

Place in Movement: Tracing Human-Altered Landscapes Along the Niagara Escarpment

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ABSTRACT

The Niagara Escarpment, a 440-million-year-old landform, cuts through a property owned by the University of Toronto in Caledon, Ontario in Canada. The property juxtaposes impacts from historical quarrying activity which burrowed directly into the Escarpment's slope, the greater context of the region's urban development demands, and the Escarpment's identity as an ancient geological formation, ecological refugium, and old-growth forest housing ancient species such as *Thuja occidentalis*.

This project explores the university's responsibility in advocating for the protection of the Escarpment's unique ecologic conditions, including the distinct cliff ecosystems and the novel successional plant communities evolving on sites of former quarry activities. Interventions on the trail system, cave bridges and lookouts, and the boardwalk and path system, along with guidance of signage and trail markers, will bring visitors to areas where former quarry activities sculptured the Escarpment's limestone faces and are now reclaimed by a system of lush novel wetlands and habitats in evolutionary stages. Connecting to a system of existing public trails, this project leverages the university's educational and recreational objectives to form new strategic partnerships with local conservancy groups, aiming at monitoring and managing access and habitat protection.

KEYWORDS

Niagara Escarpment; Industrial Heritage; Abandoned Quarry; Ecological Habitat; Geology; Wetland; Trail System

HIGHLIGHTS

- Indigenous-led conservation efforts and partnerships with local conservancy groups are emphasized to enhance sustainability and stewardship
- Interventions were proposed on the trail system, cave bridges and lookouts, and the boardwalk and path system
- The interventions aim to balance the site's educational and recreational use with the preservation of its delicate ecosystems

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1 Introduction

In Caledon, Ontario of Canada, The University of Toronto owns a 150-acre property, Hart House Farm, which acts as a recreational and extracurricular venue for students and community members. The property is located within a land parcel which cuts through one of the most unique and significant natural areas in Ontario—the Niagara Escarpment. At 440 million years old, this landscape feature is home to over 40% of Ontario's rare species and is comprised of old-growth cedar forests up to 1,000 years old, caves, wetlands,

and an ancient geologic formation that recalls millions of years of global tectonic activity.^[1] The vastness of this geological being is evident through limestone cliff faces, dramatic topographical changes, and an abundance of fossils that scatter trail edges and the forest floor.

However, the Escarpment is also marked by a history and complicated reality of being a sought-after resource for mineral extraction.^[2] Centuries of intense quarrying activities have dramatically altered its faces, leaving industrial remnants across the Escarpment's slope at Hart House Farm.^[3]

In recent years, the university has expanded its definition of how this place is meant to be experienced and continues to explore how it can best serve its ever-expanding community. This site is also located in one of southern Ontario's fastest-growing regions.^[4] Given the increasing building demands and the Escarpment's history as a resource for stone and aggregate industry, the tension between development and conservation poses a threat to the area's rich biodiversity.^[2]

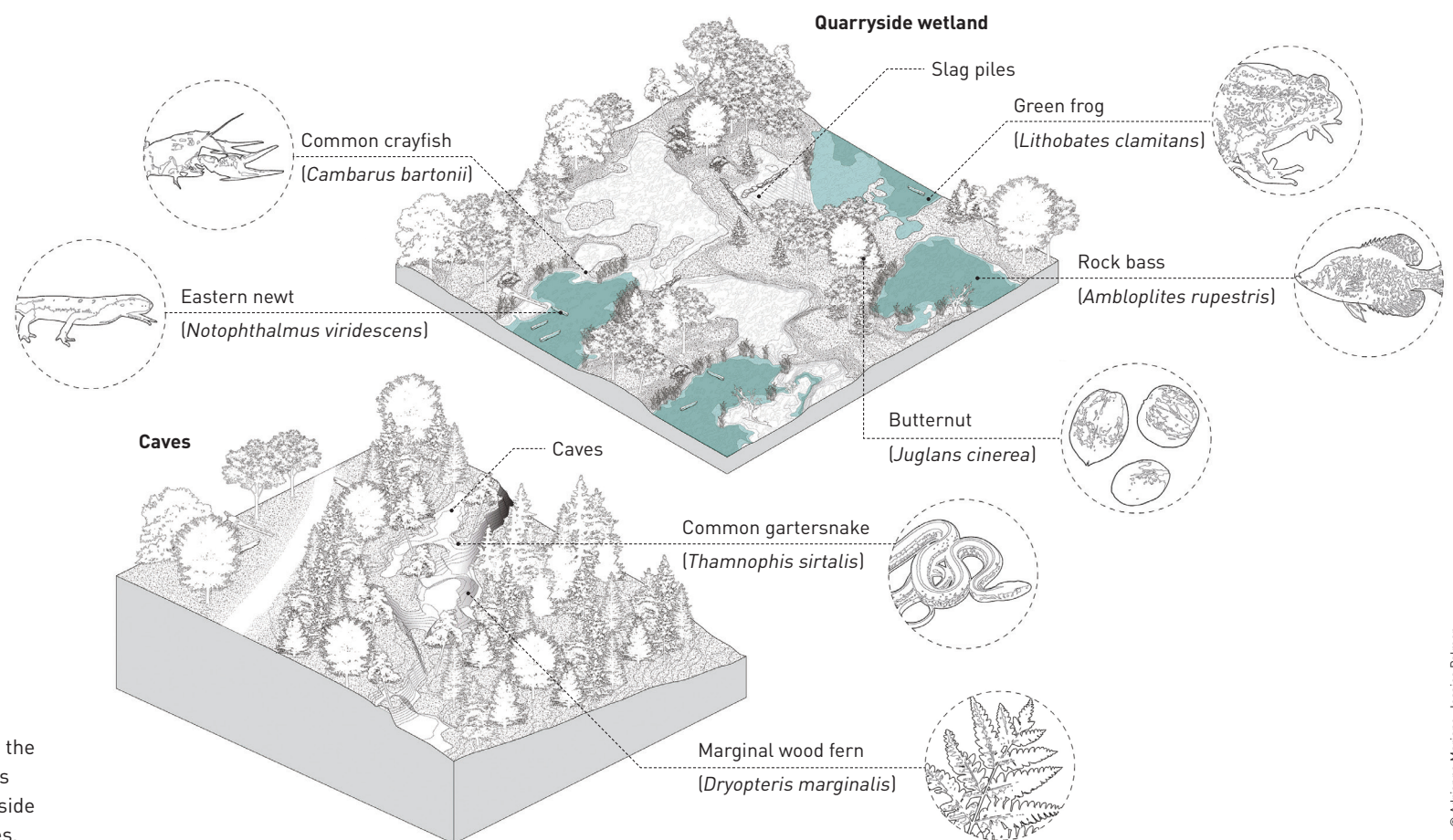
The university's ownership of this property is a gift to students, faculty, alumni, and community members. However, it also entails

a substantial responsibility towards its conservation and protection. This represents an opportunity for the university to take an advocacy role on regional conservation and appreciation of the Escarpment through educational initiatives.

This article presents a project which seeks to leverage the university's cross-disciplinary collaborations to connect existing public trail systems and highlight former quarry sites along the Escarpment. The interventions consider the site's current and future identity as a recreational and educational space, a venue for community gatherings, teaching and Indigenous ceremonies, as well as a place for appreciating and forming deeper relationships with the hydrological, geological, and ecological systems.

2 Existing Site Conditions

The limestone caves and cliffs on the north side of the site are a key feature for visitors to Hart House Farm. Delicate moss-covered rock ecosystems span the cliffs' edges, and several access points currently allow visitors to descend into the crevices (Fig. 1). But as noted by forestry professors and ecologists during site



1. Axonometric diagram showing the important species along the Quarryside wetland and caves.



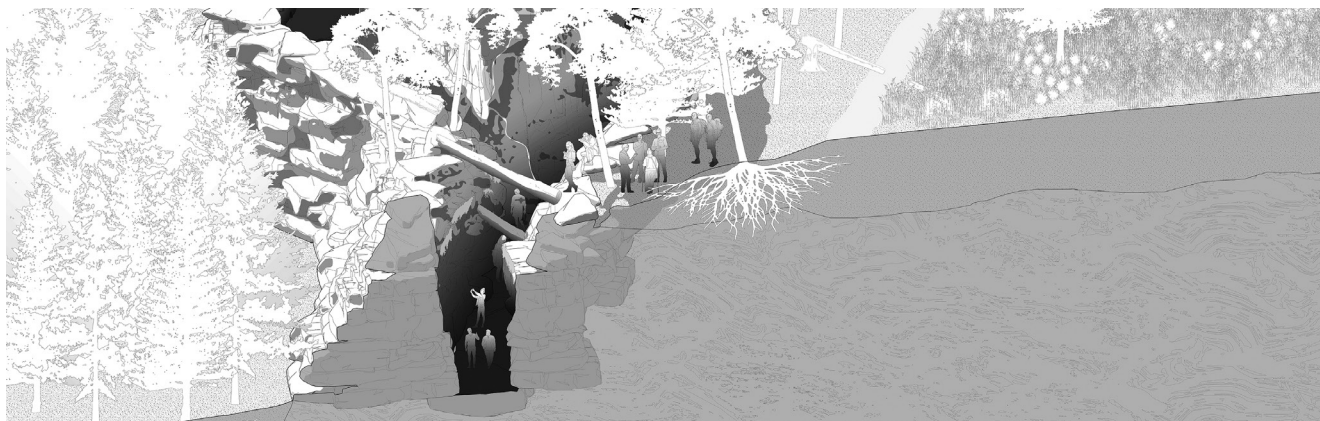
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visits, unguided exploration is putting these ecosystems at risk. Degradation caused by climbing and trampling is reducing ground cover around the cedar forest and impacting extremely sensitive and slow-growing mosses, lichens, and unique plant communities inside the caves (Fig. 2).^[5] Representatives from Hart House Farm have also emphasized the cultural importance of this area to past and present visitors and expressed concerns about finding solutions that would allow continuous access to these sensitive areas while minimizing unmeant harm (Fig. 3).^[6]

The second area of focus is the Bruce Trail Conservancy-owned quarryside property, adjacent to Hart House Farm, which has been impacted by the quarrying activities throughout the

late 19th and 20th centuries and is now evolving into a series of lush successional wetlands (Fig. 4). These complex and novel habitats can support aquatic, reptilian, and vegetative life. Given that these habitats span property lines between Hart House Farm and the Bruce Trail Conservancy land, this project considered both properties as one site. It envisioned that interventions, such as trail systems and conservation efforts, should extend beyond property lines over time as collaborative opportunities with other private property owners arise (Fig. 5).

Since the quarrying stopped, the quarryside has experienced structural decay and vegetative overgrowth. Bordered by the Escarpment's rich biodiversity and hydrological influences, these

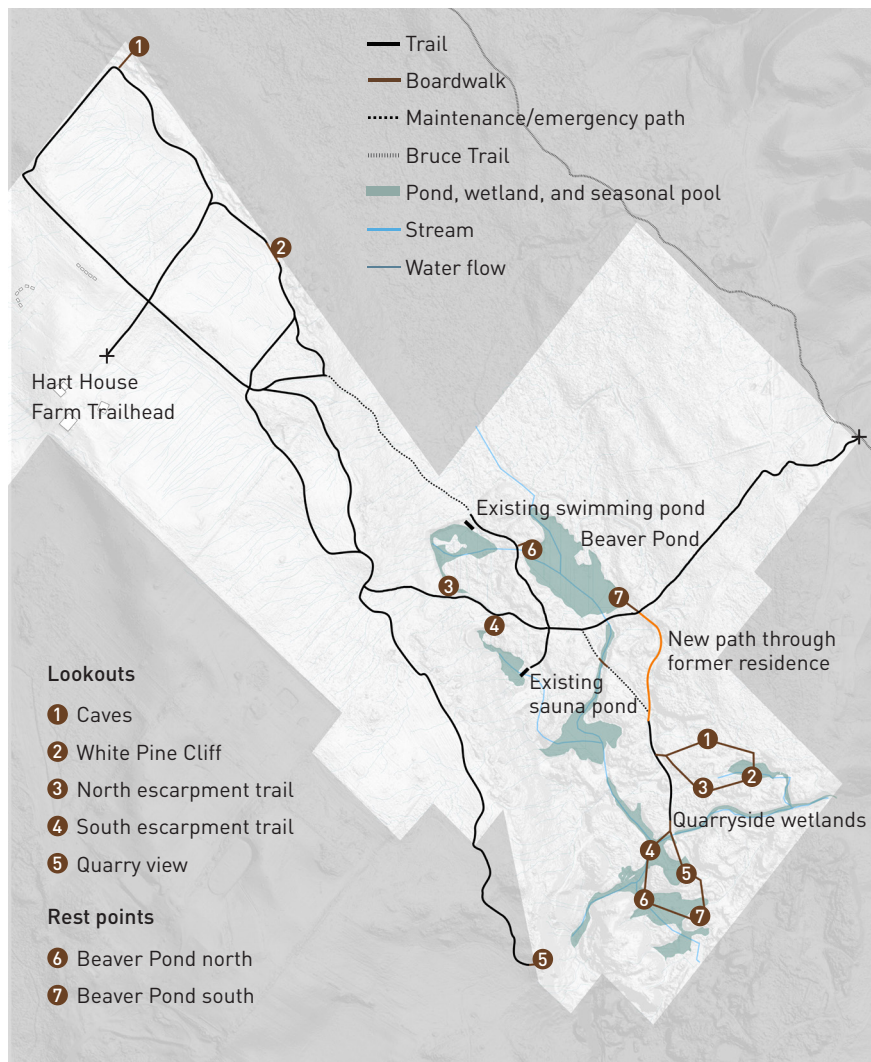


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2. Photos of rocks, piles, and quarries overgrown with sensitive ecology.
3. Section of people trampling over the precious species on the caves.
4. Section of quarrying activity remnants at the quarryside property.



5. Map showing the existing and proposed trails.

abandoned quarries have become seasonal pools, wetlands, and alvars as successional vegetation reclaims these former industrial sites into novel ecological communities.^[7] However, this area is not currently open to the public and requires extensive junk removal and trail reshaping to make it a safe place to visit.

The third focus was on the overall connectivity between these areas and forming stronger, more open linkages to the Bruce Trail, Canada's oldest and longest marked public footpath^[8], which is directly southeast of both properties. Along the main pedestrian trail, several erosion issues were observed in extremely steep areas leading down the Escarpment to the swimming and sauna ponds. The trail from the farm property to the Bruce Trail is lined with a number "no trespassing" signs, reflecting the management institution's awareness about liability issues associated with unmanaged public access.

3 Design Approaches

Considering the future of Hart House Farm amidst the regional development pressures and the university's efforts to accommodate growing numbers of visitors, the primary design question was how to increase the carrying capacity of the site. The second priority was to create possibilities for visitors to engage with former quarrying areas to understand the impacts of extraction. The design aims to balance welcoming as many visitors as possible and allowing the site's unique ecologies to thrive, employing simple wayfinding and accessibility strategies.

Although all interventions will require disturbance during construction, the long-term goal is to enhance sustainability across the site and embrace anthropogenic landscapes as avenues for valuable learning and engagement. All changes should involve an institution-wide increase in Indigenous-led conservation efforts by community partners such as the Bruce Trail Conservancy, Niagara Escarpment Biosphere Network, and Credit Valley Conservation, to connect Hart House Farm with other stewardship activities across the region.

4 Design Interventions

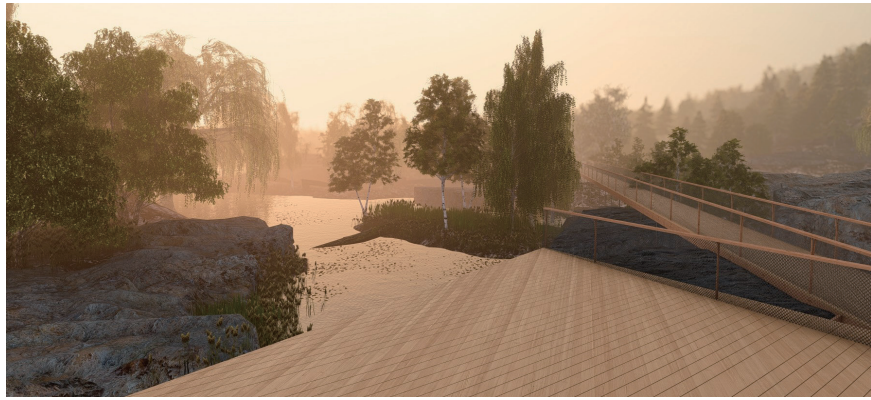
4.1 Trail System

Within the existing trail system at Hart House Farm, there is one primary path that leads to different attraction areas, including the exposed cliff edges of the Escarpment and the natural swimming ponds. These areas are experiencing high levels of erosion and degradation due to maintenance and foot traffic on the steep slopes. During a visit in November of 2023, the project team noticed an underused secondary path that leads down to the Escarpment, allowing visitors to walk between the swimming and sauna ponds.

To address the erosion issue, it is proposed to make this secondary path the optimal pedestrian route to the Escarpment's faces. This path is gentler in slope and requires minimal regrading, reducing on-site cut-and-fill. Moreover, the addition of simple wooden steps in the path's steepest sections will reduce the risk of degradation caused by erosion, allowing the existing primary path to be used mainly for maintenance and emergency purposes (Fig. 5).

4.2 Cave Bridges and Lookouts

The second major change is to modify access around the caves. The project team has identified that these caves and cliff plant communities are extremely slow-growing and sensitive to ground



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6. Rendered perspective of the proposed wetland boardwalk.

activities.^[9] The forest canopy in these areas is primarily white cedar (*Thuja occidentalis*), with root systems forced to navigate through rock crevices. As a result, the trees mature slower than its surrounding canopies, creating the illusion that they are much younger. Given that the Escarpment faces are the main attractions to the farm, these cedars and their surrounding plant communities are being unknowingly damaged by passersby through soil compaction, introduction of invasive species, and trampling both above the caves and within the spongy crevice floors.

In response, the project suggests rerouting the main trails through the successional field and away from the cave edges (Fig. 5). Further interventions in the cave area will focus on a phased approach to protecting extremely delicate and old-growth cedars, moss, and lichen communities which live on shallow rocky soil. In the short term, slag rocks from abandoned quarry sites on the quarryside property will form new trail edges, managing access to the caves towards key spots for visitors to rest. In the long term, these edges will extend from the main trail to a simple boardwalk leading to the cave's edge, allowing visitors to experience the dramatic vantage points and learn about the cliffs' delicate ecosystems (Fig. 6).

On the north side of the cave area, between the trails and the boardwalk (Fig. 7), stone slabs leftover from quarrying activities will form large benches. This will provide new vantage points to experience caves and cliff faces, while reducing the stressors currently placed on this sensitive environment by visitors (Fig. 8). Moreover, a bridge will be introduced to connect to a lookout that overlooks the cliff edges and the fissure (Fig. 9). These high points of interest and dramatic vantage points will be enhanced with signages explaining the sensitivities of the area and the impact of access changes.

4.3 Boardwalk and Path System

The third intervention is to promote the experience of the novel system of wetlands south of Hart House Farm on the quarryside property. Several old buildings on the site have not been maintained and are in need of repair or removal. Additionally, a significant amount of junk is scattered adjacent to beaver dams, seasonal wetlands, and existing trails. The first step in providing access to this area is to clear structures and junk, while creating a new trail from the beaver pond to the quarryside property (Fig. 10).

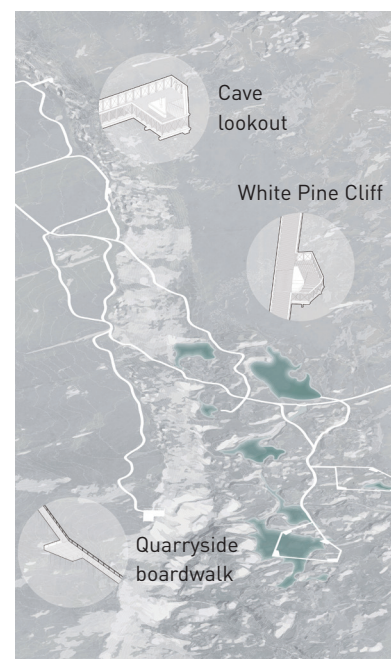
The intervention will allow visitors of Hart House Farm and Bruce Trail hikers to experience these lush novel habitats in their evolutionary stage, as they continue to mature and expand over time. A system of boardwalks will span slag piles and wetlands, facilitating visitors' interaction with a landscape dramatically altered by extraction practices (Fig. 11). Subtle didactic panels at rest points can further educate visitors about the site's quarrying history and the restoration process, showcasing its current state as a rich ecological habitat.

These trails will extend from existing connection points with the Bruce Trail system. In wet areas, trails will turn into boardwalks, offering visitors views into wetland habitats and cutouts along the Escarpment's faces. With the continued interest in quarry remnants and the regional historical importance of stone building techniques,

7. Axonometric drawing of the path system and viewing platform placement.

8. Viewing platform overlaid on top of the precious caves and its delicate ecosystem.

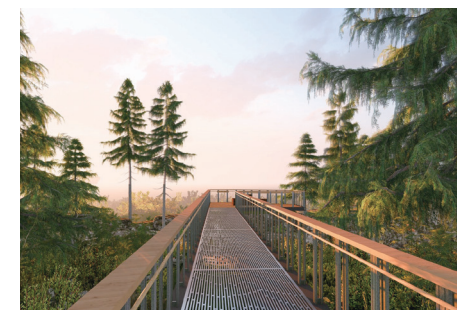
9. Perspective of the elevated path and viewing platform over the caves.



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Pillar

- Placed at trailheads
- Describes the trails' features, history, and possible names (like cedar, wood, fern, fossil, etc.)

Signage

- Placed at the entrance of caves, Quarryside boardwalks, and trailheads
- Describes the area's relationship with the Escarpment (such as the caves and the former quarries) and the landform history
- Text-based

Railing attachment

- Placed along railings at lookouts near caves and along upper Escarpment trails
- Made of either wood or metal, featuring etched fossils, plant matter, and other site "artefacts" that tell the stories of the landforms



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the materiality of stone slag will be represented in the form of signage and trail markers. Stone slabs from the quarryside property will act as wayfinding devices, symbolic landscape elements throughout the complex site, and didactic panels at key points that interpret varied accessibility based on a gradient of sensitive habitats (Fig. 12). The creation, naming, and placement of these stone markers and panels offer a chance for community members to name the site's trails and new areas of exploration, reflecting the university's and the site's evolving patterns of use and relationship-building.

5 Conclusions

The University of Toronto has an opportunity at Hart House Farm to take on the role of a regional advocate for the Niagara Escarpment conservation through community partnerships and stewardship that will inspire neighbouring properties to protect and manage the sensitive natural features throughout the region. By connecting this important place with its surrounding context, an ancient geological form, and new habitats forming from extractive industrial processes, Hart House Farm and quarryside landscapes and communities can build resilience as they continue their process of evolution.

10. Perspective of the quarry with proposed boardwalk.

11. Perspective of the dedicated path that uses quarried rocks from site to deter people from overstepping the sensitive ecology.

12. Examples of educative wayfinders and panels of the site's rich ecological habitat.

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Competing interests | The authors declare that they have no competing interests.

场所变迁： 追溯尼亚加拉断崖沿线的人类改造景观

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摘要

在一片隶属于加拿大多伦多大学的土地上有一处令人惊叹的景观，拥有4.4亿年地质历史的尼亚加拉断崖横穿其中。为满足城市大规模发展的需求，在这片土地曾开展过长时间的工业采石活动；同时，断崖作为古老的地质构造和生态避难所，保留了北美香柏（*Thuja occidentalis*）等原始森林栖息地。

本项目探讨了多伦多大学在保护断崖独特生态环境方面的责任，涵盖特殊的悬崖生态系统和在旧采石场遗址上形成的新生演替植物群落。通过针对步道系统、洞穴桥梁和观景台、栈道和路径系统提出的设计干预，及借助标识和路径标记，可将游客引导至由以往采石活动所塑造的断崖石灰岩岩面——如今这些地方已被郁郁葱葱的新生湿地和逐步演化的栖息地所覆盖。该项目将连接现有的公共步道系统，优化场地的教育和休闲功能，同时与当地自然保护组织建立全新的战略合作伙伴关系，以更加有效地管理和监督游客访问，并兼顾栖息地保护。

关键词

尼亚加拉断崖；工业遗产；废弃采石场；生态栖息地；地质；湿地；步道系统

文章亮点

- 对拥有4.4亿年地质历史的尼亚加拉断崖进行保护
- 指出场地的保护需由当地人民主导及与当地自然保护团体合作，以增强其可持续性和管理效果
- 提出了针对步道系统、洞穴桥梁和观景台，以及栈道和路径系统的干预措施，旨在平衡该地区的教育和休闲功能、保护脆弱的生态系统

编辑 王颖