# Promoting Collaborative Geodesign in a Multidisciplinary and Multiscale Environment: Coastal Georgia 2050, USA

Rosanna RIVERO[1], Alison SMITH[2], Hrishikesh BALLAL[3] and Carl STEINITZ[3,4]

[1]College of Environment and Design, University of Georgia, USA · rrivero@uga.edu
[2]College of Environment and Design, University of Georgia, USA
[3]Centre for Advanced Spatial Analysis, University College London, UK
[4]Graduate School of Design, Harvard University, USA

## Abstract

This paper summarizes the process and results from a three-day geodesign workshop conducted in Athens, Georgia, USA, involving the application of a digital design online workflow that enables rapid, real time geodesign collaboration. Twenty five participants, from a variety of disciplines, organizations, and interests, were involved in producing a single negotiated and agreed design, from a series of conceptual designs that were created and evaluated at two scales: a county and a historic site scale. A coastal county (Chatham, GA), where the historic city of Savannah is located, and a historic site (Wormsloe), were both the subject of study. Scenarios for 2030 and 2050 were studied by participants, based on expected changes from large projects such as the $706 million Savannah Harbor Expansion Project (SHEP), long term changes from climate (sea level rise, natural hazards), and increasing tourists and visitors to the Wormsloe Historic Site. During the workshop, the online application facilitated the process of visualizing and comparing the different models following STEINITZ' geodesign framework (representation, evaluation, change, impact, and decision models), as well as engaging in negotiation and decision-making among different interest group teams.

## 1 Introduction

Geodesign borrows from a number of different domains: architecture, engineering, landscape architecture, urban planning, traditional sciences etc. and takes a holistic and complementary view on the design process incorporating the different stakeholders (DANGERMOND 2010). The promise of Geodesign when used in a digital environment differs from traditional design done digitally in the way it can be implemented. Traditionally, digital design involves the use of spatial optimization models of planning or allocation of land use to build a plan. Additionally, the workflow is around digitizing and drawing of plan objects, which constitute a design in a serial fashion and once they are drawn, they are then evaluated for performance. However in the context of geodesign, design is facilitated by a collaborative process where the computers respond to changes in design as it is being built by various stakeholders. Thus what makes geodesign fundamentally different from traditional design process is the workflow or the process of creating a design. The ability to create a design collaboratively, to measure the impacts of this creation as you proceed, and implement a platform of collaboration and communication; all of these form the basis of the

Buhmann, E., Ervin, S. M. & Pietsch, M. (Eds.) (2015): Peer Reviewed Proceedings of Digital Landscape Architecture 2015 at Anhalt University of Applied Sciences. © Herbert Wichmann Verlag, VDE VERLAG GMBH, Berlin/Offenbach. ISBN 978-3-87907-555-3.

geodesign workflow. Fast iteration, quick design cycles are also way in which geodesign workflow differs significantly from a traditional one.

Carl STEINITZ, Professor Emeritus of Landscape Architecture and Planning at Harvard University, developed some early and fundamental ideas about the geodesign workflow (STEINITZ 2012). STEINITZ developed a model of landscape change that enables design and assessment of alternative futures. In his book, *A Framework for Geodesign*, STEINITZ describes eight different ways of designing for change and a ninth mixed example (STEINITZ 2012). *The basic problem of geodesign can be stated as, "How do we get from the present state of this geographical study area to the best possible future?".*

The "Steinitz Framework" has been put in practice for a number of years on large landscape change problems and in the form of intense two or three day workshops where participants from diverse academic and professional backgrounds and levels of experience come together and go through the process to build a design iteratively in a compressed timeframe. The framework takes a multi system approach to problems that is novel both from a design and from an analysis point of view.

It has been already recognized that "*the specific ingredients of each project will depend on the issues, participants, available data, information, knowledge, culture, values, geographic context, and available technology*" (MCELVANEY 2012). There represented a steep learning curve, during the initial phases of the workshop, that were a combination of the *complexity of the online tool itself*, and the added *complexity of the social/human interaction.* The workshop was an environment where participants may not have had a common language, knowledge, or area/field of interest, to initiate in an expedited way, their work in their respective teams.

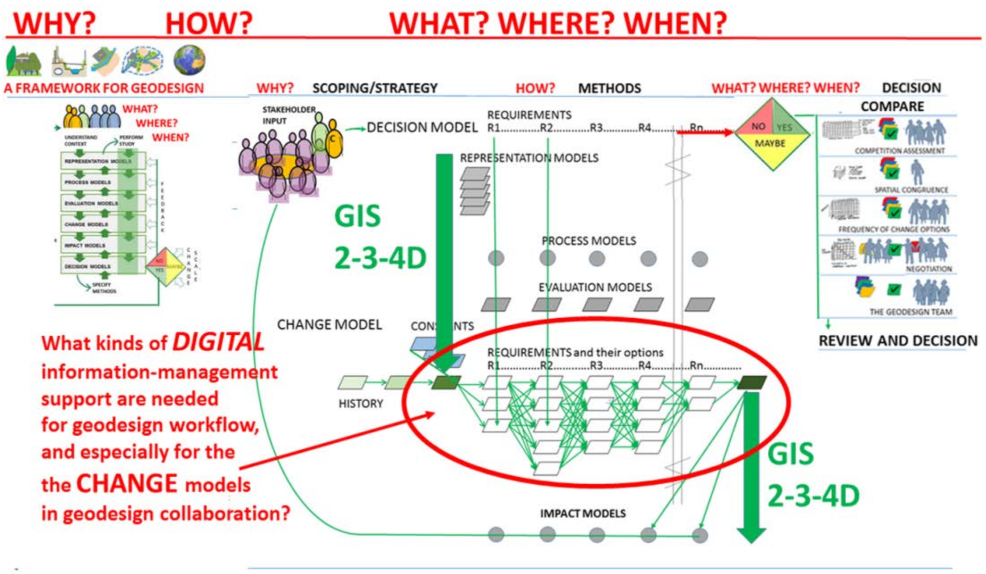


**Fig. 1:** Geodesign framework for the Georgia Workshop (reprinted from Carl STEINITZ)

The geodesign workshop presented in this paper, is based on previous research questions intended to understand and develop the kind of digital information management support that is needed for implementing STEINITZ framework, particularly for the change, impact, and decision models, as shown in Figure 1. Following that original research question, this workshop is intended to test the implementation of the framework, with the set of tools already developed, and evaluate its capacity to promote a unified, collaborative, and mutually agreed design, as a result of a multidisciplinary environment, with a two-scale study area.

# 2 Workshop Planning, Objectives, and Process/Methods

## 2.1 Pre-Workshop Planning and Objectives

The issue at hand was to produce a single negotiated design, based on a series of constrains for long term future scenarios (2030 and 2050) for Chatham County, GA and the Wormsloe Historic Site. During the workshop, it was expected that a series of conceptual designs would be produced by the teams, to be evaluated, discussed, and negotiated at two scales: a county and a historic site scale.

With this purpose in mind, a three-day workshop planning was initiated by Professor Carl STEINITZ and Dan Nadenicek, Dean of the College of Environment and Design, at the University of Georgia. Planning efforts started in November 2014, with a steeting committee composed of two teams: a leading team, from the Centre for Advanced Spatial Analysis (CASA), University College London, UK, and a local team, from the University of Georgia. The way the group organized responsabilities were:

- The CASA/UK team, led by Carl STEINITZ provided their expertise in landscape architecture and planning, as well as leading and conducting geodesign workshops internationally, along with the software design, implementation, and support.
- The UGA team was in charge of planning tasks, among others, the selection of the study areas and its boundaries, the participants and the teams, the mapping and compilation of other data and information, the definition of the issues, the interest groups, and the future scenarios, and finally, the logistics.

Preliminary decisions to be made were: a) the area of study, b) the initial ten systems or issues, and their associated assessment maps, and c) the list of participants, based on their knowledge or stake in any of the ten issues. Later in the preliminary process, another decision had to be made about five interest groups.

The design method for the workshop was the constraining method, that is one of nine geodesign design methods described by STEINITZ (STEINITZ 2013). This method is useful when the the geodesign team is not sure of the decision models, but also where there are many options for each requirement. The strategy to follow for making decisions is by comparing and selecting design options in the sequence rank order of decision importance.

## 2.2 Digital Design Workflow

In 2015 the framework was transformed into software that enables a digital design workflow. This was the topic of the dissertation of Hrishikesh Ballal, a PhD student at the Centre for Advanced Spatial Analysis at University College London, under the direction of Carl STEINITZ, Mike Batty and James Cheshire. The digital workflow is an open system where the participants bring their data and ideas into the tool and after going through the various stages of the framework are able to collaborate and build plans to address the challenges the region faces. The tool is an open system and supports most commonly available geospatial file formats such as Shapefile, KML, WKT, GeoJSON etc. and data that can be exported out in a Shapefile format. The system is fundamentally a designing aid that interacts with commonly available GIS data and other models and helps the users in building the design and finally the built data can be exported for use in advanced 3D visualizations etc. This software is freely available at www.geodesignstudy.com, and it was used in the workshop. The tool has two core functionalities: The ability to draw and synthesize diagrams by participants into a design and the ability to compare different synthesis. The participants of the workshop were given 20 minutes of training on the tool usage and there was help and support available at hand in person and also in the form of articles and videos on software usage provided to participants prior to the workshop.

The software includes a project setup step where the initial requirements are built into the project. The tool enables participants to create diagrams and select a number them to build final designs by enabling digital synthesis. Diagrams can be built by the participants using sketching, importing existing data and linking to dynamic models. In addition the tool provides platform collaboration during design creation and also helps in analyzing the created designs. The versioning system implemented enables the users to quickly modify the design until they are satisfied with its performance. The tool enables multiple ways of collaboration: open mode, team mode among others and also supports multiple ways to design. The tool is novel in a way that it enables near real-time analysis of designs over multiple systems. The tool extends the existing work done in planning support systems and it can accommodate any model from any discipline as long as the model can output a map with three to five colors. The tool also specifies the user of color and test that enforces a shared language of communication and enables broad collaboration among experts from diverse disciplines.

## 2.3 The Area/The Challenges/The Multiscale Approach

The workshop looked specifically at issues affecting changes in the landscape at two scales: a) Chatham County, in the state of Georgia; and b) Wormsloe Historic Site, located in the Isle of Hope, city of Savannah. Several considerations were into account for the selection of these 2 areas. Chatham County is one of six coastal counties in Georgia, with the historic city of Savannah as its capital, one of the oldest planned cities in the U.S., founded by General Oglethorpe on February 12, 1733. The city was founded on a high bluff on the Savannah River, 18 miles inland from the Atlantic Ocean, surrounded to the East by marshes, and barrier islands such as Tybee Island (currently a tourist town of about 3,000 residents). With an estimated population for 2013 of 278,434 (US CENSUS 2015), this region manages 245 manufacturing companies that employ more than 15,000 (SEDA 2015), with the port expansion project being one of the most important economic projects.

The Port of Savannah is the fourth busiest container port and the second busiest port of the eastern USA region, after the Port of New York and New Jersey (RAMOS 2012). The Georgia Port Authority implemented a major economic plan that allowed large conglomerates like Home Depot and Pier 1 Imports to all make Savannah their primary distribution center (BUNTIN 2009). The Savannah Harbor Expansion Project (SHEP), is a $706 million project, and the state's highest trade infrastructure priority, that involves dredging thirty-two miles of the Savannah Harbor navigation channel from forty-two to forty-seven feet, to attract and accommodate Post-Panamax ships (RAMOS 2012).

One of the most defining and famous ecological features of the Georgia coastline is the salt marsh ecosystem, that is the result of river water inflow meeting the salt water from the Atlantic Ocean. Unlike other states in the U.S. eastern seaboard, and by enacting the Coastal Marshlands Protection Act in 1970, Georgia has been successful in protecting these ecological areas, and the multitude of plants and wildlife species associated with its sediments and nutrients, including spartina, needlerush, algae, marsh hens, purple square-back crabs, blue crabs, mussels, and multiple bird species. (SEABROOK 2013).

Wormsloe Historic Site is the oldest and one of the most significant of all Georgia estates. Noble Jones, one of the colony's charter settlers, founded the plantation along the banks of the Skidaway River in the mid-1730s, and the land has remained in the hands of the same family ever since. Wormsloe's history is a microcosm of Georgia's story. The property was an important military post protecting early Savannah from Spanish forces in Florida, it served as a site of colonial agricultural experimentation, the plantation grew cotton with the labor of slaves and then freedpeople. Wormsloe was an early participant in the tourist economy that transformed the 20th century Lowcountry. Preliminary research suggests that Wormsloe contains numerous Native American artifacts in addition to its Colonial and Civil War-era antiquities. The site supports significant native plant and animal species, and this diversity was explored and documented by several prominent early naturalists,

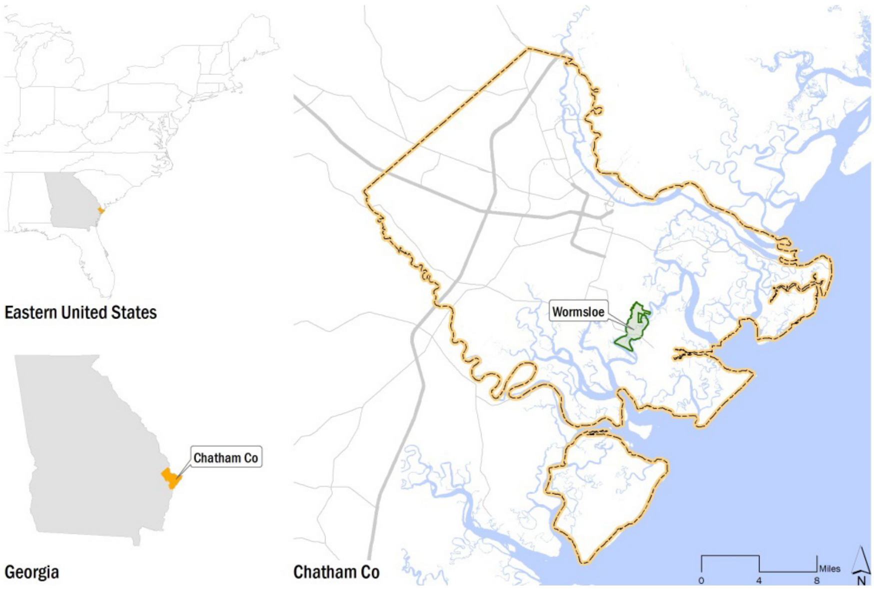


**Fig. 2:** Study area for the geodesign workshop, showing the location of Chatham county in the State of Georgia, and the Eastern coast of the US, and highlighted in green, the location of Wormsloe Historic Site

including John and William Bartram. The coastal salt marsh, oak hammocks, and mixed pine forests are well-preserved examples of coastal ecosystems, and serve as refuges for a wide variety of wildlife. The Wormsloe Institute is working to continue this legacy by partnering with UGA to support interdisciplinary research at the cradle of Georgia history. UGA faculty, graduate students, and the Wormsloe Scientific Advisory Council are collaborating to shape research initiatives on site, and to coordinate the institute's long-term goals (ROSS 2015).

## 2.4 Identifying and Mapping the ten Systems or Issues

As a part of the geodesign workshop, a steering committee of UGA faculty was assembled to address all aspects of the planning phase. One of tasks of the steering committee was to create the 10 evaluation maps to be used during the workshop. The 10 evaluation maps created include: 1. Climate Change, 2. Nature/Ecology, 3. Surface Water, 4. Groundwater, 5. Historic/Cultural/Archaeological Resources, 6. Visual/Tourism, 7. Agriculture/Forestry, 8. Housing, 9. Commercial/Industrial, 10. Transportation. A matrix was created for the evaluation maps to identify the criteria to be considered, person responsible for identifying the criteria, data sources, etc. Each evaluation map is defined as either a "vulnerability map" or an "attractiveness map" and consists of three levels/colors (high = red, medium = yellow, low = green). The criteria to be considered for each map were determined by expert knowledge and GIS data was collected to map these criteria. The primary source for GIS data was the SAGIS (Savannah Area Geographic Information System) website (http://www.thempc.org/SAGIS.htm) although other data sources were used as well.

The GIS mapping methodology was streamlined to facilitate easy integration into the geodesign.com software. The following process was used for each evaluation map using ArcGIS software:

1. Gather all the data layers into group layers in ArcMap by color/level (red = high, yellow = medium, green = low).
2. Complete the following steps for each color/level:
   - Dissolve any features if needed.
   - Create new shapefile for each level/color with attributes for "Type" and "Color".
   - Copy dissolved features from each layer needed.
   - Use the "SimplifyPolygon" and "Aggregate Polygon" tools to generalize features.
3. Combine the three colors/levels into one shapefile:
   - Use the county boundary polygon layer and multiple iterations of the "Erase" and "Union" tools to combine the three colors/levels and ensure there are no overlaps.
   - Use the "SimplifyPolygon" tool further generalize the combined features and to resolve any topological errors.

Once a few of the evaluation maps were complete they were tested with the software. These initial tests identified a key problem: the data is too detailed. All of the data used to create the evaluation maps is at the parcel level and very detailed. While the generalization methods described above simplified the data, many of the shapefiles created exceeded the 2,000 feature limit of the geodesign.com software. To resolve this issue, the shapefiles were rasterized at a cell size ranging from 50-600 using the "Feature to Raster" tool and then converted back to a vector format using the "Raster to Polygon" tool. This method resolved the issue of having too many features within one shapefile but also increased the level of generalization for the evaluation maps.

The resulting series of maps are shown in Figure 3. The final step, before the workshop started, was to uploaded the in the digital online software application.

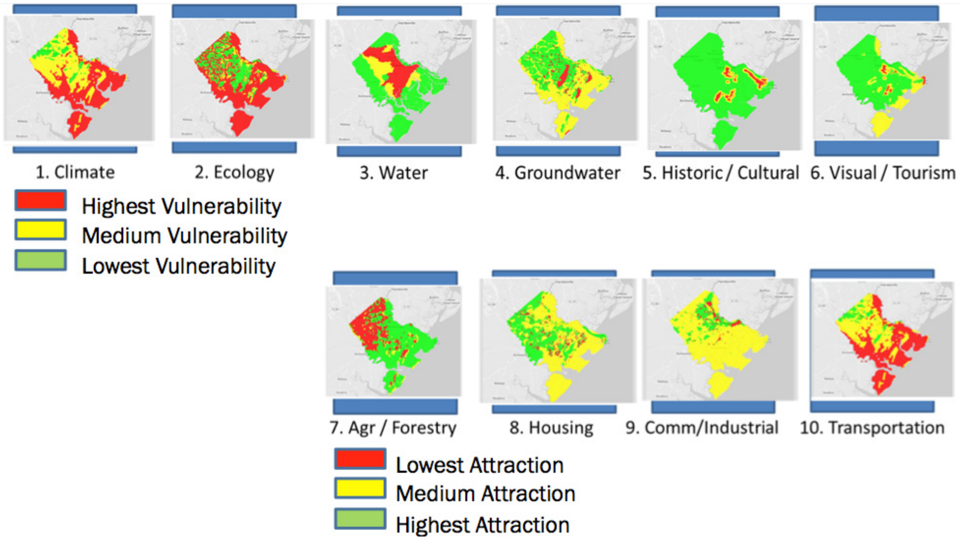


**Fig. 3:** The Process/Evaluation Models for the 10 system, with a color symbology (red-yellow-green) indicating high to low vulnerability, or high to low attraction, depending the issue represented

## 2.5 The Participants

Identifying or selecting the participants is key to the process, as collaboration among them is one of the fundamental characteristics of the geodesign process. After the decision was made about the 10 systems or issues, then it becomes critical to have a good representation and balance of the 3 members that will be part of each of the 10 teams. A good balance indicates that the geodesign planning team should account for people that could be either experts on that particular topic (but not necessarily know the study area well), or people with very good knowledge of the area (residents, land managers, researchers, etc.).

In the Georgia workshop, participants included: public agencies (Coastal Regional Commission of Georgia, Wormsloe State Park), non-profit (Ossabaw Island Foundation), universities (University of Georgia, University of North Georgia, Pennsylvania State University, and Georgia State University), and private consultants. In terms of disciplines, those that were represented at the workshop included: design professions (planning, landscape architecture), sciences (geography, ecology, engineering, soil scientists), technology (GIS administrators, GIS analysts, remote sensing experts), and local experts (the people of the place, as referred in STEINITZ' framework). Faculty and students from various Colleges, Departments, and Institutes at UGA, including, Carl Vinson Institute of Government, Odum School of Ecology, Geography, Engineering, CED, and others, were participants.

Other faculty and guests attended part of the workshop when specific topics of interest, such as the Savannnah port expansion project, or issues related to water, were addressed.

# 3 Workshop Process and Outcomes

The dynamic of the three-day workshop encompassed: a) A morning of introductions and presentations about the Geodesign framework, a hands-on software tutorial, and initial breakdown into the ten evaluation teams, b) An afternoon of designs for Change and Impact Models, under the five interest groups, c) A second day of work in 5 interest groups for Change and Impact Scenarios, d) A third (final) day of Comparative assessment and Decision Models, and final presentations.

## 3.1 Process and Evaluation Models (10 teams)

The first task to be accomplished in the Workshop was the assessment of the ten systems. Inputs to the online tool have been already added (the ten system maps) and the groups were ready for work with these, and get familiar with the application, in order to produce their first set of collaborative designs or diagrams. Questions and associated models in the figure 3 refer mainly to the past and existing conditions, representing the baseline for evaluation, and future reference for the next stage (change).

During this part of the process, questions to be answered are: is the area seen as attractive? Why? Are there current environmental problems or risks? Which? Where? In the software application, the assessment maps have been already loaded in the system (as explained earlier), and the ability to use these maps for analyses is possible by overlaying different assessment maps.

Initial teams were assigned to work with the ten assessment maps, encompassing all areas from natural to built environment systems, including: climate, ecology, water and groundwater, historic and cultural resources, visual and tourism, agriculture and forestry, housing, commercial and industrial land uses, and transportation. In the afternoon, participants shifted into five interest groups, advocating for the following areas: ecologist/environmentalists, developers, planners, climate-advocates, and Wormsloe Historic advocates.

At the end of this first stage, and after current conditions were evaluated, each team digitally drew conceptual designs (in the form of points, lines, or polygons) using the software drawing tool. An important distinction, while drawing these proposals, was that a design can be either a project or a policy. A project, drawn in solid color, is an actual design action (construction of a road, a building, etc.), while a policy is a proposal such as a legal protection status proposal. A sample of a drawing showing a project and a policy is shown in figure 4. The participants sketched out the diagrams or conceptual designs, after using a variety of techniques, based on their expertise, the use of existing maps, overlaying these maps with existing map, and discussion of ideas. They sketched many diagrams, using the software sketching tool. A total of about 270 diagrams were added in the workshop by the end of the exercise. These diagrams were synchronized across all the connections to the project and participants were able to see the diagrams being added dynamically. At the end, an aproximate set of ten recommendations were developed and presented at the end of the process and evaluation models.


**Fig. 4:** Two diagrams displaying the difference between policy (shown in hatched red color, on the left side map) and project (shown in solid red color, on the right side map). The diagram on the left shows policy designs for protected areas from the tourism and visual team, while the one on the right shows projects for commercial and industrial areas near the port of Savannah, from the commercial and industrial team.

## 3.2 Stage 2: Change Models

Change, impact, and decision models address the second set of questions in STEINITZ' framework, as they are concerned with the future more than the past and the present. These require a bigger effort from participants on synthesis and design.

### 3.2.1 Change Scenarios

In order to plan for the future (2030 and 2050 scenarios) the workshop planning team had to make some assumptions. This set of assumptions for the future requires an understanding of the area, the review of statistical data, current plans and projects, and other sources. For the purpose of the workshop, these were the assumptions made:

- The port capacity will double, the Savannah port is the fourth busiest container port in the United States and the second busiest in the eastern seaboard, the port embarked USD 706 million on a expansion project that will also dredge thirty two miles of the harbour navigation channel comprised of which miles of the Savannah River downstream to its mouth, and fourteen miles of the Atlantic Ocean entrance channel − from forty-two to forty-seven feet to attract and accommodate Post-Panamax ships.
- The population of the county will double at a higher density because of the increase in industrial activity. Land use allocation (residential, commercial and industrial land uses) were estimated, based on these population projection assumptions (for 2030 and 2050), and those from a Socio-Economic and Land Use Data Report, for the Chatham Urban Transportation Study (MPC 2014), and the most current Comprehensive Plan, adopted in November 2006, and reviewed 2012 (MPC 2012).
- An increase in visitation and tourism in the county would be fourfold, given not only population rise and increase in commerce and industry, but also increase mobilization and visitation from adjacent states of Florida and South Carolina. Particularly, and

because of Florida is experiencing high taxes, a migration trend of baby boomers has been occurring in the states of Georgia and North Carolina.

- Finally, assumptions of risk from long term climate predictions of sea level rise and natural hazards (increased flooding, and storm surge from storms and hurricanes) to this coastal region, being on the path of a hurricane, were considered.

Final Scenarios, based on the previous assumptions, are shown in table 1. For Chatham County, the goal is to double the population and all urban land uses by 2050, providing infrastructure as needed, and enhance environmental resilience. Participants were reassigned to five interest groups, each of which were tasked with making their self-interests' "best design" for 2030 and 2050.

For Wormsloe State Park, the objective was to double tourist visitors by 2030 in two stages, provide for large public events that are twice as populous as now, identify its' zone of management-interest beyond Park property and propose a management plan for that area which enhances the Park's historic role and enhances environmental resilience. You will need to estimate these requirements for the Park.

**Table 1:** Population, land allocation, and visitors estimations for both areas, Chatham county and Wormsloe, for 2030 and 2050

| **Chatham County** | **Current Estimate** [(1)] | **2030 Increment** | **2050 Increment** | **2050 Cumulative** |
|---|---|---|---|---|
| Population | 278,434 | 100,000 | 200,000 | 578,434 |
| Housing (area in Ha) [(2)] | 13,124 | 10,000 | 10,000 | 33,124 |
| Commercial/Industrial (area in Ha) [(2)] | 7,063 | 4,000 | 6,000 | 17,063 |
| **Wormsloe Historic Site** | | | | |
| Maximum number of visitors | 4,000 | 8000 | 16,000 | |
| Parking capacity (average day) | 30 | 60 | 120 | |

[(1)] 2013 Population Estimate. U.S. Census Bureau: State and County QuickFacts.

[(2)] Estimates derived from Chatham Current and Future Land Use GIS Data, and Projections 2030 Chatham Urban Transportation Study, and housing density distribution from 2006 Comprehensive Plan and Chatham County-Savannah Metropolitan Planning Commission.

### 3.2.2 Change and Impact Models: Design Process − Policies and projects maps for 2030 and 2050 scenarios (5 interest teams)

After the initial stage of process and evaluation of the 10 systems, the participants were then divided into five change teams representing different interest groups. One of the teams (Wormsloe) worked on a smaller scale, being this the first time that the workflow was being tested on two different scales. The change teams were:

- Developers: The key agenda for the developers was to promote development of industry, commerce and transportation in addition to economic development in the area.

- Climate Change: The key objective for the climate change team was to prepare designs that addressed the need for mitigation and adaption policies and projects, in order to minimize risks posed by rising sea level and the threat of storms and hurricanes.
- Environmentalists: The key objective for this team was to preserve and conserve areas of ecological value, including wetlands, floodplains, green space, and groundwater recharge areas, while enhancing the environmental opportunities of this region.
- Planners: The regional planners were tasked with building a comprehensive regional plan taking into account the positions and considerations at a regional level.
- Wormsloe: The Wormsloe team worked on a smaller scale and their task was to produce a plan for Wormsloe in the context of a county.

The teams were asked to build a plan for 2030 and 2050 and in another task the teams were asked to build a plan considering the worst case for 2030 and 2050. The task was to select a group of projects and policies that satisfied their interest group. The participants were able to select individual diagrams and design plans for their group at a rapid pace.

Figure 5 shows a set of maps for each of the five interst groups, with a summary of selected policies and projects for 2030 and 2050. As shown, four of the groups look at the whole county, and the last one (two figures on the right side) looked at Wormsloe. Each group had to develop three types of scenarios, the worst case scenario, a 2030, and 2050 scenario.

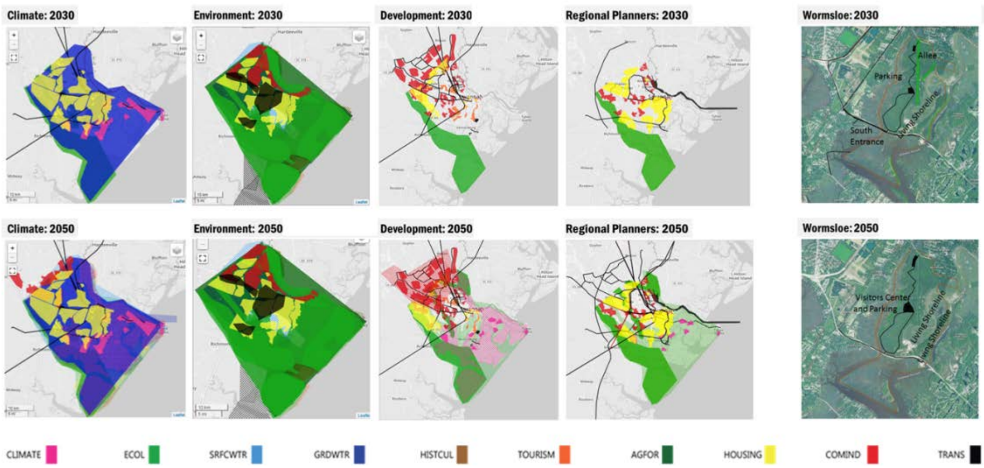


**Fig. 5:** The 5 interest group set of maps, with 2030 and 2050 scenarios for each of them, including Wormsloe (focused scale area)

### 3.3 Stage 3: Comparative Assessment, Decision Models, and Final Negotiation

At this point of the workshop, the objective was to compare the performance of various designs, and this could be done in various ways. This addresses the 5$^{th}$ question in the geodesign framework "what difference might the changes cause"? and it is answered by an evaluation of the impacts of these changes. It is possible to compare designs (graphically, just by comparing the maps) (6a), comparing their impacts (6b), and comparing the costs

(6c). It would be also possible to compare component diagrams of policies and projects, compare frequency of diagrams. A comparison is made based on: Design (shown in the 5 maps), Decision Models, Impacts Summary, and Total Costs.


**Fig. 6:** Comparison of the five interest group team results, by comparing (a) graphically (directly by comparing maps) (b) by comparing impacts, and (c) comparing costs

The evaluation/comparison of models can be performed using different metrics: competition, spatial arrangement, frequency of use, and strategic coalition-sociogram. In the Georgia geodesign workshop, one of the options considered was the frequency of use. The systems allow teams to reuse the diagrams from other teams, when they suited their ideas or their needs. Ideally, one of the ways to measure success of certain design is by the frequency that the different teams use a particular diagram. Figure 8 shows a comparison based on the frequency of diagram inclusion. In this process, there were more than 270 diagrams produced, but only a few were used 2 or 3 times. The majority was used one, and in some cases, two at the most.

Another tool for negotiation utilized in this workshop was the Sociogram for Negotiating Agreement (STEINITZ 2012). With this tool, each team acts as a reviewer of the other teams, and decides how compatible or what level of agreement, there is in their designs, and they complete their results in a matrix, with a scale from −2 (never – no agreement) to +2 (complete agreement). Figure 7 shows the results from the matrix, and how affinities or compatibilities among teams (with +1 and +2) were grouped, with climate/environmental/ and Wormsloe (lower right corner of the matrix) being the ones showing more compatibility, and planning and development (upper left side of the matrix).


**Fig. 7:** Results from strategic coalition-sociogram technique

As a result of the strategic coalition/sociogram technique, two teams resulted during this first negotiation phase. The diagrams utilized for the first stage of negotiation (from the original diagrams produced by the 10 initial system teams), are shown in Table 2. Figure 8 shows the 2050 scenarios for these 2 teams.

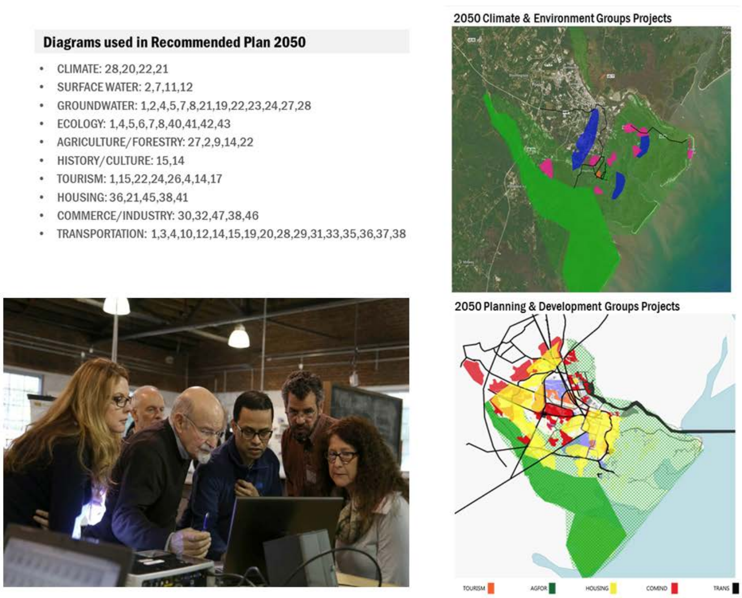


**Fig. 8:** Diagram selected from the original 10 teams, for the 2 merged teams

Figures 9 and 10 shows a series of maps, with the cumulative designs, including both projects and policies, for each of the systems, and the final recommended plan for 2050.

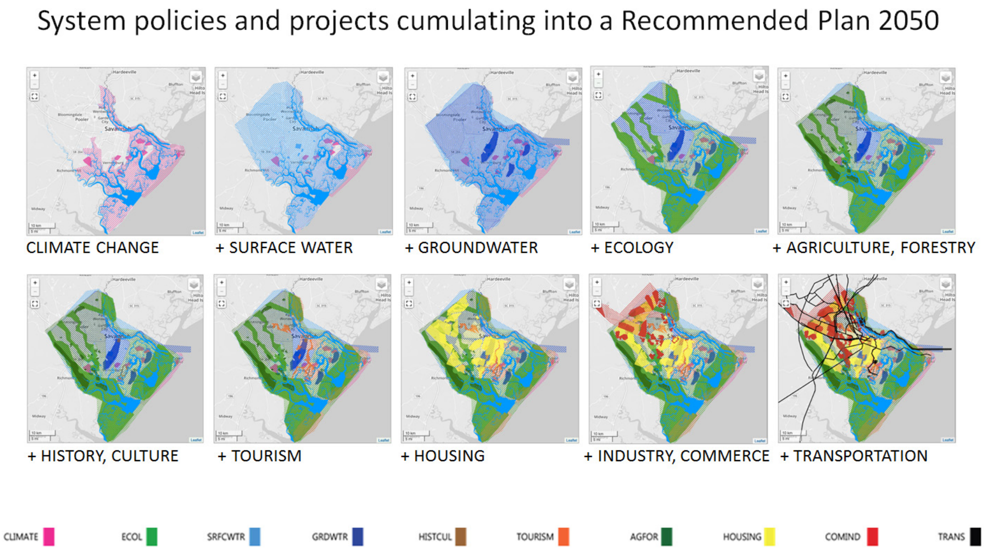


**Fig. 9:** Summary of selected policies and projects per system, displayed in a cumulative fashion from left to right, starting with climate change, in the upper left corner, and ending at the lower right corner, with transporation, that represents the final proposed plan for 2050

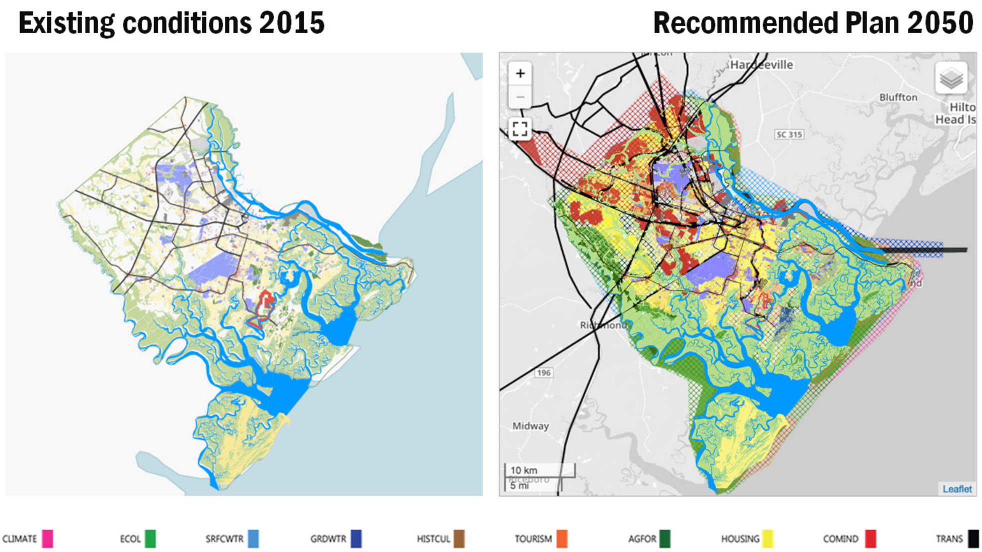


**Fig. 10:** Existing conditions (2015) and final recommended plan for 2050, from the results from the workshop

# 4 Discussion and Conclusions

A geodesign workshop, under the framework presented in this paper, requires a long and careful preparatory/ planning phase, that involves: assembling a planning team; developing, testing, and constantly monitoring the tool (requires many iterations with the software), the tool itself; a clear understanding of the framework, the criteria, and the mapping associated with it, in terms of assessment and risk or vulnerabilities; and a careful selection and balance of participants, based on their expertise, their local knowledge, and their roles, in planning, implementing, and making decisions. During all of these phases, flexibility and capacity to deal with the unknowns and uncertainties, and being able to make fast decisions in this environment, is one of the key aspects.

The goal of the workshop, its core value, is the ability to empower the participants, with the aide of the tool itself, and working in a fast pace environment, with a lot of unknowns, in producing individual and team designs, but ultimately, to be able to make decisions, and work in toward a *rapid assessment and planning of the area*. It is an environment of fast learning pace, not only on the tool, but also in how to collaborate with each other. It relies on a combination of technical expertise, local knowledge, but more than anything, willingness to take risks, be creative, be ready to make "decisions on the fly", and negotiated on values, ideas, and compromises.

About the applications of this particular geodesign process for our study region, these are the most important conclusions, from Brian Orland, Distinguished Professor of Landscape Architecture, Pennsylvania State University: a) Chatham County can accommodate residential growth through increasing density in and near existing residential areas. However, since much of the warehousing and industrial development associated with the port will be single story, it will be impossible to accommodate the required area within the boundaries of Chatham County, b) As well as protecting its environment and consolidating increased development in its northwestern area, it will be necessary to expand development outside Chatham County. This will mean growth in adjoining Georgia counties and the need for increasing cooperation and collaboration in planning with South Carolina, areas which will also benefit from the growth of the Savannah region.

The application of the geodesign framework to the planning process itself, particularly in the Coast of Georgia, were clearly expressed during the final group presentation, during the last day of the workshop, by Lupita McClenning, Director of Planning and Government Services at the Coastal Regional Commission. Her remarks were recognition to the future, not only of this region, by stating that by 2050 we are responding to a changing world and a changing population. *This requires a long term coordination between land use controls and public/private investments, on the local, on the regional and cross states scales in order to be effective and efficient. Decisions have impacts that extend jurisdictional boundaries by the time you reach 2050. In order to advance a growing and bounce economy, in order to protect the environment, and the natural and cultural resources, to provide for infrastructure we have to coordinate land use controls and public capital investment at that scale, not just local, not just regional, but we have to cross through the state in order to accommodate the growing population. This all comes with encompassing social transition. As a regional planner it is just great being able to work with experts and being able to ground truth planning with science, there is no other way to do it. This kind of tools for decision making is absolutely necessary as we move into the future.*

## 5 Acknowledgments

The Geodesign Workshop was possible thanks to funding provided by the College of Environment and Design at the University of Georgia, the Wormsloe Foundation, and the Rado Family Foundation. Our thanks goes to many people involved in the planning and implementation of the workshop: Dan Nadenicek, the Dean of the College of Environment and Design, at UGA, for his initial ideas and further commitment to make this workshop possible; Carl STEINITZ, for his unconditional availability and energy while planning and leading the 3-day workshop; the UK team (Hrishikesh Ballal, and Tess Canfield), for software design and support, and great advise on implementing the geodesign framework; the UGA Planning Committee (Rosanna Rivero, Alison Smith, Sarah Ross, Jon Calabria, Alfie Vick, Marguerite Madden, and Tommy Jordan); the workshop participants without whom the workshop would not have been possible (names and affiliations shown in Figure 11); and our support/video/technology crew, Donnie Longenecker, Russell Oliver, Audra Lofton, Lee Cornell, and our CED staff and faculty who made all of this possible. Additional thanks to Pratt Cassidy for the use of the Broad Street facilities, to our wonderful hosts at Wormsloe, Craig and Diana Barrow; and to our distinguished guests: Bruce and Andrea Rado founders and former CEO of ERDAS, Fred Marland, (on the phone), who was instrumental on the Coastal Marshland Protection Act in 1970, and Ellen Harris, Director of Urban Planning and Historic Preservation, Chatham County-Savannah Metropolitan Planning Commission Finally, our gratitude to our UGA faculty guests, Marshall Shepherd, Stephen RAMOS, Elizabeth Kramer, Bill Tollner, David Gattie, Jason Christian, and Lawrence Hornakand.

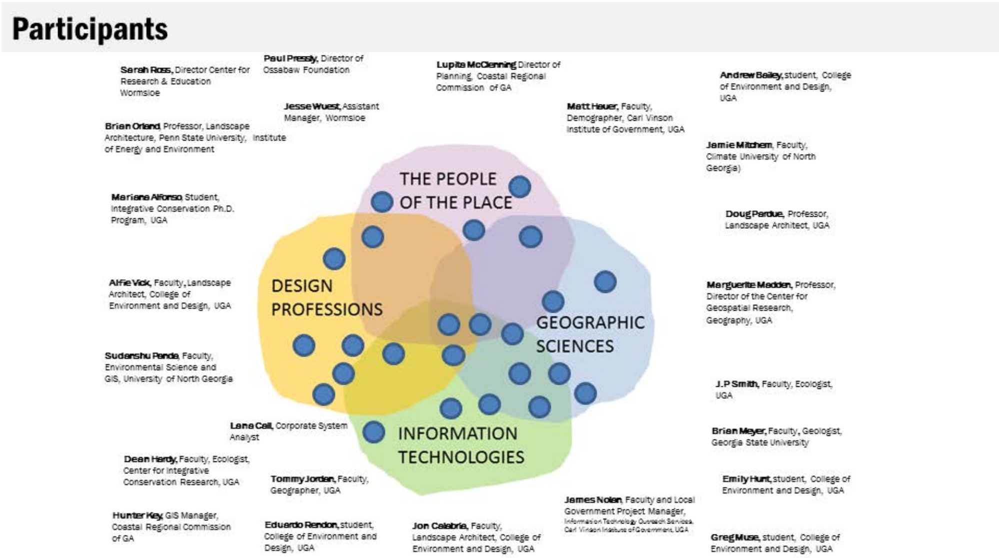


**Fig. 11:** Participants in the Georgia geodesign workshop, and their location in STEINITZ geodesign people diagram

## References

CHATHAM COUNTY-SAVANNAHMETROPOLITANPLANNINGCOMMISSION (2015), Comprehensive Planning Report. http://www.thempc.org/documents/CompLRPlanning/Reports/landusedata2033.pdf (03.10.2015).

DANGERMOND, J. (2010), GeoDesign and GIS – Designing our Futures. In: BUHMANN, E., PIETSCH, M. & KRETZLER, E. (Eds.), Peer Reviewed Proceedings of Digital Landscape Architecture 2010 at Anhalt University of Applied Sciences. Wichmann, Berlin/Offenbach, 502-514.

FLAXMAN, M., (2010a), Fundamentals of GeoDesign. In: BUHMANN, E., PIETSCH, M. & KRETZLER, E. (Eds.), Peer Reviewed Proceedings of Digital Landscape Architecture 2010 at Anhalt University of Applied Sciences. Berlin/Offenbach, Wichmann, 28-41.

FLAXMAN, M. (2010b), Geodesign: Fundamentals and Routes Forward. Presentation to the Geodesign Summit, January 6, 2010, Redlands, CA.

MCELCANEY, S. (2012), Geodesign: case studies in regional and urban planning. ESRI Press, Redlands, CA.

RAMOS, S. J. (2014), Planning for a competitive port expansion on the U.S. eastern seaboard: The case of the Savannah Harbor Expansion Project. In: Journal of Transport Geography, 36, 32-41.

SAVANNAH ECONOMIC DEVELOPMENT AUTHORITY (SEDA) (2015), http://www.seda.org. (03.10.2015).

SEABROOK, C. (2012), The World of the Salt Marsh: Appreciating and Protecting the Tidal Marshes of the Southeastern Atlantic Coast. The University of Georgia Press, Athens, GA.

STEINITZ, C. (2012), A Framework for Geodesign: Changing geography for Geodesign. ESRI Press, Redlands, CA.

STEINITZ, C. (2014), Which Way of Designing? In: LEE, D., DIAS, E. & SCHOLTEN H. (Eds.), Geodesign by Integrating Design and Geospatial Sciences. Springer, 11-43.

WILSON, T. D. (2012), The Oglethorpe Plan: Enlightment design in Savannah and beyond. University of Virginia Press, 257 p.