REAL-TIME LANDSCAPE ASSESSMENT: THE CLAYTOR LAKE VISUAL MANAGEMENT STUDY

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Abstract.—This paper describes the development of a visual management tool that allows landscape architects and planners, government officials, and community members to view the visual characteristics of the landscape in three dimensional (3D) real time from their homes or offices. The tool uses Google Earth, a free and easy-to-learn software that could be used by citizens and public officials. The user can view various landscape overlays, including land cover, visual quality, and visual sensitivity, and assess the extent to which proposed development will fit the scenic characteristics of the existing landscape. This paper describes pilot testing of the tool on the shoreline of Claytor Lake in southwest Virginia. Key viewpoints are identified systematically. While the resolution of Google Earth is not very detailed, the application includes links from each viewpoint to an archive of higher resolution photographs of the shoreline. This archive can be used to record and document incremental change over time. It also contains links to visual design guidelines that can help make proposed development more compatible with the visual character of the landscape in each area. The tool is envisioned as a prototype that can be used by citizens and public officials to make decisions about development around the Lake.

INTRODUCTION

We came to see, but could only listen.

How many of us have worked on visual assessment studies that sit on a shelf in a planner's office collecting dust? Visual inventories and management plans can be rather lifeless compared to actually seeing the landscape. In the past, visual concerns were mostly related to resource extraction on public lands or large infrastructure projects, such as installation of electric power lines. These days we find more and more people concerned about the scenic quality of the landscapes in which they live. This relationship between people and how they live in a landscape is called dwelling and results in a unique "sense of a place" that is very important. The visual characteristics of these places are critical to maintaining this relationship between people and the landscapes they dwell in. What tools can landscape architects use to help people live in and enjoy a place without destroying this special quality?

How many of us have watched the eyes of an engineer or planner glaze over as you try to explain visual characteristics of a landscape of concern to them, such as the visual complexity or sensitivity? But the moment that you produce real images of the landscape, they come to life. They gather around excitedly pointing at the images and have no shortage of opinions about what looks good. What type of tools can landscape architects use to help professionals involved in land development better understand what is important about the visual character of the land and how development might affect its scenic value?

Traditional methods of scenery management rely on single viewpoints for visual assessments. If multiple viewpoints are used, the assessment tool becomes more cumbersome. Williams et al. (2007) noted that even though photographs have been found by researchers to be a valid surrogate to represent actual landscapes, the images are still subject to viewpoint selection and lack of nonvisual information associated with the viewshed (Rohrmann and Bishop 2002). The ability to look at a landscape from multiple viewpoints would be a clear benefit.

STUDY METHODS

Experts use computers, but what about the rest of us?

Study Objectives

The objectives of the study were to develop a digital scenery management tool for Claytor Lake that:

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- Can display in three dimensions the geospatial landscape data that is typically displayed two dimensionally
- Allows the viewer to view three-dimensional (3D) geospatial data from multiple viewpoints
- Uses open source (free) software that is readily available to public officials and the public
- Can attach nonvisual geospatial data to critical viewpoints in the landscape, such as panoramic photographs recording landscape change over specific periods of time, 2D viewshed maps depicting seen-areas from that point, and design guidelines

The tool was envisioned as dynamic and easy to use in an office or home to explore the landscape in 3D and visualize how proposed landscape changes would affect the scenic quality of the landscape (Ghadirian and Bishop 2008). The application or tool should contain panoramic photos and design guidelines for different locations around Claytor Lake. Google Earth was a good choice for the platform because it is a free, readily available, and easy to use software that citizens and public officials could use to make decisions about development occurring around the Lake.

Study Area Selection

Claytor Lake, in Pulaski County, Virginia, was selected to pilot test the new tool because it has a number of characteristics that make it a good candidate:

- The study area is a popular water-oriented recreation and retreat destination in southwest Virginia.
- The scenic experience of the Lake is important to recreationists and local residents (see Fig. 1).
- The impact of development on scenic quality is a particular concern because of the steep shoreline in many places.
- Scenery management in this area will protect the existing scenic beauty and integrity of the Lake and provide future development guidelines for stakeholders.

The Claytor Lake Visual Management Study was completed for American Electric Power Company (AEP), at the request of residents who live around the Lake. The study described in this paper was undertaken by a research team from the Landscape Architecture Program and the Community Design Assistance Center (CDAC) at Virginia Tech for AEP.

A dam on the New River in southwest Virginia creates the Claytor Lake impoundment. The Lake has a surface area of 4,472 acres (1,810 ha) and is approximately 21 miles (34 km) in length. AEP generates electric power with the dam. AEP is required to conduct a periodic public outreach program to maintain its license to generate power on the New River. It was during this outreach program that local residents expressed concern regarding the effect of development on the scenic quality of the Lake (see Fig. 2).

Figure 1.—The shoreline of Claytor Lake is very scenic but also steep and rugged in many places. Photo by P. Miller, used with permission.

Figure 2.—New development is occurring along the shoreline of Claytor Lake. This includes homes, boat houses, docks, erosion control structures, and development on steep slopes. Some local citizens have expressed concern that this development could have an adverse effect on scenic quality if not done with care. Photo by P. Miller, used with permission.

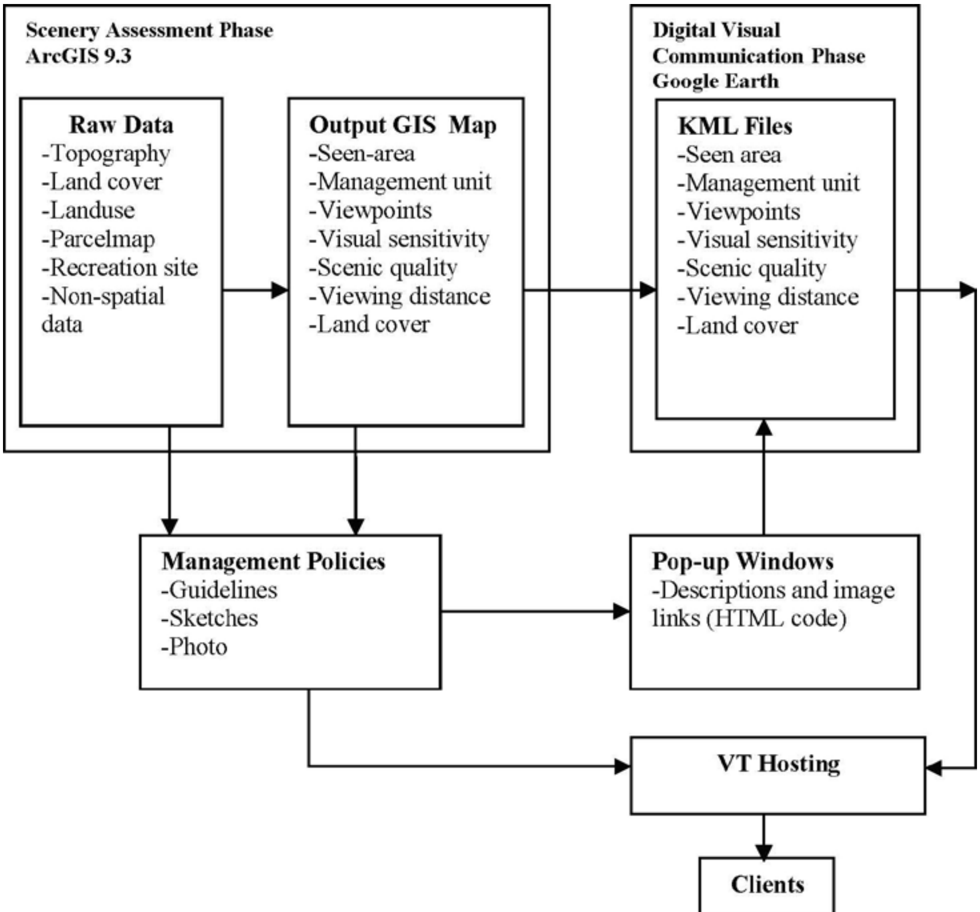


Figure 3.—Flow chart of procedures used in the study. Source: Claytor Lake Research Project, Landscape Architecture Program, Virginia Tech. May 2009.

Study Phases

The initial visual landscape management study was fairly typical and included assessments of visual quality and visual sensitivity of the viewshed around the Lake, as well as other landscape characteristics. The second, more unconventional, part of the study used the new tool to allow people to view the landscape in 3D from an office or someone's home. The users of the tool could control viewing locations and explore viewsheds around the Lake in order to better understand how proposed changes would affect the scenic value of this special place.

The methods used in this study can be divided into four phases: 1) scenery assessment, 2) digital visual communication, 3) management policies, and 4) pop-up windows (Fig. 3.)

The Scenery Assessment phase involved extensive fieldwork and geographic information system (GIS) lab work that any visual study requires. We used GIS data to produce the following maps:

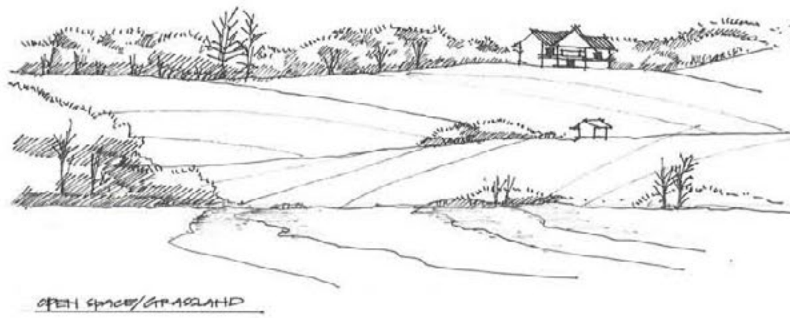
- Critical viewpoints (31 points, ½ mile apart) (Litton 1973)
- Seen areas (viewsheds)
- Distance zones (foreground, middleground, and background)
- Land cover
- Visual units (areas with similar visual characteristics – see Fig. 4) (Lewis and Sheppard 2006)
- Scenic quality
- Visual sensitivity
- Visual management units

Open Space/Grassland Characteristics

This unit is characterized by gently sloping pastoral lands, open spaces, canopied forests and few residential structures. There are no man-made structures near the shoreline. Mixed forests border the pasture. The pastoral qualities are quite picturesque. The area has a high diversity of textures, colors and forms.

Scenic Quality and Visual Sensitivity

The scenic quality in this unit is moderately high, and the visual sensitivity differs based on the location of the unit.



Flat Settlement Characteristics

The flat settlement unit is a landscape with a narrow strip of intensive development next to water, usually with steep wooded slopes directly behind the built structures. The dominant visual element in this unit is settlement on the flat, open space along the shoreline. This unit contains certain man-made structures such as residential development, retaining walls, and boat docks.

Scenic Quality and Visual Sensitivity

The scenic quality in this unit ranges from moderately low to moderate, The visual sensitivity is either moderately low or high because of the location of the unit.

Hilly Settlement Characteristics

This unit in characterized by settlement on upper hill slopes or ridgelines. Distant views are limited by topography and vegetation. Housing, stairs, boat docks and retaining walls are common man-made features in this unit. Retaining walls and stairs on the steep slopes are the main man-made intrusion in this unit that detracts from scenic quality.

Scenic Quality and Visual Sensitivity

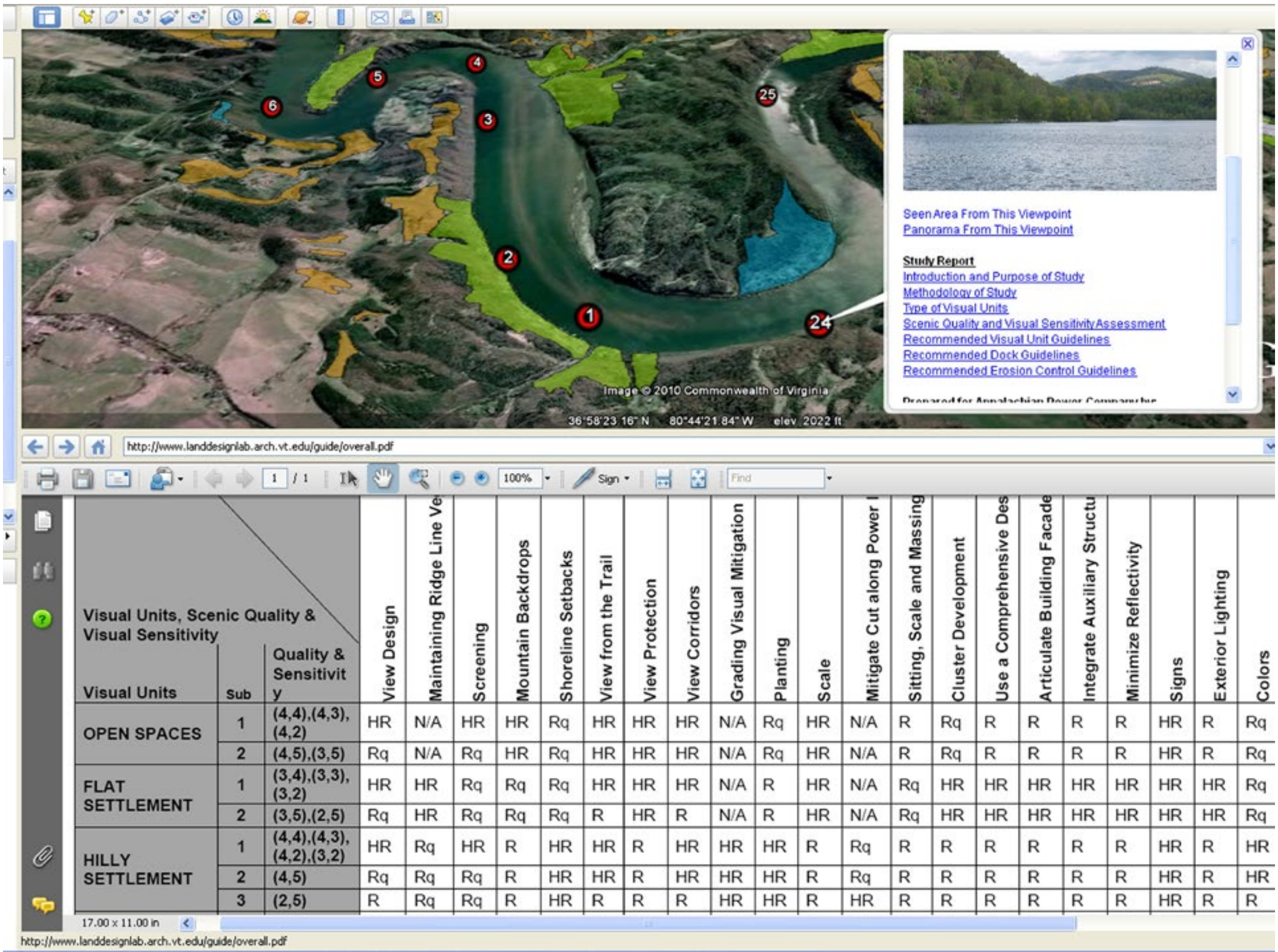
The scenic quality in this unit is either moderately low or moderately high since settlement density changes. The visual sensitivity varies because of the location of the unit.

Figure 4.—Example of selected visual units with descriptions and assessment of scenic quality and visual sensitivity. There were eight visual units in a variety of locations around the Lake. Source: Claytor Lake Research Project, Landscape Architecture Program, Virginia Tech. May 2009.

We collected photographic panoramas and design guidelines for typical proposed development for each visual management unit (see description below). Then, in the Digital Visual Communication phase, we converted the GIS maps from the first phase to KML files for 3D overlays in Google Earth (MacFarlane et al. 2005).

The Management Policies phase of the study involved preparing design guidelines for the visual management units based on traditional procedures using visual sensitivity and scenic quality (Fig. 5) (Tetlow and Sheppard 1979). We used sketches to illustrate guidelines for different types of development including the location of structures relative to the shoreline, the use of vegetation to avoid silhouetting structures, shoreline access on steep sites (see Figs. 6 and 7), shoreline erosion structures, and boat docks.

For the Pop-up Windows phase, we linked development policies, design guidelines, and panoramic photographs to each viewpoint via a pop-



Visual Units, Scenic Quality & Visual Sensitivity: Visual Units	Sub	Quality & Sensitivity	View Design	Maintaining Ridge Line Ve	Screening	Mountain Backdrops	Shoreline Setbacks	View from the Trail	View Protection	View Corridors	Grading Visual Mitigation	Planting	Scale	Mitigate Cut along Power l	Sitting, Scale and Massing	Cluster Development	Use a Comprehensive Des	Articulate Building Facade	Integrate Auxiliary Structu	Minimize Reflectivity	Signs	Exterior Lighting	Colors
OPEN SPACES	1	(4,4),(4,3),(4,2)	HR	N/A	HR	HR	Rq	HR	HR	HR	N/A	Rq	HR	N/A	R	Rq	R	R	R	R	HR	R	Rq
	2	(4,5),(3,5)	Rq	N/A	Rq	HR	Rq	HR	HR	HR	N/A	Rq	HR	N/A	R	Rq	R	R	R	R	HR	R	Rq
FLAT SETTLEMENT	1	(3,4),(3,3),(3,2)	HR	HR	Rq	Rq	Rq	HR	HR	HR	N/A	R	HR	N/A	Rq	HR	HR	HR	HR	HR	HR	HR	Rq
	2	(3,5),(2,5)	Rq	HR	Rq	Rq	Rq	R	HR	R	N/A	R	HR	N/A	Rq	HR	HR	HR	HR	HR	HR	HR	Rq
HILLY SETTLEMENT	1	(4,4),(4,3),(4,2),(3,2)	HR	Rq	HR	R	HR	HR	R	HR	HR	HR	R	Rq	R	R	R	R	R	R	HR	R	HR
	2	(4,5)	Rq	Rq	Rq	R	HR	HR	R	HR	HR	HR	R	Rq	R	R	R	R	R	R	HR	R	HR
	3	(2,5)	R	Rq	Rq	R	HR	R	R	R	HR	HR	R	HR	R	R	R	R	R	R	HR	R	R

Figure 5.—Screen capture depicting visual management units at viewpoint # 24 (upper window) with access to pop-up link to development guidelines (open space, flat settlement, and hilly settlement) for this visual unit of the shoreline. Source: Google Earth, May 2009 and Claytor Lake Research Project, Landscape Architecture Program, Virginia Tech. May 2009

Figure 6.—Switchback access down to a boathouse on a steep shoreline detracts from scenic quality. It will be difficult to maintain and will continue to erode over time. Photo by P. Miller, used with permission.

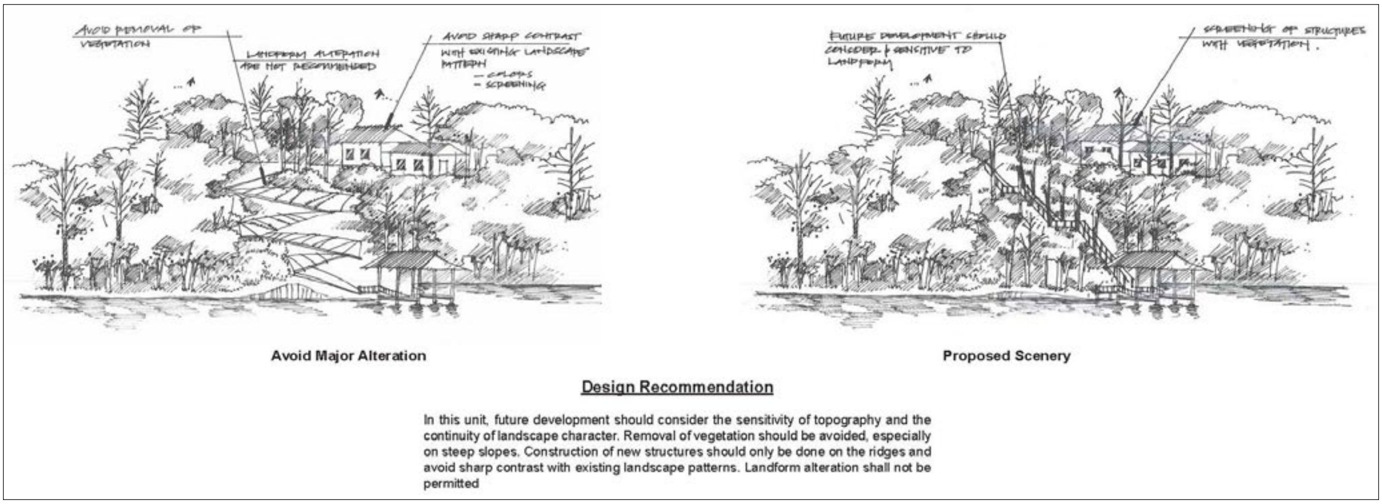


Figure 7.—Example of illustrated design guideline for shoreline access on steep shoreline. Source: Claytor Lake Research Project, Landscape Architecture Program, Virginia Tech. May 2009

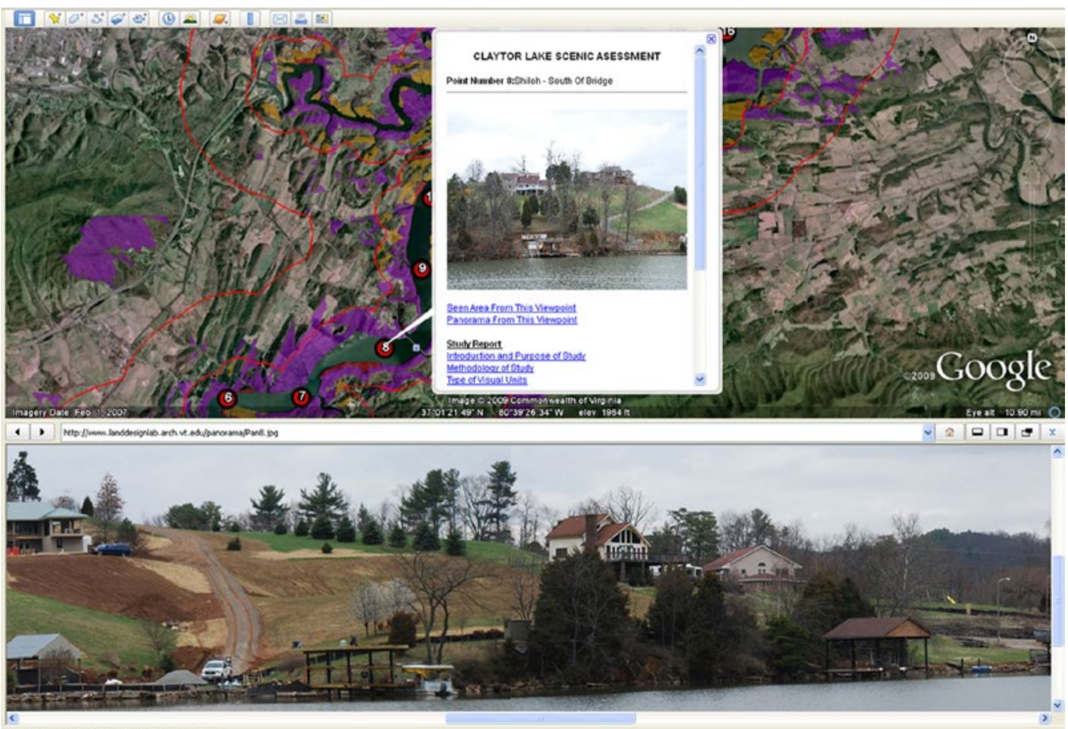


Figure 8.—Screen capture depicting viewing distances zones (red lines) and seen-area (purple shading) in upper window with access to scrollable panoramic photographs from viewpoint #8 (lower window). This can be accessed from a pop-up menu, allowing simultaneous comparison (photo and seen-area) for a specific viewing location. Source: Google Earth and Claytor Lake Research Project, Landscape Architecture Program, Virginia Tech. May 2009.

up window. We took panoramic photographs from each viewpoint, capturing the present condition of the landscape. We envisioned adding photographs in the future to provide a photographic record of change along the shoreline over time. When viewed in Google Earth, the user can easily access the panoramic photos for each viewpoint plus reports on the background of the project, methods, assessment procedures, terminology, contacts, and development guidelines and recommendations (Fig. 8).

The use of “pop-up windows” was very useful for integrating various types of information that allow users to have a deeper understanding of the scenic assessment process (see Fig. 9). The ease of access should make the task of evaluating the visual implications of a

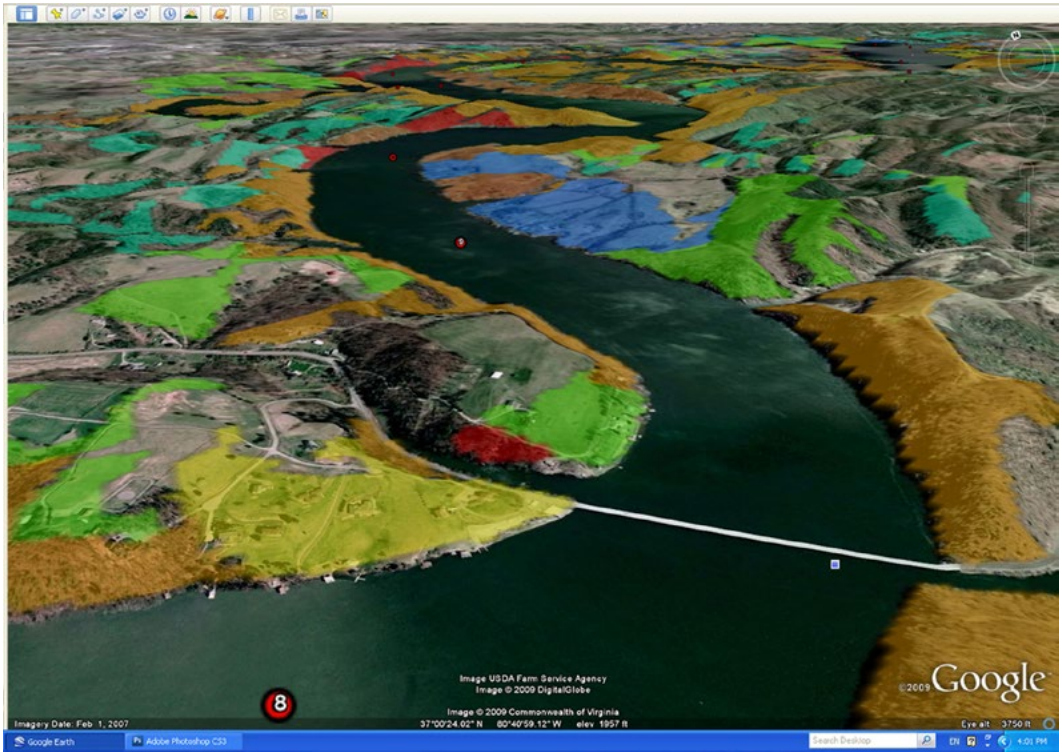


Figure 9.—Users can obtain different views of the landscape by changing viewing distance (zoom) and viewing angles. Source: Google Earth May 2009 and Claytor Lake Research Project, Landscape Architecture Program, Virginia Tech. May 2009

proposed development much more understandable and provide design guidance for specific areas around the Lake (Appleton and Lovett 2003). It should also make the process less frustrating for property owners and government officials (Williams et al. 2007).

CONCLUSIONS

Seeing the future means looking now.

It is clear from this study that a real-time scenery management tool would help guide development and preserve scenic values in landscapes that are important to people. But are we ready for these tools? There are two things that need to happen before these tools can make a real difference in preserving scenic quality: 1) an improvement in the technology, and 2) changes in the regulatory system in most places in the United States. Each of these is discussed in more detail below.

Technology

There are many visualization tools and applications available for managing the scenic value of the landscape. However, many of these are too complicated for citizen stakeholders to use (Appleton et al. 2002). Thus, many of the available applications have been ignored due to poor accessibility and lack of intuitive understanding (Appleton and Lovett 2003).

Google Earth images are arguably not very good due to low resolution but they can still provide valuable spatial information to stakeholders and researchers (see Fig. 9). Also, this technology is improving, and higher resolution images are already available on platforms similar to Google Earth. The advantages of using Google Earth or similar applications include ease of access, dynamic 3D visualizations, and simultaneous access to multiple sources of information. MacFarlane et al. (2005) have suggested that in the future, landscape assessment will not depend on typical hard copy data presentations but will involve mostly hyperlinked data that are interactive through Web browsing techniques.

Another factor is that lower production costs can be expected since investment in human resources to produce printed materials will be reduced by displaying scenic, geospatial information in a digital format. Lower cost will encourage use.

Regulatory System

In many locations, the land development laws and regulations do not include mechanisms for preserving scenic quality. We believe that the lack of regulation is primarily due to the difficulty of understanding visual concepts and principles, both among professionals and citizens. Scenic quality is something that most people know when they see it, but they lack knowledge of the visual concepts and principles necessary to explain why a landscape is scenic. A tool that allows people to view both the landscape and information about how it might be developed would make policy and regulation more understandable.

It would be particularly helpful if proposed developments could be simulated and viewed in the landscape. In fact, The National Capital Region Planning Commission is already doing this. They call it, "EyeSite AR/Augmented Reality." The application combines building information modeling (BIM) and GIS to simulate proposed building in the urban landscape. We believe that regulatory mechanisms will follow once these tools become increasingly available and can aid in understanding the visual implications of landscape change.

Final Thoughts

The combination of these technologies will provide a remarkable opportunity for landscape managers to deliver their ideas effectively to the public and efficiently receive feedback. At the same time, these new technologies and new applications of existing technologies encourage landscape managers and citizens to engage in positive interaction and critique proposals for new development in a way that can preserve scenic value and enhance sense of place. Orland et al. (2001) and Lewis and Sheppard (2006) have also noted that visualizations can be a "common currency of planning" that can encourage participation and understanding among users, providing a basis for managing scenery in a manner consistent with public values.

As we stand at this moment looking into the future and contemplating the opportunities that visual technologies present us, we feel compelled to express a bit of caution. No matter how good the digital representations and the value of the knowledge they can provide us, we should also remember that nothing can ever be as rich as the experience of the landscape. This is why we do this work.

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