

# **NIAGARA ESCARPMENT BIOSPHERE RESERVE**

## **Periodic Review Report, 2002**

The UNESCO “Statutory Framework of the World Network of Biosphere Reserves” (1996) requires each biosphere reserve to be reviewed periodically, defined as every ten years. The purpose is to determine that a given biosphere reserve continues to meet the criteria for inclusion in the world network, and to up-date background information about the designated area and the on-going biosphere reserve activities. The following is the first periodic review report for the Niagara Escarpment Biosphere Reserve (NEBR), prepared for submission through Canada/MAB (the Canadian “focal point” for the UNESCO “Man and the Biosphere” Program in Canada) and the Canadian Commission for UNESCO.

This report is in three sections. The first summarizes the main findings and conclusions of the reviewers. The second is a narrative to highlight main events and activities of the biosphere reserve since its inception, and the context within which these occurred. The third is the completed Periodic Review Form.

There is a large and rather scattered array of background information about the Niagara Escarpment area which the reviewers tried to bring together and summarize for its relevance to a periodic review of the biosphere reserve. Most of the information was obtained from various libraries, internet web sites or other secondary sources. It was supplemented by telephone interviews, and informal discussions with a number of people as occasions allowed, especially during the fifth “Leading Edge” Conference at Burlington, Ontario, on October 17-20, 2001. This additional help, information and insights were very much appreciated. Our special thanks go to:

Leslie Adams, Protect Our Water and Environmental Resources (POWER), Halton Hills, Ontario.

Robert Barnett, Chair, Escarpment Biosphere Conservancy, Toronto.

Frank Burrows, Resource Management Specialist, Bruce Peninsula National Park and Fathom Five National Marine Park, Tobermory, Ontario.

Alice Casselman, President, Association of Canadian Educational Resources (ACER), Toronto.

Neil Hester, Niagara Escarpment Co-ordinator, Ontario Ministry of Natural Resources, Georgetown, Ontario.

Stewart Hilts, Director, Centre for Land and Water Stewardship, University of Guelph.

Richard Murzin, Communications Manager, Niagara Escarpment Commission, and NEBR representative on CBRA/ACRB.

Gordon Nelson, Director, Heritage Resources Centre, University of Waterloo.

Linda Pim, Conservation Policy Coordinator, Federation of Ontario Naturalists, and board member for the Coalition on the Niagara Escarpment (CONE) citizens' group, Toronto.

Sue Powell, former staff member, Niagara Escarpment Commission, and board member for the Coalition on the Niagara Escarpment.

Michael Puddister, Credit Valley Conservation Authority.

Deborah Ramsay, Policy Advisor, Ontario Ministry of Natural Resources.

Frank Shaw, former Director (retired), Niagara Escarpment Commission.

Mark Wiercinski, Secretary, Bruce Peninsula Biosphere Association,  
Tobermory, Ontario.

Jacqueline Winters, Executive Director, The Bruce Trail Association.

Although Richard Murzin, Frank Burrows, Fred Roots, and two anonymous reviewers relayed comments on a first draft, the points emphasized in this report, as well as any errors or serious omissions that remain, are those of the reviewers. Special thanks also go to the Niagara Escarpment Commission for the preparation of maps and the cover page.

George Francis and Graham Whitelaw,  
Canadian Biosphere Reserves Association,  
Reviewers on behalf of Canada/MAB and the Canadian Commission for  
UNESCO.

February 2002.

## 1. Main Findings and Conclusions

### Background

The Niagara Escarpment is a prominent cuesta that exposes ancient geological limestone features along its cliff face. This landscape formation extends across southern Ontario and through neighbouring US jurisdictions. In Ontario, urban and rural development over the years combined with quarrying and other resource uses gradually disrupted this landscape. As a result, public interest and concerns arose starting about three decades ago over how best to protect the cuesta's natural features and associated values. Initial studies of possible land use planning solutions led, in 1973, to the Ontario provincial government passing the Niagara Escarpment Planning and Development Act. This Act created a 17 member Niagara Escarpment Commission (NEC) whose first task was to prepare a provincial plan for the 725 km portion of the escarpment formation in southern Ontario. For the next 12 years, various planning proposals were subjected to extensive public debate and formal public hearings before the Niagara Escarpment Plan (NEP) was finally approved by the provincial government in June 1985.

This plan established land use designations for a 184,000 ha "corridor" along the escarpment formation to be administered through a development permit system by the NEC. It also provided for a Niagara Escarpment Parks and Open Space System consisting now of 117 parks (with five more proposed) administered by different government authorities along the entire length of the escarpment, and connected by the Bruce Trail (for hiking/walking) along some 800 km of main trails and an additional 200 km of side trails. At the northern end of this escarpment formation in the Bruce Peninsula, the Bruce Peninsula National Park and Fathom Five National Marine Park were created in 1987 after six years of public consultations and inter-governmental negotiations.

Thus, by the late 1980s, legal and administrative provisions were in place for the first large, modern landscape-scale environmental land use plan in Canada (as the Commission was publicizing the NEP at the time), and along with the two new National Parks provided a framework of land use configurations consistent with the concept of a biosphere reserve. There were also quite well developed expressions of the logistic functions of a biosphere reserve as a result of research, surveys and inventories, education and information programs conducted by other agencies and organizations along the escarpment. Informal consultations about a possible biosphere reserve designation were initiated in 1989 through the former Working Group on Biosphere Reserves of Canada/MAB with the NEC, and subsequently with the National Parks authorities. The idea was well received. A nomination submission was approved by Canada/MAB in June 1989, submitted to UNESCO/MAB in September 1989, and approved in February 1990.

The NEC is composed of nine citizens-at-large (including its Chair) and eight people representing municipalities along the escarpment, all appointed by the provincial cabinet. The day-to-day work of the staff brings the Commission into contact with a large number of landowners, businesses and non-governmental organizations representing a wide cross-section of interests. The NEC also had to work closely with a federal parks agency, four provincial ministries, the Ontario Heritage Foundation, seven Conservation Authorities, eight county or regional municipalities, and 37 rural townships, towns and cities (in the late 1980s).

At the time of the nomination, it was expected that the NEC would take a lead in developing or strengthening biosphere reserve activities in cooperation with various government agencies and other organizations. A senior staff person was appointed in 1990 to represent the NEBR in the Working Group on Biosphere Reserves and he continues to work closely with its successor, the Canadian Biosphere Reserves Association / l'Association Canadienne des

Reserves de la Biosphere (CBRA/ACRB). Other staff have participated actively in biosphere reserve-related work.

Major budget and staff reductions to provincial ministries and to the NEC since 1995 limited what the Commission can do. Thus, the NEC has been pre-occupied mainly with administering the development permit system and plan amendment process along the entire length of the escarpment plan area, and with lengthy formal reviews of the Niagara Escarpment Plan (especially during 1990-1994 and 1999-2001) as called for under the provincial statute. The National Parks administration, also with budget restrictions, has been occupied with management planning and consultations and certain local land use issues.

### Main Findings

The logistics of organizing and supporting a biosphere reserve committee of some kind that would be at arms-length and independent from the Commission was raised from time-to-time but has never been fully addressed. During the past decade, the array of activities which biosphere reserves are intended to foster were developed through initiatives taken by different agencies and non-governmental groups. The NEC in cooperation with other organizations helped with some of these. Substantial research, monitoring, and education work has been accomplished in areas such as archaeology, biological inventories, cliff ecology, conservation education, cumulative effects monitoring, demonstration projects for ecological restoration, policy analyses, and watershed studies. The NEC has also sponsored five "Leading Edge" conferences which bring together many people to report on and discuss on-going work concerning the Niagara Escarpment, and display works of art, crafts, and distinctive local products such as fruits and wine.

With reference to the criteria for biosphere reserves in Article 4 of the Statutory Framework for the World Network of Biosphere reserves, applied to the NEBR: [**NOTE:** This is section IX from the periodic review report that follows].

1. Biosphere reserves should encompass a mosaic of ecological systems representative of major biogeographic regions, including a gradation of human interventions.

The NEBR has a rich mosaic of forest and freshwater aquatic ecosystems, including a portion of the Great Lakes (Georgian Bay), as well as distinctive escarpment rim, cliff-face, and talus slope ecosystems. The forest ecosystems fall within two major ecoregions, recognized by provincial, national and international classifications of physiographic or other ecoregions. Gradation of human interventions range from very little in some areas constituting nature reserves, to major historical modifications of forest ecosystems now being protected to allow natural restoration, through to continuing extractive uses of lands for forest products, building materials (pits and quarries), intensive agriculture and agricultural products (wine), and intensive outdoor recreation activities. Portions of the biosphere reserve are situated in urban industrial landscapes in which the escarpment provides a linear-like open space “green” corridor, often with urban park-like modifications for human uses.

2. Biosphere reserves should be significant for biological diversity conservation.

The diverse terrestrial and aquatic habitat mosaics support a rich flora and fauna including a number of species which are otherwise endangered, threatened, or rare in Canada or the province of Ontario. The Bruce Peninsula is able to support a small, but apparently viable population of black bears *Ursus americanus* which contrasts, symbolically, with the situation in the southern urbanized portion of the biosphere reserve. Forest cover in the northern half of the Niagara Escarpment constitutes about 68% of the area included in the Niagara Escarpment Plan; in the south, forest cover is about 45% and is more fragmented. Special habitat types such as karst limestone formations, calcareous cliffs, talus slopes, limestone pavement formations (alvars), and remnant prairie

savannas each have their own quite distinctive biotic communities, and/or species richness for biota such as bats, ferns, orchids, and species of small land snails. Restoration of spent pits and quarries is adding to the diversity of habitat mosaics, and some of these have used considerable creative design; one outstanding example is the Royal Botanical Gardens in Hamilton. The escarpment appears to serve a corridor function for at least some species, notably migrating birds. Some 64% of the known vascular plant flora in Ontario are found in the NEBR.

**3.** Biosphere reserves should provide an opportunity to explore and demonstrate approaches to sustainable development on a regional scale.

Such opportunities have been taken in various ways. The Niagara Escarpment Plan is supportive of local agriculture in the context of maintaining settled rural landscapes, and the Niagara Escarpment Commission (NEC) has fostered private land stewardship for forests, wetlands, and wildlife through stewardship recognition awards to landowners. Some creative designs for the restoration of pits and quarries to productive “after-uses” are being implemented. In cooperation with Conservation Authorities, measures are also being taken to protect the quality of waters flowing across the escarpment, and of headwater streams originating on the escarpment flowing through larger watersheds off the escarpment. A number of private sector initiatives to promote local tourism draw heavily on the scenic and historical values associated with the escarpment. Habitat restoration measures are also being carried out on lands associated with recreational use of the Bruce Trail and on other selected sites.

**4.** Biosphere reserves should have an appropriate size to serve the three functions of biosphere reserves (set out in Article 3).

The 725 km axis of the NEBR gives ample scope for the geological, archaeological, historical and ecological research that has been undertaken over

the years. Implementation of a framework for cumulative effects monitoring of the environmental conditions of the escarpment, along with the need to maintain the ecological integrity of the two national parks in the Niagara Escarpment Parks and Open Space System (NEPOSS), are being done opportunistically through different organizations, and monitoring protocols are being tested in cooperation with the Ecological Monitoring and Assessment Network (EMAN) coordinated through Environment Canada. Public education and information programs for different school and other groups are conducted by school boards, conservation authorities, national and provincial parks in the NEPOSS, and several non-governmental organizations. Demonstration projects to promote good land use were noted above.

**5.** Biosphere reserves should include these functions through appropriate zonation.

The zonation concepts of a biosphere reserve are expressed by the land use designations of the Niagara Escarpment Plan and the management plans for some of the major parks in the NEPOSS. The escarpment Plan has detailed criteria for administering development permits for land or resource use changes under this system. However, the transition area / zone of cooperation should be viewed as including some watersheds associated with the escarpment lands as well as the concept of an "Upper Bruce Peninsula Ecosystem" which is a key one for the national parks.

**6.** Biosphere reserves should have organizational arrangements for the involvement and participation of various authorities and groups in carrying out the functions of biosphere reserves.

These arrangements exist, but without a specific biosphere reserve organization they have so far developed from initiatives taken by various authorities, groups or individuals. The NEC has helped facilitate coordination in

some circumstances, but given severe budget cuts and its pre-occupation with administration of the development permit system, it has let leadership be taken by others when this helps broaden the base for support for the values associated with protecting the escarpment. It also distances these other activities from political disputes which the “top-down” administration of the Niagara Escarpment Plan by the Commission, under the terms of the Niagara Escarpment Planning and Development Act, can evoke. The consultation processes adopted for management planning for the two national parks, in the context of a “greater ecosystem” philosophy, appear to be leading to the formation of a community-based biosphere reserve ideal in the upper Bruce Peninsula. The potential for extending and strengthening community-based involvement and “ownership” of the biosphere reserve appears to be strong, and needs some catalyst to develop it.

7. Biosphere reserves should have provisions for management of human use and activities in the buffer zones, a management policy or plan for the area of the biosphere reserve, a designated authority or mechanism to implement this policy or plan, and programs for research, monitoring, education and training.

Management of human use and activities in buffer zones and the general area of the biosphere reserve are provided for by policies and land use designations in the Niagara Escarpment Plan, augmented by national park plans. Programs of the Conservation Authorities for watersheds having some of their headwater sources associated with the escarpment complement these plans with various landowner programs for soil and water conservation. Research, monitoring, and training are increasingly being conducted through partnership arrangements between government and non-government organizations and universities in the general area of the escarpment. Possible linkages to international research programs merit more consideration.

Directions to Pursue

*Community-based linkages and networks:* There have been considerable expressions of community-based interest in the NEBR notably by the recent creation of a Bruce Peninsula Biosphere Association, and publicity provided in various ways by the NEC and by non-governmental organizations such as the Coalition on the Niagara Escarpment (an alliance of 26 member organizations), the Bruce Trail Association, and the Escarpment Biosphere Conservancy. Yet there is still a continuing challenge of how best to realize the ideals of a biosphere reserve suitably adapted for the different situations along the Niagara Escarpment. The NEBR is rich in components, but still rather weak in linkages and networks that could relate biosphere reserve functions throughout the entire NEBR area, foster the communications needed to maintain a “big picture” overview of conservation and sustainability matters of interest and concern for the whole area, and become better connected with UNESCO/MAB and other biosphere reserves. The biosphere reserve cooperation plans currently being developed by NEBR (and other biosphere reserves) under guidance from CBRA/ACRB is a good step towards addressing this issue.

*Other activities to strengthen:* The three main ones are further development of comprehensive management-oriented monitoring, extension of the application of the “transition area / zone of cooperation” concept to related watersheds and to the Upper Bruce Peninsula Ecosystem (recognized by the national parks), and determining the most useful role for NEBR in the context of “eco-tourism” and agricultural tourism activities that are developing.

*Need for staff capacity devoted to the NEBR:* Given the geographic scale of the NEBR and the complicated overlay of government jurisdictions, agencies and other organizations which can contribute to a functioning biosphere reserve, it is essential that at least one full-time staff person who can act on behalf of the biosphere reserve be retained. This might be arranged under some shared cost basis between a government agency such as the NEC and the private sector. CBRA/ACRB recognizes this to be a problem in other Canadian biosphere

reserves, and plans to work closely with its biosphere reserve representatives (including NEBR) to explore options for resolving this issue.

---

**The main conclusion of the reviewers is that the Niagara Escarpment Biosphere Reserve definitely merits continued membership in the World Network of Biosphere Reserves.**

## NIAGARA ESCARPMENT BIOSPHERE RESERVE

### 2. Background, Overview and Issues

The Niagara Escarpment is a cuesta landscape that exposes ancient geological features from the Ordovician and Silurian eras some 445-420 million years ago. This cuesta formation surfaces in upper New York State, southern Ontario, the upper peninsula of Michigan and in the Green Bay area of Wisconsin. In southern Ontario, it appears as a 725 km landscape ridge and related topography extending from the Niagara River to Georgian Bay, and surfaces again along the Manitoulin Island. The aesthetic, recreational, resource attributes, and ecological features associated with this rather linear landscape formation have become increasingly recognized over the past 30 years or so, as well as threats to them arising from incompatible urban and rural development and some of the more intensive resource use practices, such as limestone quarrying of the escarpment itself.

#### *The Niagara Escarpment Plan*

In 1967, the Premier of Ontario commissioned a study of issues associated with protection of this escarpment from Niagara through to the Bruce Peninsula (but not including Manitoulin Island). The resulting report in 1968 recommended that escarpment lands be protected by a provincial plan which would include a system of multi-purpose parks along the escarpment with some mix of other land use standards and regulations to protect the natural features and values of this landscape. In 1971, the government followed up on the intent of some of these recommendations by increasing funding for provincial land acquisitions on the escarpment, and by developing a new policy, statute and regulations governing the operation of pits and quarries in Ontario. In 1972, the government formed a Niagara Escarpment Inter-Ministerial Task Force to

consider the overall goals and objectives that should be in a comprehensive policy for the escarpment, the kinds of planning processes that would be most appropriate, and priorities for government acquisition of lands. This task force, in 1973, essentially suggested “a planning system featuring strong, provincially-directed land-use regulation plus public ownership where necessary”.

In response to the task force, the government passed the Niagara Escarpment Planning and Development Act in 1973:

“to provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment, and to ensure only such development occurs as is compatible with that natural environment”.

This statute also established the Niagara Escarpment Commission (NEC), a 17 member body with nine members including its Chair to represent the public-at-large, and eight members to represent the counties or regional municipalities of the escarpment area. Members are appointed for a three-year term which can be renewed, generally for only a second three-year term. The Commission’s first task was to prepare a provincial plan in keeping with this statute. Three associated bodies were also created: a Regional and County Advisory Committee (Municipal Advisory Committee) of elected municipal officials and planners from the plan area; an Interest Groups Advisory Committee (Public Interest Advisory Committee) from diverse resource use and landowners in the area; and an Inter-Ministerial Liaison Committee to link the Commission with various provincial government ministries. While this planning was going on, the NEC was empowered to administer an interim development control system for site-level planning.

The NEC released its preliminary proposals in 1977 and these generated considerable negative responses because of their scope and perceived complexity. A considerably revised “proposed plan” was issued in 1979, reducing the area covered by 62%. Public hearings on this proposal went on for 26

months and resulted in a four-volume 1,400 page Hearing Officers' report in January 1983. Following receipt of this report, the Niagara Escarpment Commission released its "Final Proposed Plan" for the escarpment area in June 1983. The government subsequently issued its recommended policies for the Niagara Escarpment Plan in 1984, and following an opportunity for further public comment, it gave its final approval for a slightly modified version of the Commission's plan in June 1985.

This final plan applied to a more narrow band of lands along the immediate escarpment area, totalling 1,837 km<sup>2</sup>, only 38% of the area that had been considered earlier. At the time, about 90% of the lands in the plan area were privately owned, and about 90% of the plan area also were designated under three land use zones, in about equal proportion, i.e. Escarpment Natural Area, Escarpment Protection Area, and Escarpment Rural Area. Some 51,000 ha were to constitute a Niagara Escarpment Parks System. Priorities for land acquisitions were associated with rounding out this system and for securing a continuous route for the Bruce Trail (for hiking/walking) that would link the parks along the entire length of the escarpment. New regulations and restrictions were placed on pits and quarries in the plan area, and the NEC would continue to administer a development permit system. Under the existing legislation this responsibility could be delegated to regional or local municipalities by the provincial Minister in charge. A \$25 million trust fund was set up under the Ontario Heritage Foundation for use over a 10 year period to help acquire lands, and support research and educational activities associated with the escarpment. The NEC was to report to the provincial government through the Ministry of Municipal Affairs. (In 1990, the Ministry of the Environment and Energy was assigned this oversight role, and in 1997 responsibility for NEC was transferred to the Ministry of Natural Resources).

*New National Parks*

In 1981, and in part with encouragement from the NEC, the federal government initiated public consultations to determine the feasibility of establishing a new national park on the tip of the Bruce Peninsula to represent one of the 39 representative “Natural Areas of Canadian Significance”. In addition, Parks Canada already owned 14 small islands near the peninsula as part of its Georgian Bay Islands National Park at the time. Earlier, in 1972, Ontario established the first underwater park, Fathom Five Provincial Park, off the Bruce Peninsula, mainly to protect a number of shipwrecks found there. As the consultations for the new national park unfolded, it was suggested that the federal government acquire Fathom Five as part of the national park proposal. In July 1987, Canada and Ontario signed an agreement to establish both Fathom Five National Marine Park and the Bruce Peninsula National Park. Provincial lands, some from within the Niagara Escarpment Plan Area, were transferred to the federal government to form the nucleus of these parks. Additional lands are to be added through purchase on a willing seller-buyer basis. In some cases, outstanding issues of aboriginal rights have to be resolved.

#### *Potential for a Biosphere Reserve*

By the late 1980s then, these new institutional arrangements for the Niagara Escarpment landscape provided the framework for developing a biosphere reserve. Core areas were provided by the Escarpment Natural Area designation on private lands and in the 117 park sites along the escarpment. Buffer zones and transition areas were provided by other land use designations in the Niagara Escarpment Plan, and by similar equivalents that would come from master planning for the provincial and national parks. Outdoor education centres and park interpretive centres existed in the area. Considerable geological and archaeological work had been conducted in the escarpment area, local historical accounts of European settlement were available, and a reconnaissance survey of major ecological sites had been completed. Several non-governmental

organizations were becoming involved in escarpment issues, many in support of the intent to conserve the escarpment landscape and associated values. Unlike any other biosphere reserve in Canada (and relatively few globally), this one would have its own statutory authority and administrative organization.

With that in mind, in the fall of 1988 the Chair of Canada MAB's Working Group on Biosphere Reserves raised the idea of a biosphere reserve designation informally with the Chair of NEC; the latter requested a presentation to the Commission, explaining the concept and how it might apply to the escarpment. This was done on January 12, 1989. Following the presentation, the Commission approved in principle its support for a biosphere reserve nomination, but requested staff to review the idea in more detail, and solicit comments from the Ministry of Municipal Affairs, then officially responsible for the NEC, the Ministries of Natural Resources and of Citizenship and Culture, both of which had responsibilities for escarpment protection and stewardship, and the Ontario Natural Heritage League, a coordinating body among public and private organizations for the protection and management of natural areas. Consultations were then initiated with the National Parks Directorate about including the Bruce Peninsula National Park and Fathom Five National Marine Park in a biosphere reserve nomination.

By its March 1989 meeting, the NEC had received favourable comments, and the Commission accepted the staff report to endorse the proposal to seek a UNESCO designation of the escarpment and the two national parks as a biosphere reserve. Extensive public consultations were thought not to be necessary because the Commission itself was made up of municipal representatives and the public-at-large, and the nomination was for a designation of recognition that did not interfere with existing statutory authority or permitted uses and property rights as set out in the Plan. The two national parks had public consultations already under way to help draw up management guidelines.

A nomination submission was then prepared in consultation with staff in NEC and the national parks. It was approved by Canada/MAB on June 1, 1989. Endorsements were received from the three ministries, the Ontario Natural Heritage League, and the National Parks Directorate by the end of June 1989. The nomination was sent to UNESCO/MAB in September 1989. As noted in the nomination submission:

“From the point of view of NEC, a designation would give international recognition to the years of work that have gone into developing the first large ‘protected landscape’ in Canada, and help extend the basis of support and involvement for some needed research, monitoring, education and demonstration activities. For Canada/MAB it will bring increased visibility for the ideals of MAB and biosphere reserves because of the geographic location of the proposed biosphere reserve in the most urbanized region of Canada (within about one hour’s travel time for about 6 million people). For the global network of biosphere reserves, it will help confirm the wide applicability of the concept in practice, and the potential role for biosphere reserves in highly developed, settled areas.”

The nomination was approved by UNESCO in February 1990, and a recognition ceremony was held on April 4, 1990. The ceremony was hosted by the Premier of Ontario, and as a special guest, the Director-General of UNESCO observed that:

“The protection of this complex landscape within a rapidly urbanizing region is a tremendous feat of will and co-ordination requiring leadership, hard work, imagination, tenacity, and a good dose of human psychology to apply it” [quoted in *Renewing the Vision*, 1993:i]

### *Plan Reviews*

Controversy has ebbed and flowed around the NEC and the Niagara Escarpment Plan not only during the period leading to their creation, but also since then as the Commission carries out its responsibilities. Many of the disputes focus on particular development permit or plan amendment decisions. Some of it is directed to the government's appointments to and funding for the Commission, and a small undercurrent seems to be little more than perpetual resentment about governance generally and its impact on property rights. Disputes surfaced again when, within just a few months of becoming a biosphere reserve, the first five-year review called for under the terms of the Niagara Escarpment Planning and Development Act, was initiated in June 1990.

Terms of Reference for the review were set by the Minister of the Environment (responsibility for NEC was assigned to this ministry from the Ministry of Municipal Affairs in 1990), and were interpreted by the NEC to confirm that the Niagara Escarpment Plan was generally working well. The review was to focus on a number of particular topics. The NEC issued its proposed revisions to the Plan in June 1991. Changes announced by the Minister included stronger restrictions on the creation of building lots in areas designated Escarpment Natural and Escarpment Protection; additional standards and development criteria on new, existing and decommissioned pits and quarries; restrictions on golf courses in Protected Areas; improve criteria to protect water resources; provisions to allow small-scale commercial uses that directly support continuing agriculture; provisions for tourist accommodation in the Rural Area; criteria to protect habitat and biodiversity and recognition for the Niagara Escarpment status as a biosphere reserve; criteria to protect cultural heritage, including archaeological sites and especially native burial sites; and greater recognition of the importance of the Bruce Trail.

Hearing Officers appointed by government held public hearings over an eight month period, and issued their report one year later in March 1993. In response to this, the Commission issued their final recommendations on the plan

review in August 1993, and the provincial government approved a revised Niagara Escarpment Plan in June 1994.

This review took longer than had been expected. Proponents at both ends of the development/protection spectrum said the review did not go far enough. There were some who felt that the NEC should not have been so directly involved in the review and that it should have been led by a more independent party (of their choosing). There was disagreement between the NEC and the Hearings Officers over the interpretation of the NEPD Act. The Commission argued that the statute's protection provisions took precedence over development while the Hearing Officers interpreted the statute more as a guideline promoting orderly growth much like the provincial Planning Act. The need for environmental data on which to base policy and development permit decisions, which had been generally recognized for some time, was also acknowledged by the review. There was some discussion about the implications of the biosphere reserve designation, and some members of the Canada/MAB Working Group on Biosphere Reserves provided informal advice on this. It was generally accepted that the biosphere reserve designation did not imply that no policy modifications could be made. The government accepted the NEC's interpretation of the NEPD Act and the revised Plan it approved had stronger protection provisions.

In June 1999, the government initiated a second five-year review of the NEP following a radically different approach from the first one. This review was much more focused on selected issues, i.e. the development of estate wineries, rural tourism, signage, environmental monitoring, intensive recreational development in escarpment parks, and the status of land trusts. The government clearly stated before beginning that the fundamentals of the Niagara Escarpment Plan and its implementation by the Commission were sound. The two most controversial issues -- resource extraction (mining, forestry and water) and building lot creation -- were not up for discussion.

Among the amendments to the Plan proposed by the NEC were the inclusion of explicit reference to biosphere reserve requirements in statements about the objectives and management plans for the Niagara Escarpment Parks and Open Spaces System (NEPOSS), and for environmental monitoring. The Hearing Officers' report (October 2001) largely endorsed the NEC proposals with one notable exception: for wineries and other commercial uses related to grape-growing, the NEC had recommended greater latitude than the Hearing Officers. Following a review of this report by the NEC and the Ministry of Natural Resources, a revised Niagara Escarpment Plan is expected to be approved by the provincial cabinet in 2002.

Parks Canada also engaged in public consultations from 1989, first to identify issues to be addressed in plans for Fathom Five National Marine Park and the Bruce Peninsula National Park, and then for the preparation of the management plans. This latter phase was carried out in part through consultations with an 18 member local advisory committee, and the management plans were formally approved in 1998. The plans include a vision, mission, and objectives statement looking ahead for the next 15 years, and these include reference to a "greater ecosystem" perspective for the Upper Bruce Peninsula region, consistent with the principles of a biosphere reserve.

Government programs at both the federal and provincial level were cut-back and slowed down by major funding cuts over a several year period during the mid-1990s. The NEC, for example, had its budget and staff reduced by about one-half in 1995-1996 as a result of government-wide policies to reduce budget deficits.

### *Functioning as a Biosphere Reserve*

At the time of the nomination of the NEBR, it was expected that the NEC would take a lead in developing or strengthening biosphere reserve activities in cooperation with various government agencies, including Parks Canada. The Commission, as noted, is composed of people representing escarpment municipalities and citizens-at-large (the latter including its Chair) and the day-to-day work by staff in particular, brought it into contact with a large number of landowners, businesses, and non-governmental groups representing a wide cross-section of interests. Yet, the NEC's main responsibility and continual pre-occupation remained with administering the NEP through issuance of development permits and processing plan amendments, a number of which required extensive negotiations with private landowners and/or their legal representatives. The staff had to service Commission meetings every three to four weeks. Budget and staff reductions in 1995 severely restricted what else it could do, especially when the Commission had additional work preparing for, and responding to, matters associated with official reviews of the NEP (which has been part of its responsibilities during six of the last 11 years).

NEC had a senior staff person represent the biosphere reserve on the former Canada/MAB Working Group on Biosphere Reserves, now replaced by the Canadian Biosphere Reserves Association / l'Association Canadienne des Reserves de la Biosphere (CBRA/ACRB), where he continues to play a constructive role. Other staff have from time to time contributed, often as volunteers to projects associated with biosphere reserves. While the idea of evolving a biosphere reserve technical or other kind of committee was discussed internally by the Commission, the logistics of organizing and supporting one that would have had to be at arms-length from the Commission itself has never been fully addressed.

This issue lost its urgency once it became apparent that the array of activities which biosphere reserves are intended to foster were being developed through initiatives taken by different agencies and non-governmental groups,

without an apparent need for some committee to oversee or coordinate them. Information about these initiatives became more widely shared when the NEC, in cooperation with other organizations, organized a series of “Leading Edge” conferences and related workshops in 1994, 1995, 1997, 1999, and 2001 that brought together up to two hundred or more people on each of the last three occasions to report on and discuss on-going work concerning the Niagara Escarpment. Some highlights are noted below with reference to the logistic functions of biosphere reserves.

Research: Some money from the \$25 million Niagara Escarpment Fund administered by the Ontario Heritage Foundation over ten years (1985-1995) was allocated for escarpment-related research through an annual grant application program; altogether about \$677k helped support 41 projects on a wide range of topics. In addition, several groups have conducted collaborative research over the years. The main examples include continued investigations of about 80 archaeological sites discovered within a 30 km radius of the Crawford Lake area by the London Museum of Archaeology (affiliated with the University of Western Ontario); extensive, detailed, ecological inventories and surveys by the Ontario Ministry of Natural Resources with support from the Ontario Heritage Foundation and the Niagara Escarpment Commission; multi-disciplinary research on the stunted old-growth cedar forests and the cryptoendolithic microflora on the cliffs and talus slopes of the escarpment by the Cliff Ecology Research Group, University of Guelph; fisheries research in cooperation with the Chippewas of Nawash First Nation by the Axelrod Institute of Ichthyology, University of Guelph; studies of private landowner stewardship practices and attitudes, and preparation of practical stewardship information for escarpment landowners by the Centre for Land and Water Stewardship at the University of Guelph; studies of the greater ecosystem concept applied to the Bruce Peninsula National Park and of the Niagara Escarpment Plan review processes by the Heritage Resources Centre, University of Waterloo; and the recent formation of a Cabot Head Research

Station and Bruce Peninsula Bird Observatory in the NEBR by the Friends of Cabot Head and Ontario Parks.

Monitoring: The lack of baseline data on the environmental conditions of the escarpment which could be used to assess the effectiveness of the Plan was addressed soon after the Ontario Ministry of Environment and Energy (MOEE), was assigned to be the host ministry to which the NEC reported. With help from consultants, a Cumulative Effects Monitoring Program keyed to the goals and objectives of the Plan was developed by 1995. Implementation of this has been largely on an opportunistic basis, making use of surveys being done by others such as the forest bird monitoring program of the Canadian Wildlife Service, forest health surveys by Natural Resources Canada, and the SI/MAB biodiversity monitoring plots established under the Ecological Monitoring and Assessment Network (EMAN). This has been supplemented by student work for theses such as GIS analyses of forest fragmentation over time, and university field courses such as one to introduce monitoring using protocols for SI/MAB biodiversity plots. In addition, Parks Canada has a statutory obligation to manage national parks to maintain their “ecological integrity”, and staff from the Bruce Peninsula National Park have explored this, drawing upon concepts about cumulative effects monitoring. An Ecosystem Conservation Plan was recently completed for the national park, and the feasibility of using different monitoring protocols is being tested and implemented in cooperation with other parks and with EMAN. This Ecological Integrity Monitoring Program (ELMP) has remained a high priority for the national parks.

Public education and information: The NEBR had a number of outdoor or environmental education centres with programs designed for use by school groups, and maintained by individual school boards or Conservation Authorities. Budget cuts imposed by the provincial government over the past five years or so have closed some of these facilities, severely restricted use of others, and/or led to contracting out arrangements by Conservation Authorities either to operate

their former outdoor centres, or provide a suite of conservation education services on a cost-recovery basis. Some non-governmental groups are now providing outdoor and environmental education opportunities; for example, the Association for Canadian Educational Resources (ACER) has linked environmental monitoring with schools on the escarpment and elsewhere. The NEC has developed an education kit for teachers and publishes a series of tourist brochures; it also maintains a comprehensive, up to date and growing web site. Non-governmental organizations such as the Coalition on the Niagara Escarpment and the Bruce Trail Association publish information materials and operate web sites. Detailed plans and designs have been developed for two proposed market-oriented centres, the Giant's Rib Discovery Centre near Hamilton and Escarpment Centre Ontario, near Owen Sound, with programs and services expected to appeal to a wide variety of publics; the biosphere reserve theme is prominent in both.

---

For matters of special interest in the experience of Canadian biosphere reserves, the following may be noted:

*Continuing justification for a biosphere reserve and appropriateness of the zonation.*

The biosphere reserve designation was initially publicized most extensively by the NEC, to the extent that earlier public perceptions in some cases seemed to equate it with NEC and its regulatory work; for example, one local group in 1992 wondered whether the designation could be "suspended" until such time as their concerns about the Commission were resolved. With severe budget and staff reductions since 1995, and a perception in some circles that mainly "pro-development" people had been appointed to the Commission, some watch-dog groups such as the Coalition on the Niagara Escarpment (CONE) and Protect Our Water and Environmental Resources (POWER) have modified their

approach. Because they thought the NEC was not doing enough to protect the escarpment environment they have broadened their activities towards building community support and partnerships that are supportive of the intent of the Niagara Escarpment Planning and Development Act and the Niagara Escarpment Plan. It now seems that the biosphere reserve designation is becoming more widely known as an acknowledgement of the general ideals that many people share for the Niagara Escarpment region, and more groups are identifying the designation in their information materials.

The administrative overlay for the Niagara Escarpment area continues to be rather complicated (although modified somewhat since 1989). Besides the Niagara Escarpment Commission, it includes one federal agency, four provincial Ministries and the Ontario Heritage Foundation, seven Conservation Authorities, seven counties or regional municipalities, and parts of 21 rural townships, towns and cities (down from 37 following recent amalgamations by the provincial government). Recurring land and resource use issues guarantee continual public concern and episodic media attention, as well as involvement from many non-governmental organizations and community groups in disputes and decision making processes that affect their interests. At least 60 community organizations and citizen groups (identified during this review) are active in the NEBR area on matters relating to local development, conservation, fish and wildlife, various land and resource use issues, environmental protection, and cultural heritage and tourism. There is a continual need for some way of standing back from the numerous immediate local concerns to consider also the larger landscape over the longer-term. The biosphere reserve designation seems increasingly helpful as a reminder of this, and as a symbolic ideal it could be promoted as a strong and appropriate instrument to help mobilize collective efforts.

The zonation, which was configured by the land use designations in the Niagara Escarpment Plan, was initially appropriate for what had to be done. It is subject to on-going modifications only from actions such as land securements for

conservation purposes, or minor adjustments to the Niagara Escarpment Plan. It has also resulted in a restricted legal interpretation of the area considered to be the transition area / zone of cooperation.

If the role of the Niagara Escarpment in protecting headwater resources for adjacent watersheds is taken into account, especially for watersheds under the jurisdiction of the Nottawasaga Valley, Credit Valley, Halton Region, Hamilton Region, and the Niagara Peninsula Conservation Authorities, then a broader conceptual interpretation of zones of cooperation can (and should) be considered. Watershed programs of the Conservation Authorities are consistent with the functions of a biosphere reserve in zones of cooperation.

The existence of the NEBR has also encouraged other people to start exploring the possibility of a biosphere reserve designation for parts of Manitoulin Island (a continuation of the same geological formation), to note similarities of conservation and sustainability issues on the Oak Ridges Moraine (a distinctive landform that runs north of the Greater Toronto Area and connects with the Niagara Escarpment in the Regional Municipality of Peel), and explore the concept of “The Great Arc” to review conservation interests and prospects for the entire escarpment formation wherever it has surfaced in neighbouring US jurisdictions.

### *Continuing local involvement*

Members of the NEC itself represent municipalities and the public-at-large, the latter including the Chair. As noted above, there is continuing local involvement with issues associated with the Niagara Escarpment. The initial idea of having some representative group of people convened through the Commission to foster the logistic functions of a biosphere reserve in particular, posed operational difficulties given the 725 km long region to be considered.

Even if the resources were available to adopt this approach, it would have been necessary for such a group to be independent, and be perceived to be independent, from the Commission and the kinds of disputes it has to cope with in carrying out its responsibilities. However, given that a number of initiatives from other organizations are helping to fulfill the functions of a biosphere reserve, the question now is how best to foster information exchange to keep abreast of on-going initiatives throughout the NEBR.

A “Bruce Peninsula Biosphere Association” has formed within the past year around the two national parks on the Bruce Peninsula. This new association has taken care to distance itself from old controversies between the national park and its neighbours and users. The association is concentrating on devising projects that relate to school education and environmental monitoring, which are generally perceived as neutral and non-threatening across the local community.

This suggests possibilities for other groups, oriented to different sections of the escarpment adopting a similar approach. Much depends on peoples’ sense of place, and the emergence of “local champions” to adapt the biosphere reserve concept to their particular communities and local economic contexts. It is not difficult to envision groups forming around escarpment-related conservation and sustainability issues in the Niagara Peninsula, the Hamilton region, and in the Halton Hills Region through Grey County sections of the escarpment; this would be similar, for example, to the way in which the Bruce Trail Association (BTA) is organized. Eventually such groups could decide on some association among themselves, along with how best to represent the NEBR in national and international programs.

### *Effectiveness of management plans*

There is no separate organizational entity for the NEBR so the management plans for the area are comprised primarily by the Niagara

Escarpment Plan (NEP) and management plans for the two national parks. The NEP is very much a “living document” given its continuous application through the development permit system administered by the Commission, relatively frequent amendments, and the intensive and quite lengthy reviews it has undergone with extensive public consultations to consider policy or other revisions. The need for monitoring of the escarpment as one basis for assessing the effectiveness of policy and management practices was recognized before the NEBR was designated, but the design and implementation of an appropriate monitoring program continues to pose conceptual and practical challenges. Similarly, the management plans for the two national parks (in particular) will be reviewed again by 2003, and the statutory requirements to manage national parks to maintain their ecological integrity also pose conceptual and practical challenges. There have been regular consultations and exchange of information about these issues at the staff level in federal and provincial agencies. These plans implement the land use configurations required for a biosphere reserve (with the caveat that the zones of cooperation might be interpreted more widely) and they also include requirements for monitoring and related research; national park plans also have specific provisions for educational activities.

*Science in the context of national and international programs.*

Research and monitoring in the biosphere reserve has been directed towards the program objectives of the different groups undertaking it. There has been a great deal of work over the past decade or so, and some bibliographic compilation of this combined with technical reviews to assess the state of knowledge about the NEBRA area would be useful. There are some actual and potential links to national and international science programs. The Ecological Monitoring and Assessment Network (EMAN) has assisted with SI/MAB plots and other monitoring activities associated with the cumulative effects monitoring for the Niagara Escarpment Plan and ecological integrity monitoring for the national parks. The latter may also be seen as an evolving national program

which would have to extend beyond park boundaries along the lines recommended in 2000 by the “Panel on the Ecological Integrity of Canada’s National Parks”. The conceptual frameworks and experience from both the cumulative effects monitoring for the escarpment and ecological integrity monitoring for the national parks, address state-of-the-art issues. They could provide a major contribution for collaborative work that UNESCO/MAB, EURO/MAB, or the “Biodiversity Resources for Inventorying and Monitoring” (BRIM) program might undertake.

The Cliff Ecology Research Group at the University of Guelph has achieved international recognition for their work on the escarpment. Their success in developing a 2,878 year dendrochronological sequence for the stunted old-growth eastern white cedar forest on the escarpment is a good potential link into further climate change work.

Links with UNESCO/MAB or other international science programs have not been developed. There is need for a re-invigorated Canada/MAB to provide information exchange and cooperation among Canadian science programs associated with UNESCO (and other international organizations) and individual biosphere reserves in Canada.

*The biosphere reserve and issues of sustainability.*

The “Leading Edge” conferences, co-sponsored by the Niagara Escarpment Commission with other agencies and escarpment businesses in 1994, 1995, 1997, 1999, and 2001 have provided a broad forum for presentation and discussion of many issues consistent with the concept of a biosphere reserve. These have included reports from on-going research in both the natural and social sciences and discussion of their implications. The conferences have helped reveal the extent to which local economies associated with the escarpment are changing to become much less dependent on the older resource

extraction, agricultural, or manufacturing industries, and more dependent upon new high technology service industries and tourism.

“Quality of life” values, rather than access to raw materials, are becoming more evident by the extent to which areas near the escarpment are being acquired for estate homes, hobby farms, and recreational properties. A number of rural villages on or near the escarpment are catering to arts and crafts, antiques and boutiques, often in renovated 19th century buildings. Seasonal recreation and tourism has become an important component in local economies, and several major destination tourist and conference centres operate in scenic areas such as the Beaver and Hockley valleys and Blue Mountain areas and in the Niagara wine region of the NEBR. While “sustainability” issues remain, the values underlying these changes (as represented by the biosphere reserve designation) are more conducive for pursuing environmentally or ecologically more sensitive uses of the landscape.

---

The continuing challenge facing the NEBR is how best to realize the ideals of a biosphere reserve suitably adapted for the particular ecological and socio-economic contexts in which it is situated. It is rich in components, but still rather weak in linkages and networks that could relate biosphere reserve functions throughout the entire NEBR area, foster the communications needed to maintain a “big picture” overview of conservation and sustainability matters of interest and concern for the whole area, and become better connected with UNESCO/MAB and other biosphere reserves. For this, some organizational capacity needs to be developed.

Related issues to consider are:

- (1) strengthening commitments to implement monitoring for cumulative effects and ecological integrity in a comprehensive and management-oriented manner;
- (2) strengthening community involvement in biosphere reserve activities along the escarpment, perhaps focusing on certain “nodes” or sections which exhibit different mixes of more local issues and opportunities;
- (3) exploring application of the “transition area / zone of cooperation” concept to watersheds or portions of them associated with escarpment lands and to the “Upper Bruce Peninsula Ecosystem”;
- (4) obtaining more recognition (or publicity) about the key role of NEBR sites in local tourism ventures;
- (5) keeping abreast of the wide range of on-going programs and activities that contribute to the realization of a biosphere reserve for periodic reporting out to all concerned; and
- (6) being mindful of larger scale landscape perspectives that recognize landform connections to the Oak Ridges Moraine (an east-west landform just north of the Greater Toronto Area) and other occurrences of the Niagara Escarpment formation (“The Great Arc”) for comparative studies, exchange of planning and management experience, and possible cooperation on particular matters of mutual concern.

Given the geographic scale of the NEBR and the complicated overlay of government jurisdictions, agencies and other organizations which can contribute to a functioning biosphere reserve, it is essential that at least one full-time staff person who can act on behalf of the biosphere reserve be retained. This might be arranged under some shared cost basis between a government agency such as the NEC and the private sector. CBRA/ACRB recognizes this as a problem to be addressed in most Canadian biosphere reserves, and plans to work closely with its biosphere reserve representatives (including the NEBR) to explore options for resolving this issue. It is a pre-requisite for developing the NEBR along the lines indicated above.

### 3. PERIODIC REVIEW FORM FOR BIOSPHERE RESERVES

#### I. NAME OF THE BIOSPHERE RESERVE

Niagara Escarpment Biosphere Reserve

#### II. COUNTRY

Canada

#### III. PHYSICAL CHARACTERISTICS OF THE BIOSPHERE RESERVE

##### Latitude and Longitude

Tobermory (north end):	45° 15'N	81° 40'W
Niagara Falls (south end):	43° 8'N	79° 5'W

*Please enclose a map showing the general location of the biosphere reserve.*

Please see [Figure 1](#): General Location of the Niagara Escarpment Biosphere Reserve, and [Figure 2](#): "The Great Arc".

##### Biogeographical Region

*Indicate the name usually given to the biogeographical region in which the biosphere reserve is located.*

Biogeographic Provinces of the Nearctic Realm (Udvardy)1985.

1.5.3 Lake Forest (northern portion \*)

1.6.5 Eastern Forest (southern portion\*)

UNESCO Major Ecosystem Types of the World, 1996.

Boreal needleleaf forest or woodlands (northern portion)

Temperate and sub-polar broadleaf forests or woodlands (southern portion).

Canadian Ecological Land Classification. 1996.

Mixwood Plains Ecozone

Manitoulin-Lake Simcoe Ecoregion, #134.

Lake Erie Lowland Ecoregion, # 135.

Ontario Site Regions and Districts, 1959.

5E Georgian Bay Site Region.

Site District 2.

6E Lake Simcoe-Rideau Site Region.

Site Districts 1,3,4,5.

7E Lakes Erie-Ontario Site Region.

Site District 2.

[\* Generally the northern portion of the NEBR is the Bruce Peninsula and areas of the escarpment extending south from there into the Halton Hills Region; conversely, the southern portion of the NEBR is the Niagara Peninsula through to Hamilton, and extending north into the Halton Hills Region. There is no clear demarcation in Halton or elsewhere, rather there is a gradual transition in the dominant forest and other plant species along this north-south axis.]

*The enclosed map has been prepared on the basis of information available at the Secretariat. Indicate if the biosphere reserve is correctly sited and whether it lies within the appropriate ecosystem type.*

[Not applicable]

## **Topography of the region**

*Briefly describe the major topographic features (wetlands, marshes, mountain ranges, dunes, landscapes, etc...).*

The NEBR is defined by exposed limestone cliffs that form a ridge (cuesta formation) that extends some 725 km across southern Ontario from the Niagara River to the Georgian Bay (Lake Huron). This landform is considered to be a distinctive physiographic region in Ontario. The ridge formation is flanked by a surficial landscape of glacial origin, with features such as glacial moraines, drumlins, and eskers (some of which have buried portions of the escarpment), pre- and post-glacial river valleys, mesa-like outliers of the escarpment formation, numerous creeks and waterfalls, and a karst topography of cave formations. Wetlands and small lakes in areas extending back from the brow of the escarpment provide headwater sources for a number of watersheds.

The cliffs are most spectacular at the Niagara River gorge (Niagara Falls itself has eroded the escarpment upstream and lies outside of the area recognized for the biosphere reserve), at various points near and especially north of the city of Hamilton, and along the Georgian Bay. At some points they arise some 50 metres or more above the lowland below; a comparable 60m cliff face was recently documented for a submerged portion of the escarpment within Fathom Five National Marine Park.

## **Climate**

*Briefly describe the climate of the area using one of the common climate classifications.*

Ecoclimatic Regions of Canada (1989).

The northern portion of the biosphere reserve is within the Cool Temperate Ecoclimatic Province, Humid Mid-Cool Temperate Region (MCTh). Summers are warm

and winters are mild. Monthly precipitation usually exceeds 70 mm and is distributed fairly evenly throughout the year.

The southern portion of the biosphere reserve is within the Moderate Temperate Ecoclimatic Province, Humid High Moderate Temperate Region (HMTh). Summers are humid and warm to hot. The mean daily temperature can remain above 0°C for eight to nine months (April through November). Winters are mild and snowy. Monthly precipitation averages 75 mm.

#### Tobermory (northern region)

Average temperature (warmest month):	22.5°C
Average temperature (coldest month):	-2.8°C
Annual Precipitation:	808.5 mm of which 180.8 mm is snow.
Altitude:	183 m

#### Niagara Falls (southern region)

Average temperature (warmest month):	27.2°C
Average temperature (coldest month):	-0.9°C
Annual precipitation:	942.3 mm of which 162.9 is snow.
Altitude:	183 m

### **Geology, geomorphology, soils**

*Briefly describe the main land formations and characteristics.*

The limestone formations of the Niagara escarpment date from the Ordovician and Silurian eras some 445-420 million years ago. The limestone strata, which include shales and sandstones, are deposited on a Pre-cambrian basement anticline, an arch-like formation acting as a hinge line that separated two ancient sedimentary basins, the

Alleghany basin to the southeast, and the Michigan basin to the west. Crustal movements associated with the formation of these two basins have given the limestone strata a regional slope (or dip) southeastward and southwestward in the order of about 4-6 m per km. The strata are capped by erosion-resistant dolomite (dolostone). Some of the strata are rich in fossils, including corals and stromatopoids, bryozoans, trilobites, brachiopods, molluscs, nautiloids and cephalopods.

After the lands that now form southern Ontario emerged from the seas some 245 million years ago, various erosion processes came into play, especially through glaciation in recent millenia. The escarpment developed because of a differential hardness in the limestone strata; the stratigraphic succession revealed by erosion is reflected in the irregular occurrence of the escarpment face as it gradually “migrated down dip” and increased in height.

The glacial till provides different mixes of silts, sands, clay and gravel deposits in the escarpment area. Shallow rocky soil characterizes areas close to the brow of the escarpment itself.

### **Significance for conservation of biological diversity: habitats and characteristic species**

*List main habitat types (e.g. humid tropical forest, savanna woodland, alpine tundra, coral reef, seagrass beds) and land cover (e.g. residential areas, agricultural land, grazing land).*

The main habitat types (summarized below) include forest ecosystems and wetlands complexes on the plateau of the escarpment, a cliff ecosystem associated with the rim, cliff-face and talus slopes of the escarpment itself, and a portion of the Great Lakes surrounding the Bruce Peninsula.

Several groups of biota in the biosphere reserve exhibit an unusual species richness. For example, all eight species of bats known from Ontario (several of which

are associated with cave and crevice formations which serve as diurnal resting sites or hibernacula) have been found in the NEBR. There are also 54 species of ferns (and several hybrids) from eight different fern families, and including one of the largest extant populations in North America of Hart's-tongue fern *Phyllitis scolopendrium*. There are also 44 species of orchids (Orchidaceae). Several plant species which are largely or exclusively endemics to the Great Lakes basin are also found in the biosphere reserve, i.e. Kalm's St. John's-wort *Hypericum kalmianum*, Provancher's (Philadelphia) fleabane *Erigeron provancheri*, lakeside daisy *Hymenoxys herbacea*, Ohio goldenrod *Solidago ohioensis*, Houghton's goldenrod *S. houghtonii*, Hill's thistle *Cirsium hillii*, and dwarf lake iris *Iris lacustris*.

[a] Type of habitat: Escarpment forests.

There is forest cover over much of the escarpment formation to the extent it is often now viewed as a "green corridor", although still quite fragmented in a number of places because of other land uses. This corridor extends over two main forest regions (recognized in both national and provincial ecoregion classifications). The southern portion of the escarpment is within a deciduous forest region (known locally as "Carolinian Canada") and the northern portion is within a mixed deciduous-conifer forest region. The escarpment forests exhibit a rich mix of forest types associated with different abiotic conditions along the 725 km length of the biosphere reserve.

Main species:

Dominant tree species along much of the escarpment area include sugar maple *Acer saccharum*, red maple *A. rubra*, American beech *Fagus grandifolia*, basswood *Tilia americana*, white pine *Pinus strobus*, eastern hemlock *Tsuga canadensis*, eastern white cedar *Thuja occidentalis*, and white ash *Fraxinus americana*. Along the southern portion some species that are at or close to the northern limits of their continental range are found, such as black oak *Quercus velutina*, shagbark hickory *Carya ovata*, black walnut *Juglans nigra*, sycamore *Platanus occidentalis*, sassafras *Sassafras albidum*, and tulip tree *Liriodendron tulipifera*. Along the middle and northern portions of the escarpment mixedwood forests also include white birch *Betula papyrifera*, yellow birch *B. lutea*,

mountain maple *Acer spicatum*, trembling aspen *Populus tremuloides*, white spruce *Picea glauca*, jack pine *Pinus banksiana*, and balsam fir *Abies balsamifera*.

#### Main human impacts:

These forests are all remnants from the extensive forests which covered the entire region prior to European settlement beginning in the late 1790s. The region was extensively cleared for agricultural uses and settlements throughout the 19<sup>th</sup> century. Most of the forests have been cut over to varying degrees and a number, especially in the more northern portion of the escarpment area, have also been extensively burned in the past.

#### Relevant habitat management practices:

The main efforts now are to recognize good forest management practices and provide protection for the remaining forests through a combination of public measures such as the creation of parks and park management plans, the Niagara Escarpment Plan, municipal tree by-laws, and promoting private stewardship among private landowners. The latter draws upon a mix of tax incentives, conservation easements and stewardship recognition programs. Restoration work is also underway, especially to restore oak-savanna ecosystems in the Dundas Valley, and to reduce forest fragmentation in the Halton Hills region of the escarpment.

#### [b] Type of Habitat: Wetland complexes

This comprises a diverse set of habitats, including small shallow lakes and ponds, bogs and fens, and creeks and streams. Some provide significant headwater sources for groundwater recharge into shallow till deposits that may augment base flows along stream corridors below the escarpment, or act as regulators of surface water flows for watersheds extending well beyond the escarpment. Their varying biological attributes have been documented at the site level for particular “areas of natural and scientific interest”.

#### Main species:

1. Lakes and ponds, including beaver ponds and artificial impoundments. Submerged and floating aquatic plants occur in a variety of open water situations. The most common species include floating pondweed *Potamogeton natans*, variable-leaved pondweed *P. gramineus*, flat-stemmed pondweed *P. zosteriformis*, and northern water-milfoil *Myriophyllum exalbescens*. Other species commonly associated with these are fragrant water-lily *Nymphaea odorata*, bushy naid *Najas flexilis*, bullhead lily *Nuphar variegata*, common duckweed *Lemna minor*, common coontail *Ceratophyllum demersum*, common bladderwort *Utricularia vulgaris*, and stonewort *Chara sp.* Some of these waterbodies also have shallow or deep emergent aquatics including common cattail *Typha latifolia*, reed canary grass *Phalaris arundinacea*, hard-stemmed bulrush *Scirpus acutus*, rice canary grass *Leersia oryzoides*, Small's spike-rush *Eleocharis smallii*, Canada blue-joint *Calamagrostis canadensis*, hairy-fruited sedge *Carex lasiocarpa*, and tussock sedge *C. stricta*.

2. Fens and bogs, graminoid and treed. Trees most associated with fens and bogs are tamarack *Larix laricina*, white cedar *Thuja occidentalis*, balsam fir *Abies balsamea*, black spruce *Picea mariana*, red maple *Acer rubra*, and ash *Fraxinus sp.* Other common plant species are sweet gale *Myrica gale*, leatherleaf *Chamaedaphne calyculata*, Labrador tea *Ledum groenlandicum*, shrubby cinquefoil *Potentilla fruticosa*, buttonbush *Cephalanthus occidentalis*, highbush blueberry *Vaccinium corymbosum*, tawny cottongrass *Eriophorum virginicum*, twig-rush *Cladium mariscoides*, and beaked sedge *Carex utriculata*.

3. Streams and creeks. These are largely unvegetated, although some may have water cress *Nasturtium microphyllum*. The presence of fish such as brook trout *Salvelinus fontinalis* indicate possible spring-fed watercourses.

#### Human impacts:

These arise mainly from land use practices in the associated watersheds.

#### Relevant habitat management practices:

Wetlands within the Niagara Escarpment Plan Area (and the two National Parks) are generally protected. The NEC has conducted studies of artificial ponds and their possible effects on water quality and flows. The role of escarpment wetlands as sources

for groundwater or surface water flows in the Credit River watershed have been explored through hydrogeological studies.

[c] Type of Habitat: Escarpment rim, cliff face, and talus slopes.

Work by the Cliff Ecology Research Group at the University of Guelph has documented a quite unusual ecosystem found along the rim, cliff face and talus slopes of the escarpment. This ecosystem has a very stunted old-growth forest, distinctive assemblages of breeding birds, small mammals, lichens, ferns and other plants, and extensive occurrences of cryptoendolithic microflora existing about 1-5 mm inside the limestone rock. Research is underway to explore hypotheses about ecosystemic relationships among these biota through nutrient exchange processes and biogeochemical recycling by the cryptoendolithic microorganisms.

#### Main species:

The uneven age old-growth forest is of eastern white cedar *Thuja occidentalis*, with individual trees commonly several centuries old and some exceeding 1,000 years of age; the oldest so far documented have been 1,555, 1,650, and 1,890 years old respectively. Most grow out of crevasses on the rim or cliff face of the escarpment. Dead cedars which have fallen on to talus slopes also decay extremely slowly and there is a record of one specimen that had remained there for over 3,200 years. Many ferns grow on the cliff face, including maidenhair spleenwort *Asplenium trichomanes*, green spleenwort *A. viride*, wall-rue *A. ruta-muraria*, rock polypody *Polypodium virginianum*, smooth cliff-brake *Pellea glabella*, and bulblet fern *Cystopteris bulbifera*. Characteristic herbs include bird's-eye primula *Primula mistassinica* and butterwort *Pinguicula vulgaris*. Although the cliff vegetation remains similar in floristic composition along the entire escarpment (in contrast to the plateau forests) a number of grasses with arctic affinities occur on the northern parts of the escarpment such as *Poa glauca*, *P. alpina*, and *P. canby*.

A variety of crustose lichens also occurs on the cliff face as well as rich communities of epilithic and cryptoendolithic micro-organisms. The cryptoendolithic flora occur inside translucent limestone and consist of fungi, bacteria, and algae. They have

to be cultured under laboratory conditions before they can be identified. Some 19 taxa of eukaryotic algae and 9 taxa of cyanobacteria have been found.

A number of species of small land snails thrive on the limestone cliff area, and sample plots (0.01-0.1 ha) from the Bruce Peninsula have yielded from 17 to 30 different species of them. Over 70 species of arthropods have been found in “madicolous habitats” created by waterfall sprayed rocks and underground seepages down the cliff face, and 13 of these were completely restricted to these areas.

#### Main human impacts:

Inaccessibility has served to protect this habitat but some of the stunted trees have been impacted negatively by rock-climbing pursuits (climbers grab on to the tree stems or attach ropes to them). There have been instances of the deliberate removal of some specimens for the bonsai trade.

#### Relevant habitat management practices:

The rim and cliff face of the escarpment is formally protected under the Escarpment Plan and the Bruce Peninsula National Park Management Plan. The Cliff Ecology Research Group and the NEC are working with climbing clubs and others to provide information about the impacts of climbing and to restrict this pursuit to some designated sections of the escarpment away from the more significant occurrences of the old growth cedars.

#### [d] Main Habitat Type: Aquatic ecosystems in Lake Huron

The waters surrounding the Bruce Peninsula in Lake Huron and Georgian Bay (and including Fathom Five National Marine Park) exemplify an oligotrophic lake with both cold and warm water fish communities represented in them. The waters immediately east of the escarpment fill the deepest part (about 90 m) of Georgian Bay. The lake bed under the Upper Bruce Peninsula Ecosystem (identified as a “greater ecosystem” for the two national parks) has several significant geomorphological features, including a submerged section of the Niagara escarpment, glacial erosion

features, remnants of submerged forest, and an underwater waterfall structure associated with a major mixing zone of waters flowing between Lake Huron and Georgian Bay. Shallow littoral zones (less than 10 m in depth) occur along portions of the peninsula and islands, and provide important spawning and feeding areas for certain fish.

#### Main species:

Lake Huron has 92 species of fish, of which 77 appear to be native species (the rest were deliberately or accidentally introduced into the Great Lakes). The nearshore fish community is composed of species such as walleye *Stizostedion vitreum*, yellow perch *Perca flavescens*, small mouth bass *Micropterus dolomieu*, largemouth bass *M. salmoides*, sunfish *Lepomis gibbosus*, rock bass *Ambloplitis rupestris*, channel catfish *Ictalurus punctatus*, muskellunge *Esox masquinongy*, and northern pike *E. lucius*. The offshore deep water fish community is composed of species such as lake trout *Salvelinus namaycush*, chinook salmon *Oncorhynchus tshawytscha*, rainbow trout *O. mykiss*, lake whitefish *Coregonus clupeaformis*, lake herring *C. artedii*, bloaters *C. hoyi*, alewives *Alosa pseudoharengus*, rainbow smelt *Osmerus mordax*, burbot *L. lota*, slimy sculpin *Cottus cognatus*, deepwater sculpin *Myoxocephalus thompsoni*, and trout-perch *Percopsis omiscomaycus*.

#### Main human impacts:

Commercial fishing out of Tobermory began by 1850, peaked during the period from about 1900-1930, and declined considerably by 1946. Overfishing combined with the appearance of exotic species such as sea lampreys *Petromyzon marinus*, alewives, and rainbow smelt altered fish communities considerably. Deepwater ciscoes *Coregonus reighardi* were extirpated. Some shoreline spawning areas were lost to shorefront development. At the present time, commercial fishing has declined to a small number of boats fishing for lake trout, lake whitefish and yellow perch, mainly for local sale and consumption.

#### Relevant habitat management practices:

In 1992, the Lake Huron Committee of the Great Lakes Fishery Commission agreed that the overall objective for fisheries management in Lake Huron was: "over the next two decades to restore an ecologically balanced fish community dominated by top

predators and consisting largely of self-sustaining indigenous and naturalized species capable of sustaining an annual harvest of 8.9 million kg.” Specific objectives were agreed upon for the favoured species of sports fish in particular. The area within the biosphere reserve is managed by the Ontario Ministry of Natural Resources in a manner deemed to be consistent with these general objectives. In 1993, a court decision recognized the commercial fishing rights of the Chippewas of Nawash and Saugeen First Nations in this area, and the native people set their own fishing regulations in 1996. In 2000, a co-management agreement for managing the commercial fishery was signed between the First Nations and Ontario for a four-year period, and it commits both Parties to negotiate a long-term agreement for the fisheries.

Habitats of special interest:

*Describe and indicate location of habitats which are unique or exceptionally important from the point of view of conservation.*

Besides habitats noted above, other sites of conservation interest are limestone cave and crevice formations; alvar formations on the Bruce Peninsula; remnant prairie ecosystems in the Dundas Valley; and all remaining Great Lakes natural shorelines, meadow marshes, and dune formations. The up-drafts along the escarpment in the Niagara Peninsula are especially important for the spring migration of raptors, as documented annually since 1975 by the Niagara Peninsula Hawkwatch at Grimsby.

Endangered or threatened plant and animal species:

*Identify species (with scientific names) or groups of species of particular interest for conservation, in particular if they are threatened with extinction.*

Please see Annex 1: Endangered, Threatened, or Rare Animal and Plant Species. [Attached]

#### IV. ZONATION

Names of the different areas

*Indicate the names of the different areas which make up the core area(s) and buffer zone(s).*

Please see below.

Spatial configuration

Please see [Figure 3](#): Land Use Designations for the Niagara Escarpment Plan Area, and the set of maps with [Annex 2](#): The Niagara Escarpment Plan.

*A BIOSPHERE RESERVE ZONATION MAP of a relatively large scale (1:25,000 or 1:50,000) showing the delimitations of all core area(s) and buffer zone(s) must be provided. Also indicate the approximate extent of the transition area(s).*

Size of the terrestrial Core Area(s): 63,400 ha.

Size of the terrestrial Buffer Zone(s): 113,300 ha.

Approximate size of terrestrial Transition Area(s)  
14,000 ha. (in the NEP area)

*Brief justification of this zonation (in terms of the various roles of biosphere reserves) as it appears on the zonation map.*

#### IV ZONATION

In the 1989 nomination submission, it was noted that the “core area” could be interpreted in either of two ways, both of which would indicate that a substantial core area existed. The first would consider all the lands designated as “Escarpment Natural Areas” together with the entire Bruce Peninsula National Park, less those parts of escarpment natural areas that were included within this new national park. Core areas calculated this way came to about 69,500 ha. The other way would consider the core area to include all “Nature Reserve Parks”, “Natural Environment Parks” larger than 100 ha that would remain largely undisturbed, and lands owned by the federal government for the two national parks; this would include 34 sites totaling some 18,460 ha, and all were set within a much larger and mostly continuous buffer zone around them.

In a policy decision several years ago, the NEC has defined the “core area” to be lands designated as “Escarpment Natural Areas”, portions of the two national parks and portions of some lands owned by the Niagara Parks Commission, for a total of about 63,400 ha. The national parks administration at this point see their role mainly as contributing to the core area functions (although they are also active in the logistic functions within their area as well). The Niagara Parks Commission owns and maintains greenbelt space with gardens and a number of tourist facilities along the Canadian side of the Niagara River, including areas within the Niagara Escarpment Plan Area; it declined to become officially involved with the biosphere reserve nomination in 1989.

In addition, mention is made of nine “nodal parks” that have been recognized among the 117 sites that constitute the “Niagara Escarpment Parks and Open Space System” (NEPOSS). [Please see [Figure 4: Niagara Escarpment Parks](#)]. Nodal parks are to be developed with visitor facilities, interpretive information, and access points from which to explore other nearby parks which can be reached by the Bruce Trail, a 800 km walking trail that links all the parks in NEPOSS. The current list of nodal parks (which is subject to change) from north to south are:

Bruce Peninsula and Fathom Five National Marine Parks, an 15,524 ha (eventually) and 11,180 ha areas respectively, owned by Parks Canada;

Spirit Rock Conservation Area, a 90 ha area owned by the Grey Sauble Conservation Authority;

Inglis Falls Conservation Area, a 215 ha area owned by the Grey Sauble Conservation Authority;

Pretty River Valley Provincial Park, a 993 ha natural environment park owned by Ontario Parks;

Mono Cliffs Provincial Park, a 737 ha natural environment park owned by Ontario Parks;

Terra Cotta Conservation Area, and “Centre for Environmental Learning”, a 173 ha area owned by the Credit Valley Conservation Authority;

Crawford Lake/Rattlesnake Point Conservation Area, a 482 ha area owned by the Halton Region Conservation Authority;

Dundas Valley Conservation Area, a 1,046 ha area owned by the Hamilton Region Conservation Authority; and

Ball’s Falls Conservation Area, a 94 ha area owned by the Niagara Peninsula Conservation Authority.

Additions to the NEPOSS are being made as opportunities allow. About 20% of the plan area is now publically owned. During the first decade of the Niagara Escarpment Plan, 2,658 ha were acquired for parks, and 53 km were secured for the Bruce Trail. Funds are currently available for land purchases under a provincial Natural Areas Protection Fund, some transfers of lands are underway from the Parkway Belt West Plan corridor in the Hamilton area, and easements or other acquisitions are being made through non-governmental organizations such as the Bruce Trail Association, the Nature Conservancy of Canada, and the Escarpment Biosphere Conservancy. Five more parks (bringing the total to 122) have been proposed by NEC and endorsed in a recent Hearing Officers’ report.

The 1989 nomination considered the “buffer zone” to include all lands designated as “Escarpment Natural Area”, “Escarpment Protection Area”, and “Resource Management Area” Parks (minus the core areas defined in terms of the park categories), for a total of about 93,350 ha. The “transition area” / “zone of cooperation” in the 1989 nomination was deemed to include all remaining lands in the Niagara Escarpment Plan area and the surface waters of Fathom Five National Marine Park for a total of 87,600 ha. The NEC’s policy defines the buffer zone to include the “Escarpment Protection Areas” and “Escarpment Rural Areas”, and defines the zone of cooperation to include “Urban Areas”, “Escarpment Recreation Areas” and “Mineral Resource Extraction Areas” as these are designated in the Niagara Escarpment Plan.

The biosphere reserve zonation pattern is continuing to evolve for the Niagara Escarpment Biosphere Reserve. Besides possible additions to the core area through future acquisitions, the Bruce Peninsula National Park is in the process of mapping “resource values” on which to base a comprehensive park zoning scheme. Parks Canada has also recognized “The Upper Bruce Peninsula Ecosystem” as a larger region of interest extending over a sizable aquatic area of Georgian Bay and Lake Huron adjacent to the Bruce Peninsula, and extending north almost to the south-east corner of Manitoulin Island.

### *Watershed connections*

[Please see [Figure 5: Watersheds Associated with the Niagara Escarpment](#), and [Figure 6: Conservation Authorities Associated with the Niagara Escarpment](#)].

Watershed connections were not considered in the 1989 nomination. Some watersheds have headwaters originating on the Niagara Escarpment lands, and other watersheds flow across the escarpment. Under the auspices of Conservation Authorities, a number of these watersheds have demonstration areas for improved management or habitat restoration practices which came about through collaborative planning and implementation arrangements consistent with the purpose of a biosphere reserve. In two cases, there are hydrological links to “remedial action plans” (RAPs) carried out for “areas of concern” designated under the US-Canada Great Lakes Water Quality Agreement. Black Ash Creek, a relatively small 32 km<sup>2</sup> watershed that connects the escarpment with Collingwood Harbour on Georgian Bay has its headwaters arising in

the Petun Conservation Area on the escarpment. This area, along with a fish hatchery, is managed on behalf of the Nottawasaga Valley Conservation Authority by the Georgian Triangle Anglers Association. Below the escarpment, bio-remedial fish habitat improvements were carried out (especially to attract spawning rainbow trout) as part of the more extensive comprehensive restoration and remedial measures for the Collingwood Harbour RAP. Of the 43 areas of concern in the Great Lakes Basin, Collingwood was the first, and (as of 2001) the only one to be delisted under criteria set by the Great Lakes Water Quality Agreement.

The 171 km<sup>2</sup> Spencer Creek watershed flows through escarpment lands (and waterfalls) into the Dundas Marsh at the west end of Hamilton Harbour/Burlington Bay, a major “area of concern” on Lake Ontario. The comprehensive multi-agency RAP for Hamilton Harbour is overseen by a Bay Area Restoration Council. One of the remedial programs is The Hamilton Harbour Watershed Stewardship Project, sponsored by the Council along with the Halton Region and Hamilton Region Conservation Authorities. This project works with landowners in the Spencer Creek (and Grindstone Creek, another small watershed that links the escarpment with the marsh) to implement land use practices that reduce erosion and pollution run-off into creeks, and provide streambank vegetation to protect fish habitat.

The Nottawasaga Valley Conservation Authority sponsored a multi-agency collaboration to prepare the Nottawasaga Valley Watershed Plan (1996-2015) for an area covering some 3,200 km<sup>2</sup>, with headwater hydrological connections to the Niagara Escarpment in a number of areas. The NEC is listed among the 14 “key players” that could advise or otherwise work with landowners and agencies on 30 needed “actions” to implement this plan.

The NEC has also worked with the Credit Valley Conservation Authority to study the effects of artificial ponds on water flows and water quality in the Credit Valley watershed. This watershed of some 1,000 km<sup>2</sup> flows through a portion of the Niagara Escarpment Plan Area. The Credit River Watershed Plan sets an overall collaborative management approach, and sub-watershed plans are being prepared for 20 sub-watersheds, some of which are related to the escarpment lands. Considerable effort is

going into developing a vibrant sports fishery, including the re-introduction of Atlantic Salmon, *Salmo salar*.

In the Niagara Peninsula, the Twelve Mile Creek watershed drains a 178 km<sup>2</sup> area whose headwaters originate from groundwater upwellings in the Fonthill Kame in the Niagara Escarpment Plan Area. The Niagara Peninsula Conservation Authority along with local municipalities and “The Friends of the Twelve” citizen group are working on the principles and management actions needed “to protect, enhance and restore the watershed for future generations”. The Authority is also working with various agencies and groups on an overall management plan for the 291 km<sup>2</sup> Twenty Mile Creek Watershed which includes some escarpment lands.

### *Reinterpreting zonations*

The zonations of the NEBR have been interpreted by the NEC in terms of the land use designations of the NEP augmented by the national parks. This resulted in a relatively small area formally (legally) recognized as the transition area / zone of cooperation. However, considering the hydrological connections of watersheds to the escarpment cuesta formation and the concept of the Upper Bruce Peninsula Ecosystem adopted by the national parks, a much larger zone of cooperation for the NEBR (including an underwater component) should be recognized. The challenge is to develop some organizational expression of these connections through biosphere reserve activities. This is not something that the NEC should be expected to initiate (because of public misperceptions of intent that could easily arise), but non-governmental groups could take up this challenge in the context of their growing involvement with the NEBR.

## **V. HUMAN ACTIVITIES**

### **Population living in the reserve**

Approximate number of people living within the Biosphere Reserve.

It has been generally assumed that about 120,000 people live within the NEBR but the proportions associated with the different zones of the biosphere reserve (as interpreted from designations in the Niagara Escarpment Plan area) are not known. The 1996 official census data for municipalities lying entirely or partly within the Plan area report a population of about 1,090,000 people, but almost 90% of this total comes from the two main urbanized regions (Hamilton-Dundas and St. Catharines-Niagara) which straddle the escarpment lands. There is a strong seasonal influx of visitors to and through the Bruce Peninsula area during the summer months.

*Brief description of local communities living within or near the Biosphere Reserve.*

The NEP area originally included part or all of 37 local municipalities and eight counties or regional municipalities (“regions”); the latter are strengthened county-level governments over urban areas where some planning and administrative responsibilities of local municipalities have been delegated to the “upper tier” county level. The two largest communities, both of which “sprawl” over the escarpment in the southern portion of the biosphere reserve, are Hamilton-Dundas (1996 population: 624,360 for the census metropolitan area) and St. Catharines-Niagara (1996 population: 345,223 for the census metropolitan area). Smaller communities along the northern portion of the escarpment are largely rural and seasonal tourist service centres. Communities along the middle portion of the biosphere reserve, influenced by the Greater Toronto Area, serve a substantial rural non-farm population among whom are people with estate homes and/or hobby farms, and village-based businesses catering to arts, crafts, antiques and boutiques.

During the last few years the provincial government has amalgamated and/or re-structured many municipal governments in Ontario, and it is not clear whether this will continue. As of this periodic review, there are now only 21 local municipalities associated with the NEBR, but the geographic extent of the NEBR remains the same. [Please see [Figure 7](#): Municipalities in the Niagara Escarpment Plan Area].

*Indicate ethnic origin and composition, minorities etc., their main economic activities (e.g. pastoralism) and the location of their main areas of concentration, with reference to a map if appropriate.*

Urban populations reflect a multi-cultural range of people whose ethnic origins are mainly from Europe, but also from the Middle East, Latin America, Asia and Africa. Smaller towns are more likely to reflect third or fourth generations of people whose ancestry was British, American or northern European. About 1,000 First Nations people of Odawa/Chippewa heritage live on the Saugeen and Neyaashiinigiing (Cape Croker) Indian Reserves on the Bruce Peninsula.

*Name(s) of nearest major town(s).*

Greater Toronto Area: City of Toronto, four regional municipalities (including Halton Region which is partly within the NEBR) and 24 local municipalities. Population of 5.1 million (1999).

Buffalo/Niagara Frontier Region (USA): City of Buffalo, Niagara and Erie Counties (with the contiguous escarpment cuesta formation crossing it). Population of 1.18 million (2000).

**Cultural significance of the site**

*Briefly describe the Biosphere Reserve's importance in terms of cultural values (religious, historical, political, social, ethnological).*

About 260 archaeological sites are known from the NEBR, but most have not been investigated in detail. These include at least one that dates from the "Paleo-Indian" period over 10,000 years ago. Archaeological work has also documented native occupations of several sites on the escarpment from the 13<sup>th</sup> to 17<sup>th</sup> century; one of these sites has been partly reconstructed at Crawford Lake for public information/education purposes. It is most likely that some sites along the escarpment had religious or spiritual significance for native people; one outlier pinnacle of rock and cave formations near the former native village of Ekarinniondi (now in the Town of Blue Mountains) is known to have been a sacred place.

There are also 546 recognized historical sites and buildings in the biosphere reserve, all relating to earlier European settlement and historical events. Five such sites have been included in the NEPOSS (parks system), including two associated with the war of 1812-1814, and three associated with early agricultural and industrial settlements. The Welland ship canal, as a key link in the Great Lakes-St. Lawrence Seaway, is of considerable recent historical and economic significance. Many of these historic sites have been identified by a series of bronze plaques erected by the NEC.

### **Use of resources by local populations**

#### Uses or activities in the Core Area(s)

Human activities are government mainly by the NEP. Under this Plan the NEC equates “Escarpment Natural Areas” with core areas, along with portions of the two national parks. Escarpment Natural Areas are:

“escarpment features which are in a relatively natural state and associated with stream valleys, wetlands, and forests which are relatively undisturbed ... these contain important plant and animal habitats and geological features and cultural heritage features and are the most significant natural and scenic areas of the escarpment. The policy aims to maintain these natural areas” [NEC Plan, n.d., c 1994:11].

Pre-existing occupancies and land uses within such areas are permitted, but only quite limited kinds of development would be allowed under the development control permit system administered by the Commission.

#### Main land uses and economic activities in the Buffer Zone(s):

The NEC considers “Escarpment Protection Areas” and “Escarpment Rural Areas” to be equivalent to buffer zones. The protection areas:

“are important because of their visual prominence and their environmental significance. They are often more visually prominent than Escarpment Natural Areas. Included in this designation are Escarpment features that have been significantly modified by land-use activities such as agriculture or residential development, land needed to buffer prominent Escarpment Natural Areas, and natural areas of regional significance. The policy aims to maintain the remaining natural features and the open, rural landscape character of the Escarpment and lands in its vicinity” [NEC Plan, n.d. c 1994:12-13].

The rural areas: “are an essential component of the Escarpment corridor, including portions of the Escarpment and lands in its vicinity. They provide a buffer to the more ecologically sensitive areas of the escarpment”. [NEC Plan, n.d. c 1994:15].

A wide range of land occupancies and uses are permitted in these areas, including various commercial uses, recreational uses consistent with existing natural, topographic and landscape features, and a number of pre-existing facilities or uses at particular locations. Development permits are required before other changes can be made.

These core and buffer lands seem also to include most (but perhaps not all) of the 117 sites that presently constitute the NEPOSS; each park site is owned and managed independently by one (and occasionally two or three) of several other agencies. The original intent of the NEP to develop a NEPOSS Manual (“...which sets out minimum standards and general guidelines for all park and open space agencies” to provide a shared image, signage, and policies) has not been realized. The set of sites is linked by the Bruce Trail so that recreational walking can occur somewhere within “nature reserves”, the most protected park category, or zone within a park. Other uses of parks depend on policies and practices of agencies managing the particular sites. Those designated as “resource management areas” for example, permit hunting, fishing, and motorized recreational vehicles, and some of the “conservation areas” maintained by Conservation Authorities provide for multipurpose recreation activities including swimming, fishing, and boating on artificial water impoundments.

Main land uses and major economic activities in the Transition Area(s):

All other NEP zoning categories, i.e. Urban and Minor Urban Areas, Escarpment Recreation Areas, and Mineral Resource Extraction Areas, are included as the transition area / zone of cooperation. Policies that apply to them under the NEP are intended to maintain scenic values of lands within the vicinity of the escarpment and relate to matters such as farm severences, wayside pits and quarries, and to directing growth of urban and small urban centres away from the Escarpment Natural and Escarpment Protection Areas. For the extended zone of cooperation proposed above, land use is governed by regional or county governments and local municipalities; cooperative programs with landowners are conducted by the watershed-based Conservation Authorities.

Possible adverse effects of uses or activities in the transition area(s) and remedial measures taken:

A number of possible developments could have negative impacts, either directly such as expansion of quarrying on the escarpment itself, or indirectly by urban development that could press up to either the rim or the base of the escarpment cliff face, or developments such as towers of various kinds that disrupt "viewsapes". The NEPD Act was a response to evidence that these kinds of impacts were occurring, and the NEC and NEP created under this Act are the responses taken to prevent this from becoming worse. Outside of the NEP area, land use activities are subject to the provincial Planning Act administered by regional or county governments and local municipalities.

If known, give a summary of past/historical land uses(s) of the main parts of the Biosphere Reserve:

The following summary overview is for a period of about 10,000 years, divided into three sections: Pre-European, European contact, and European settlement.

### Pre-European

The region of Ontario within which the NEBR is situated was probably occupied soon after the last de-glaciation some 11 - 10.5 kybp (thousand years before present); the earliest “projectile points” found by archaeologists date from this era. A “late Paleo-Indian Period” (from about 10.5 - 9.5 kybp) was thought to have supported small numbers of people attracted to glacial lake shorelines to hunt caribou in tundra-like conditions. White chert (flint-like quartz) from a source near the Beaver Valley (in the Kolapore Uplands) within the present biosphere reserve was used during this period to make projectile points.

The “Archaic Period” from about 9.5 to about 2.9 kybp has been divided by archaeologists into an early, middle, and late era in part to recognize cultural adaptations among hunter-gatherers as climate changed following the complete disintegration of the Laurentian ice cap. Vegetation (with its associated “game” species) gradually went from tundra conditions through conifer forests, to mixed forests, and eventually deciduous forests in the general region of the biosphere reserve, and all three general forest types continue to exist along a north-south gradation in the NEBR. The indigenous people were thought to have lived in small bands of from 10-50 people who tended to gather around lakeshores and rivers in spring and summer in order to catch fish, then moved inland in small family groups to hunt and trap during the fall and winter. Their gradual adaptations to environmental change are indicated by elaborations in projectile points, various stone tools, the use of copper obtained from sources along Lake Superior (beginning about 5.5 kybp), and in the making of (or acquiring through trade) ornaments found in some more elaborate burial complexes towards the end of this period. Several archaeological sites from this era have been discovered along the NEBR.

The beginning of the “Woodland Period” some 2.9 - 2.8 kybp is marked by the appearance of pottery, and during the succeeding centuries, pottery, tool inventories, and burial sites became more elaborate. In the southern part of the region, horticulture/agriculture appeared with the introduction of maize (perhaps as early as 1,350 ybp), that was supplemented by the gathering of wild nut crops (acorns, walnuts, chestnuts) and then by the introduction of beans, squash and some tobacco; bows and arrows replaced spears as hunting weapons at about the same time. Settlements gradually became larger, and served as a year-round base of operations for some

people. By about 1,500 ybp, they were characterized by multi-family “long houses” inside an area surrounded by multiple rows of palisades that suggested a need for defences against raids or warfare.

There has been considerable discussion over the extent to which these developments came about from the slow migration of people into the region, from displacements of earlier inhabitants through warfare and occupation, and/or from the diffusions of artifacts and other cultural influences into the region through relatively long-distance trade linkages with other regions. Trade was thought to have been very extensive between about 2,200 - 1,800 ybp. By the “Middle Woodlands Period” (2,400 to 1,400 ybp) two distinct linguistic groups of indigenous peoples occupied the region. Iroquoian groups appeared to expand both east and west from origins in the Niagara area (within what is now Ontario) but they also had historical connections with related language groups to the south and east of the lower Great Lakes. Algonquian groups occupied regions to the east, north and west of the Great Lakes, and included the Odawa (Ottawa) people on the Bruce (Saugeen) Peninsula within the current biosphere reserve. Isolated campsites of the Early Woodlands people have been discovered at four areas on the escarpment from Niagara to Halton, sites from the Middle Woodlands period are concentrated in the northern portion of the NEBR, and several Late (Terminal) Woodland sites (1,500-450 ybp) have been identified from Hamilton north to the Bruce Peninsula.

An “Ontario Iroquoian Tradition” is believed to have started about 1,100 ybp with the appearance of small villages seasonally occupied over a number of years, and an increasing reliance upon maize and other crops supplemented by seasonal hunting and fishing. The historically known tribes are thought to have emerged by about 600 ybp. They included the “Neutrals” (or Attiwandaron) occupying areas overlapping the southern part of the present biosphere reserve, and the Hurons (or Wyandots) occupying areas to the north and east immediately south of Georgian Bay. The Hurons had formed a Confederacy among four groups of people by about the year 1,560, including a group known as the Petuns (or Tionontati) who had small settlements on or near the escarpment in the Blue Mountains area. A number of Neutral/Huron archaeological sites have been discovered in or near the NEBR, and one has been reconstructed for public education purposes at Crawford Lake, a site inhabited by

Iroquoians during three distinct periods between AD 1,250 and 1,650. The Bruce Peninsula itself remained occupied by the Odawa (also known now as the Saugeen or Chippewas) an Ojibwa (or Anishnawbe) people who are descendents of Algonquian linguist groups.

### European Contact.

French explorers, traders and missionaries were the first Europeans to develop alliances with indigenous peoples in the region of the biosphere reserve, beginning early in the 17th century. Samuel de Champlain visited Georgian Bay in 1616, and encountered a native encampment at a site near to the present-day Owen Sound. The French pursued exploration and the fur trade from what is now Montreal up the Ottawa River and across into the Great Lakes through the French River, trading with the Hurons and in part through them, with various Algonquian groups. There were also some briefer contacts made with the Neutrals in the Niagara Peninsula region. This trade was in competition with that of the British and Dutch to the south and east of the Great Lakes which was carried out through alliances with Iroquois groups who had formed a five nation Confederacy (the Haudenosaunee). This competition included mutual raids and attacks which grew in number and intensity especially after about 1615.

European contact and trade brought firearms, better quality tools (e.g. axes, knives, and brass kettles), infectious diseases such as small pox, influenza and measles, and alcohol along with it. As the fur trade declined in the area south of the St. Lawrence and Lake Ontario, Iroquois raids extended further into the region of Ontario associated with the current biosphere reserve. As a result, the Huron settlements east of the escarpment, which peaked in the 1630s with about 20,000 people living in 18-25 palisaded villages, were destroyed by 1649 through a combination of warfare, disease, dispersal of people further to the west, or assimilation of survivors into other native groups. The main Petun settlements along the escarpment were destroyed in 1640 and most survivors moved west, while the Neutrals main villages through the southern part of the region were all destroyed by 1650.

As the fur trade continued to move through the upper Great Lakes and further west, the “de-populated” region of Ontario began to become re-occupied by various

Ojibwa groups who moved in from the northeast or west between 1690 and 1710. The increasingly long-distance raids mounted by the Iroquois from south of the Lakes into what is now Michigan and elsewhere to the west became less effective, and French-backed counter-offensives resulted in the Mississaugas (an Ojibwa group) also coming into southern Ontario along Lakes Erie and Ontario where they settled in by 1696.

In 1701, a major peace treaty was concluded in Montreal by the French with 32 native groups from both the Iroquoian and Algonquian regions through the Great Lakes Basin and somewhat beyond. Under this treaty, the Iroquoian groups ceded southern Ontario, and the Mississaugas then rapidly occupied the area. For much of the first half of the 18th century there was a continual contest between the French and British over control of lands and the fur trade, and this moved through the regions to the west and south of the Great Lakes as an integral part of a much larger struggle between France and Britain in Europe and elsewhere. It appears that the area of the NEBR was not directly affected by these events, and trade relations between the native people and the French carried on under the lasting terms of the 1701 treaty.

### European Settlement

The situation began to change when the Seven Year's War in Europe (1756-1763) led to intensified warfare on the colonial frontier of North America. After the French defeat in Quebec in 1760, the British took control of defense posts, settlements and trade under the terms of the 1763 Treaty of Paris. In 1776, the American colonies declared their independence from Britain, and effectively gained it by 1781. Another Treaty of Paris in 1783 defined what is now the United States - Canada border, and subsequent agreements led to the withdrawal of all British garrisons from the US by 1796. It also led to a substantial number of "United Empire Loyalists - American Tories" seeking refuge, beginning soon after 1776. The first influx of people from the United States settled in what is now Niagara, Queenston, and St. Catharines, and by 1784, in the Hamilton area (all in or near the present biosphere reserve). Most brought with them some equipment and farming practices used in the former American colonies, and forests were quickly cleared.

A Royal Proclamation in 1763 had recognized native peoples' possession of lands they occupied under British sovereignty, hence land cessions had to be negotiated through the auspices of the Crown before settler occupation could legally occur. Two Treaties were negotiated by the British with the "Mississaugas and Chippewas" in 1781 and 1792 that effectively ceded lands along the north shore of the lower Great Lakes including the Niagara Peninsula through to Hamilton. Upper Canada (now southern Ontario) was brought into existence by the British under the Constitution Act of 1791, and the entire Upper Canada was divided into 19 counties in 1792.

The British-American War of 1812-1814, triggered by British harassment of American merchant ships on the Atlantic, was carried on in a number of arenas, including a substantial Indian uprising against the Americans in reaction to the continuing seizure and occupation of Indian lands in the region between the Alleghenies and the Mississippi. Two main skirmishes were fought within the area of the NEBR, one to repulse a major American invasion at Queenston in October 1812, and another to repulse a raid at Stoney Creek (now part of Hamilton) in June 1813. This war was officially ended by ratification of the Treaty of Ghent in 1815.

Immediately following this period, the British embarked on a major drive to settle Upper Canada with immigrants largely from Britain. Two Treaties with the "Chippewas" in 1818 ceded lands covering the escarpment area from Hamilton north to about Georgian Bay, and another one signed in 1836 reserved the Bruce (Saugeen) Peninsula for the Chippewas providing those who lived south of there moved to the peninsula or Manitoulin Island. As European settlement continued, two Treaties in 1854 and 1857 surrendered the Bruce (Saugeen) Peninsula and created the Indian Reserves currently occupied by the Saugeen and Nawash Ojibwas/Chippewas today. (In 1994, they launched a lawsuit against Canada and Ontario seeking major compensation for an alleged breach of fiduciary obligations under the Treaty of 1854; this matter remains unresolved as of 2002).

British policy was to provide land grants to retired military veterans (with the size of the land grants depending upon rank) and to the United Empire Loyalists, in lieu of pensions or compensation. The government of Upper Canada also awarded land grants to themselves, and to surveyors or other contractors in lieu of salary or contract

payments. Lands granted to settlers had conditions attached for land and road front clearances. Generally, European settlement in and around most of the present biosphere reserve occurred over a relatively short period of less than 50 years, moving generally from the southern parts of the biosphere reserve area to the north. Land surveyors laid out the concession lines and lots in regular rectangular patterns for each township, forests were cleared, roads were constructed, and farms and rural settlements were established. Around some areas of the escarpment (e.g Collingwood) land grants were more often sold rather than settled and led to delays of up to 20 years or more between the original land surveys and land “alienation” from the Crown, the subsequent purchase of the lands from grantees or land dealers, and their conversion into farm settlements.

Railroads were constructed starting in the 1850s, notably the Grand Trunk Railway and the Great Western Railroad. In Mono Township (Dufferin County) for example, settlers first arrived in the 1820s and more than 80% of the forests were cleared by 1885 (and more still in succeeding decades). Not all of the soils were suitable for agriculture and considerable soil erosion and loss of organic content quickly followed. To the north in Bruce County, the government opened the first colonization road to Lake Huron in 1848, a railroad reached Southampton in 1871 and most of the southern part of the county was settled by 1881. The pace of settlement depended considerably on the development of road and rail transportation and in some areas this was impeded by the escarpment formation.

Escarpment waterfalls provided locations for earlier settlements around grist mills and sawmills. Some thrived during the 19th century as other facilities were built such as small paper mills, tanneries, blacksmith shops, brick kilns, card clothing factories, dyeing works, distilleries, cooperage works, general stores and inns. As some local prosperity grew, especially along the southern portion of the escarpment area, some people tried to recreate a local aristocracy in Upper Canada and had elaborate homes constructed, often by Scottish masons using escarpment building stone and local bricks. Some still remain as local historical sites. Besides the railroads, the largest infrastructure project was the building of the 43 km first Welland Canal between Lake Ontario and Lake Erie (to by-pass Niagara Falls, and also traverse the escarpment) which was completed in 1829.

Industrialization continued into the 20th century with the invention of hydro-electric energy production and transmission beginning at Niagara Falls in the early 1900s. The St. Catharines and Hamilton regions grew into major industrial centres which eventually became part of a lower Great Lakes “industrial heartland” for North America with a bi-national integrated economy in many sectors. The pace and form of this development was influenced strongly by the general prosperity of the 1920s, the economic depression of the 1930s, the industrial expansion occasioned by World War 2, the post-war expansion of consumer goods from the late 1940s to about 1970, the period of “stagflation” and “de-industrialization” of old heavy industries and manufacturing in the Great Lakes Basin during the 1970s and 1980s and subsequent recovery through “knowledge-based” businesses since then.

The southern portion of the biosphere reserve is now largely within a sprawling area of urban-industrial development. The soils and micro-climate between the escarpment and Lake Ontario were particularly suited for orchards and vineyards; although much of this has been lost to urbanization and a major transportation corridor, a thriving wine industry has developed in recent years, serving both domestic and international markets. Much of the rest of the escarpment area has been influenced by the growth of the Greater Toronto Area which extends west to include the Halton Region (within the biosphere reserve) and is characterized by the acquisition of estate homes, hobby farms and recreational properties, in part to enjoy the rural scenery associated with the escarpment. Quarries on or near the escarpment have been a source of much of the building materials used for this growth, and the resulting conflict in land use values helped lead to the NEPD Act, the NEC and the NEP. Along the northern portion of the escarpment, the agricultural sector has stabilized or declined, and the economic base of local communities is increasingly dependent on recreational and seasonal tourism.

## **Tourism**

*If tourism is a major activity, how many visitors come to the Biosphere Reserve each year?*

Extensive tourism is associated with the NEBR. Some tourism is focused directly on escarpment lands, such as walking the Bruce Trail system, visiting various of the 117 parks in the NEPOSS, or using downhill skiing facilities developed on the slopes of the escarpment. Some destination inns and conference facilities (including ski resorts) have been built in the more attractive landscapes of the escarpment, such as Hockley Valley, Beaver Valley and the Blue Mountains. There is a wide range of multiple purpose tourism operations that include stops at sites within the NEBR, and a large number of organized or self-directed excursions that are routed to or through scenic areas associated with the escarpment formation. These are fostered by a number of tourism associations and private sector tour operators, some of whom make reference to the biosphere reserve designation to give added interest. Bed and breakfast establishments are fairly common now.

The NEC promotes the NEPOSS on its website and through a series of colourful and informative brochures that highlight nature-based touring along different sections of the escarpment (i.e. Bruce Peninsula, Northern Grey County, Southern Grey County, Simcoe/Dufferin, Peel/North Halton, and the Niagara Region). Up-dates of these materials are now being prepared in collaboration with other groups, for example, the new “Niagara Region Explorer” (which advertises the NEBR designation) was prepared through a partnership with the Niagara Economic and Tourism Corporation and the Wine Council of Ontario.

The NEC has also become more active in fostering eco-tourism, in part as a participant in the Canadian Biosphere Reserve Association’s (CBRA/ACRB) Tourism Project being carried out under the auspices of the Canadian Tourism Commission. The NEC hosted an environmental tourism workshop in October 1999, produced a framework for a sustainable tourism pilot project in the Niagara region, recruited a tourism and communications specialist to increase NEC’s capacity to work in this area, and launched the Travel Links service on the NEC website. The links service provides background information about the escarpment lands within eight travel regions in the NEBR, and in turn links to 24 local tourism websites in the NEBR area and to about 40 other tourism websites that are associated with tourism in this general region of Ontario.

Recently, initiatives were taken by the Coalition on the Niagara Escarpment (CONE) to erect signs on regional and county roads to inform people they were entering a biosphere reserve; 14 signs with the message “Welcome to the Niagara Escarpment, a World Biosphere Reserve” were erected in Dufferin County with due local ceremony in 2000. Another eight were erected in the Town of Caledon (Regional Municipality of Peel) in 2001 and in the Regional Municipality of Halton in 2002; it is planned to erect more along the entire extent of the NEBR by 2006. CONE has also prepared an informative and colourful brochure about the NEBR and has distributed them through service stations, convenience stores, restaurants and other outlets near the escarpment to tie in with the nearby road signs. CONE also seeks community involvement and support for maintaining the road signs and other communication activities.

In addition, the Milton Chamber of Commerce in cooperation with the provincial Ministry of Transportation has placed “Escarpment Country” signs on a major expressway (Highway #401) crossing the Biosphere Reserve and on several local roads in an effort to further develop the “Escarpment” tourism brand. Other tourism bodies at the local or county level also promote various activities and services, including many that are associated with escarpment lands in their jurisdictions. Conservation Authorities, Parks Ontario and Parks Canada actively promote their parks through WEB sites, literature and other media including television and radio.

There is no readily available information about how many people visit the NEBR. The wine tourism associated with 60 wineries in the Niagara region is estimated to draw about 450,000 visitors annually. The Bruce Peninsula and Fathom Five Marine National Parks currently receive 350,000 tourists/year (all tourists visiting the Upper Bruce). Some 45,000 visitors use the day use facilities at Cyprus Lake and the adjacent Georgian Bay shoreline, and 10,000 individuals use the Bruce Trail within the Park. The main Cyprus Lake campground has 60,000 user-nights per year. One estimate suggests that the Bruce Trail attracts some 500,000 hikers per year.

*Type(s) of touristic activities (study of fauna and flora, recreation, camping, hiking, sailing, horseriding, fishing, hunting...).*

All of the above as well as boating (various kinds), cycling, mountain biking, golf, swimming, scuba diving, cross-country and downhill skiing, snowshoeing and snowmobiling. The general impression is that the “four seasons” recreational tourism activities have been increasing over the past decade, but no specific data were found to confirm this.

*Tourist facilities and description of where these are located.*

Full scale tourism facilities are widely available in cities, towns and destination sites along the escarpment. A number of the 117 parks have camping and associated outdoor recreation facilities.

### **Income and benefits to local communities**

*Indicate for the activities described above whether the local communities derive any income directly or indirectly and through what mechanism.*

Much of the tourism draws upon services provided by communities in or near the NEBR, but there are no readily available data on economic impacts. A preliminary survey conducted in the summer of 1994 for portions of the Bruce Trail indicated that an estimated 21,700 users (during the period and places of study) spent about \$20 each locally. One estimate places tourism expenditures associated with the NEPOSS and Bruce Trail in the order of \$100 million annually.

## **VI. RESEARCH AND MONITORING PROGRAMMES**

*Brief description and list of past research and/or monitoring activities.*

Considerable work has been carried out over the years on the geology, archaeology, natural history, and local settlement history of the NEBR. Some of the main thrusts of this work are noted below in alphabetical order of sub-headings (and not by some implied judgement of relative importance). Support for this work has come from a

number of sources, including \$667,000 from the Niagara Escarpment Fund (administered by the Ontario Heritage Foundation) over a 10 year period (1985-1995) for 41 research projects, based on individual applications to this fund. A number of these projects supported escarpment-related work by graduate students in various Ontario universities. In recent years, the NEBR has participated in collaborative projects sponsored by the CBRA/ACRB for studies in land use change, climate trends, ecological restoration projects, and eco-tourism.

### *Archaeology*

The Crawford Lake Archaeological Research Program began in 1973 after corn pollen found in bottom cores taken from Crawford Lake in 1971 suggested that Iroquoian native horticulture was practiced nearby from c 1,300 to 1,650 A.D. Subsequent work over about a 15 year period by a number of people mainly associated with the London Museum of Archaeology affiliated with the University of Western Ontario [[www.uwo.ca/museum](http://www.uwo.ca/museum)], has uncovered evidence of four villages in the immediate area, one of which has been partly re-constructed for public information and education purposes. Similar pollen records have been obtained from two other lakes on the escarpment in the Halton Hills Region. The Program has also documented over 80 Iroquoian sites in the escarpment area, and 32 village sites have been “test-excavated”. More than 200,000 artifacts or other items have been recovered, making this one of the largest samples for any region of Iroquoia. Another private collection of Neutral Indian artifacts collected in the Ancaster (Hamilton) area over the years has been deposited with the Woodland Indian Cultural Education Centre, in Brantford, Ontario.

### *Biological inventories*

Detailed field inventories have been made for 107 sites within the Escarpment Plan Area that have been designated by the Ontario Ministry of Natural Resources as “areas of natural and scientific interest” (ANSIs) because of their biotic and/or geomorphological attributes (Riley and others 1996). This inventory identified 101 “general vegetation community types” of which 58 were deemed to be of special conservation concern, and about 2,100 “specific community types” or species associations defined through detailed mapping of vegetation plots.

The inventory and plot surveys by Riley and others (1996) identified 1,177 native species of vascular plants (which constitute 64% of the native flora of Ontario) as well as 378 non-native species, and an estimated 288 species of mosses and liverworts. Altogether, 325 species of birds have been recorded, of which 193 are breeding or summering species. Cabot Head (on the Bruce Peninsula) has been identified as an “Important Bird Area” of continental significance by Bird Life International because of concentrations of migrating birds. Also recorded from the NEBR are 49 species of native and three non-native mammals; 91 species of native fish and 10 non-native species; 39 native species and one non-native species of reptiles and amphibians; and an estimated 98 species of butterflies. Biological inventory information has also been compiled for particular sites owned by Parks Canada, Ontario Parks, Conservation Authorities, and the Bruce Trail Association.

### *Cliff ecology*

The “Cliff Ecology Research Group” was created in the Department of Botany of the University of Guelph in 1985. It has undertaken a wide range of research within the NEBR on topics at quite different spatial and temporal scales relating to the physiology, population dynamics and community ecology of the stunted old-growth forest of eastern white cedars that occur on the rim, cliff face and talus slopes of the escarpment. The group has been able to develop a 2,878 year dendrochronology sequence for these trees which could help paleoenvironmental research. They also discovered the existence of the cryptoendolithic micro-organisms on the escarpment and have studied a number of topics associated with them. [For a discussion of this work, set in a global context of cliff ecology, see Larson and others 2000, and [www.uoguelph.ca/botany/cerg/index.html](http://www.uoguelph.ca/botany/cerg/index.html)].

### *Cumulative effects monitoring*

Soon after the Ontario Ministry of the Environment was assigned (in 1990) to be the lead agency to which NEC reported, it initiated the development of an escarpment monitoring program through studies and consultations with a number of agencies and interest groups. A cumulative effects monitoring framework, drawing heavily upon the Great Lakes monitoring experience, was agreed upon, and keyed to the particular goals and specific objectives of the Niagara Escarpment Plan. This was launched in 1995 as the Ontario Niagara Escarpment (ONE) Monitoring Program, but implementation of it

was soon crippled by a severe reduction in budget and staff imposed on the Ministry and the NEC by the provincial government. Some aspects of ONE have been explored through project funding from various sources and some volunteer monitoring activities. Partnerships have been formed with the Ecological Monitoring and Assessment Network (EMAN) Coordinating Office in Environment Canada to continue to establish and maintain forest diversity (SI/MAB) plots, with Natural Resources Canada for monitoring tree health, and the Canadian Wildlife Service for monitoring breeding birds.

Monitoring is also linked to school programs through the Association of Canadian Educational Resources (ACER), an organization founded in 1987 to develop materials for life-long learning. In 1997, ACER became a partner with the NEC, EMAN, and the Ministry of the Environment to organize paired SI/MAB plots at three outdoor centres along the escarpment, one for teaching and educational purposes and the other for research. [Please see [Figure 8](#): Location of SI/MAB Forest Biodiversity Plots in the NEBR].

National Parks have a statutory requirement to restore and maintain the “ecological integrity” of parks, and Bruce Peninsula and Fathom Five National Marine Parks have developed monitoring protocols for integrity which are also based on cumulative effects monitoring. Ontario Parks is currently exploring similar approaches (which would be applied to their escarpment parks), so the possibility of some shared cumulative effects monitoring being implemented throughout the NEBR under cooperative arrangements is improving.

### *Fisheries*

Faculty and graduate students associated with the Axelrod Institute of Ichthyology established in 1990 at the University of Guelph have been engaged in limnological and fish biology research around the Bruce Peninsula in cooperation with Chippewas of Nawash First Nation. Much of the current work is directed to factors associated with the life history and ecology of lake whitefish [[www.axelfish.uoguelph.ca](http://www.axelfish.uoguelph.ca)].

Habitat protection and restoration work to enhance the sports fishery have been carried out in watersheds associated with the NEBR, notably for the Credit River, and some areas of the Nottawasaga River system.

### *Policy analyses*

The NEC has undertaken specific research in support of policy development associated with the 1990 and 2000 Niagara Escarpment Plan Five Year Reviews, as well as specific policy issues that have arisen between five year reviews. The following is a listing of the policy research undertaken for the two five year reviews.

#### 1990 Niagara Escarpment Plan Five Year Review Policy Research Papers:

1. Municipal Official Plans
2. Density Approach
3. Retirement Lot Policy
4. Second Dwellings
5. New Lots for Agricultural Purposes
6. Infilling
7. Re-creation of Original Township Lots (for issues associated with land severances)
8. Food Land Guidelines
9. Plans of Subdivision
10. Minor Urban Centres
11. Mineral Resource Extraction
12. Commercial Development
13. Parks System
14. Heritage Resources
15. Ponds
16. Contour Changes
17. Provincial Policy Statements
18. Escarpment Link
19. Kolapore Highlands

#### 2000 Niagara Escarpment Plan Five Year Review Policy Research Papers:

[[www.escarpment.org/plan\\_review.htm](http://www.escarpment.org/plan_review.htm)]

1. Estate Wineries
2. Rural Tourism
3. Signage Policies
4. Environmental Monitoring
5. Intensive Recreational Development in Escarpment Parks
6. The Status of Land Trusts

Policy-related work associated with the Niagara Escarpment has also been carried out at the Heritage Resources Centre, University of Waterloo. One study was a review and critique of the Niagara Escarpment Plan Review process (1991) and another examined the implications of adopting a “greater ecosystem” perspective for the Bruce Peninsula and Fathom Five National Marine Parks (1997).  
[[www.fes.uwaterloo.ca/research/hrc/hrcbody.htm](http://www.fes.uwaterloo.ca/research/hrc/hrcbody.htm)]

*Brief description of on-going research and/or monitoring activities.*

The “Leading Edge” Conference Series was established by NEC to provide a forum for researchers, policy makers, academics, consultants and the public to share their work on the Niagara Escarpment. The Table below tallies the main conference papers by broad topic area and provides a good indication of where research and related interests are being directed to the Escarpment.

<b>Topic</b>	1994	1995	1997	1999	2001
Biota surveys/birds	4	1	4	5	5
Cliff ecology	8	2	-	4	6
Community involvement	2	1	6	4	6
Geology & geomorphology	5	4	3	1	2
Monitoring	3	2	6	5	11
National parks	4	1	7	1	7
Planning & sustainability	8	12	9	9	19
Restoration projects	-	1	1	4	6
Tourism	1	-	1	3	4

Monitoring appears to have gained in popularity as a topic of research since the NEC and others have placed more priority on monitoring, and as results have become available for analysis and reporting. Earlier conferences appear to have received more papers on geology/geomorphology; however, every conference has had at least one paper on this topic. The most popular theme in all years has been the environmental planning and sustainability theme. Tourism appears to be increasing in popularity while research on parks, birds and the cliffs of the Niagara Escarpment continue to remain of interest.

The items listed below (from Leading Edge conference papers) are examples of recent or current work; they are not listed in some presumed order of importance.

### Abiotic research and monitoring

Georgian Bay cobble beach ridges along the Niagara Escarpment.

Pre-history drainage across the submerged Niagara Escarpment in the Upper Bruce Peninsula Ecosystem.

3-D Underwater Mapping: The Submerged Niagara Escarpment of Fathom Five National Marine Park in a New Light, Georgian Bay, Lake Huron.

Landform assemblages along the Niagara Escarpment: Stoney Creek to Queenston.

Process and biophysical change on the face of the Niagara Escarpment.

The role of gravitational creep and spreading in the evolution of escarpment landforms.

Dating the frequency of surface processes on the Niagara Escarpment.

Geomorphological research on the northern Bruce Peninsula and Tobermory Islands.

Groundwater impacts associated with limestone quarries on the Niagara Escarpment in the Niagara Peninsula.

Groundwater movement in buried valley aquifers linked across the escarpment in the Halton Region.

Fossil pollen analyses of two escarpment swamps.

### Biotic research and monitoring

The forest bird monitoring program on the Niagara Escarpment.

Distribution of *Ambystomatid* salamanders along the Niagara Escarpment.

Endolithic algae as a component of limestone cliffs of the Niagara Escarpment.

Seed rain, seed bank and seedling establishment on cliff faces of the Niagara Escarpment.

Role of disturbance in Niagara Escarpment land systems.

Population size, genetics, movement and habitat requirements of black bears on the Bruce Peninsula.

Management of the Eastern Massasauga Rattlesnake within the Bruce Peninsula National Park.

Seasonal patterns of birds in forests of the central Niagara Escarpment.

Terrestrial and amphibious gastropods of the Alvar Arc (includes the NEBR).

The effect of regional landscape patterns and forest fragmentation on woodland biodiversity along the southern portion of the Niagara Escarpment.

### Socio-economic research and monitoring

The significance of the Niagara Escarpment in early Paleo-Indian land use and subsistence during the late Pleistocene.

Development of a cultural landscape assessment method for the Niagara Escarpment Plan Area.

The northern Niagara Escarpment cultural landscape.

Archaeological research in the Crawford Lake area of the Niagara Escarpment.

War and peace among Iroquois of the Crawford Lake area, AD 1000-1651.

The human dimensions of ecosystem management: research and application at Bruce Peninsula National Park and Fathom Five National Marine Park.

Designing a “Master Steward” Program for Niagara Escarpment landowners.

Encouraging environmental care: A code of ethics for Short Hills Park.

*Estimated number of national scientists participating in research within the Biosphere Reserve on a permanent or occasional basis.*

The *estimated* number is in the order of 50.

*Estimated number of foreign scientists participating in research within the Biosphere Reserve on a permanent or occasional basis.*

Difficult to gauge, possibly 3-5 individuals.

*Research station(s) within the Biosphere Reserve.*

From north to south:

Both National Parks in the Bruce Peninsula can be viewed as field research operations (Parks Canada spends approximately \$300-500k annually on research and monitoring); the Emmett Lake Research Station which is administered by the Bruce Peninsula National Park has accommodation for 8-12 people, computer support, one

SI/MAB plot, numerous 20m X 20m monitoring plots and two climate stations within the park.

Cabot Head Research Station: maintained by The Friends of Cabot Head and Ontario Parks, mainly for bird studies. A Bruce Peninsula Bird Observatory was established at Cabot Head in 1996 to carry out hawk banding (ringing) projects, and it was incorporated as a member-based charitable non-profit organization in 2000 to undertake migration monitoring and banding for all land birds in accordance with protocols used by the Canadian Migration Monitoring Network of Bird Studies Canada.

The Royal Botanical Gardens (RBG) [[www.rbg.ca](http://www.rbg.ca)]: The RBG (in Hamilton) was officially incorporated in 1941 as a separate institution with scientific and education objectives. Gardens were constructed beginning in the 1920s and 1930s in 800 ha of old quarries and gravel pits, with a vision originally inspired by the Kew Gardens in London, England. RBG now owns about 1,100 ha of properties (including a four kilometre section along the Niagara Escarpment, ravines, Carolinian forest, old meadows and wetlands) with some 30 km of walking trails. There are about 100 ha of formal gardens in five separate areas exhibiting 50 different collections of cultivated plants, and three small nature “sanctuaries” which include some lands within the Niagara Escarpment Plan Area. The RBG Centre is a headquarters with information and visitor services, special collections, and it sponsors a large array of public programs on evenings and weekends. A 800 ha area along the Dundas Marsh (Cootes Paradise) has a nature interpretation centre, an arboretum, and a number of guided or self-guided nature trails, and school programs for pre-school and primary school pupils. RBG also sponsors the Canadian Botanical Conservation Network (established in 1995) to promote habitat protection for plants, and education and conservation programs at botanical gardens and arboreta across Canada.

Brock University [[www.brocku.ca](http://www.brocku.ca)]: The university and its campus lie within the NEBR at St. Catharines, Ontario. The university was established in 1964 and now has six Faculties with an undergraduate enrollment of about 10,000 and a graduate enrollment of about 600 students. The Department of Biological Sciences and the Centre for the Environment established two SI/MAB plots, one on campus and the other adjacent to Short Hills Provincial Park, and incorporated field work into undergraduate

teaching in ecology. The Centre has also conducted workshops on land stewardship with the Niagara Community Land Stewardship Council.

*Permanent research station(s) outside the Biosphere Reserve.*

Universities which have had individual faculty members or graduate students conducting work in the NEBR in recent years include: Brock University (St. Catharines); McMaster University (Hamilton); Ryerson Polytechnic University (Toronto); Queen's University (Kingston); University of Guelph (Guelph); University of Toronto (Toronto); University of Waterloo (Waterloo); University of Western Ontario (London); and Wilfrid Laurier University (Waterloo). These institutions have multiple laboratory, computer and other facilities. The Cliff Ecology Research Group at the University of Guelph maintains permanent plots on the escarpment lands.

Canada Centre for Inland Waters: 1967, Burlington, Ontario [[www.cciw.ca](http://www.cciw.ca)]. Provides facilities for the National Water Research Institute (Canada's largest freshwater research institute), Fisheries and Oceans Canada (especially for Great Lakes work), and the Ecological Monitoring and Assessment Network (EMAN) that helps coordinate monitoring networks across Canada; EMAN has helped establish and maintain SI/MAB plots in the NEBR, and elsewhere.

Environment Canada, Meteorological Services of Canada, Atmospheric and Climate Science Directorate, [[www.msc-smc.ec.gc.ca/acsd](http://www.msc-smc.ec.gc.ca/acsd)]. Collects data and provides support for atmospheric chemistry and atmospheric depositions measurements through national networks of monitoring sites. Some recent work has used data from SI/MAB biodiversity plots, including those in the NEBR.

*Research facilities of research station(s) (meteorological and/or hydrological station, experimental plots, laboratory, library, vehicles, computers etc...).*

*Other facilities (e.g. facilities for lodging or for overnight accommodation for scientists etc...).*

There is ample accommodation available along the entire area of the NEBR.

**Indicate how the results of research programmes have been taken into account in the management of the biosphere reserve**

The Cliff Ecology Research Group documented the negative effects of climbing on cliff face ecosystems in the Bruce Peninsula National Park, with the result that climbing has been restricted to six established climbing routes to minimize this environmental damage. A collaborative study of the cumulative effects of artificial ponds on stream water quality (comparisons between streams with such ponds and streams without them) in the Credit River system (which flows across the escarpment lands) indicated negative effects from increasing temperatures associated with ponds; modifications of policies within the Niagara Escarpment Plan Area have been suggested.

**VII. EDUCATION, TRAINING AND PUBLIC AWARENESS PROGRAMMES**

**Describe the types of activities related to**

Environmental education and public awareness:

Numerous agencies, groups and schools are involved in environmental education and public awareness activities focused on the Niagara Escarpment. Printed materials of various kinds are produced by agencies and non-governmental organizations that own or manage lands on the escarpment (Parks Canada, Ontario Parks, Conservation Authorities, the NEC and the Bruce Trail Association), and most maintain websites. Special documentation has also been prepared by various groups, for example, a handbook with stewardship information for escarpment landowners by the Centre for Land and Water Stewardship, University of Guelph (1994), and a Citizen's Guide to Protecting the Niagara Escarpment, by the Coalition on the Niagara Escarpment (1998).

Until 1995, the NEC produced a high-quality annual magazine (*Cuesta*) and was in the process of revitalizing a quarterly newsletter. Staff reductions and budget cutbacks resulted in the cancellation of these publications. The Commission continues to publish a series of 11 tourist brochures (*Niagara Escarpment Explorer*), despite cancelled funding, through funding partnerships with tourism and economic development agencies in the biosphere reserve and with non-government organizations. These brochures each feature an Escarpment region and local parks and points of interest. The latest of these travel brochures, for the southern region of the Escarpment, was produced in conjunction with wineries in the biosphere reserve.

The Commission is also the first point of contact for Escarpment information and answers approximately 500 requests for information per year from the general public, students and teachers. The NEC has developed an education kit for teachers, which includes background materials, role playing exercises and suggestions on how to fit the material into the recently revised provincial public school curriculum. Some of the material will be available as a teaching resource at the NEC's web site.

The NEC operates a comprehensive, up-to-date and growing website ([www.escarpment.org](http://www.escarpment.org)). The NEC has plans to expand the site to include monitoring data and other educational material and to use electronic communications for public outreach. (The site recently proved to be an effective way to quickly share information from the recent Niagara Escarpment Plan Review. Five thousand people downloaded more than 6,500 documents during the review in 2001.)

CONE and the BTA each have longstanding publications, respectively, a quarterly newsletter and a quarterly magazine. Both organizations also operate websites; CONE [[www.interlog.com/~cone/page\\_main.html](http://www.interlog.com/~cone/page_main.html)] and the BTA [[www.brucetrail.org](http://www.brucetrail.org)].

The NEC, in cooperation with other organizations has played a major role for education and awareness by sponsoring the "Leading Edge" Conference series to provide a forum for researchers, policy makers, academics, consultants and the public to share their work on the escarpment, and also network and celebrate the Niagara

Escarpment Biosphere Reserve as one of Ontario's and Canada's most special places.

The themes for the five conferences were:

1994 – A conference linking research, planning and community in the Niagara Escarpment.

1995 – A conference exploring the connections and interrelationships between environment, use and culture in the Niagara Escarpment Biosphere Reserve.

1997 – A conference exploring research, monitoring and community involvement in Ontario's World Biosphere Reserves.

1999 – Making connections: A conference exploring three interrelated Biosphere Reserve themes – Communities in action; research, monitoring and conservation projects; and natural capital.

2001 – Focus on the Biosphere - A conference exploring three interrelated Biosphere Reserve themes – Communities in action; research, monitoring and conservation projects; and natural capital.

The conference has developed over the years to include such special events as Visual Voices, an art show featuring Niagara Escarpment artists and Taste Time, an opportunity for wineries and other agricultural producers to share their product with participants at the conference. The Conferences have also brought together people from other biosphere reserves in Canada and guests from other countries who discuss their work and experience in making the concept of a biosphere reserve work in practice. The conferences attracted over 200 participants on each of the last three occasions.

Other programs or approaches to education and awareness include:

#### NEPOSS Interpretive Centres and Signage.

The Bruce Peninsula and Fathom Five National Marine Parks are developing extensive educational activities both for visitors and for communities associated with the parks. The rationale is:

“Because of Parks Canada's objective to foster environmental advocacy, educational users are a high priority visitor group. Bruce Peninsula National Park provides outstanding on-site experience in environmental education. The three group tenting sites in Cyprus Lake Campground provide opportunities for school and other youth groups, and are heavily used. Currently, there are 5,000 visitors per year in this category, most come during the spring and fall shoulder seasons. Special interpretive programs are available to groups by prior reservation; primarily guided hikes focused on specific themes and resources,

but many teachers also present their own programs. Over 1000 educational users take advantage of these programs annually” (Management Plan, 1998: 40).

The Niagara Escarpment Land Acquisition and Stewardship Fund helped Conservation Authorities in particular to develop information materials including interpretive signage during the period 1985-1995, but some of the print material has either run out or become somewhat dated, and the NEC is seeking the resources for updating and reprinting. Interpretative signage is in some (but not all) of the provincial parks on the escarpment. The NEC has erected bronze plaques at historic sites along the escarpment.

### Outdoor Centres

A number of field centres for outdoor education and/or environmental studies have been built and maintained on or near the escarpment by School Boards or Conservation Authorities. The NEC is trying to compensate by developing a teachers’ kit to be tailored to recent revised public school education requirements. Because of budget cuts during the past decade, some centres have been closed or are being maintained by technical staff in place of professional educators, while others have been scaled back or incorporated into some wider range of information and education activities available on a fee-paying basis. Some of the main programs, from north to south along the escarpment are:

#### *Conservation Nature Tours*

These were developed by the Saugeen Valley and Grey Sauble Conservation Authorities “to provide educationally based nature vacations” with all revenues going directly back into “environmental projects and services”. A wide variety of day-long or multi-day excursions and special workshops are available for a range of age groups, and with different skill requirements, under the direction of 14 instructors. Many trips are associated with the escarpment lands.

*Institute for Outdoor Education and Environmental Studies*, Oliphant, maintained by the Bluewater District School Board.

The Centre is on a 130 ha former farm (away from the escarpment) with seven buildings primarily to serve about 5,000 students annually from the Bruce and Grey Counties schools. It is open for adult workshops and field trips during the summer and on week-ends during the school year. Programs are run in cooperation with the Bruce Peninsula National Park, Ministry of Natural Resources, and two Conservation Authorities (above). About 75 courses are available.

*Residential Outdoor Schools* maintained by the Toronto District School Board.

There are four of these within an area of about 25 km or less from Shelburne, Ontario. Each is on or close to the escarpment but in different headwater tributaries of the Nottawasaga River. The schools were originally built and maintained by different school boards in the Greater Toronto Region prior to an amalgamation.

The *Boyne River Natural Science School*, built by the Toronto Board of Education in 1973, is on 60 ha of land adjacent to Boyne Valley Provincial Park and close to Mono Cliffs and Hockley Valley Parks. This residential school provides instruction for numerous school groups, including all Grade 7 students in the Toronto region who attend the school for one week at different times of the year. The facilities can accommodate 130 students and staff.

The *Mono Cliffs Outdoor Education and Conference Centre* is on the escarpment adjacent to Mono Cliffs Provincial Park, one of the nodal parks in the NEPOSS. It can accommodate groups of up to 80 people and mainly serves students and staff from Toronto region schools. Facilities and some courses/workshops are available to others during non-school periods. (This Centre also advertises the biosphere reserve designation).

The *Noisy River Environmental Education Centre* is on a 40 ha area close by the escarpment and is used in May and June and again in September and October for week-long or weekend visits by Grade 7 students and staff, and secondary school leadership groups. It can accommodate up to 36 people under canvas tents with wooden platforms.

The *Pine River Outdoor Education Centre* sponsors week-long programs for about 1,600 Grade 6 students annually with their teachers; it can host other groups at other times.

#### *Terra Cotta Nature Centre / Centre for Environmental Learning*

This facility was built in the Terra Cotta Conservation Area by the Credit Valley Conservation Authority. Maintenance for the Centre and programs are now operated by two people and their associates from Guelph who offer day programs for school children (Grades 1-6) and nature programs for youth on a fee-for-service basis arranged with individual schools.

#### *Hamilton Region Conservation Authority*

After severe budget cuts in the mid-1990s, the Authority closed its field centres and its entire public education program. It has replaced this with a fee-for-service program that organizes group activities, tours, and catered special events that make use of its conservation lands and other facilities in the Hamilton region.

#### *Environmental, Outdoor Education Programs, City of Hamilton Schools.*

Activities linked to curriculum requirements can be arranged by teachers at 3 day-use “program sites”, including the Outdoor Education Centre in the Christie Conservation Area, formerly operated by the Conservation Authority.

#### *Woodend Environmental Centre and the St. Johns Outdoor Studies Centre. Niagara District School Board.*

The Woodend Centre is an old estate home located in the 45 ha Woodend Conservation Area, and is used by students and staff from schools in the district. The St. Johns Centre is in an old two-room school house adjacent to Shorthills Provincial Park. It hosts about 14,000 students annually from 130 schools for half day or full day visits accompanied by teachers; technical staff and volunteers provide an array of activities keyed to the elementary through to secondary school curricula (ages 5-17).

Two major new initiatives are underway to develop market-oriented public information and education services. Both feature a biosphere reserve theme prominently

(in their design) and they expect to draw upon different tourist markets. One is for a \$4.7 million “Escarpment Centre, Ontario” to be built near Owen Sound within the 215 ha Inglis Falls Conservation Area (a “nodal park” for NEPOSS in the Sydenham Valley) owned by the Grey Sauble Conservation Authority. It is to be a 16,000 ft [1,440m]<sup>2</sup> “hands-on interpretive and research centre” close to Inglis Falls on the escarpment itself. A local group has promoted this project since 1997 and now has a business plan, an interpretive plan, and the architectural designs; a management board was appointed in May 2001 to oversee the construction and management of this facility [[www.escarpmentcentre.org](http://www.escarpmentcentre.org)]. Some 100,000 visitors are expected annually.

The other initiative comes from a non-profit corporation registered as the “Giant’s Rib Discovery Centre” which by 2001 had a \$20 million capital fund-raising campaign underway to create this Centre in a 36 acre (14.7 ha) abandoned quarry by the escarpment at Waterdown (Hamilton). The architectural designs call for a display area of from 1000-2000 m<sup>2</sup> with high-tech interactive exhibits including a simulator of flying up and down the escarpment, and a simulated cave with fossils and hibernating bats. There is to be an 11 m tall tower adjacent to the display area which will house an Imax theatre, administrative offices, a gift shop featuring escarpment specialties, and a restaurant at the top with a commanding view of the escarpment and Burlington Bay/Hamilton Harbour. One wall of this complex will face directly on the quarry to form an escarpment wall. The rest of the site will have constructed wetlands (that will also treat stormwater) and a small forest. The Centre is billed as the “gateway to the Niagara escarpment, a world biosphere reserve”, and is to be marketed as one tourist site among a number in the region, including the Royal Botanical Gardens and the Crawford Lake Indian Village, both of which are closely linked to the escarpment and the NEBR [[www.mgp.ca/profile/giantsrib.htm](http://www.mgp.ca/profile/giantsrib.htm)]. Some 200,000 visitors annually are expected.

### Demonstration Projects and Stewardship Programs

Besides the fish habitat improvement projects noted for some of the watersheds associated with escarpment, there are several other habitat restoration projects underway in the NEBR area, including:

Rehabilitation of Dufferin Aggregates Quarry: This 467 ha site along the escarpment is undergoing a progressive rehabilitation after the extraction of high quality aggregate materials. The long-term plan calls for 271 ha of lakes, 14 km of shorelines, and 13 km of cliff face. Some 40 guided tours a year are given to those interested in this restoration program.

Restoration of oak-savanna ecosystems in the Dundas Valley. This is a collaborative endeavour for nine sites totalling 32.2 ha. Two are being restored through replanting of native species, and seven other remnant sites are being enlarged through plantings to increase forest interior habitats.

Experimental restoration of disturbed cliff edges. This project in Bruce Peninsula National Park is conducting comparative tests on the survival of white cedar seeds and different age seedlings in cliff edge areas on sites subject to trampling vs ones that are not.

The NEC established a “Development Achievement Awards” program in 1988 which “honours landowners for excellence in design, construction and landscaping of development projects in the Niagara Escarpment Plan area”. About 10-12 of these awards have been issued annually in recent years, with the general expectation that they help encourage high standards for new development projects. Private land stewardship is fostered in several ways, including provincial programs to provide tax reductions for owners of woodlands and wetlands meeting certain criteria, and subsidies for small projects such as erosion control, planting vegetation strips along streams, and other habitat restoration measures. Around about 1997, the Ontario Ministry of Natural Resources created county-level “stewardship councils” staffed by (former) district officers with seed funding to foster stewardship by private landowners (and groups such as local woodlot-owners associations), in part through demonstration projects, workshops and the provision of technical information and advice. There are eight stewardship councils covering different sections of the escarpment lands.

Training programmes for specialists:

University-based research programs, such as the Cliff Ecology Research Group, have training as an integral part of the work done with and by graduate students. Since 1996, the University of Waterloo in association with the NEC have run an eight to ten day field course for second year undergraduates to collect data from SI/MAB forest biodiversity plots, using several different protocols; two other universities are interested in doing this as well. Georgian College (Barrie, Ontario) has offered extension courses on “Woodlot Management for Fun, Profit and Reduced Taxes” co-sponsored with the stewardship councils along the northern portion of the escarpment.

**Indicate whether there are facilities for education and training activities, as well as visitors' centres for the public**

These exist, as noted in the summaries above.

**VIII. INSTITUTIONAL ASPECTS**

**State, Province, Region or other administrative units**

*List in hierarchical order administrative entitie(s) in which the Biosphere Reserve is located (e.g. state(s), counties, districts).*

Canada

Parks Canada Agency

Province of Ontario

Ministry of Natural Resources

Niagara Escarpment Commission

Ministry of Environment

Ministry of Municipal Affairs and Housing

Ministry of Agriculture, Food and Rural Affairs

Ontario Heritage Foundation

Grey Sauble Conservation Authority  
 Nottawasaga Valley Conservation Authority  
 Credit Valley Conservation Authority  
 Toronto and Region Conservation Authority  
 Halton Region Conservation Authority  
 Hamilton Region Conservation Authority  
 Niagara Peninsula Conservation Authority

*Municipal governments prior to recent amalgamations or re-structuring.*

Bruce County	<u>1996 Population</u>
St. Edmunds Township	1,007
Lindsay Township	500
Eastnor Township	1,443
Village of Lions Head	550
Albemarle Township	1,217
Amabel Township	3,917
Town of Wiarton	<u>2,400</u>
	11,034
 Grey County	
Keppel Township	2,904
Sarawak Township	2,832
City of Owen Sound	21,390
Derby Township	2,891
Sydenham Township	3,206
St. Vincent Township	2,610
Holland Township	2,904
Euphrasia Township	1,513
Blue Mountains Township	3,904
Artemesia Township	2,881

Osprey Township	<u>2,247</u>
	49,282
Simcoe County	
Clearview Township	12,407
Dufferin County	
Mulmur Township	2,903
Mono Township	<u>6,552</u>
	9,455
Regional Municipality of Peel	
Town of Caledon	39,893
Regional Municipality of Halton	
Town of Halton Hills	42,390
Town of Milton	32,104
City of Burlington	<u>136,975</u>
	211,469
Regional Municipality of Hamilton-Wentworth	
Town of Flamborough	34,037
Town of Ancaster	23,037
Town of Dundas	23,125
City of Hamilton	322,352
City of Stoney Creek	<u>54,318</u>
	456,869
Regional Municipality of Niagara	
Town of Grimsby	27,183
Town of Lincoln	18,801
City of St. Catharines	130,926
Pelham Township	14,343

City of Thorold	17,883
City of Niagara Falls	76,917
Town of Niagara-on-the-Lake	<u>13,238</u>
	299,291

Total 1996 population of local municipalities: 1,089,700

*Municipal governments under the recent/current restructuring (from north to south).*

Bruce County

Municipality of Northern Bruce Peninsula

Town of South Bruce Peninsula

County of Grey

Township of Georgian Bluffs

Municipality of Meaford

Township of Chatsworth

Municipality of Grey Highlands

Town of the Blue Mountains

County of Simcoe

Township of Clearview

County of Dufferin

Town of Mono

Township of Mulmar

Regional Municipality of Peel

Town of Caledon

Reginal Municipality of Halton

Town of Halton Hills

Town of Milton

City of Burlington

City of Hamilton

Regional Municipality of Niagara

Town of Grimsby

Town of Lincoln

City of St. Catharines  
 Town of Pelham  
 City of Thorold  
 City of Niagara Falls  
 Town of Niagara-on-the-Lake

*Community Organizations and Groups in the NEBR Area*

The following groups are active in the NEBR area in matters pertaining to the functions of a biosphere reserve. This list (which may not be complete) is only to exemplify the organizational context within which the biosphere reserve is situated.

Aggregate Producers Association of Ontario  
 Alpine Club of Canada - Toronto Section  
 Bay Area Restoration Council  
 Beaver Valley Heritage Society  
 Belfountain Community Planning Organization

Blue Mountain Watershed Trust  
 Bruce Peninsula Biosphere Association  
 Bruce Peninsula Tourism Association  
 Bruce Trail Association  
 Cabot Head Important Bird Area Steering Committee

Caledon Countryside Alliance  
 Caledon Ratepayers Association  
 Canadian Environmental Law Association  
 Canadian Organic Growers  
 Canadian Peregrine Foundation

Cheltenham Area Residents Association  
 Coalition on the Niagara Escarpment  
 Conserver Society of Hamilton and District Inc.  
 Earthroots  
 Ecological Farmers Association of Ontario

Escarpment Biosphere Conservancy  
 Escarpment Country (Milton)  
 Federation of Ontario Naturalists  
 Friends of the Bruce District Parks Co-Operating Association  
 Friends of Cabot Head

Friends of Fathom Five Park  
 Friends of the Niagara Escarpment  
 Friends of the Red Hill Valley  
 Friends of Short Hills Park  
 Georgian Triangle Anglers Association

Grey Association for Better Planning  
 Grey Association for Democracy and Growth  
 Halton/North Peel Field Naturalists Club  
 Hamilton Halton Watershed Stewardship Program  
 Hamilton Naturalists' Club

Huron Fringe Naturalists Club  
 Niagara Falls Nature Club  
 Niagara Mountain Bike Association  
 Niagara Peninsula Hawkwatch  
 Ontario Federation of Agriculture

Ontario Forestry Association  
 Ontario Marine Heritage Committee (Tobermory)  
 Ontario Property and Environmental Rights Alliance  
 Ontario Streams  
 Owen Sound Field Naturalists

Ontario Underwater Council  
 Peninsula Field Naturalists  
 Preservation of Agricultural Lands Society  
 Preserve Our Water and Environmental Resources - Halton Hills  
 Saugeen Field Naturalists

Save the Oak Ridges Moraine Coalition  
 Senior League Endowment Society of Collingwood  
 Sierra Club - Eastern Canada Chapter  
 Stoney Creek Residents Against Pollution  
 Toronto Caving Group

Upper Bruce Peninsula Sportsmen's Association  
 Upper Credit Field Naturalists  
 Vintners Quality Alliance  
 Wildlands League (Ontario Chapter, Canadian Parks & Wilderness Society)  
 Wine Council of Ontario

## **Management plan/policy**

*Indicate if a management plan or policy exists for the overall biosphere reserve.*

Yes. While there is no separate organizational entity for the NEBR the management plan or policy for the biosphere reserve is constituted by the provincial Niagara Escarpment Plan, complemented by management plans for the Bruce Peninsula National Park and Fathom Five National Marine Park. The Bruce Trail Association also has a plan for the maintenance and management of different sections of the Trail. For the extended zones of cooperation suggested above, the Official

Policies Plans (prepared under the provincial Planning Act) of regions, counties and local municipalities, and watershed plans of Conservation Authorities would apply.

*If yes, briefly describe the main characteristics of this plan and precise the modes of application.*

The Provincial Government's main responsibilities for the Niagara Escarpment are administered through the *Niagara Escarpment Planning and Development Act* (NEPDA), 1973, and the *Niagara Escarpment Plan*, 1985 and subsequent revisions. The purpose of the NEPDA is:

“to provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment, and to ensure only such development occurs as is compatible with that natural environment”.

The objectives of the Act are:

- a. to protect unique ecologic and historic areas;
- b. to maintain and enhance the quality and character of natural streams and water supplies;
- c. to provide adequate opportunities for outdoor recreation;
- d. to maintain and enhance the open landscape character of the Niagara Escarpment in so far as possible, by such means as compatible farming or forestry and by preserving the natural scenery;
- e. to ensure that all new development is compatible with the purpose of this Act as expressed in section 2;
- f. to provide for adequate public access to the Niagara Escarpment; and
- g. to support municipalities within the Niagara Escarpment Planning Area in their exercise of the planning functions conferred upon them by the Planning Act”.

The NEPDA required the preparation of an environmental land use plan and after 12 years of public consultation, plan preparation and hearings, the Niagara Escarpment Plan was adopted in 1985. The Act required the creation of the NEC, a 17 member body of nine people (including its Chair) representing the public-at-large and eight representatives from municipalities in the Plan area. The Act sets out a unique system of development control replacing traditional zoning used in most other parts of the Province. The Niagara Escarpment Plan achieves its conservation mandate mainly through regulation with some public ownership (about 10% of the Plan Area). Regulation takes the form of seven land use designations: natural, protection, rural,

minor urban, recreation, urban and mineral extraction. The plan lists the type and intensity of uses and lot creation permitted in each designation. Detailed criteria determine how a permitted use or lot creation should be carried out. The plan's seven land use designations comprise a hierarchy, with decreasing levels of environmental protection. "Escarpment natural" is the most highly protected, covering the cliff face and including a system of public parks and parts of the Bruce Trail, the longest footpath in Canada. At the other end of the spectrum are "urban" and "mineral resource extraction" areas, which allow optimum production from human-dominated ecosystems. The Niagara Escarpment Parks and Open Space System (NEPOSS) is identified in the NEP as setting "out policies for the park system as a framework for the establishment and coordination of a network of publicly owned lands within the Plan Area. [Please see [Annex 2: Niagara Escarpment Plan and Maps](#)].

The Federal Government's main responsibilities with respect to the NEBR is for the Bruce Peninsula National Park and Fathom Five National Marine Park administered under the National Parks Act by the Parks Canada Agency. Section 8.2 of the Canada National Parks Act (SC 2000 Ch 32) notes that "(m)aintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks" and Section 2.1 states that "'ecological integrity' means, with respect to a park, a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes". The two parks are administered by 25 full time staff and 25 seasonal staff of which 12 person years are dedicated to the Warden Service (for park security, search and rescue, and resource conservation including some research) and two person years to biological/ecological matters. Park administration is guided by two management documents - The Bruce Peninsula National Park Management Plan [Please see [Annex 3](#)] and the Fathom Five National Marine Park Management Plan [Please see [Annex 4](#)]. These are supplemented by an Ecosystem Conservation Plan and the Ecological Integrity Statement (2001) which provides a vision for the year 2020 in the context of the "Upper Bruce Peninsula Ecosystem" extending beyond the immediate park boundaries. The vision includes:

- \* completed land acquisition
- \* self-sustaining populations of lake trout, black bears and rattlesnakes
- \* the park is regarded as an ecological benchmark reflecting broader landscape change within southern Ontario and the Great Lakes.
- \* staff advocate for protection beyond park boundaries increasing awareness and action among other jurisdictions
- \* the visitor center is a regional center for ecological understanding
- \* ecological integrity is the first priority of park management.

The strategy also outlines roles and responsibilities for all staff categories with respect to ecological integrity.

## Bruce Trail

The Bruce Trail Association (BTA) was established in 1967 to develop a public footpath along the Niagara Escarpment and promote protection of the Escarpment and appreciation of its natural beauty. The BTA is a non-profit organization dedicated to the development and maintenance of over 800 km of main trails and an additional 200 km of side trails along the Niagara Escarpment between Niagara Falls and Tobermory, Ontario. Membership includes hikers, naturalists and others from Ontario and elsewhere.

About 46% of the optimum trail route has been secured since the BTA's inception. Eleven properties were purchased during 1999-2000 to secure 10.6 km of optimum trail route and to protect the Niagara Escarpment. Over \$1.4 million has been raised by the BTA so far toward the essential goal of providing a continuous, natural secured path of discovery on the Niagara Escarpment; it is now in the third year of a 15 year campaign to raise \$40m to purchase or otherwise secure all escarpment lands along the optimum route of the trail. The BTA has eight staff and about 700 active volunteers in nine BTA clubs who assume responsible for maintaining different sections of the trail, and carrying out habitat inventory and restoration work.

Authority in charge of administration of the whole, i.e. of implementation of this plan/policy:

### National Parks Agency

Bruce Peninsula National Park and Fathom Five National Marine Park.

## Ministry of Natural Resources

Niagara Escarpment Commission.

### Total number of staff of Biosphere Reserve:

At present, the NEBR has no organizational entity, staff nor budget of its own. Staff from different government agencies and non-governmental organizations carry out work that can be associated with biosphere reserve functions as part of their regular program duties. The NEC, for example, has had about three full-time equivalent staff working on monitoring-related studies, and the BPNP has two field biologists conducting research and monitoring work. Staff from other organizations maintain the NEPOSS and outdoor education programs related to the escarpment. Decisions about the what proportion of staff work (e.g. in communications or interpretive programs) could be attributed to biosphere reserve functions would be quite arbitrary, and is not attempted for this review.

### Financial source(s) and yearly budget:

*Indicate the source and the relative percentage of the funding e.g. from national, regional, local administrations, private funding, international sources etc.) and the estimated yearly budget in the national currency.*

[Please see statement under “staff”, above].

### Authority in charge of administration of each zone:

#### Core area(s):

Parks Canada (part), Ontario Parks (part), Conservation Authorities (part), and private landowners subject to the NE Plan.

#### Buffer zone(s):

[Same as for core areas]

Mechanisms of consultation and coordination among these different authorities:

There is informal communications at the staff level among government agencies and non-governmental organizations, and some collaboration for particular projects.

Where appropriate, National (or Provincial) administrations to which the biosphere reserve reports:

A designated senior staff person from the NEC reports informally to the Canadian Commission for UNESCO through the Chair of Canada/MAB and the Canadian Biosphere Reserves Association / l'Association Canadienne des Reserves de la Biosphere (CBRA/ACRB).

### **Mechanism for consultation of local communities**

*Indicate how and to what extent local people living within or near the Biosphere Reserve.*

Have been associated with the biosphere reserve nomination:

The creation of the Niagara Escarpment Plan required 12 years of consultations and public hearings, and the creation of the two national parks took six years of consultations and negotiations. The NEC is structured to represent the public-at-large and municipalities in the plan area, and it also had a public advisory body at the time. The Commission adopted the view that it, along with three provincial Ministries to which it reported, had sufficient authority to seek a biosphere reserve designation without further public hearings. The national parks involvement was decided by senior officials in Ottawa.

Participate in the decision process and management of resources:

Most of the NEBR is under private ownership, but is subject to restrictions outlined in the Niagara Escarpment Plan. There is an orderly process for seeking development permits or plan amendments where these may be necessary. Collaborative work conducted by the Conservation Authorities, the Stewardship Councils, and other bodies provide opportunities for participation in particular resource management or restoration projects. Non-governmental organizations are increasingly taking initiatives that are supportive of the NEBR designation, notably the Coalition on the Niagara Escarpment, the Bruce Trail Association, and the Escarpment Biosphere Conservancy.

**Indicate whether you consider the participation of local communities to be satisfactory, and, if not, what measures are envisaged to improve this situation.**

There is still a need to develop some organizational capacity for the biosphere reserve that could help it broaden local support for biosphere reserve activities and help incorporate biosphere reserve perspectives into local activities. A community-based biosphere reserve group is forming around the two national parks as one outcome of consultations with an 18 member local advisory committee for developing the park management plans. There is potential for similar groups forming around other sections of the NEBR that could evolve into an organization for the biosphere reserve; there is no single government catalyst for this, and it may well have to come from NGO initiatives.

### **Protection regime of the core area and possibly of the buffer zone**

*Indicate the type (e.g. under national legislation) and date since the legal protection came into being and provide justifying documents...*

Parks Canada Agency Act, SC 1998 C. 31.

Canada National Parks Act, SC 2000 C.32.

Niagara Escarpment Planning and Development Act, RSO, c N2

[Please see [Annex 5](#)]

Conservation Authorities Act, RSO, c. C27.

Provincial Parks Act, RSO 1990, c P 34.

### **Land tenure of each zone**

*Percentage of ownership in terms of national, state/provincial, local government, private, etc...*

Core Area(s): Federal: 24%; Provincial: 10%; Private: 66% (under strict development permit provisions)

Buffer Zone(s): Provincial: ~10%?; Private: ~90% (under development permit provisions)

Transition Area(s): Private: ~100%?

*Foreseen changes in land tenure.*

*Is there a land acquisition programme, to purchase private lands, or plans for privatisation of public lands?*

As noted above (under zoning) some funds for land purchases for park areas are available under the provincial Natural Areas Protection Fund, and 1,492 ha have been acquired since 1998. About 2,200 ha of lands originally set aside in the Parkway Belt West corridor in the Hamilton area in 1978 are slowly being transferred for inclusion under the Niagara Escarpment Plan Area. Easements or other acquisitions are being made by non-governmental groups such as the Bruce Trail Association, the Nature Conservancy of Canada, and the Escarpment Biosphere Conservancy.

## IX. CONCLUSION

### **Brief justification of the way in which the biosphere reserve fulfills each criterion of article 4:**

1. Biosphere reserves should encompass a mosaic of ecological systems representative of major biogeographic regions, including a gradation of human interventions.

The NEBR has a rich mosaic of forest and freshwater aquatic ecosystems, including a portion of the Great Lakes (Georgian Bay), as well as distinctive escarpment rim, cliff-face, and talus slope ecosystems. The forest ecosystems fall within two major ecoregions, recognized by provincial, national and international classifications of physiographic or other ecoregions. Gradation of human interventions range from very little in some areas constituting nature reserves, to major historical modifications of forest ecosystems now being protected to allow natural restoration, through to continuing extractive uses of lands for forest products, building materials (pits and quarries), intensive agriculture and agricultural products (wine), and intensive outdoor recreation activities. Portions of the biosphere reserve are situated in urban industrial landscapes in which the escarpment provides a linear-like open space “green” corridor, often with urban park-like modifications for human uses.

2. Biosphere reserves should be significant for biological diversity conservation.

The diverse terrestrial and aquatic habitat mosaics support a rich flora and fauna including a number of species which are otherwise endangered, threatened, or rare in Canada or the province of Ontario. The Bruce Peninsula is able to support a small, but apparently viable population of black bears *Ursus americanus* which contrasts, symbolically, with the situation in the southern urbanized portion of the biosphere reserve. Forest cover in the northern half of the Escarpment constitutes about 68% of the area included in the Niagara Escarpment Plan; in the south, forest cover is about 45% and is more fragmented. Special habitat types such as karst limestone formations,

calcareous cliffs, talus slopes, limestone pavement formations (alvars), and remnant prairie savannas each have their own quite distinctive biotic communities, and/or species richness for biota such as bats, ferns, orchids, and species of small land snails. Restoration of spent pits and quarries is adding to the diversity of habitat mosaics, and some of these have used considerable creative design; one outstanding example is the Royal Botanical Gardens in Hamilton. The escarpment appears to serve a corridor function for at least some species, notably migrating birds. Some 64% of the known vascular plant flora in Ontario are found in the NEBR.

**3.** Biosphere reserves should provide an opportunity to explore and demonstrate approaches to sustainable development on a regional scale.

Such opportunities have been taken in various ways. The Niagara Escarpment Plan is supportive of local agriculture in the context of maintaining settled rural landscapes, and the Niagara Escarpment Commission has fostered private land stewardship for forests, wetlands, and wildlife through stewardship recognition awards to landowners. Some creative designs for the restoration of pits and quarries to productive “after-uses” are being implemented. In cooperation with Conservation Authorities, measures are also being taken to protect the quality of waters flowing across the escarpment, and of headwater streams originating on the escarpment flowing through larger watersheds off the escarpment. A number of private sector initiatives to promote local tourism draw heavily on the scenic and historical values associated with the escarpment. Habitat restoration measures are also being taken on lands associated with recreational use of the Bruce Trail and on other selected sites.

**4.** Biosphere reserves should have an appropriate size to serve the three functions of biosphere reserves (set out in Article 3).

The 725 km axis of the NEBR gives ample scope for the geological, archaeological, historical and ecological research that has been undertaken over the years. Implementation of a framework for cumulative effects monitoring of the environmental conditions of the escarpment, along with the need to maintain the ecological integrity of the two national parks in the Niagara Escarpment Parks and Open

Space System (NEPOSS), are being done opportunistically through different organizations, and monitoring protocols are being tested in cooperation with the Ecological Monitoring and Assessment Network (EMAN) coordinated through Environment Canada. Public education and information programs for different school and other groups are conducted by school boards, conservation authorities, national and provincial parks in the NEPOSS, and several non-governmental organizations. Demonstration projects to promote good land use were noted above.

**5.** Biosphere reserves should include these functions through appropriate zonation.

The zonation concepts of a biosphere reserve are expressed by the land use designations of the Niagara Escarpment Plan and the management plans for some of the major parks in the NEPOSS. The escarpment Plan has detailed criteria for administering development permits for land or resource use changes under this system. However, the transition area / zone of cooperation should be viewed as including some watersheds associated with the escarpment lands as well as the concept of an "Upper Bruce Peninsula Ecosystem" which is a key one for the national parks.

**6.** Biosphere reserves should have organizational arrangements for the involvement and participation of various authorities and groups in carrying out the functions of biosphere reserves.

These arrangements exist, but without a specific biosphere reserve organization, they have so far developed from initiatives taken by various authorities, groups or individuals. The NEC has helped facilitate coordination in some circumstances, but given severe budget cuts and its pre-occupation with administration of the development permit system, it has let leadership be taken by others when this helps broaden the base for support for the values associated with protecting the escarpment. It also distances these other activities from political disputes which the "top-down" administration of the Niagara Escarpment Plan by the Commission, under the terms of the Niagara Escarpment Planning and Development Act, can evoke. The consultation processes adopted for management planning for the two national parks, in the context of a "greater ecosystem"

philosophy, appear to be leading to the formation of a community-based biosphere reserve ideal in the upper Bruce Peninsula. The potential for extending and strengthening community-based involvement and “ownership” of the biosphere reserve appears to be strong, and needs some catalyst to develop it.

7. Biosphere reserves should have provisions for management of human use and activities in the buffer zones, a management policy or plan for the area of the biosphere reserve, a designated authority or mechanism to implement this policy or plan, and programs for research, monitoring, education and training.

Management of human uses and activities in buffer zones and the area of the biosphere reserve generally are provided for by the policies and land use designations in the Niagara Escarpment Plan, augmented by park plans. Programs of the Conservation Authorities for watersheds having some of their headwater sources associated with the escarpment complement these plans with various landowner programs for soil and water conservation. Research, monitoring and training are increasingly being conducted through partnership arrangements between government and non-government organizations and universities in the general area of the escarpment. Possible linkages to international research programs merit more consideration.

**Does the biosphere reserve have cooperative activities with other biosphere reserves (exchanges of information and personnel, joint programmes, etc...).**

At the national level:

A senior staff person at NEC has represented the NEBR in the Working Group on Biosphere Reserves of Canada/MAB (1990-1996) and the CBRA/ACRB; he currently is Treasurer of the Association. The “Leading Edge” Conferences have provided opportunities for considerable sharing of information and experience. Information is also available at the following websites:

[http://www.thegreenpages.org/cbra-acrb/br-rb/niagara\\_escarpment.asp](http://www.thegreenpages.org/cbra-acrb/br-rb/niagara_escarpment.asp)

<http://www.escarpment.org>

[http://parkscanada.pch.gc.ca/np/np\\_e.htm](http://parkscanada.pch.gc.ca/np/np_e.htm)

Through twinning and/or transboundary biosphere reserves:  
Not applicable so far.

Within the World Network (including Regional Networks):  
A case study on NEBR was presented at the Seville Conference in 1995. A revitalized Canada/MAB would have a major role to play to help bridge gaps between international research and other programs and individual biosphere reserves.

**Obstacles encountered, measures to be taken and, if appropriate, assistance expected from the Secretariat**

[No comments from representatives of major management agencies]

### **List of Figures and Annexes**

- Figure 1: General Location of the Niagara Escarpment Biosphere Reserve
- Figure 2: “The Great Arc”
- Figure 3: Zones for the Niagara Escarpment Plan Area
- Figure 4: Niagara Escarpment Parks
- Figure 5: Watersheds Associated with the Niagara Escarpment
- Figure 6: Conservation Authorities associated with the Niagara Escarpment
- Figure 7: Municipalities in the Niagara Escarpment Plan Area
- Figure 8: Location of SI/MAB monitoring sites in the NEBR
- 
- Annex 1: Endangered, Threatened or Rare Animal and Plant Species [attached]
- Annex 2: The Niagara Escarpment Plan (as amended)
- Annex 3: Bruce Peninsula National Park Management Plan
- Annex 4: Fathom Five National Marine Park Management Plan
- Annex 5: Niagara Escarpment Planning and Development Act (as of January 2001)

### Reference Documents Consulted for the Periodic Review

Beaulieu, Alain, Roland Viau and Francis Back. 2001. *The Great Peace: Chronicle of a Diplomatic Saga*. Montreal: 1701-2001 Corporation des Fetes du Tricentenaire de la Grande Paix de Montreal.

Bruce Peninsula National Park, *Management Plan*. 1998.

Chapman, L.J. and D.F. Putnam. 1984. *The Physiography of Southern Ontario*. Third Edition. Ontario Geological Survey Special Volume 2.

Fathom Five National Marine Park, *Management Plan*. 1998.

Hilts, Stewart, Peter Mitchell and Ann-Ida Beck. 1994. *Caring for Your Land: A Stewardship Handbook for Niagara Escarpment Landowners*. University of Guelph.

Larson, Douglas W., Uta Matthes, and Peter E. Kelly. 2000. *Cliff Ecology: Pattern and Process in Cliff Ecosystems*. Cambridge University Press.

Lawrence, Patrick L. and J. Gordon Nelson. 1997. *Ecosystem Conservation Plans (ECPs) for Bruce Peninsula National Park (BPNP) and Fathom Five National Marine Park (FFNMP): Background Information Study*. Heritage Resources Centre, University of Waterloo.

Niagara Escarpment Commission. *The Final Proposed Plan for the Niagara Escarpment*. June 1983.

Niagara Escarpment Commission. *Renewing the Vision*. Niagara Escarpment Plan Review Hearing. Response to the Hearing Officers' Report. Niagara Escarpment Commission Report. August 1993.

Niagara Escarpment Commission. *Proceedings of Leading Edge Conferences*, 1994, 1995, 1997, and 1999, and *Abstracts* 2001.

Niagara Escarpment Commission. Set of *Plan Review* documents. April 2001.

Niagara Escarpment Hearing Office. *Niagara Escarpment Plan Review Hearing - Recommendations of the Hearing Officers*. Toronto. October 15, 2001.

Pim, Linda, Richard Lindgren and Ian Attridge. 1998. *Protecting the Niagara Escarpment: A Citizen's Guide*. Coalition on the Niagara Escarpment.

*Regional Planning in Ontario: The Niagara Escarpment*. Ontario Ministry of Treasury, Economics and Intergovernmental Affairs. May 1973.

Riley, J.L., J.V. Jalava and S. Varga. 1996. *Ecological Survey of the Niagara Escarpment Biosphere Reserve*. Volume I: *Significant Natural Areas* (v + 629pp.); Volume II: *Technical Appendices* (vii + 310 pp.). Ontario Ministry of Natural Resources, Ontario Heritage Foundation, and the Niagara Escarpment Heritage Protection and Land Stewardship Program.

Shannon, Bill. 2000. *Land: Struggle for Settlement*. Ottawa: Self-published Master's thesis on settlement history of Collingwood Township.

Tanner, Helen Hornbeck (Ed.) 1986. *Atlas of Great Lakes Indian History*. University of Oklahoma Press.

Tovell, Walter M. 1992. *Guide to the Geology of the Niagara Escarpment, with Field Trips*. (Edited by Lorraine Brown). Niagara Escarpment Commission and the Ontario Heritage Foundation.

Williamson, Ronald F. and Christopher M. Watts (Eds.). 1999. *Taming the Taxonomy: Towards a New Understanding of Great Lakes Archaeology*. Toronto: Eastendbooks and The Ontario Archaeological Society, Inc.

## ANNEX 1

### Endangered, Threatened, or Rare Animal and Plant Species

*Identify species (with scientific names) or groups of species of particular interest for conservation, in particular if they are threatened with extinction.*

**[Note:** Information for this section was compiled from three sources: [1] the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) which determines the conservation status of endangered or threatened wildlife based on documented evidence provided by specialists. The May 2001 list of species from COSEWIC was used to identify those known to occur in the Niagara Escarpment Biosphere Reserve (NEBR); [2] the conservation status of these species, assigned by the Ontario Natural Heritage Information Centre (ONHIC). The ONHIC classification is based on the system developed by The Nature Conservancy (US) which ranks status “globally” (for entire range) and by jurisdictions. For example, over the entire range of a species, G5 is “very common, secure under present conditions”, and G4 is “uncommon to common, usually more than 100 known occurrences”. For jurisdictions (S=State), S1 is “extremely rare, usually 5 or fewer occurrences or a very few vulnerable to extirpation”; S2 is “very rare, usually between 6 and 20 occurrences with many individuals susceptible to extirpation”; and S3 means “rare, usually between 21 and 100 known occurrences”. The ONHIC status of these species for Ontario is noted below the COSEWIC categories; [3] the status of these species in the NEBR was taken mainly from the intensive biological inventories of “areas of natural and scientific interest” identified within the Niagara Escarpment Plan Area by Riley and others (1996). In addition, the list below includes species recorded within the NEBR that have been ranked S1 or S2 by the ONHIC, but have not been assessed or given a ranking by COSEWIC. These various conservation rankings can change as additional information becomes available.

**Species**

**COSEWIC**

**Status in the NEBR**

## ONHIC

Birds

Acadian flycatcher <i>Empidonax vireescens</i>	endangered G4 S3	probably breeding at 1 site
Barn owl <i>Tyto alba</i>	endangered G5 S1	breeding confirmed, 1 site
Henslow's sparrow <i>Ammodramus henslowi</i>	endangered G4 S1	probably breeding, 1 site
King rail <i>Rallus elegans</i>	endangered G4/G5 S2	3 site records
Loggerhead shrike <i>Lanius ludovicianus</i>	endangered G5 S2	breeding confirmed, 5 sites
Northern bobwhite <i>Colinus virginianus</i>	endangered G5 S1/S2	observed at 1 site
Peregrine falcon <i>Falco peregrinus</i>	endangered G4 S2	breeding confirmed, 4 sites
Prothonotary warbler <i>Protonotaria citrea</i>	endangered G5 S1/S2	breeding confirmed, 1 site
Hooded warbler G5 S3	threatened sites	breeding confirmed, 2 <i>Wilsonia citrina</i>
Great Egret <i>Casmerodus albus</i>	-- G5 S2	breeding confirmed, 1 site
Tufted titmouse G5 S2/S3	-- Niagara area	Breeding confirmed, <i>Baeolophus bicolor</i>
White-eyed vireo	--	probably breeding, 1 site

<i>Vireo griseus</i>	G5 S2	
Yellow-breasted chat	--	breeding confirmed, 1 site
<i>Icteria virens</i>	G5 S2/S3	
<u>Mammals</u>		
Gray fox	--	2 records
<i>Urocyon cinereoargenteus</i>	SZB [vagrant]	
Small-footed bat	--	rare
<i>Myotis leibii</i>	G3 S2/S3	
<u>Herpetofauna</u>		
Black rat snake	threatened	1 reported sighting
<i>Elaphe obsoleta</i>	G5 S3	
Eastern fox snake	threatened	1 record
<i>Elaphe vulpina gloydia</i>	G3 S3	
Massasauga rattlesnake	threatened	occurs regularly in the
<i>Sistrurus catenatus</i>	G3/G4 S3	Bruce Peninsula
Queen snake	threatened	2 reported sightings
<i>Regina septemvittata</i>	G5 S2	
Spiny softshell turtle	threatened	occurs at 2 sites
<i>Apalone spinifera</i>	G5 S3	
Jefferson's salamander	--	occurs at several
<i>Ambystoma jeffersonianum</i>	G5 S2	sites
Northern Dusky Salamander	--	occurs at 1 site
<i>Desmognathus fuscus</i>	G5 S1	
Wood turtle	--	1 record

<i>Clemmys insculpta</i>	G4 S2	
<u>Fish</u>		
Deepwater sculpin	--	2 reports
<i>Myoxocephalus thompsoni</i>	G5 S2/S3	
Lake chubsucker	--	reported at 1 site
<i>Erimyzon sucetta</i>	G5 S2	
Shortjaw ciscoe	--	1 report
<i>Coregonis zenithicus</i>	G2 S2	
Silver shiner	--	reported at 2 sites
<i>Notropis photogenis</i>	G5 S2/S3	
<u>Plants</u>		
Bent (drooping) trillium	endangered	reported from 1 site
<i>Trillium flexipes</i>	G5 S1	
Cucumber magnolia	endangered	reported from 1 site
<i>Magnolia acuminata</i>	G5 S2	
Hoary mountain-mint	endangered	1 historic site (Hamilton)
<i>Pycnanthemum inconum</i>	G5 S1	
Red mulberry	endangered	rare
<i>Morus rubra</i>	G5 S2	
Round-stemmed purple false foxglove	endangered G4 S2	recently found on alvars on Bruce Peninsula
<i>Agalraia guttingeri</i>		
American ginseng	threatened	rare, but occurs in a number of areas
<i>Panax quinquefolius</i>	G4 S3	

American chestnut <i>Castanea dentata</i>	threatened G4 S3	rare
American columbo <i>Fraseria(Swertia) caroliniensis</i>	-- G5 S1	4 sites
American water-willow <i>Justicia americana</i>	threatened G5 S2	1 historic site (Niagara Falls)
Golden seal <i>Hydrastis canadensis</i>	threatened G4 S2	1 site
White wood aster <i>Aster divaricatus</i>	threatened G5 S1	reported from 7 sites
Appalachian sedge <i>Carex appalachica</i>	-- G4 S2/S3	reported from 2 general locations
Arrow arum <i>Peltandra virginica</i>	-- G5 S2	2 sites
Autumn coral-root <i>Corallorhiza odontorhiza</i>	-- G5 S2/S3	2 sites
Bicknell's sedge <i>Carex bicknellii</i>	-- G5 S2	1 site
Biennial Gaura <i>Gaura biennis</i>	-- G5 S2	1 site
Black cohosh <i>Cimicifuga racemosa</i>	-- G5 S2	2 sites
Brainerd's hawthorn <i>Crataegus brainerdii</i>	-- G5 S2	1 site
Carey's sedge	--	1 site

<i>Carex careyana</i>	G5 S2	
Clinton's bulrush	--	1 site
<i>Scirpus clintonii</i>	G4 S2	
Compta hawthorn	--	4 sites
<i>Crataegus compta</i>	G5? S2?	
Conspecta hawhorn	--	4 sites
<i>Crataegus conspecta</i>	G3/G4 S1	
Creeping fragile fern	--	1 site
<i>Cystopteris protrusa</i>	G5 S2	
Davis' sedge	--	1 site
<i>Carex davisii</i>	G4 S2	
Deerberry	--	3 sites
<i>Vaccinium stamineum</i>	G5 S1	
Downy foxglove	--	4 sites
<i>Aureolaria virginica</i>	G5 S1	
Erect knotweed	--	1 historic site
<i>Polygonum erectum</i>	G5 S1	
Few-fruited sedge	--	2 sites
<i>Carex oligocarpa</i>	G4 S2	
Field (blue) toadflax	--	1 site
<i>Linaria canadensis</i>	G4/G5 S1	
Forked panic grass	--	3 sites
<i>Panicum dichotomum</i>	G5 S2	
Fox grape	--	5 sites
<i>Vitis labrusca</i>	G5 S1	

Giant pinedrops	--		2 sites
<i>Pterospora andromedea</i>		G5 S2	
Gleaming hawthorn	--		1 site
<i>Crataegus corusca=hilli</i>		G3/G5 S2/S3	
Hairy-jointed meadow parsnip	--		1 site
<i>Thaspium barbinode</i>		G5 S1	
Hill's pondweed	--		3-4 sites
<i>Potamogeton hillii</i>		G3 S2	
Honey locust	--		5 sites of which 1 is probably native
<i>Gleditsia triacanthos</i>		G5 S2	
Incised puccoon	--		1 historic site (Hamilton)
<i>Lithospermum incisum</i>		G5 S1	
Lakeside daisy	--		3 sites
<i>Hymenoxys acaulis</i>		G2 S2	
Limestone oak fern	--		1 site
<i>Gymnocarpum robertianum</i>		G5 S2	
Marble-seed	--		1 historic site (Hamilton)
<i>Onosmodium molle</i>		G4? S2	
Panicled hawkweed	--		5 sites
<i>Hieracium paniculatum</i>		G5 S2	
Perfoliate bellwort	--		several sites, Niagara region
<i>Uvularia perfoliata</i>		G5 S1	
Porcupine grass	--		reported from 1 general location
<i>Stipa spartea</i>		G5 S3	
Prairie dropseed	--		3 sites

<i>Sporobolus heterolopis</i>	G5 S2	
Prairie fringed orchid	--	1 site
<i>Platanthera leucophaea</i>	G2 S2	
Prostrate tick-trefoil	--	1 site
<i>Desmodium rotundifolium</i>	G5 S2	
Putty-root	--	1 historic site (Hamilton)
<i>Aplectrum hyemale</i>	G5 S2	
Rattlesnake hawkweed	--	2 sites
<i>Hieracium venosum</i>	G5 S2	
Round-leaved hawthorn	--	1 site
<i>Crataegus suborbiculata</i>	G3? S2	
Rugulose grape fern	--	1 site
<i>Botrychium rugulosum</i>	G3 S2	
Shumard oak	--	1 site (may be hybrid oaks)
<i>Quercus shumardii</i>	G5 S2/S3	
Schreber's aster	--	2 sites
<i>Aster schreberi</i>	G4 S2	
Six-weeks fescue	--	1 site
<i>Vulpia octoflora</i>	G5 S2	
Slender satin grass	--	several sites
<i>Muhlenbergia tenuiflora</i>	G5 S2	
Smith's club-rush	--	1 historic site
<i>Scirpus smithii</i>	G5? S2?	
Squarrose sedge	--	1 historic site (Saint Catherines)
<i>Carex squarrosa</i>	G4/G5 S2	

Stemless yellow violet	--	1 site
<i>Viola rotundifolia</i>	G5 S1	
Stiff gentian	--	1 historic site
<i>Gentiana quinquefolia</i>	G5 S2	
Sweet/cherry birch	--	1 site?
<i>Betula lenta</i>	G5 S1	
Sundrops	--	1 site
<i>Oenothera pilosella</i>	G5 S2	
Trail plant	--	2 sites (recent rediscovery)
<i>Adenocaulon bicolor</i>	G5? S1	
Wall-rue spleenwort	--	several sites
<i>Asplenium ruta-muraria</i>	G5 S2	
Wedge grass	--	1 site
<i>Sphenopholis nitida</i>	G5 S1	
Whorled milkweed	--	1 site
<i>Asclepias verticillata</i>	G5 S2	
Wild potato vine	--	1 site
<i>Ipomoea pandurata</i>	G5 S1	
Wood vetch	--	3 sites
<i>Vicia caroliniana</i>	G5 S2	
Virginia flax	--	1 site
<i>Linum virginianum</i>	G4/G5 S2	
Violet bush-clover	--	1 site
<i>Lespedeza violacea</i>	G5 S1	

