A GIS-based analysis of plantation spatial organization: Stewart Castle, Jamaica

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1. Models of Plantation Spatial Organization
Archaeological and historical sources have traditionally employed one of two basic models to identify and analyze the spatial organization of plantation sites:

a. The centrality of production model hypothesizes the organization of plantation space primarily based on the minimization of movement of laborers and raw materials and the maximization of efficiency.

b. The centrality of control model interprets the same organization based on the strategic placement of key plantation elements. This model holds that the location of key elements was intended to control the movement of people and resources on the plantation landscape.

To assess the strength of the centrality of control model, GIS-based viewshed analysis was used to evaluate the degree of visibility between important elements on the plantation landscape.

3. Why Viewshed Analysis?
Viewshed analysis is a valuable tool within the field of archaeology that enables analysts to translate archeological observations and events into spatial data that identifies visible and non-visible areas from that point.

By processing elevation and topographic data, viewshed analysis reveals the locations which minimize surveillance.

The visibility between these locations and the critical elements on the landscape is evaluated by the viewshed. This method is useful as it can analyze data across the entire landscape, not just in defined areas, and visibility is not limited to a single point.

Thus, the viewshed function is a useful tool to emphasize the intervisibility of key elements using visual data from an historic plantation rather than previously assumed or absent plantations.

4. Cumulative Viewshed
Each pixel generated in the cumulative viewshed is a sum total of the viewshed pixel values from all other observer points. The cumulative viewshed is a useful tool for identifying areas where visibility is not limited to a single point.

The ranked outcome of the cumulative viewshed reveals the areas that are most visible and those that are minimally visible. This information is valuable for understanding the spatial organization of key plantation elements.

In this case, the cumulative viewshed analysis identified the areas that are most visible as the Castle and the overseer's house, indicating their central role in plantation surveillance.

5. Single Viewsheds of Principal Plantation Elements
To determine the degree of intervisibility between elements, cumulative viewsheds were created to identify which areas are visible or not visible from a specific observer point. Three single viewsheds provide the most information about the intervisibility of plantation elements:

- The overseer's house
- The sugar cane fields
- The overseer's house

6. Evaluating the Surveillance Model
The results of the cumulative and single viewshed analyses confirm the surveillance argument, which presumes that the great house and the overseer's house were centers of observation designed to maximize plantation hierarchy.

The cumulative viewshed analysis identified the Castle and the overseer's house as the areas with the highest visibility values, indicating their central role in the surveillance network. This evidence supports the hypothesis that these elements were strategically placed to monitor the activities of plantation workers.

The single viewshed analysis of the sugar cane fields revealed the areas that were most visible from the Castle and the overseer's house, highlighting their role in overseeing the processing of sugar cane.

The cumulative viewshed analysis also identified the areas that were least visible, providing insights into the hidden aspects of plantation life that were not immediately apparent.

The results of these analyses suggest that the Castle and the overseer's house were central to the surveillance network, with the sugar cane fields serving as secondary nodes in the oversight system.

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References
Stancic, pp. 171-186
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