P., Little, D., Porpora, D., Rutzou, T., Smith, C., Steinmetz, G., & Vandenberghe, F. (2016). What is critical realism? Perspectives: A Newsletter of the ASA Theory Section, Fall 2017. Retrieved from: <http://www.asatheory.org/current-newsletter-online/what-is-critical-realism>
- Arciniegas, G., & Janssen, R. (2012). Spatial decision support for collaborative land use planning workshops. *Landscape and urban planning*, 107(3), 332-342
- Arciniegas, G., Janssen, R., & Rietveld, P. (2013). Effectiveness of collaborative map-based decision support tools: Results of an experiment. *Environmental modelling & software*, 39, 159-175.
- Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Institute of planners*, 35(4), 216-224.
- Artz, M., (2010) Changing Geography by Design. In *Changing Geography by Design: selected reading in geodesign*. ESRI, Redlands, CA.
- Atzmanstorfer, K., Resl, R., Eitzinger, A., & Izurieta, X. (2014). The GeoCitizen-approach: community-based spatial planning—an Ecuadorian case study. *Cartography and geographic information science*, 41(3), 248-259.

- Bailey, K. D. (1994). *Quantitative Applications in the Social Sciences: Typologies and taxonomies*. Thousand Oaks, CA: SAGE Publications, Inc.
- Bailey, K., & Grossardt, T. (2010). Toward structured public involvement: Justice, geography and collaborative geospatial/geovisual decision support systems. *Annals of the Association of American Geographers*, 100(1), 57-86.
- Ballal, Hrishikesh. 2015. *Collaborative Planning with Digital Synthesis*. Dissertation, Centre for Advanced Spatial Analysis, Faculty of the Built Environment, University College London.
- Batty, M. (2013). Defining geodesign (= GIS+ design?). *Environment and Planning B: Planning and Design*, 40(1), 1-2.
- Beitzell, E. (1962). *A History of St. Francis Xavier Roman Catholic Church (Old Newtown): The Manor of Little Britton, St. Mary's County, Maryland*. St. Francis Xavier Church.
- Bhaskar, R. (1979). *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Science*. Atlantic Highlands, NJ: Humanities Press.
- Binns, T., Hill, T., & Nel, E. (1997). Learning from the people: participatory rural appraisal, geography and rural development in the 'new' South Africa. *Applied Geography*, 17(1), 1-9.
- Blake, J. (1999). "Overcoming the 'value-action Gap' in Environmental Policy: Tensions between National Policy and Local Experience." *Local Environment* 4 (3): 257-278.
- Borges, J., & Ballal, H. (2017). Geodesign for everyone: A case study in Brazil. Retrieved from <https://newcities.org/perspectives-geodesign-for-everyone-a-case-study-in-brazil/>
- Boroushaki, S., & Malczewski, J. (2010). Measuring consensus for collaborative decision-making: a GIS-based approach. *Comput Environ Urban Syst*, 34, 322–332.
- Brown, G. & Kyttä, M. (2014). Key issues and research priorities for public participation GIS (PPGIS) for land use planning: A synthesis based on empirical research. *Applied Geography*, 46, 122–136
- Brown, G. (2012). Public Participation GIS (PPGIS) for regional and environmental planning: Reflections on a decade of empirical research. *URISA journal*, 24(2), 7-19.
- Brown, G. (2012b). An empirical evaluation of the spatial accuracy of public participation GIS (PPGIS) data. *Applied geography*, 34, 289-294.

- Brown, G., & Chin, S. Y. W. (2013). Assessing the effectiveness of public participation in neighbourhood planning. *Planning Practice and Research*, 28(5), 563-588.
- Brown, G., & Fagerholm, N. (2015). Empirical PPGIS/PGIS mapping of ecosystem services: A review and evaluation. *Ecosystem Services*, 13, 119-133.
- Brown, G., & Weber, D. (2012). Measuring change in place values using public participation GIS (PPGIS). *Applied Geography*, 34, 316-324
- Burby, R. J. (2003). Making plans that matter: Citizen involvement and government action. *Journal of the American Planning Association*, 69(1), 33-49
- Buttimer, A., & Seamon, D. (1980). *The human experience of space and place*. New York, St. Martin's Press.
- Cadag, J. R. D., & Gaillard, J. C. (2012). Integrating knowledge and actions in disaster risk reduction: the contribution of participatory mapping. *Area*, 44(1), 100-109.
- Cahill, C. (2010). 'Why do they hate us?' Reframing immigration through participatory action research. *Area*, 42(2), 152-161.
- Cameron, J., & Gibson, K. (2005). Participatory action research in a poststructuralist vein. *Geoforum*, 36(3), 315-331.
- Campagna, M., & Di Cesare, E. A. (2014). Geodesign From Theory to Practice: In the Search for Geodesign Principles in Italian Planning Regulations. *Tema. Journal of Land Use, Mobility and Environment*.
- Campagna, M., Di Cesare, E. A., Matta, A., & Serra, M. (2019). Bridging the Gap Between Strategic Environmental Assessment and Planning: A Geodesign Perspective. In *Environmental Information Systems: Concepts, Methodologies, Tools, and Applications* (pp. 569-589). IGI Global.
- Caquard, S. (2014). Cartography II: Collective cartographies in the social media era. *Progress in Human Geography*, 38(1), 141-150.
- Carnes, S. A., Schweitzer, M., Peelle, E. B., Wolfe, A. K., & Munro, J. F. (1998). Measuring the success of public participation on environmental restoration and waste management activities in the US Department of Energy. *Technology in society*, 20(4), 385-406.
- Carton, L. J., & Thissen, W. A. H. (2009). Emerging conflict in collaborative mapping: Towards a deeper understanding?. *Journal of Environmental Management*, 90(6), 1991-2001.



- Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World development*, 22(7), 953-969.
- Chambers, R. (2006). Participatory mapping and geographic information systems: whose map? Who is empowered and who disempowered? Who gains and who loses?. *The Electronic Journal of Information Systems in Developing Countries*, 25(1), 1-11.
- Cloke, P., & Johnston, R. (Eds.). (2005). *Spaces of geographical thought: Deconstructing human geography's binaries*. Sage.
- Cocco, C., Fonseca, B. M., & Campagna, M. (2015). Applying geodesign in urban planning: case study of Pampulha, Belo Horizonte, Brazil. *Revista Brasileira de Cartografia*, 67(5).
- Coglianesi, C. (2002). Is Satisfaction Success? Evaluating Public Participation in Regulatory Policymaking. Harvard University, John F. Kennedy School of Government Working Paper No. RWP02-038. Retrieved from SSRN: <https://ssrn.com/abstract=331420>
- Cresswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five tradition (3<sup>rd</sup> Edition)*. Washington D.C.: Sage Publications.
- Cresswell, T. (2015). *Place: An introduction* (Second ed.) Chichester, West Sussex, UK: J. Wiley & Sons.
- Crossland, M. D., Wynne, B. E., & Perkins, W. C. (1995). Spatial decision support systems: An overview of technology and a test of efficacy. *Decision support systems*, 14(3), 219-235
- Curran, R. E. (2014). *Papist Devils*. CUA Press.
- Cushner, N. P. (2002). *Soldiers of God: The Jesuits in colonial America, 1565-1767*. Buffalo, NY: Language Communications.
- Dangermond, J. (2010). Geodesign and GIS—designing our futures. *Peer Reviewed Proceedings of Digital Landscape Architecture, Anhalt University of Applied Science, Germany*.
- Dept. of Housing and Community Development. (2018). Maryland Opportunity Zones Website. Retrieved from <https://dhcd.maryland.gov/Pages/OZ-Conference.aspx>
- Dietz, T., Fitzgerald, A., & Shwom, R. (2005). Environmental Values. *Annual Review of Environment and Resources*, 30(1), 335–372.  
<https://doi.org/10.1146/annurev.energy.30.050504.144444>

- Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., & Vandenberg, M. P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proceedings of the National Academy of Sciences*, 106(44), 18452-18456.
- Drahota, A. M. Y., Meza, R. D., Brikho, B., Naaf, M., Estabillo, J. A., Gomez, E. D., ... & Aarons, G. A. (2016). Community-academic partnerships: A systematic review of the state of the literature and recommendations for future research. *The Milbank Quarterly*, 94(1), 163-214.
- Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of social issues*, 56(3), 425-442.
- Eikelboom, T., Janssen, R., & Stewart, T. J. (2015). A spatial optimization algorithm for geodesign. *Landscape and Urban Planning*, 144 (December), 10-21.
- Elwood, S. (2002). GIS use in community planning: A multidimensional analysis of empowerment. *Environment and Planning A* 34:905–22.
- Elwood, S. (2006a). Critical issues in participatory GIS: Deconstructions, reconstructions, and new research directions. *Transactions in GIS*, 10(5), 693-708.
- Elwood, S. (2006b). Beyond cooptation or resistance: Urban spatial politics, community organizations, and GIS-based spatial narratives. *Annals of the association of American geographers*, 96(2), 323-341.
- Elwood, S. (2009). Integrating participatory action research and gis education: Negotiating methodologies, politics and technologies.
- Entrikin, J. N. (2002). Democratic place-making and multiculturalism. *Geografiska Annaler: Series B, Human Geography*, 84(1), 19-25
- Ervin, S. (2012). A system for GeoDesign. In: Buhmann, E. et al. (Eds.), *Peer Review Proceedings of Digital Landscape Architecture 2012*. Wichmann.
- Ervin, S. (2016). Technology in geodesign. *Landscape and Urban Planning*, 156, 12-16.
- Flacke, J., Shrestha, R., & Aguilar, R. (2020). Strengthening Participation using Interactive Planning Support Systems: A Systematic Review. *ISPRS International Journal of Geo-Information*, 9(1), 49.

- Flanagin, A. J., & Metzger, M. J. (2008). The credibility of volunteered geographic information. *GeoJournal*, 72(3-4), 137-148.
- Flaxman, M. (2010). Fundamentals of geodesign. *Proceedings of digital landscape architecture, Anhalt University of Applied Science, Germany*, 2, 69-72.
- Foster, K. (2016). Geodesign Parsed: Placing it within the rubric of recognized design theories. *Landscape and Urban Planning*, 156, 92-100.
- Frederiks, E. R., Stenner, K., & Hobman, E. V. (2015). Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour. *Renewable and Sustainable Energy Reviews*, 41, 1385-1394
- GeodesignHub (2019). <https://www.geodesignhub.com/>
- Georgetown University Library Exhibition. 1976. "The American Mission: Maryland Jesuits from Andrew White to John Carroll." Retrieved January 7, 2018 from: <https://www.library.georgetown.edu/exhibition/american-mission-maryland-jesuits-andrew-white-john-carroll>
- Georgetown University, Working Group on Slavery, Memory, and Reconciliation. (2016). *Report of the Working Group on Slavery, Memory, and Reconciliation to the President of Georgetown University, Washington, DC, Summer 2016*. Retrieved from: <http://slavery.georgetown.edu/report/>
- Ghose, R. (2007). Politics of scale and networks of association in public participation GIS. *Environment and Planning A*, 39(8), 1961-1980.
- Goodchild, M. F. (2010). Towards geodesign: Repurposing cartography and GIS? *Cartographic Perspectives*, (66), 7-22.
- GoodLands. (2017). "Categorization of Catholic Land in the USA." Unpublished materials reviewed by author.
- GoodLands. (2018). "GoodLands Mission." GoodLands Website. <http://www.goodlandproject.org/mission.html>.
- Grubber, K. (2015). *St. Mary's County*. Charleston, South Carolina: Arcadia Publishing.
- Hall, B. L. (2005). In from the cold? Reflections on participatory research from 1970-2005. *Convergence*, 38(1), 5.

- Hannigan, J. (2006). *Environmental Sociology 2<sup>nd</sup> Edition*. New York: Routledge.
- Harraway, J., Broughton-Ansin, F., Deaker, L., Jowett, T., & Shephard, K. (2012). Exploring the use of the revised new ecological paradigm scale (NEP) to monitor the development of students' ecological worldviews. *The Journal of Environmental Education*, 43(3), 177-191.
- Hartmann, T. (2012). Wicked problems and clumsy solutions: Planning as expectation management. *Planning Theory*, 11(3), 242-256.
- Hayek, U. W., Von Wirth, T., Neuenschwander, N., & Grêt-Regamey, A. (2016). Organizing and facilitating Geodesign processes: Integrating tools into collaborative design processes for urban transformation. *Landscape and Urban Planning*, 156, 59-70.
- Hollstein, L. M. (2019). Retrospective and reconsideration: The first 25 years of the Steinitz framework for landscape architecture education and environmental design. *Landscape and urban planning*, 186, 56-66.
- Huck, J. J., Whyatt, J. D., & Coulton, P. (2014). Spraycan: A PPGIS for capturing imprecise notions of place. *Applied Geography*, 55, 229-237.
- Hulse, D., Branscomb, A., Enright, C., Johnson, B., Evers, C., Bolte, J., & Ager, A. (2016). Anticipating surprise: Using agent-based alternative futures simulation modeling to identify and map surprising fires in the Willamette Valley, Oregon USA. *Landscape and Urban Planning*, 156, 26-43.
- Hurlbert, M., & Gupta, J. (2015). The split ladder of participation: A diagnostic, strategic, and evaluation tool to assess when participation is necessary. *Environmental Science & Policy*, 50, 100-113.
- Irvin, R. A., & Stansbury, J. (2004). Citizen participation in decision making: is it worth the effort? *Public Administration Review*, 64(1), 55-65.
- Jankowski, P., & Nyerges, T. (2001). GIS-supported collaborative decision making: results of an experiment. *Annals of the Association of American Geographers*, 91(1), 48-70.
- Janssen, R., & Dias, E. (2017). A pictorial approach to geodesign: A case study for the Lower Zambezi valley. *Landscape and Urban Planning*, 164, 144-148.
- Janssen, R., Eikelboom, T., Brouns, K., & Verhoeven, J. T. A. (2014). Using geodesign to develop a spatial adaptation strategy for south east Friesland. In D. Lee, E. Dias, & H. J. Scholten (Eds.), *Geodesign for land use planning*. Dordrecht: Springer.

- Johansson, E., & Isgren, E. (2017). Local perceptions of land-use change: using participatory art to reveal direct and indirect socioenvironmental effects of land acquisitions in Kilombero Valley, Tanzania. *Ecology and Society*, 22(1).
- Jombach, S., Kollanyi, L., Molnar, J.L. Szabo, A., Toth, T.D. (2012). GeoDesign Approach in Vital Landscapes Project. *Peer Reviewed Proceedings of Digital Landscape Architecture*. Retrieved from: [http://www.kolleg.loel.hs-anhalt.de/landschaftsinformatik/fileadmin/user\\_upload/\\_temp\\_/2012/Proceedings/Buhmann\\_2012\\_24\\_Jombach\\_et\\_al.pdf](http://www.kolleg.loel.hs-anhalt.de/landschaftsinformatik/fileadmin/user_upload/_temp_/2012/Proceedings/Buhmann_2012_24_Jombach_et_al.pdf)
- Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and psychological measurement*, 20(1), 141-151.
- Kesby, M. (2000). Participatory diagramming: deploying qualitative methods through an action research epistemology. *Area*, 32(4), 423-435.
- Kindon, S. (2010). Participatory action research. In Hay, I. (Ed). *Qualitative Research Methods in Human Geography*, 3<sup>rd</sup> edition (259-277). Oxford: Oxford University Press.
- Kindon, S., Pain, R., & Kesby, M. (2007). Participatory action research: Origins, approaches and methods. In *Participatory action research approaches and methods* (pp. 35-44). Routledge.
- Klain, S. C., Olmsted, P., Chan, K. M., & Satterfield, T. (2017). Relational values resonate broadly and differently than intrinsic or instrumental values, or the New Ecological Paradigm. *PLoS one*, 12(8),
- Kobayashi, A. (2003). GPC ten years on: Is self-reflexivity enough?. *Gender, Place and Culture*, 10(4), 345-349.
- Kolen, J., van Manen, N., & de Kleijn, M. (2014). History matters: the temporal and social dimension of Geodesign. In *Geodesign by integrating design and geospatial sciences* (pp. 173-181). Springer, Cham.
- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental education research*, 8(3), 239-260.
- Kong, H., & Sui, D. Z. (2017). Integrating the normative with the positive dimension of the new science for cities: A geodesign-based framework for Cellular Automata modeling. *Environment and Planning B: Urban Analytics and City Science*, 44(5), 837-863.

- Kuby, M., Bailey, K., Wei, F., Fowler, J., Tong, D., Zhong, Q., Lopez, O., & Sheaffer, W. (2018). Collaborative Geodesign for Alternative-Fuel Station Location using “Collablocation” Software. *Transportation Research Record*, 2672(24), 98-108.
- La Rosa, D. (2014). Geodesign for Urban Ecosystem Services. *Tema. Journal of Land Use, Mobility and Environment*. Special Issue. June 2014.
- Lê, S., Josse, J., & Husson, F. (2008). FactoMineR: an R package for multivariate analysis. *Journal of statistical software*, 25(1), 1-18.
- Lee, D. J., Dias, E., & Scholten, H. J. (Eds.). (2014). *Geodesign by integrating design and geospatial sciences (Vol. 111)*. Springer.
- Lee, M. C., & Gamez, J. L. S. (2017). (Geo)Design coastal Cities: Design with data (and nature too). *THE PLAN Journal*, Volume 2/2017(Issue 2),
- Lenferink, S., Arciniegas, G., Samsura, D. A. A., & Carton, L. J. (2016). Integrating Geodesign and game experiments for negotiating urban development. *Research In Urbanism Series*, 4(1), 71-92.
- Lewin, K. (1946). Action research and minority problems. *Journal of social issues*, 2(4), 34-46.
- Li, W., & Milburn, L. A. (2016). The evolution of geodesign as a design and planning tool. *Landscape and Urban Planning*, 156, 5-8.
- Lin, W. (2013). When Web 2.0 meets public participation GIS (PPGIS): VGI and spaces of participatory mapping in China. In *Crowdsourcing geographic knowledge* (pp. 83-103). Springer, Dordrecht
- Low, S. M., & Altman, I. (1992). Place attachment. In *Place attachment* (pp. 1-12). Springer, Boston, MA.
- Lutz, L. (2014). Heavenly Landscapes. Bay Journal. Bay Journeys Article. Retrieved from [https://www.bayjournal.com/article/heavenly\\_landscapes](https://www.bayjournal.com/article/heavenly_landscapes)
- Martin, D. G. (2003). “Place-framing” as place-making: Constituting a neighborhood for organizing and activism. *Annals of the Association of American Geographers*, 93(3), 730-750.
- Maryland Department of Natural Resources (DNR). (2019). “About the Department of Natural Resources”, Maryland DNR website. Retrieved from: [https://dnr.maryland.gov/Pages/about\\_dnr.aspx](https://dnr.maryland.gov/Pages/about_dnr.aspx)

- Maryland Park Service. (2016). *Newtown Neck State Park Master Plan*. Annapolis. Retrieved from [http://dnr.maryland.gov/publiclands/Documents/Newtowne\\_MasterPlan.pdf](http://dnr.maryland.gov/publiclands/Documents/Newtowne_MasterPlan.pdf)
- Maryland State Archives. 2017. "Maryland Historical Chronology, 1600-1699." *Maryland Manual On-Line*. Retrieved January 7, 2018
- McElvaney, S. (2012). Geodesign: Case studies in regional and urban planning. *Environmental Systems Research Institute*.
- McKenzie-Mohr, D. (2000). Fostering sustainable behavior through community-based social marketing. *American psychologist*, 55(5), 531.
- Meng, Y., & Malczewski, J. (2009). Usability evaluation for a web-based public participatory GIS: A case study in Canmore, Alberta. *Cybergeo: European Journal of Geography*. 483.
- Miller, W. R. (2012). Introducing Geodesign: the concept. *ESRI White Papers*. Retrieved from: <https://www.esri.com/library/whitepapers/pdfs/introducing-geodesign.pdf>
- Mitlin, D., & Thompson, J. (1995). Participatory approaches in urban areas: strengthening civil society or reinforcing the status quo?. *Environment and urbanization*, 7(1), 231-250.
- Moser, C., & McIlwaine, C. (1999). Participatory urban appraisal and its application for research on violence. *Environment and urbanization*, 11(2), 203-226.
- Moura, A. C. M. (2015). Geodesign in Parametric Modeling of urban landscape. *Cartography and Geographic Information Science*, 42(4), 323-332.
- Mukherjee, F. (2015). Public participatory GIS. *Geography Compass*, 9(7), 384-394.
- Muller, B., & Flohr, T. (2016). A Geodesign approach to environmental design education: Framing the pedagogy, evaluating the results. *Landscape and Urban Planning*, 156, 101-117.
- Nyerges, T., Ballal, H., Steinitz, C., Canfield, T., Roderick, M., Ritzman, J., & Thanatemanerat, W. (2016). Geodesign dynamics for sustainable urban watershed development. *Sustainable Cities and Society*, 25, 13-24.
- Obermeyer, N. J. (1998). The evolution of public participation GIS. *Cartography and Geographic Information Systems*, 25(2), 65-66.

- Orland, B., & Steinitz, C. (2019). Improving our Global Infrastructure: The International Geodesign Collaboration1. *Journal of Digital Landscape Architecture*, 213-219.
- Pain, R. (2004). Social geography: participatory research. *Progress in human geography*, 28(5), 652-663.
- Pain, R., Finn, M., Bouveng, R., & Ngobe, G. (2013). Productive tensions—engaging geography students in participatory action research with communities. *Journal of Geography in Higher Education*, 37(1), 28-43.
- PALS – Partnership for Action Learning in Sustainability. (2019). “About”. Retrieved from [http://smartgrowth.umd.edu/assets/images/pals/pals\\_flyer\\_hoco\\_updated.pdf](http://smartgrowth.umd.edu/assets/images/pals/pals_flyer_hoco_updated.pdf)
- Paradis, T., Treml, M., & Manone, M. (2013). Geodesign meets curriculum design: integrating geodesign approaches into undergraduate programs. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 6(3), 274-301.
- Parkes, M., & Panelli, R. (2001). Integrating catchment ecosystems and community health: The value of participatory action research. *Ecosystem Health*, 7(2), 85-106.
- Peck, G. (2012). *The Potomac River: A History & Guide*. Arcadia Publishing.
- Pelzer, P., Geertman, S., & van der Heijden, R. (2015). Knowledge in communicative planning practice: a different perspective for planning support systems. *Environment and Planning B: Planning and Design*, 42(4), 638-651.
- Perkl, R. M. (2016). Geodesigning landscape linkages: Coupling GIS with wildlife corridor design in conservation planning. *Landscape and Urban Planning*, 156, 44-58.
- Pierce, J., Martin, D. G., & Murphy, J. T. (2011). Relational place-making: the networked politics of place. *Transactions of the Institute of British Geographers*, 36(1), 54-70.
- Quigley, C. F., Che, S. M., Achieng, S., & Liaram, S. (2017). “Women and the environmental are together”: using Participatory Rural Appraisal to examine gendered tensions about the environment. *Environmental Education Research*, 23(6), 773-796.
- Ramasubramanian, L. (2010). *Geographic information science and public participation*. Springer Science & Business Media.
- Rambaldi, G., Kyem, P. A. K., McCall, M., & Weiner, D. (2006). Participatory spatial information management and communication in developing countries. *The electronic journal of information systems in developing countries*, 25(1), 1-9.



- Rekittke, J., & Paar, P. (2011). There is no App for that—Ardous fieldwork under mega urban conditions. *Teaching Landscape Architecture*, 26-36.
- Rekittke, J., Paar, P., & Ninsalam, Y. (2012). Foot soldiers of geodesign. *Peer Reviewed Proceedings of Digital Landscape Architecture*, 199-210.
- Relph, E. (1976). *Place and placelessness* (Vol. 1). Pion.
- Rivero, R., Smith, A., Ballal, H., & Steinitz, C. (2015). Promoting collaborative Geodesign in a multidisciplinary and multiscale environment: Coastal Georgia 2050, USA. *Digital Landscape Architecture*, 42-58.
- Rodela, R., Bregt, A. K., Ligtenberg, A., Pérez-Soba, M., & Verweij, P. (2017). The social side of spatial decision support systems: Investigating knowledge integration and learning. *Environmental Science & Policy*, 76, 177-184.
- Roderick, M. J. (2017). *Strategic Green Infrastructure Planning: A Geodesign-based Planning Support Approach* (Doctoral dissertation). University of Washington.
- Rose, G. (1997). Situating knowledges: positionality, reflexivities and other tactics. *Progress in human geography*, 21(3), 305-320.
- Roth, M., & Gruehn, D. (2014). Digital Participatory Landscape Planning for Renewable Energy—Interactive Visual Landscape Assessment as Basis for the Geodesign of Wind Parks in Germany. *Peer Reviewed Proceedings of Digital Landscape Architecture*, 84-94.
- Rowe, G., & Frewer, L. J., (2004). Evaluating public-participation exercises: a research agenda. *Sci Technol Hum Values*, 29(4):512–556
- Sack, R. D. (1992). *Place, modernity, and the consumer's world: A relational framework for geographical analysis*. Baltimore: Johns Hopkins University Press.
- Sack, R. D. (2010). *Geography as a Tool for Developing the Mind: A Theory of Place-making*. Edwin Mellen Press.
- Salter, J. D., Campbell, C., Journeay, M., & Sheppard, S. R. (2009). The digital workshop: Exploring the use of interactive and immersive visualisation tools in participatory planning. *Journal of environmental management*, 90(6), 2090-2101.
- Schlossberg, M., and E. Shuford. 2005. Delineating “public” and “participation” in PPGIS. *URISA Journal*, 16(2): 15–26.

- Schultz, P. W. (2011). Conservation means behavior. *Conservation biology*, 25(6), 1080-1083.
- Schwarz-von Raumer, H. G., & Stokman, A. (2012). GeoDesign—Approximations of a Catchphrase. *Peer reviewed proceedings of digital landscape architecture 2012 at Anhalt University of Applied Science*, 189-198.
- Seamon, D. (2018). *Life takes place: Phenomenology, lifeworlds, and place making*. Routledge.
- Shephard, K., Harraway, J., Jowett, T., Lovelock, B., Skeaff, S., Slooten, L., ... & Furnari, M. (2015). Longitudinal analysis of the environmental attitudes of university students. *Environmental education research*, 21(6), 805-820.
- Shephard, K., Mann, S., Smith, N., & Deaker, L. (2009). Benchmarking the environmental values and attitudes of students in New Zealand's post-compulsory education. *Environmental Education Research*, 15(5), 571-587.
- Sieber, R. (2006). Public participation geographic information systems: A literature review and framework. *Annals of the association of American Geographers*, 96(3), 491-507.
- Slotterback, C. S., Runck, B., Pitt, D. G., Kne, L., Jordan, N. R., Mulla, D. J., Zerger, C., & Reichenbach, M. (2016). Collaborative Geodesign to advance multifunctional landscapes. *Landscape and Urban Planning*, 156, 71-80.
- Sophonides, P., Steenbruggen, J., Scholten, H., & Giaoutzi, M. (2016). Geodesign the multi-layered water safety. *Research in Urbanism Series*, 4(1), 113-138.
- Steiner, F. R., & Shearer, A. W. (2016). Geodesign—Changing the world, changing design. *Landscape and Urban Planning*, (156), 1-4.
- Steinitz, C. (1990). A Framework for Theory Applicable to the Education of Landscape Architects (and Other Environmental Design Professionals). *Landscape Journal*, 9(2), 136-143.
- Steinitz, C. (1995). Design is a Verb; Design is a Noun. *Landscape Journal*, 14(2), 188-200.
- Steinitz, C. (2012). A framework for geodesign: Changing geography by design. *Esri Press*, Redlands, CA.
- Steinitz, C. (2016). On change and geodesign. *Landscape and Urban Planning*, (156), 23-25.
- Stern, P. C. (2000). Toward a Coherent Theory of Environmentally Significant Behavior.

- Journal of Social Issues*, 56(3), 407–424.
- Stern, P. C., Dietz, T., Abel, T. D., Guagnano, G. A., & Kalof, L. (1999). A Value-Belief-Norm Theory of Support for Social Movements: The Case of Environmentalism. *Human Ecology Review*, 6(2), 81–97. Retrieved from [http://cedar.wvu.edu/hcop\\_facpubs](http://cedar.wvu.edu/hcop_facpubs)
- Stern, P., Dietz, T. & Guagnano, G. (1995) The New Ecological Paradigm in social-psychological context, *Environment and Behavior*, 27(6), pp. 723-743.
- Swarns, R. L. (2016, April 16). 272 slaves were sold to save Georgetown. What does it owe their descendants? *New York Times*. Retrieved from: <https://www.nytimes.com/2016/04/17/us/georgetown-university-search-for-slave-descendants.html>
- te Brömmelstroet, M. (2017). PSS are more user-friendly, but are they also increasingly useful?. *Transportation Research Part A: Policy and Practice*, 104, 96-107.
- The Examiner, January 29, (2009). “State buys 4,400 acres of waterfront from Jesuits.” Retrieved from: <https://www.washingtonexaminer.com/state-buys-4-400-acres-of-waterfront-from-jesuits>
- Trouillet, B. (2019). Aligning with dominant interests: The role played by geo-technologies in the place given to fisheries in marine spatial planning. *Geoforum*, 107, 54-65.
- Tuan, Y. F. (1977). *Space and place: The perspective of experience*. U of Minnesota Press.
- Tulloch, D. (2017). Toward a working taxonomy of geodesign practice. *Transactions in GIS*, 21, 635-646.
- Tulloch, D. and Walton G. (2013). Heeding its lessons – How the new field of geodesign can still learn from past experiences. *Proceedings of Digital Landscape Architecture*. Anhalt University of Applied Sciences.
- Tulloch, D. L. (2008). Is VGI participation? From vernal pools to video games. *GeoJournal*, 72(3-4), 161-171.
- Turner, B. L., & Robbins, P. (2008). Land-Change Science and Political Ecology: Similarities, Differences, and Implications for Sustainability Science. *Annual Review of Environment and Resources*, 33(1), 295–316.

- Voinov, A., Kolagani, N., McCall, M. K., Glynn, P. D., Kragt, M. E., Ostermann, F. O., ... & Ramu, P. (2016). Modelling with stakeholders—next generation. *Environmental Modelling & Software*, 77, 196-220.
- Wadsworth, Y., (1998). What is Participatory Action Research. *Action Research International Paper 2*. Retrieved from <https://www.montana.edu/cpa/news/images/articles/hires/img200603291143660763-1.pdf>
- Warren-Kretzschmar, B., Lincoln, C., & Ballal, H. (2016). Geodesign as an Educational Tool: A Case Study in South Cache Valley. *Journal of Digital Landscape Architecture*, 222-232.
- Whitman, G. P., Pain, R., & Milledge, D. G. (2015). Going with the flow? Using participatory action research in physical geography. *Progress in physical geography*, 39(5), 622-639
- Wilcoxon, F. (1945). Individual Comparisons by Ranking Methods. *Biometrics Bulletin*, 1(6), 80-83.
- Williams, D. R., & Patterson, M. E. (1996). Environmental meaning and ecosystem management: Perspectives from environmental psychology and human geography. *Society & Natural Resources*, 9(5), 507-521.
- Wilson, M. W. (2015). On the criticality of mapping practices: Geodesign as critical GIS? *Landscape and Urban Planning*, 142, 226–234.
- Wu, C. L., & Chiang, Y. C. (2018). A geodesign framework procedure for developing flood resilient city. *Habitat International*, 75, 78-89.
- Yang, P. P. J., Chi, C. S. F., Wu, Y., & Quan, S. J. (2018). A Geodesign Method of Human-Energy-Water Interactive Systems for Urban Infrastructure Design: 10KM2 Near-Zero District Project in Shanghai. *Engineering*, 4(2), 182-189.
- Yeung, H. W. C. (1997). Critical realism and realist research in human geography: a method or a philosophy in search of a method? *Progress in Human Geography*, 21(1), 51–74.
- Zolkafli, A., Brown, G., & Liu, Y. (2017). An evaluation of the capacity-building effects of participatory GIS (PGIS) for public participation in land use planning. *Planning Practice & Research*, 32(4), 385-401.
- Zook, M. A., & Graham, M. (2007). Mapping DigiPlace: geocoded Internet data and the representation of place. *Environment and Planning B: Planning and Design*, 34(3), 466-482.