Planning for Long, Wide Conservation Corridors on Private Lands in the Oak Ridges Moraine, Ontario, Canada

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Abstract: *We explored the role of conservation biology in the planning of a natural-heritage system that includes long, wide conservation corridors situated primarily on private lands, and established to connect natural core areas in the Oak Ridges Moraine of Ontario, Canada. We based our review on government documents, semi-structured interviews with participants involved in this land-use planning process, and our involvement with the issue from 1990 through 2002. Conservation biology had a major influence on the outcome of the land-use planning process for this moraine. The landform was identified as an area of value by the environmental movement within the context of a number of ongoing government studies that began in the late 1980s and early 1990s. Conservation biologists and planners in government, the environmental movement, and the private sector carried out work related to conservation biology, including inventories and the development and application of criteria for the delineation of core areas and conservation corridors. Once the political timing was favorable (2001–2002), decision makers linked the science of conservation biology to planning policies and law in Ontario. The Oak Ridges Moraine land-use planning process was precedent setting in Canada, and possibly internationally. To our knowledge this is the first time long, wide conservation corridors on private lands were regulated through land-use-planning legislation and led to restrictions on urban development and aggregate resource extraction.*

Keywords: conservation corridors, conservation legislation, land-use planning, Oak Ridges Moraine, private land

Planificación para Corredores Largos y Anchos en Terrenos Privados en la Morrena Oak Ridges, Ontario, Canadá

Resumen: *Exploramos el papel de la biología de la conservación en la planificación de un sistema de patrimonio natural que incluye corredores de conservación largos y anchos situados principalmente en terrenos privados, establecidos para conectar áreas núcleo naturales en la Morrena Oak Ridges de Ontario, Canadá. Basamos nuestra revisión en documentos del gobierno, entrevistas semiestructuradas a participantes en este proceso de planificación de uso de suelo y en nuestra participación en el tema entre 1990 y 2002. La biología de la conservación tiene una influencia mayor en el resultado del proceso de planificación del uso de suelo en esta morrena. Este sitio fue identificado por el movimiento ambientalista como un área de valor en el contexto de una serie de estudios promovidos por el gobierno que comenzaron a finales de los 80 y comienzo de los 90. Biólogos de la conservación y planificadores en el gobierno, el movimiento ambientalista y el sector privado trabajaron en torno a la biología de la conservación, incluyendo inventarios y el desarrollo y aplicación de criterios para la delineación de áreas núcleo y corredores de conservación. Una vez que el tiempo político fue favorable (2001–2002), los tomadores de decisiones ligaron la ciencia de la biología de la conservación con las políticas de planificación y las leyes de Ontario. El proceso de planificación del uso del suelo en la Morrena*

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Oak Ridges sentó precedentes en Canadá y posiblemente en el extranjero. A nuestro saber, esta fue la primera vez que se reguló a corredores largos y anchos mediante legislación de planificación de uso de suelo, lo que derivó en la restricción del desarrollo urbano y la extracción de recursos agregados.

Palabras Clave: corredores de conservación, legislación para la conservación, Morrena Oak Ridges, planificación del uso del suelo, terrenos privados

Introduction

The Oak Ridges Moraine (ORM) is in southern Ontario, Canada, and extends from the Niagara Escarpment in the west to the Trent River in the east (Fig. 1). The moraine is a glacial landscape feature created by multiple advances and retreats of glaciers during the Pleistocene. The moraine is approximately 195,000 ha in size, 160 km in length, and between 3- and 24-km wide (Chapman & Putnam 1984; Government of Ontario 2002). Much of the moraine was deforested during settlement in the early 1800s. Deforestation, particularly on sandy soils, led to extensive erosion. Conservation efforts by the Ontario government in the 1930s and 1940s resulted in extensive reforestation. Today the moraine supports an abundance of native plant and animal species. It is a groundwater recharge and discharge area for some 65 watercourses, has dozens of small kettle lakes, and is a unique and visual landform. The moraine is an important source of aggregate building material for urban areas to the south. A significant portion of the moraine is located immediately north of Toronto, Canada's largest and most rapidly growing city, and is under heavy development pressure. The ORM area is more than 90% privately owned and has a population of over 100,000. There is some agricultural activity, its recreational resources are important, and the area is home to many wealthy suburbanites (Oak Ridges Moraine Technical Working Committee 1994; Regional Municipalities of York, Durham and Peel 1999).

Threats to the ORM from urban development resulted in a land-use conflict that started in the late 1980s and lasted 15 years. The planning outcomes of this conflict, including the Oak Ridges Moraine Conservation Act and Oak Ridges Moraine Conservation Plan (Government of Ontario 2001, 2002), are significant (Parliamentary Commissioner for the Environment 2003; Hanna & Webber 2005; Hanna et al. 2007). The conditions that led the Ontario Parliament to pass the Act and the government to prepare the plan were influenced through advocacy by citizens and the environmental movement, media engagement, political timing, and acceptance of conservation biology principles. We focus on the latter, highlighting the precedent-setting nature of the use of conservation biology as a basis for the legal protection of extensive core areas consisting of environmentally sensitive lands and long, wide conservation corridors that

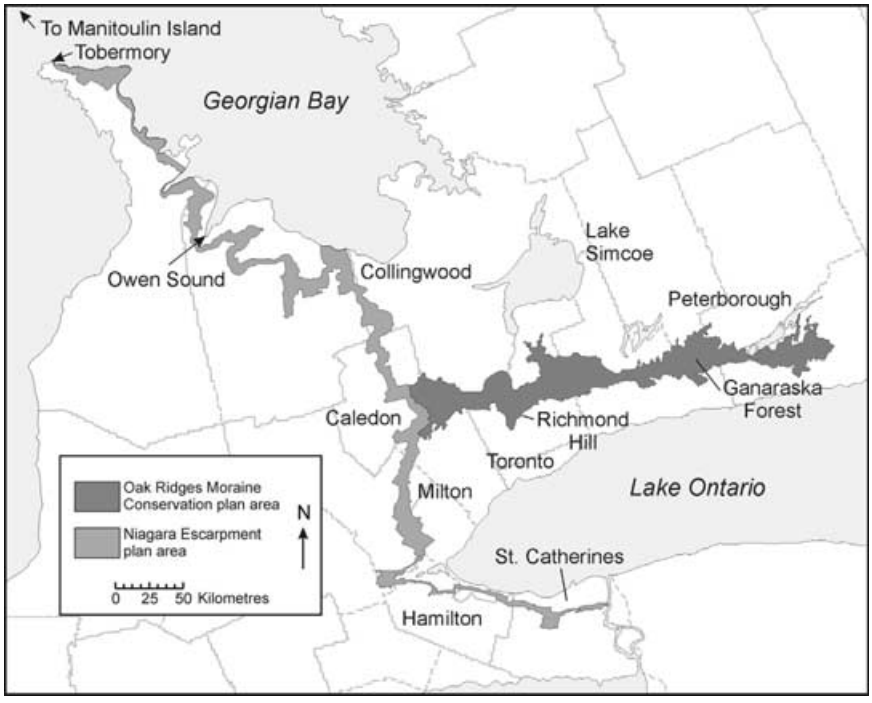

Figure 1. Plan areas demarcated in the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan.

link core areas. Together these core areas and conservation corridors create a natural-heritage system, primarily across private lands, many of which were proposed for development.

A natural-heritage system is composed of core areas and conservation corridors. Core areas are relatively large, undisturbed zones that protect important natural habitats, maintain and possibly enrich biodiversity, and protect sensitive groundwater recharge and discharge zones. Core areas can also include lands that could have their ecological function enhanced through restoration. Conservation corridors are linkage spaces that connect distinct core areas (Smith & Hellmund 1993; Noss & Cooperrider 1994; Hunter 1996). Small core areas may not be sufficiently large to maintain ecological integrity, and the movement of species between core fragments may be enhanced by the presence of corridors (Harris 1985; Noss & Harris 1986). This movement may also have several positive impacts on species populations. The goal of using corridors to link habitat is often a desirable component of any conservation strategy (Soule 1991).

Our intent was not to critique the principles, approaches, or science of conservation biology that were applied in ORM land-use planning. Rather, we explored the influence of conservation biology within the context of changes to the governance of ORM land-use planning from the late 1980s through 2002. We reviewed government documents, used the long-interview technique in 18 semi-structured interviews (McCracken 1988) with participants in the ORM land-use planning process, and drew from our personal involvement with planning in the area that included work for the Ontario Ministry of the Environment and Toronto Region Conservation Authority, involvement in land-use planning hearings, and volunteering for ORM environmental organizations.

Evolution of Oak Ridges Moraine Governance of Land-Use Planning

Land-use planning processes for environmentally sensitive areas were first developed in the Region of Waterloo, Ontario, in the early 1970s. Environmentally sensitive area planning reduced natural heritage loss through the application of tools available in the Province of Ontario's Planning Act. The reorganization of some county governments into city-centered, regional governments during the late 1960s and early 1970s provided the opportunity for new initiatives in planning. One idea involved designating environmentally sensitive areas in official regional land-use plans to provide limited control over development through regulation without the need for municipal purchase (Eagles 1981; Hilts 1983). Environmentally sensitive areas include natural landscapes that provide vital ecological functions or contain features such as aquifer recharge areas; headwaters; unusual plants, wildlife, or landforms; breeding or over wintering animal habitats; rare or endangered species; and combinations of habitat and landforms of value for scientific research or conservation (Eagles 1981).

There are two main policy provisions of environmentally sensitive area planning. First, the proponent of any land-use change must conduct an environmental impact study, following guidelines set out in the official plan, to determine the sensitivity of the designated area to any proposed changes. Second, the proponent must work with the municipality to achieve a plan that attempts to protect the designated area. If protection is not possible, then the landowner can apply for an official plan amendment, which requires public participation (Eagles 1981). Gains in environmental protection were made through environmentally sensitive area planning across Ontario throughout the 1970s and 1980s (Krause et al 2001; Gosselin, 2004). Nevertheless, the approach could not fully protect regional natural-heritage systems that extended over many municipalities such as the one that came to be recognized along the ORM. The need to address regional natural-heritage protection initiated public and environmentalist concerns in the 1980s. By the late 1980s threats to the ORM resulted in one of southern Ontario's most acrimonious land-use issues and initiated significant changes to the governance of moraine land use.

The concept of actor system dynamics (Francis 1988, 2003) helps explain the fluid, dynamic, and self-organizing nature of governance and how ORM land-use planning evolved to include conservation biology. The concept includes three main components: (1) the domain or the boundary of a planning issue (e.g., physical or issue based); (2) the regime or rule set governing the domain; and (3) the actions and interactions of government, the private sector, and civil society that create, modify, or maintain domains and regimes. The ORM actor system included civil society (primarily organizations of the environmental movement), government staff and politicians, private sector companies, media, academics, and citizens. The main nongovernmental environmental organizations involved were the Save the Oak Ridges Moraine Coalition, made up of local environmental and community groups (e.g., Concerned Citizens of King Township and Save the Ganaraska Again); Federation of Ontario Naturalists (now Ontario Nature); Save the Rouge Valley; Earth Roots; and the Nature Conservancy of Canada. This suite of organizations represents a spectrum of institutionalized (those who work with government and the private sector) to noninstitutionalized groups, and they all played important roles in the moraine protection effort. Government agencies included the Ontario Provincial Ministries of Municipal Affairs, Environment, and Natural Resources and the local conservation authorities and municipalities within the ORM. The development sector included a number of large and influential land development companies and

their consultants and lawyers. The media, primarily the *Toronto Star* newspaper, took an active interest in the ORM as part of its political reporting on the Progressive Conservative government from 1995 through 2002.

The environmental movement drew early inspiration and vision from the Niagara Escarpment land-use planning experience that predated activity on the ORM by 20 years, in particular, governance through stand-alone legislation and an associated land-use plan concentrating on environmental protection (Fig. 1). The Niagara Escarpment Planning and Development Act was passed by the Ontario Parliament in 1973 and the Niagara Escarpment Plan was approved by the Conservative Government in 1985 (Government of Ontario 1973, 1985). These actions were taken in response to extensive public pressure during the 1960s and were based on a subsequent government-supported study that made recommendations on land-use planning, aggregate extraction, land acquisition, and a Niagara Escarpment parks system (Niagara Escarpment Study Group 1968). By 1989 some elements of the environmental movement decided to pursue similar legislative protection for the ORM. These actors came to share a stake in the ORM domain once the special value of the geographic space had been successfully communicated and marketed by the environmental movement. This success was achieved by ensuring that the content of government studies carried out during the late 1980s and early 1990s included recognition and recommendations for the protection of the moraine as an area of provincial interest (Ontario Environmental Assessment Advisory Committee 1989; Kanter 1990; Royal Commission on the Future of the Toronto Waterfront 1992). The subsequent social actions and interactions that transpired among the actors within the ORM domain through networking, education, generation and evaluation of information, agenda setting, and negotiation of outcomes altered the system of rules (laws, regulations, customs) that now regulate land-use planning on the moraine.

In addition to the early period of environmental movement visioning that led to the recognition of the ORM as a domain, there were four other events that led to the governance structure now in place. First, in 1991 guidelines were developed by the New Democratic Party Government of Ontario for the purpose of reviewing development proposals on the moraine in the absence of an established provincial policy (Government of Ontario 1991). The guidelines were designed as a stopgap measure to protect the ORM while more study was undertaken. This additional study and research was carried out by the Oak Ridges Moraine Technical Working Committee (1992–1994) and eventually led to the Oak Ridges Moraine Strategy for the Greater Toronto Area: An Ecosystem Approach for Long Term Protection and Management (Oak Ridges Moraine Technical Working Committee 1994).

Second, in 1995 the Progressive Conservative Party was elected to government in Ontario on a common sense and open-for-business platform. This government had an initial lack of interest in environmental matters. In response to the election of the Conservative Government, the environmental movement abandoned attempts to have the ORM strategy document implemented. Instead, it focused on public education, including the publication of a coffee table book on the ORM and prepared for future advocacy and media initiatives.

Third, in October 1999 allegations of a political scandal were leveled by the development sector against the Minister of Municipal Affairs. These allegations vaulted the issue into the media spotlight, and most significantly the political scandal was translated by the environmental movement into a media "environmental" issue.

Fourth, in March through May 2001 Ontario Municipal Board hearings on numerous subdivision development proposals in the town of Richmond Hill were held. The Ontario Municipal Board is an independent tribunal that adjudicates appeals on land-use planning disputes. It provides a public forum for resolving disputes (Ontario Municipal Board 2006). The environmental movement and many people living in and around the town made it clear they were opposed to the development in Richmond Hill on the Oak Ridges Moraine. As the legal and public debate raged, the government suspended the hearings and proposed Parliamentary and government initiatives to address the ORM issue including passage of the Oak Ridges Moraine Conservation Act and development of the Oak Ridges Moraine Conservation Plan. Throughout each of these four periods, the environmental movement and some government actors moved the planning agenda forward, arguing that conservation biology should form the basis for delineation of a natural-heritage system for the ORM and that the system should be regulated through planning law.

Adoption of Conservation Biology Principles in ORM Land-Use Planning

The ORM land-use planning process occurred during the period of the emergence of conservation biology as a legitimate science. This particular example of land-use law and planning in Ontario reflects the progress of this legitimatization. A review of key documents showed that conservation biology influenced the outcome of the ORM plan. Early evidence of conservation biology principles being proposed as the basis for the development of a natural-heritage system for the Toronto region (including the ORM) is in the 1991 document *A Natural Heritage Framework: A Strategy for the Protection and Management of Natural Heritage in the Greater Toronto Area* (Ontario Ministry of Natural Resources 1991). This document played an important role in first bringing conservation biology into the ORM debate. The consultant

Table 1. Design principles of the natural-heritage system set out in *A Natural Heritage Framework: a Strategy for the Protection and Management of Natural Heritage in the Greater Toronto Area* (Ontario Ministry of Natural Resources 1991).

Principle
Natural core areas are basic building blocks for a natural heritage system.
The bigger a natural area, the greater biodiversity it is likely to have.
The more diverse the mixture of plant communities in a natural area, the more diverse the plant and animal species and ecological processes in it.
Connected natural areas are more diverse than unconnected natural areas.
Water bodies should be incorporated into a natural-heritage system wherever possible.
Natural areas that minimize length of interface with human-dominated landscapes are generally less vulnerable to human intrusion.
All land area should be examined for opportunities to enhance natural heritage values.
All natural heritage systems are sensitive and complex ecosystems for which discrete protection and management plans should be prepared.

Table 2. Natural-heritage-system selection criteria identified in *Natural Heritage Systems for the Oak Ridges Moraine Area: Greater Toronto Area Portion* (Geomatics International 1993).

Criterion
Areas designated environmentally sensitive
Areas designated of natural and scientific interest
Coldwater streams, warm water streams, spawning areas, and wildlife habitats; an area of 30 m on either side of the stream is included to allow for habitat protection measures
Wetlands
Habitats of rare, threatened, and endangered species as well as species of conservation interest
Old-growth forests areas regardless of size or shape
Areas of continuous natural forest (not plantation) $\geq$ 30 ha in total size regardless of composition, age, or shape
Areas of contiguous forests (not plantation) $\geq$1000 ha
Streams and creeks that intersect nodes (cores) along with a 30-m area along each side of the stream
Contiguous natural and plantation forests that serve to connect core areas to core areas and core areas to stream corridors
Continuous or recurring patterns of slopes exceeding 10% that serve to connect core areas, stream corridors, and forested corridors

planners hired to prepare a strategy for natural-heritage delineation (discussed below) during the tenure of the Oak Ridges Moraine Technical Working Committee used the 1991 Ontario Ministry of Natural Resources framework to guide their work. The framework document sets out a hypothetical natural-heritage system based on eight natural-heritage design principles and devised, within the context of a human-dominated landscape, natural core areas, natural corridors, and connecting links (Table 1). The document also sets out methods to identify and map existing natural-heritage information in Ontario, for example environmentally sensitive areas.

The consulting work referred to on natural-heritage planning prepared for the Technical Working Committee is documented in *Natural Heritage Systems for the Oak Ridges Moraine Area: Greater Toronto Area Portion* (Geomatics International 1993). Prior to Geomatics International's study, most other natural-area mapping was carried out with hard-copy maps. Geomatics International was one of the first companies to use geographic information systems, and this allowed for large-scale analysis conducive to the incorporation of conservation biology. This work formed the basis for the natural-heritage system proposed by the Technical Working Committee in the ORM protection strategy document (Oak Ridges Moraine Technical Working Committee 1994). Eleven specific selection criteria were defined and used to map the natural-heritage system (Table 2). This system's map included a core area of 22% and corridor area of 4% of the greater Toronto area portion of the ORM. We believe this 1993 document is the first expression of core and corridor concepts, based on conservation biology, for use in Canada in a major land-use planning effort.

The 1994 Ontario Ministry of Natural Resources document, *The Natural Heritage of Southern Ontario's Settled Landscapes: a Review of Conservation and Restoration Ecology for Land Use and Landscape Planning* (Riley & Mohr 1994), further contributed to the use of conservation biology in the ORM land-use planning process. The objective of this government-agency paper was to review ecological concepts relevant to settled landscapes and to examine how these might be used in land-use planning and landscape design. The document has three chapters. The first deals with concepts in conservation biology for settled landscapes and covers biodiversity, natural heritage, sustainable use, and ecological considerations in landscape planning. The second chapter deals with landscape design applications and covers core conservation lands and waters (landscape retention), corridors and countryside (landscape retention and restoration), and connecting links (landscape restoration and replacement). Chapter 3 deals with strategies in landscape planning through land-use planning, environmental impact studies, local decision making, environmental advisory committees, and stewardship. Evidence of the document's influence is found in the fact that it was submitted by the government in its "book of evidence" to the Richmond Hill Oak Ridges Moraine Ontario Municipal Board hearing held in 2001.

The second of the three documents included in the government's book of evidence was *Heritage Features on the Oak Ridges Moraine, Greater Toronto Area Portion* (Ontario Ministry of Natural Resources 1999). This report and its maps highlight the significant natural features of

the ORM within the greater Toronto area and detail inventory work carried out by the Ontario Ministry of Natural Resources. The information was made available to municipalities, other public agencies, interest groups, and the general public. The third document included in the book of evidence was *A Natural Heritage System for the Oak Ridges Moraine--Cores and Conceptual Linkages Greater Toronto Area Portion* (Ontario Ministry of Natural Resources 2000). This document highlights a natural-heritage system for the moraine in the greater Toronto area showing the location of major natural core areas and conceptual linkages. It complements and builds on the system map and accompanying report prepared by the Ontario Ministry of Natural Resources in 1999 (discussed above). This 2000 report is significant because it contains wording that situates the natural heritage of the moraine in a regional, rather than local, system context, with links to the Niagara Escarpment in the west, to forested river valleys in the greater Toronto area, and to the Grand River watershed to the southwest (Ontario Ministry of Natural Resources 2000).

In this 2000 report conceptual linkages in the greater-Toronto-area portion of the moraine are identified that connect 12 major natural core areas. These are major east-west links proposed, a minimum of 2 km wide, to provide connectivity for a broad spectrum of species, including larger mammals (Ontario Ministry of Natural Resources 2000). The document has references that support the proposed wide width of the corridors (Noss 1992; Bennett 1999). The identification of such wide corridors was controversial, leading some to suggest that the government was moving beyond the science in identifying and locating the linkages. Others suggested that existing Ontario planning law and policy did not allow the government to designate private land for preservation based on such science.

The Town of Richmond Hill Oak Ridges Moraine Ontario Municipal Board hearings played an important role in the planning process. Major urban development had been proposed for Richmond Hill. The development had been approved by the town, but was objected to by the environmental movement, the Toronto Region Conservation Authority, and the Ontario Ministry of Natural Resources. The proposed development would have limited future eastwest ecological connectivity across southern Ontario from the Trent River basin to the Niagara Escarpment. Parties to the hearing included the town of Richmond Hill, the province of Ontario, the Toronto Region Conservation Authority, two groups of development companies, and some elements of the environmental movement. When denied standing at the hearing, the City of Toronto financially supported efforts of the Toronto Region Conservation Authority and the environmental movement (Save the Rouge Valley). Daily coverage of the hearings by Canada's largest newspaper, the *Toronto Star*, moved the issue to the fore of public and government concern. This was the first time in Canadian history that conservation biology was presented and debated frequently in the popular press.

The importance of core areas and linkages among core areas was highlighted at the hearing by the environmental movement, which retained Reed Noss to provide evidence on conservation biology and natural-heritage protection. Within this hearing all parties largely accepted the concept of protecting core areas from urban development. The major differences of opinion occurred around the need for linkages, their size, and location. The developers proposed only a few, minor local corridors. The province of Ontario and the environmental movement proposed long corridors of up to 2 km wide. The Toronto Region Conservation Authority proposed intermediate-sized corridors 200- to 300-m wide. The conservation authority witnesses, Paul Eagles and Dena Lewis, testified that they thought the current Ontario planning policy and law in Ontario did not allow for the acceptance and approval of the linkage system as proposed by the government. Within weeks of this testimony, the Conservative Government of Ontario canceled the hearings and asked Parliament to approve the Oak Ridges Moraine Protection Act in 2001. Parliament passed this law and thus froze development on the moraine for 6 months and provided for a collaborative process involving multiple stakeholders in the development of a new planning approach for the ORM.

An ORM Advisory Panel was created to make recommendations to the government on moraine planning. Panel members included representatives from the environmental movement, regional governments, conservation authorities, and the development sector. The Ontario Ministry of Natural Resources provided the panel with maps that contained extensive biological information. Numerous scenarios based on conservation biology were prepared and evaluated. The panel proposed protection of core areas and long, wide corridors through new planning legislation. The new legislation required the development of an ORM plan. Parliament unanimously passed the Oak Ridges Moraine Conservation Act in 2001, based on the advisory panel's recommendations. The Oak Ridges Moraine Conservation Plan was subsequently prepared and approved in 2002.

The plan included extensive core areas and long, wide, regional corridors. There are four land-use designations in the plan. The natural core designation comprises 38% of the plan area, including areas with a high concentration of key natural-heritage features, hydrologically sensitive features, and landform conservation areas. Areas designated natural core are subject to restrictive policies (e.g., no new subdivisions or aggregate extraction activities). The natural linkage designation comprises 24% of the plan forming part of a central corridor system that supports, or has the potential to support, regional wildlife movement. This designation is also subject to restrictive policies,

including no new subdivision development. The designation does allow for some aggregate extraction. The countryside designation comprises 30% of the plan area and includes rural land uses such as agriculture, recreation, mineral aggregate operations, and rural settlements, but does not allow for new subdivision development. The settlement area designation makes up 8% of the plan area. This is the designation where urban development is focused permitting a range of residential, commercial, industrial, and institutional uses. The Oak Ridges Moraine Conservation Act requires that the plan be reviewed every 10 years. The act also indicates that future reviews are not to consider removing land from the natural core or linkage areas. It appears that the Parliament's intention, expressed through legislation, is to prevent changes to the core or corridor designations through future plan reviews.

Discussion, Lessons Learned, and Recommendations

The ORM emerged as a domain primarily through environmental-movement agenda setting within the context of a number of ongoing government studies during the late 1980s and early 1990s. Once the domain was established, conservation biologists and planners within government, the environmental movement, and the private sector carried out conservation biology field work and conceptual development during the 1990s. These individuals were influential in that they translated conservation biology into planning practice (Ontario Ministry of Natural Resources 1991, 1999, 2000; Geomatics International 1993; Riley & Mohr 1994). Government staff provided important information, advice, and support to the environmental movement. Several of these staff were involved in the ORM effort from the initial Technical Working Committee process (1992–1994) through the Oak Ridges Moraine Advisory Panel (2001). Similar advocacy has been reported with scientists (Strigl 2003) and specifically conservation biologists elsewhere (Krajnc 2002).

Aggressive advocacy and media work by the environmental movement created a favorable climate in 2001–2002 in which decision makers could act. The main reason the government moved on more stringent land-use planning regulation was the loss of political support throughout the area of the ORM due to government inaction on moraine protection. Proponents of ORM protection seized the opportunity created by this political weakness to link conservation biology to planning policies and law in Ontario.

Our results demonstrate that conservation biology played a crucial role in the planning for long, wide corridors along the ORM. Conservation biology was used by the environmental movement as the basis to promote protection for the ORM. Government scientists and planners extended the application of conservation biology, generated maps of a natural-heritage system for the ORM, prepared the maps as evidence for the Town of Richmond Hill Ontario Municipal Board land-use planning hearings, and created alternative land-use plans based on the maps for use by the members of the ORM Advisory Panel charged with making recommendations to the government on a new approach for ORM planning.

Of interest is the increase in the size of the natural-heritage system from the first conceptualization prepared by the Oak Ridges Moraine Technical Working Committee (Geomatics International 1993) to its current form expressed in the Oak Ridges Moraine Conservation Plan. There was a large increase in corridor area from 4% (within the greater Toronto portion of the ORM) in the Geomatics International (1993) report to 24% in the final, larger Oak Ridges Moraine Conservation Plan. This indicates that conservation biology became more sophisticated and conservation biology proponents became more effective in influencing decision making.

This legislative and planning change took place during the rule of two governments of very different political philosophies, the socialist New Democratic Party Government of Premier Bob Rae from 1990 to 1995 and the business-oriented Conservative Party Government of Mike Harris from 1995 to 2002. This shows the strength and resilience of the ideas that developed around ORM planning in this period.

The ORM land-use planning process is precedent setting in Canada, and possibly internationally. To our knowledge this is the first time a natural-heritage system that includes designation of long, wide conservation corridors on private lands based on conservation biology has been significantly regulated through land-use planning legislation. There are examples elsewhere of natural-heritage systems or greenways being delineated based on conservation biology (University of Florida 1999; Florida Department of Environmental Protection 2006; Pima County 2006). Nevertheless, implementation through land-use planning legislation that significantly limits development on private land is unique. The idea of very wide corridors designated on private land was controversial and was not possible under the previous municipal planning regime within the extant planning policy and law. Up to the year 2000, the protection of core areas, through the designation of environmentally sensitive areas in municipal official plans, was well accepted in Ontario. The delineation of local corridors was emerging as a planning tool, but was undertaken sporadically. The designation of regional corridors for conservation on private land as occurred on the ORM is new. The idea of a regional natural-heritage system recognized in legally defined planning documents is also new.

There were four main lessons learned from the ORM land-use planning issue. First, domain creation, in this

case identification of the ORM as a significant landscape, was important in terms of communicating the value of the ORM to government staff, politicians, the public, and media. This generated interest so that these actors could begin to work on regime change (new approaches to land-use planning for the moraine). Second, regime-change activities have the greatest success when they build on tested approaches, in this case environmentally sensitive area planning at the municipal level and the Niagara Escarpment Planning and Development Act and Niagara Escarpment Plan. Third, participants in a multiactor network, including government, the environmental movement, and the private sector, are capable of working together and reaching agreement on significant environmental protection through collaborative efforts. Fourth, collaboration mixed with advocacy produced effective results. Agenda setting created the ORM domain (1988–1992), collaboration through the Technical Working Committee (1992–1994) resulted in new research and information on the moraine, subsequent advocacy forced governmental action (1998–2001), and collaboration through the Oak Ridges Moraine Advisory Panel (2001) developed a solution.

Additional research would be useful to further the understanding of conservation biology and its application in land-use planning. First, evaluation of the effectiveness of the conservation biology used in the ORM land-use planning process is needed to determine whether the mapping criteria applied to delineate the natural-heritage system are contributing to ecological integrity. Second, a monitoring system is needed to track the state of the natural-heritage system and whether the policies in the plan related to natural heritage are being followed properly. Third, tracking is needed on whether the innovations developed through the ORM land-use planning issue are being transferred to and adopted in other jurisdictions. Fourth, an exploration of the impact on people and communities of the protection of long, wide corridors (e.g., land prices, rural community viability, human health) would contribute to emerging community sustainability issues.

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