Conservation Easements as Corporate Strategy: An application of GIS to Riparian Buffer Zones

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Overview

Since the World Commission on Environment and Development's (the Bruntland Commission) definition of sustainability in 1987, managers have struggled with sustainable development. Inherent in many industries is a tension between organizational performance (specifically meeting economic goals) and the need to meet environmental objectives. Researchers in this area have examined various strategic management approaches toward reconciliation of these goals such as changing values (Clark, 1989), social reorganization (Gore, 1992), vision expression (Lee, 1993) and transforming organizations (Vierderman, 1994). While these approaches contribute significantly to strategic intent (Hamel & Prahalad, 2005) and even strategic planning in organizations, they often fall short at the level of strategy execution, which is largely a problem of resource scarcity (money, time, HR, natural resources, etc.). This presentation demonstrates how organizations might use legal and technological managerial tools to protect natural resources, specifically watersheds, while still allowing the organization to make effective use of its assets. The use of GIS as a managerial tool for identifying highly desirable areas for conservation easements as well as determining appropriate placement of riparian buffer zones is explored. Conclusions for this approach and implications for future research are discussed.

Introduction

As organizations factor their impact on the environment into their decision-making and strategic planning, it is important to consider non-point source pollution – one of the biggest challenges in managing water quality. Non-point source pollution is simply uncontrolled polluted runoff from diffuse sources. The runoff becomes polluted by picking up nutrients, chemicals, sediments, and other pollutants, eventually depositing them into larger water bodies.

A major contributor to non-point source pollution is private and commercial riparian land use and therefore a key target for riparian buffer zones. Riparian buffer zones are vegetated strips of land that border water bodies and moderate the impact of adjacent land uses on the water bodies. Studies have shown riparian buffer zones can have positive impacts on water quality related to reduced non-point source pollutants such as sediments, nutrients and chemicals (e.g. Vought et al, 1995; Lee et al, 2003; Lovell & Sullivan, 2005). GIS analysis considering both natural factors that influence the effectiveness of riparian buffers, and economic factors could be used to optimize conservation easement and riparian buffer zone placement within a watershed.

Conservation Easements

Conservation easements are legal agreements between a landowner and an easement holder, either a charitable organization or government agency, to restrict potential development or other specified uses of the land on which the easement is held (Morrisette, 2001). The root of a conservation easement lies in property law, which allows for a fee owner of real property to relinquish some property rights while remaining the landowner (Wiebi et al., 1996). A conservation easement is the legal mechanism to conserve and preserve unique natural landscapes, historical places, sensitive ecological areas, open space, habitat for plants and animals, scenic vistas, and valuable natural resources (the lands conservation values) in perpetuity (Brewer, 2004). Conservation easements can be designed to protect a variety of conservation values, here the focus is on their use in improving water quality. Importantly, conservation easements allow for two key financial incentives to landowners (be they private parties or corporate entities): tax incentives and continued use of the land within the specified boundaries of the agreement.

Key Beneficial Aspects of Conservation Easements:
- Legal: flexible but enforceable
- Ecological: preserves natural landscapes or resources
- Economic: financial incentives for conservation

Riparian Buffer Zones

The use of riparian buffer zones to reduce nonpoint source pollution and improve surface water quality has been extensively studied in the last few decades (Lowrance & Sheridan, 2005). Riparian buffer zones have been shown to improve water quality by reducing runoff of sediments (Karr and Schlosser, 1978) and nutrients such as phosphorus and nitrogen (Lee et al., 2003) while at the same time increasing species diversity, reducing erosion, and improving in-stream habitat (Vought et al., 1995, and Lovell and Sullivan, 2005). However, the effectiveness of riparian buffer zones is not equal across a varied landscape (Tomer et al., 2003). A number of factors including slope, vegetation assemblage, buffer width, location along stream length, soil composition, and abutting land uses impact the effectiveness of riparian buffer zones. By strategically selecting locations that maximize the benefits of riparian buffer zones, firms identify these areas for conservation easements thereby optimizing the environmental objectives sought in a manner that is economically sustainable as well.

Key Beneficial Aspects of Riparian Buffer Zones:
- Reduce runoff of sediments and nutrients
- Increase species diversity
- Reduce erosion
- Improve in-stream habitat

GIS Techniques

Geographic information systems (GIS)are an ideal modern tool for evaluating varied spatial information and performing spatial targeting based on geographic criteria (Foster and McDonald, 2000). Using GIS a researcher could overlay critical riparian buffer components such as vegetation type and diversity, soil type and classification (Narumalani et al., 1997), slope and upslope drainage (Tomer et al., 2003), land use categories, property ownership, land value (Ferraro, 2002), aquatic habitat, and water quality data. A multicriteria optimization analysis (Bailey et al., 2006) within a GIS could then produce a map of strategically located riparian areas that could improve water quality in adjacent water bodies, even calculating the appropriate width of the riparian buffer based on the interrelationships of localized spatial characteristics (Xiang, 1993). These areas can then be targeted strategically for conservation easements as a market mechanism to preserve riparian lands and provide economically-viable solutions to a host of landowners.

Key Beneficial Aspects of GIS Analysis:
- Visually represents data
- Optimization modeling capabilities
- Capable of Optimizing for Multiple Criteria

Conclusions

Past studies indicate the viability of using GIS to identify optimal locations for riparian buffer zones. Tomer et al. (2003) utilized GIS terrain analysis considering slope attributes to determine overland flow patterns in an attempt to identify optimal locations for riparian buffers in an Iowa watershed. Narumalani et al. (1997) integrated remote sensing technology and GIS to identify critical areas for implementation of riparian buffers. Bailey et al. (2006) used GIS modeling to perform a multi-criteria evaluation incorporating biological, chemical, physical, and social information in determining priority locations for native woodland creation. These studies demonstrate the ability of GIS analysis to synthesize a broad array of information and identify optimal outcomes on a spatial scale. What is missing from the extant literature is the connection back to the landowners in the form of what can be done one optimal locations have been identified. It is our contention that the use of conservation easements in the form of highly specified parcels of land which create riparian buffer zones can greatly impact the positive effect firms can have on watersheds in a way that minimizes (and even enhances) economic sustainability. This application is potentially beneficial across industries, market segments, regions and size of firm, from the sole proprietorship farmer to the REIT forest products firm or the global corporate microchip producer.

Sources

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