

Under The Eye: Using an Ecosystem of Digital Tools to Analyze and Solve Land Use Planning Issues

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Abstract: Contentious problems arise when land use change occurs on a unique piece of land that is in close proximity to high quality drinking water wells. Geodesign's transparent planning process gives all community stakeholders a voice. This paper highlights the process of how Geodesign tools were used to help decision makers and landowners make difficult decisions regarding complex land use and development issues. Through a tightly structured design process, a faculty-led team worked with students, a non-profit organization, community-group leaders, municipal officials, the general public, and university leadership to study a 355-acre assemblage of university-owned peri-urban property.

Keywords: Geodesign, geospatial technology, community, drinking water, landscape architecture

1 Introduction

When a community's largest employer seeks to alter a unique piece of natural and agricultural land that is in close proximity to the region's drinking water wells, issues can arise. The President of the Pennsylvania State University requested design assistance from its own Landscape Architecture Department and Geodesign Program to study this complex issue involving multiple systems and stakeholders. The challenge was determining how to efficiently use digital tools to foster a more engaging community input process that seeks to collect deeper information than can be obtained in a typical public meeting. Geodesign's data-aware, transparent planning process gives all community stakeholders a strong voice, while helping guide decisions about what happens on the land in a democratic way. This paper highlights the process of how Geodesign tools (including Geodesignhub, ArcGIS Pro, GeoPlanner, and StoryMap, among others) were used to help decision makers and landowners make difficult decisions regarding complex land use and development issues.

Through a tightly structured design process, a faculty/staff-led team worked with students, a non-profit organization, community-group leaders, municipal officials, the general public, and university leadership to study a 355-acre assemblage of university-owned peri-urban property in State College, PA. The land in question is referred to as the Musser Gap to Valleylands Project, or "MG2V" shown in Figure 1. The students developed landscape design and management strategy ideas that were informed by a series of public meetings, community group interviews, and key stakeholder input. The ideas, values, and themes from two full semesters of student work were then used to develop scenarios with University administrators, including the President, who would be making the actual decisions about what happens on the land.



Fig. 1: The MG2V Property (Credit: D. Meehan)

This case study is unique in that the directive for the study came from the Office of the President of the University. The specific charge was this:

“The University has asked faculty and staff with expertise in land conservation and ecosystem restoration to offer an interdisciplinary course comprised of top students to study a University-owned tract of land in the Musser Gap and adjacent valleylands areas. The student team will present the findings of their landscape analysis to the University’s Facility Office and other campus leaders, to inform the University’s long-term planning for the land, and future community-based consultations. The University recognizes this property’s conservation value and is pleased that committed faculty and students can aid long-term analysis.

The University sees this course project as an important way to receive science-based information that can inform our efforts to consider conservation priorities for the land. Again, this will help inform University planning, and also inform subsequent community engagement as part of our planning process...The University believes this land is a critical environmental resource for the region, and we want to explore long-term ecological and conservation needs and opportunities.” (Penn State Old Main, June 2018)

2 Process

2.1 Fall Semester 2018

In the 2018 Fall semester, a special topics Landscape Architecture course was offered to undergraduate and graduate students. The students involved came from different major programs including Landscape Architecture, Ecology, Geodesign, Geology, Forestry, and Recreation Parks and Tourism Management. The goal of this course was for students to do a deep analytical study of the land and its context. The students began by visiting the property to observe how the land was being used on a day-to-day basis and to provide a better understanding of topography and land cover. The 355-acre tract is owned by the University but is currently leased out to a local farming family on a year-by-year basis. The family has been farming this land for over six generations and has indicated that they would like to continue

views, an online survey was conducted and collected over 1,000 responses from the community to further gather information, collect additional ideas, and further understand how the community feels about the trustworthiness of the University to enact change that is beneficial to all.

Students and faculty worked with the ClearWater Conservancy, a local non-profit organization that specializes in land conservation and preservation, to host a series of community meetings. These information sessions were open to the general public and allowed the community to provide input by drawing on paper maps to depict what they wanted to see on the land, shown in Figure 3. Students then used ArcGIS Pro to create digital geospatial data to capture this input so it could be shared in an open and transparent manner. Geoforage.io is a simple online survey tool that allows for anyone with an internet connection to provide their input. Users can digitize, or draw, an area on the map to show and then describe their own ideas for land use change. This tool was integral as it allowed those who could not make it to a community meeting know that their input was still valued and captured.



Fig. 3: Students gathering input from community members by having them draw what they want to see on a map (Credit: D. Heltman-Gray)

Key stakeholders then participated in a student facilitated workshop using Geodesignhub, an online, open-source mapping tool for negotiation and evaluation to assess community values and needs. Geodesignhub utilized the project-specific GIS data and allowed for groups to choose from ideas that came from public input or add and refine their own diagrams that represented ideas for change on the land. Participants were organized into multiple change teams, or design groups, based on their backgrounds and instructed to select a series of the previously created student diagrams to make a preferred design for the land. Designs were then compared with each other to help visualize and understand the different opinions of the people of the place.

All the information gleaned from the surveys, meetings, workshops, and community feedback was synthesized by students who created five separate design ideas for what could happen on the land. This information was presented back to the community for their final presen-

tations of the semester. The five themes depicted by students were: Minimal Intervention, Water Resource Protection, Enhancing Biodiversity, Agritourism, and Passive Recreation. Four of the design ideas are shown in Figures 4-7.

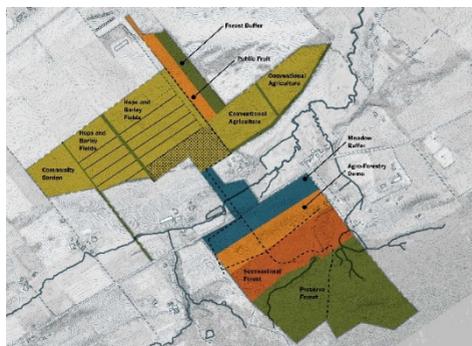


Fig. 4 & 5: Student generated design ideas: Enhancing Biodiversity & Agritourism

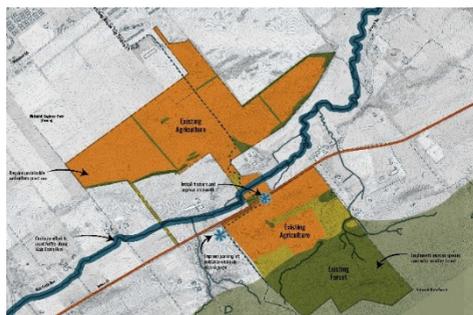


Fig. 6 & 7: Student generated design ideas: Minimal Intervention & Water Resource Protection

2.3 Summer and Fall Semesters 2019

At this point in the process, the decision was made to utilize faculty and staff expertise at the University to take the project through the next phases. The team would address the community input and student created ideas and work with University leadership groups, the decision makers, to determine the ideas that would be implemented and study the feasibility of these ideas.

The latest online analysis tools, such as Esri's GeoPlanner, were used to create dashboards to provide real-time feedback on different design scenarios. The team utilized ArcGIS Pro and ArcGIS Online to create simple maps, tables, and charts to help depict the inherent qualities of the site. The team again utilized Geodesignhub with upper level University leadership to get a sense of their values and ideas. We met with the senior management from Business & Finance, Facilities & Planning, Local Government & Community Relations, and finally the President. Each of these groups was designated as a change team and went through the same process as the earlier community Geodesignhub workshop. The leadership groups then selected a series of diagrams to make up their own design for the land.

Table 1: Agricultural land use types were rated based on their potential impact to the land and also how they met the original values set forth by the University President. A -2 rating is the most negative; 0 neutral; 2 most positive.

Land use Type	Soil Management	Pest Management	Water Management	Protect Water	Protect Biodiversity
Conventional Agriculture (Intensive Till)	-2	-2	-2	-2	-1
Conventional Agriculture (No Till)	0	-2	-2	-2	-1
Organic Agriculture	-1	-1	-2	0	1
Regenerative Agriculture	0	1	0	1	1
Demonstration/Research Agriculture	0	2	2	2	1
Pasture Lands – Cattle	-1	-2	0	-2	0
Wood Lands	0	-1	2	1	1

After these team meetings, leadership groups were all brought back into the same room to analyze and review the designs. Evaluation tools allowed decision makers to see the various scenarios which were compared to further understand areas of agreement and areas of contention. Utilizing the data from Table 1, plus additional information, the team created a GeoPlanner project file to help with synthesis of information. This enabled project participants and the team to see the impacts their choices had with regards to desired criteria for the property and how alternative options compare with each other. The process was structured to ensure that the design decisions are influenced by the values of the people of the place and reinforced by the data to support the decisions.

From this process a series of design ideas were identified and moved into the next phase of studying the feasibility. The team worked with subject matter experts across campus to start to gather additional information on costing, materials, and potential partnerships. The GeoPlanner project file was expanded to include all of the different land use types and ideas that were identified throughout the project. The team gave each feature and land use type an impact ranking based on values outlined by the President and rankings to help quantify the environmental, social, and economic impacts on the land. Multiple scenarios were created with different arrangements of land use types to gauge suitability. GeoPlanner dashboards were built so instant feedback could be provided to team members, shown in Figure 8.

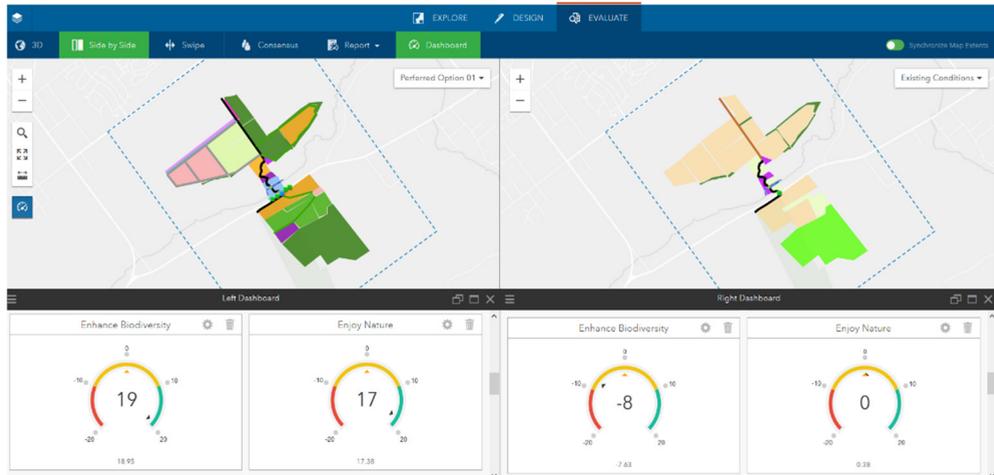


Fig. 8: Esri's GeoPlanner was utilized to show potential land use impacts for different design scenarios. In this image we see two options: on the left we have a preferred option; on the right we have existing conditions. Both scenarios show dashboards that have impacts with regards to enhancing biodiversity and enjoying nature.

3 Results and Findings

The resulting effort identified seven design elements that will be implemented for the study area. The University intends to put out a solicitation and work with a design consultant to examine and implement the seven elements, which are as follows:

- 1) Create a sequential trail experience that will guide people from the built environment – campus and downtown – to a natural environment, allowing visitors to experience the transition from an urban landscape to meadows, woodlands, farm fields, etc.
- 2) Add secondary looping trails, providing additional access to the land and scenic viewpoints.
- 3) Enhance the riparian buffer along a stream with additional plantings to help shade the run and protect it from erosion and pollutants.
- 4) Enhance the safety of crossing of a high-speed state route as visitors walk, run, and bike from one section of the property to another.
- 5) Collaboratively establish a buffer between the property and planned Regional Park that is currently under development.
- 6) Manage approximately ninety acres of existing forest on the land by promoting native plants and trees and removing invasive flora.
- 7) Phase approximately 65 acres out of agriculture into naturalized land cover to increase biodiversity and help protect water resources.

One drawback to this process was the requirement for multiple geospatial analytical tools. There still is not one single tool that can perform all of the analysis that is required for a project that is attempting to implement the Geodesign framework. The tools utilized and de-

scribed herein are more than capable, but the manipulation and modification of the data and software was a key facet as we worked through the framework. Also integral to the process are the participants from the design and science backgrounds. Without thoughtful and dedicated input from the proper personnel, throughout the entire process, this project would not have succeeded.

4 Conclusion

We believe that the entire year-and-a half long process for this project is unique in many ways. It is not often that an academic program gets the opportunity to undertake a practical project in this manner. The actions taken throughout this project allowed us to work through three iterative loops within the project timeline. The first iteration utilized numerous digital and analog tools to gather information and present it to the community for feedback in the second phase of this project. The second iteration took the student generated design ideas, based on information gathered from the community, into account before being presented to leadership. The third and final iteration took the choices from leadership teams and organized the data to help show that the final decisions that were made had agreement among decision makers, had community buy-in, and met the original values outlined by the President. This paper shows how beneficial the Geodesign framework can be with proper, holistic implementation. We hope these ideas and framework outlined here can be used as a guideline for new community engagement processes of the future.

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