Visualizing common lands: A framework component of GIS use in other cultures

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A great many barriers exist to successful and effective implementation of GIS in non western cultures and societies. The societal constraints inherent in the western origin of GIS (Wynne, 1980; Sheppard 1995) as well as translation barriers due to differences in concepts of time, scale, detail, distance, values, topology and relationships (Mark and Eigenhofer, 1995; Rundstrum, 1995) are formidable constraints to effective utilization of GIS in other cultures. Making sense of the complex barriers to GIS applications in other cultures suggests the need for a framework that permits the systematic treatment of this issue (Harris and Weiner, 1996; Duerden and Kuhn, 1995). Some researchers have begun to address the treatment of culture and GIS on a comprehensive level (Burrough and Frank, 1995; Campari and Frank; 1995;), but the diversity of cultures and use contexts indicates that treatment of specific situations and applications is more appropriate. Focusing on narrowly framed situations would help characterize underlying cognitive models contributing to the resolution of barriers facing GIS use in other cultures.

One means of framing situations is to concentrate on the relevant structures that are the foundations of how other cultures function and interact. Language is one such foundation under investigation that has important implications for understanding common cognition of space (Talmy, 1983; Campari et al, 1994; Mark and Frank, 1989). Investigation of other foundations such as economic relationships, kinship ties and resource relationships would also provide useful insight for GIS design and application.

Common lands and their management are one such variety of resource relationships that warrants investigation in the pursuit of understanding GIS use in other cultures. Sense of place has long been recognized as a formative element of culture (Relph, 1976) and is of critical importance in third world cultures (Chapman, 1997; Davis, 1995). As a phenomenon that is significantly different from the western perspective on land, investigation into the management of common lands and how to represent them would be a valuable step forward in guiding the design of GIS for use in cultures where common property resources exist.

This research paper is an exploration of fundamental characteristics and the implications for effective visualization of common lands with GIS. The following four sections present 1) the influence of common land on cognitive models; 2) a framwork of common land characteristics; 3) elements for visualizing of common lands; and 4) the utility of these representations for trans-cultural communication.

Common lands, common cognitive models.

People and cultures that share and manage common lands have different mental maps of their landscapes than cultures without common lands. Cultures are constructed of assumptions, values, behaviors and traits that the members share in common (Gagliardi, 1986). Sharing of these elements are what makes it possible for members to function in a cooperative manner. It follows that the members of a culture that have common goals and tasks would have a shared cognitive maps that, while not necessarily identical, are similar enough to characterize a common orientation (Langfield-Smith, 1992). The presence of common land in a particular culture would imply that members share a common mental map of their communal resource and the important relationships thus permitting collective management. Indeed, management of common lands is often considered to be impossible if the managing culture or organizational structure becomes dysfunctional (Gibbs and Bromley, 1989).

If presence of common land in a culture affects the shared cognitive map of land resources and relationships, than one would expect that variations in common land arrangements would be associated with similar variations in cognitive maps of that land resource. Understanding these permutations in cognitive maps of common land resources has broad implications for the utility and design of information systems (Medyckyj-Scott and Blades (1992) discuss cognitive maps and GIS design).

Data bases for land resources supported by GIS are capable of one to one relationships that are typical of western views on land: One owner has control and access to all resources present on their land. The following section demonstrates that common land resources do not share this one to one relationship, and frequently have a many to one structure that experiences periodic changes in access to resource flows. The divergence in these models is one aspect of why current GIS cannot faithfully represent the topological relationships in common land arrangements.

Elements of common land resources.

There are four general property rights regimes: open access, communal property, state property and private property. Common property is characterized by the exclusion of other users and joint use involves the subtraction of welfare from the members as a whole. Open access property has no restrictions on users, while state property is owned by the state, but rights to access are not specified (Berkes, 1989, pp. 9 - 10).

A typology of common property resources has been proposed by Buck (1989) and addresses the scale of the user pool, property rights and the nature of the resource (Table 1). Under this typology, most traditional or culturally controlled common land resources are most likely to be characterized by a smaller scale of user pool and stationary in nature.

Table 1 Buck's typology of common resources (Buck, 1989)

Scale of user pool	Property right	Nature of resource
Traditional (Internal control)	Non transferable /Exclusive	Stationary / renewable
Localized (External political control)	Non transferable /Non-exclusive	Stationary / Non-renewable
Regional (External political control)		
National (Internal political control)	Transferable / Exclusive	Fugitive / Renewable
Multinational (Little internal or external control)	Transferable / Non-exclusive	Fugitive / Non-renewable

While this typology is mostly descriptive of common lands as a whole, the character of property resources and benefit extraction would better describe the possibilities of common land resource management. Furthermore, this typology does little to support efforts to represent or visualize the nature of the resource relationships. The type of resource and nature of utilization is fundamental in determining the interaction and behavior of individuals as they engage in value extraction. Literature and case studies on common land resource use and mapping of common lands suggest that the following distinctions would be appropriate descriptive categories for common property systems (Birkes, 1989; Bocco and Toledo, 1997; Tabor and Hutchinson, 1994; Gonzalez, 1995; Peluso, 1995; Peluso, 1996; Sirat et al, 1994; Rundstrum, 1991; Vandergeest, 1996; Rocheleau et al, 1995):

Pattern of administration:

Inherited - Rights to benefits are passed on to family members
Negotiated - Members negotiate for access to communal lands
Centralized - One community member is responsible for allocating access rights

Level of access:

Full - Access to all benefit flows is permitted
Partial - Access to only certain benefit flows is allowed

Duration of access:

Permanent - Members have permanent access to benefit flows
Temporary / Cyclical - Members have only short term and/or recurring access to benefit flows at certain times.

Resource type:

Stationary/Renewable
Long rotation (forests, orchards, grazing, apiaries, etc.)
Short rotation (crops, grazing, seasonal products from forests, etc.)

Components for visualizing common lands.

While many of the typology characteristics identified by Buck are characters of the entire common land systems, the relationships that occur within them are not. The administrative dynamics of individual common lands systems are more likely to have a direct effect on not only the patterns of land use, but also the cognitive map of the community members. The relationships between the spatial distribution of resources in common lands and which members of the community have access and when are the components that characterize the actual use of common lands. Thus, visualizing common land management patterns requires the dual representation of these two elements.

Effective visualization of the dynamics in common land management systems will need to be more specific in capturing the nuances of the cognitive maps underlying common land systems than the revised typology. Characteristics of boundaries, land use, and topology of the common land use units will need to be represented before effective visualization can take place.

Boundaries relate to not only the external limits of the common land resource, but also to the varieties of internal division that delineate the access rights of individual members. These boundaries will differ depending on that entity they delineate. Four

boundary characteristics for use in delineating common land relationships are fixed or mobile, permanent vs. temporary and permeable vs. non permeable and fuzzy vs. established. Boundaries of the common lands are likely to be fixed, permanent, established and non permeable, while the boundaries relating to temporary access may be the opposite. Successful use of boundaries in representing common lands will require careful pairing of boundary type with actual land use and the cognitive map of use relationships.

Like boundary type assignment, classification of specific parcels uses of will require an understanding of the apparent use and the decision tree that led to the establishment of that use. Visualization of the multiple inputs to a land use decision tree may require multiple representations of physical land characteristics. Cultural aspects such as distance from living spaces or proximity to centers of religious importance may also play a part in assigning land uses. Temporary or cyclical patterns will also require multiple representations if the full spectrum of change over time is to be considered.

Identification of the resources and parcels in question along with their relationships to individuals or groups will be required to express topology. While the mapping of the physical resource might be fairly straight forward, representing who has access to those resource is not. Much of the representation strategy will depend on the nature of the resource and the number of entities with access rights. If the there are few distinctions in access rights (no more than 12) then there is the possibility of using split point symbols. This may also be effective in case where access is aggregated into families, tribes or by gender.

An alternative approach to mapping relationships is to focus on the access pattern rather than on the resource. Using multiple displays, the regions and resources being accessed by individuals or groups can be represented to determine an access area.

The implications and future of visualizing of common land relationships.

Clearly, designing and implementing a visualization scheme for common lands is a complex undertaking. Fundamental to this effort is an understanding of how the participants in the management and extraction of common lands view and utilize their resource in a cooperative manner. With the management of these common resources being so fundamental in the cultures in which they exist, multidisciplinary approaches will most certainly be necessary. Contributions from studies of linguistics, anthropology and sociology are areas that can provide the most immediate inputs towards visualizations of common lands. Visualization will also enable researchers in these disciplines to better understand the nature of the spatial and resource interactions of the cultures they examine.

Ideally, the members of the community themselves would be the best qualified to design and implement visualizations of their own resources. Unfortunately, traditions of computer use, representation and modeling are rarely found in cultures that have a history of subsistence resource extraction. The immediate future of these efforts will be collaborations with technologically proficient researchers who are culturally sensitive and capable in partnerships with local representatives.

The benefits of visualizations of culturally based common land management are seen in the extension of cultural means and values beyond the cultural group. Representing traditional territory and resource claims to governments or competing groups is seen as a vital step in legitimizing claims. These groups recognize the power of the map and in having others understand their perspective on their resources. Effective management of

competing resource regimes will rely on maintaining access to traditional resources and their patterns of use.

Within the community itself, representation and visualization may not seem to be worth the effort, after all, they have managed until now without GIS. But, participating in the creation of visualizations, and eventually producing their own, will lead to a better understanding of how to effectively communicate across the cultural and political barriers that are currently such a struggle.

As the world economy expands, the question of resource valuation is raised. With more effective visualizations of common property management, the resources held by a community can be more equitably valued in light of the relationships in the culture. Disruptions through inappropriate development could be prevented if an understanding of common lands dynamics could be communicated through visualization.

New Directions

Effective visualization of common lands will require a more extensive system of common lands classification and testing of information representation. The inherent relationships present in common lands management between the culture, its members and how they extract value from their resource are critical to understanding the common cultural cognitive map. A taxonomy of cultural relationships and resource use patterns would helpful towards defining what visualization techniques would be effective. Effective testing of visualization of common lands will have to address how well the models are perceived by members of other cultures if they are to be effective for establishing resource rights and subsequent valuation.

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