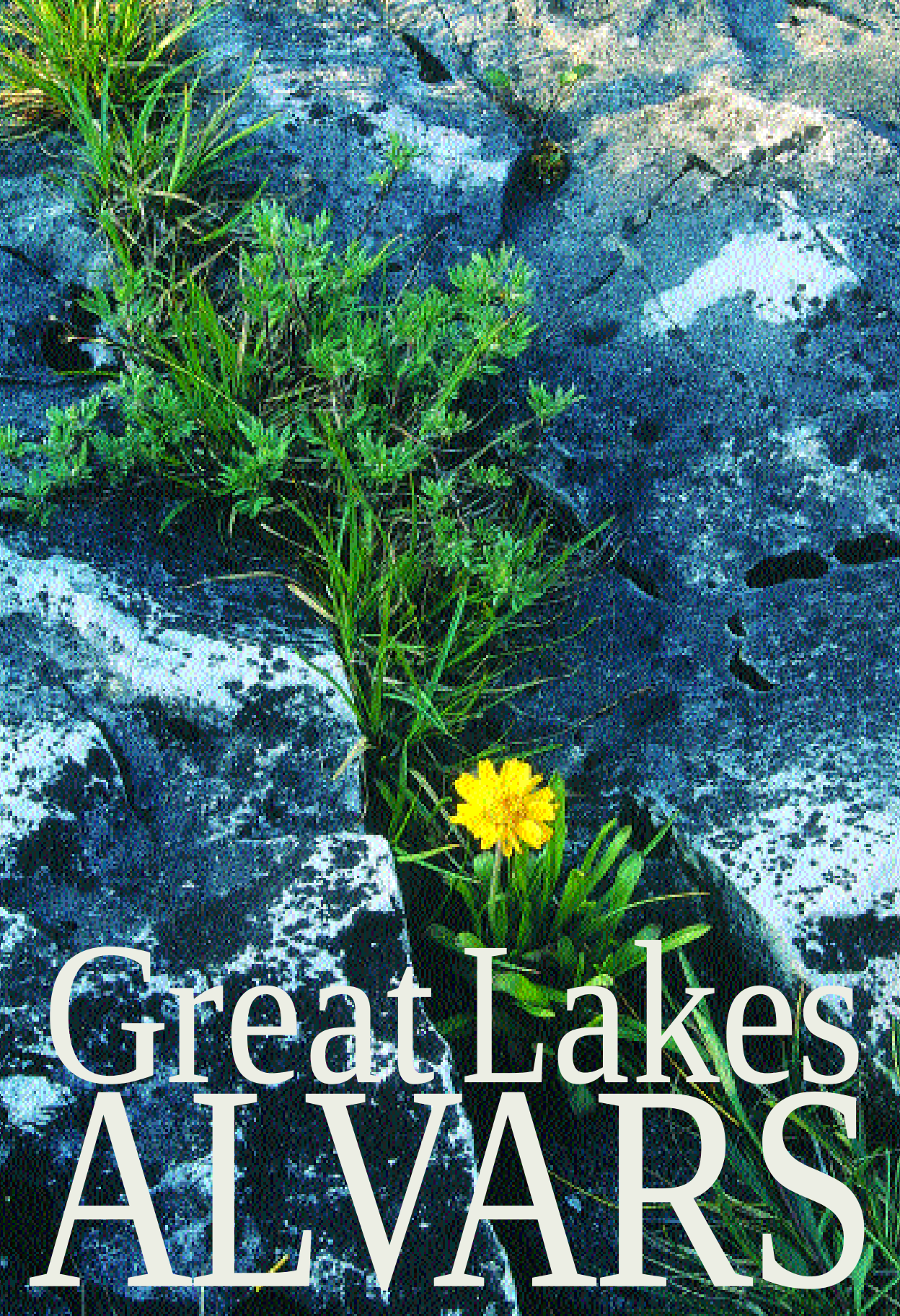
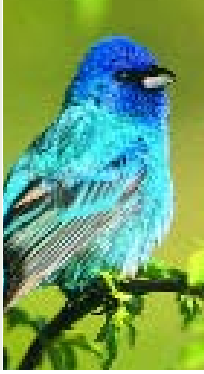

Great Lakes
ALVARS

Great Lakes Alvars



The earliest visitors to the Great Lakes region were in awe of the magnificent hardwood forests found there. But, in contrast to these lush groves, early settlers also found scattered examples of flat, barren and largely treeless limestone openings — unique landscapes now known as alvars. These rare habitats still exist where flat areas of shallow limestone bedrock have been left undisturbed. More importantly, however, we now know that these openings are far from barren, for they are home to myriad distinctive plants and animals.

opposite: Garden Peninsula, Michigan
below: Prairie smoke, above: Indigo bunting

Robert McCaw

Pat J. Comer

The environment of alvar areas is harsh — too harsh, in fact, for most trees to grow.

Habitat for the Hardy

The term *alvar* is used to describe a type of natural community, much as we use words like *prairie* or *wetland* to describe grassy or moist areas. Alvars are areas of relatively flat limestone bedrock where soils were long ago scraped away by ice, wind and water. Today, alvars thrive where environmental extremes create naturally open landscapes. They support a distinctive set of plants —uncommon wildflowers, mosses and lichens, many kinds of grasses and sedges, and even some stunted trees. Their animal life is special too, particularly their birds, land snails, leafhoppers and other invertebrates.

The environment of alvar areas is harsh — too harsh, in fact, for most trees to grow.

Ron Erwin

Alvar, west of Misery Bay, Manitoulin Island

When the summer sun shines, alvars are hot; temperatures can reach 43^{o}C at the rock surface. When the winter winds blow, they are cold; so cold that needle ice crystals churn up what little soil there is.

In spring, most alvars collect water in shallow pools and bedrock pockets, and some areas remain flooded for weeks. By early summer, with the pools long gone, the shallow soils dry to a crisp and many of the flowering plants begin to turn brown.

This combination of flooding and drought holds off the invading trees. Spring flooding and shallow soils discourage trees and shrubs from taking root, and summer drought, especially during very dry years, finishes off those that have begun to get established. Some alvars also have a recorded history of past fires, and the presence of charcoal on many sites indicates that wildfires also may have contributed to their open character.

S. R. Crispin

Ron Erwin

above: Barrie Island alvar grassland, Manitoulin Island

Creeping juniper on alvar pavement, Misery Bay, Manitoulin Island

Globally Rare Habitats

Robert McCaw

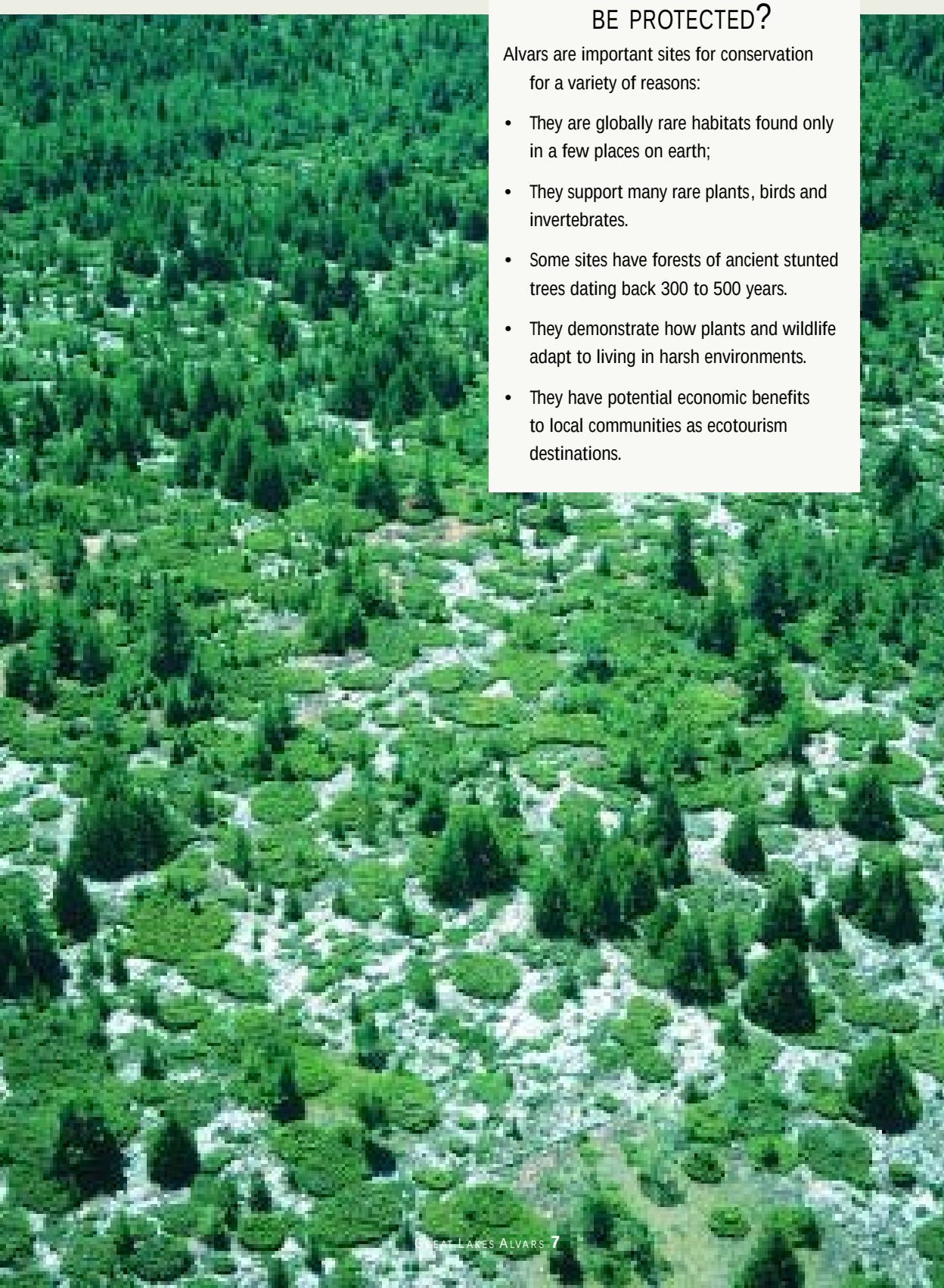
North America's alvars are concentrated within the watersheds that drain into the Great Lakes. Most of them are found in an arc that extends just south of the Canadian Shield from Michigan's upper peninsula, through Manitoulin Island, the Bruce Peninsula and the limestone plains of southcentral and eastern Ontario, to northern New York state. In addition, a few alvars are sprinkled at other sites such as the western end of Lake Ontario, in the western Lake Erie region, Wisconsin and Quebec, and along several rivers where limestone ledges are exposed. Elsewhere in the world, alvars are found in the Baltic region of Europe, in Estonia and on islands off the coast of Sweden.

Scientists in Europe have long been aware of the existence of alvars, but only in recent years have scientists and naturalists in North America recognized that they occur here as well. When field biologists began to observe that certain species of plants and animals were found mostly in open and lightly wooded habitats on flat limestone bedrock, they realized that this habitat has its own distinctive ecology. As the awareness of alvars spread, researchers documented more than 120 alvar sites across the Great Lakes basin, largely through a coordinated study called the International Alvar Conservation Initiative.

top: Blue-eyed grass
below: Alvar with jack pine, Bruce Peninsula
right: Belanger Bay alvar, Manitoulin Island

Don Kirk

Phil Kor



Why should alvars be protected?

Alvars are important sites for conservation for a variety of reasons:

- They are globally rare habitats found only in a few places on earth;
- They support many rare plants, birds and invertebrates.
- Some sites have forests of ancient stunted trees dating back 300 to 500 years.
- They demonstrate how plants and wildlife adapt to living in harsh environments.
- They have potential economic benefits to local communities as ecotourism destinations.

Scattered across the Great Lakes basin are a small number of alvar sites that are presently protected, either as publically owned parks or private reserves.

A Great Lakes Legacy

Phil Kor

Robert McCaw

The limestone bedrock associated with alvar communities was formed in warm, shallow tropical seas between 460 and 370 million years ago. More recently, glacial action has shaped the Great Lakes region, forming the landscapes we see today. The Wisconsin glaciation, beginning around 65,000 years ago, was the most recent and most influential in creating the alvars of today.

Alvars have always represented a tiny fraction of the landscape. Their current extent is estimated to be about one-fifth of one percent of the land area in the Great Lakes basin. About two-thirds of the total alvar area is in Ontario. Alvars on Drummond Island and elsewhere in Michigan account for approximately 15 percent of the Great Lakes total, Jefferson County in northern New York state has about 16 percent, and the Marblehead Peninsula and Lake Erie islands in Ohio account for most of the remaining four percent of the total.

above: Belanger Bay, Manitoulin Island
inset: Purple-stemmed cliffbrake fern
right: Maxton Plains, Drummond Island, Michigan, little bluestem grassland

and other islands along the north shore;

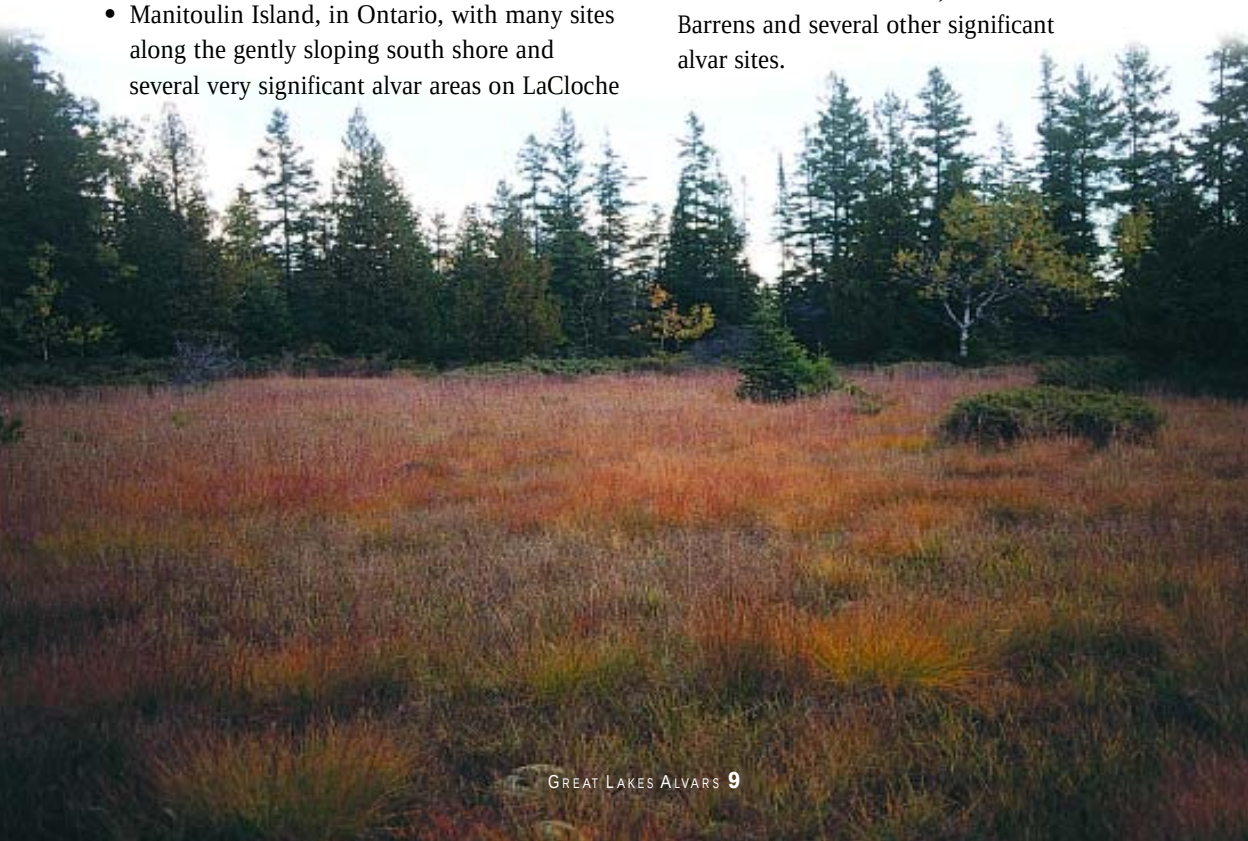
- Ontario's Bruce Peninsula, where alvars are clustered along the western shore and on the flat points and peninsulas of the Georgian Bay shore;
- Western Lake Erie, with alvar sites on Pelee Island in Ontario and Kelley's Island and the Marblehead Peninsula in Ohio;

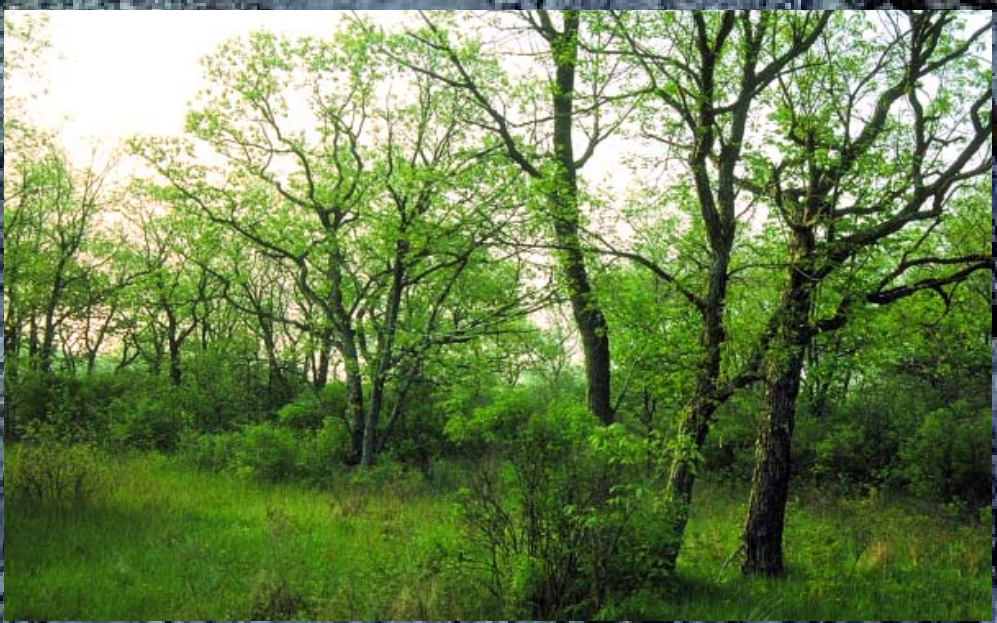
Rose Zgodzinski

Alvar sites occur primarily within a series of nine clusters:

- Garden Peninsula and Lake Michigan, where alvars are clustered along the shoreline of Michigan's Upper Peninsula;
- Drummond Island and northern Lake Huron sites in Michigan, with many high-quality alvars in close proximity;
- Manitoulin Island, in Ontario, with many sites along the gently sloping south shore and several very significant alvar areas on LaCloche
- Carden Plain, in central Ontario, with alvar sites set among grazed grasslands and forests;
- Napanee Plain, just north of Lake Ontario, with a scattering of related sites;
- Smiths Falls Plain, in eastern Ontario, with the significant Burnt Lands site as well as several smaller alvars;
- Northern New York state, with Chaumont Barrens and several other significant alvar sites.

Carol Reschke





Different Types of Alvars

Robert McCaw

Alvars can be divided into five main groups according to the plants found there.

Alvar pavements occur on very exposed rock. They are most frequently found on the Bruce Peninsula and southern Manitoulin Island. Moss and lichens are the most important parts of these communities, along with plants such as early saxifrage, false pennyroyal and tickle-grass. In this barren landscape, plant communities can only take root in bedrock cracks and where depressions in the rock have caught rainwater.

Alvar shrublands have moderate to high cover of shrubs, but very few larger trees. These areas support such species as shrubby cinquefoil, creeping juniper, common juniper and fragrant sumac. The dominant shrubs vary according to each site's location within the Great Lakes basin.

Alvar savannas have scattered trees that cover between 10 and 25 percent of their area. Savannas can look strikingly different from one another. For example, on Pelee Island in Lake Erie, chinquapin oak and blue ash savanna form a very rare community type. Further north along the shores of northern Lake Huron, white cedar and jack pine savannas provide suitable conditions for such unusual plants as dwarf lake iris and lance-leaved coreopsis.

left: Burnt Lands Alvar pavement
left inset: Oak savanna, Pelee Island
inset above: Early saxifrage on alvar pavement
below: Dwarf shrub alvar, Manitoulin Island

Ron Erwin

Don Kirk

C. Clampitt

Ron Reid

Alvar woodlands have the densest cover of trees, but patches of exposed bedrock or openings are still common. Conifers such as white spruce, white cedar and white pine are common in alvar woodlands across the Great Lakes basin and alvar woodlands in eastern Ontario and New York state are often dominated by red cedar.

Alvar grasslands have enough shallow soil to support grasses and sedges. The mix of species varies from site to site and is related, in large part, to the extent of flooding in the spring or after rainstorms. Species characteristic of alvar grasslands include tufted hairgrass, Crawe's sedge, prairie dropseed and little bluestem.

above: Carden alvar woodland
below: Northern leopard frog

Carole Reschke

Ron Erwin

Little LaCloche Island alvar grassland

Doug Larson

Twisted, gnarled trees on Bruce Peninsula coastal alvars are between 300 and 500 years old.

Alvars: The Great Lakes' Newest Ancient Forest

How can an ancient forest be new? By being so well disguised that no one sees it for what it is! Most people know about old-growth forests from images of majestic white and red pines in the area around Lake Temagami but only now are we hearing about the slow-growing ancient cedars on the cliffs of Ontario's Niagara Escarpment. And as recently as 1995, another class of ancient forest was identified on some Bruce Peninsula alvars. On these coastal alvars, an amazing discovery was made---the twisted, gnarled trees were between 300 and 500 years old. So now these ancient, undisturbed alvar communities have become the newest member of the old-growth

The Secret Life of Alvar Plants

At first glance alvars may appear barren, but they are actually rich in distinctive plants.

A recent study of the botany of Ontario alvars lists 19 species of vascular plants that rarely occur elsewhere. False pennyroyal, a blue-flowered member of the mint family, is one of the most faithful to alvar habitats. Other characteristic alvar plants include prairie smoke, Crawe's sedge, early buttercup and upland goldenrod.

There are other interesting variations of plant specialties as well. The alvars of the Bruce Peninsula, Manitoulin Island and adjacent areas in northern Michigan are notable for their arctic-alpine species such as wild chives, red anemone and alpine bluegrass. In contrast, plants more typical of the southern United States, such as downy wood mint, are found on the alvars of western Lake Erie, with other southern species on the Napanee and northern New York state alvars.

One of the rarest of alvar plants is the yellow-flowered *Hymenoxys herbacea*. This attractive wildflower has few occurrences but many names, depending on whom you ask and where you are. On Manitoulin Island, for example, it's called Manitoulin gold, on the Bruce Peninsula, it's rubberweed; and on Ohio's Marblehead Peninsula, it's known as lakeside daisy.

left: Indian paintbrush
top: False pennyroyal
centre: Lakeside daisy
bottom: Prairie smoke

Don Kirk

Robert McCaw

Don Kirk

Robert McCaw

Don Kirk

Blazing star
Harebell

Robert McCaw

Blue-eyed grass
Lance-leafed coreopsis

Robert McCaw

Robert McCaw

Robert McCaw

Indian paintbrush and bluets
Balsam ragwort

Don Kirk

Mosses, Lichens and Algae

Dr. George Peck / Ivy Images

In addition to vascular plants, alvars support many other life forms that possess the hardiness needed to survive in an environment of extremes. Lichens are much more abundant in alvars than in surrounding woodlands. As well, a number of mosses and lichens occurring on alvars are quite rare in the Great Lakes region, including some characteristic of arctic-alpine regions and others typical of northern areas.

Unexpectedly for such a dry summer habitat, a diverse mix of algae abound on alvars: gelatinous sheets of Nostoc algae that dry up to a crunchy crust; microscopic blue-green algae that coat the rocks dark grey; and even orange fuzzy structures that look like a moss but are actually Trentepolia algae Some 46 kinds of algae have been identified from sites on the Bruce Peninsula. But that's not even scratching the surface. One slimy ball of algae was estimated to contain hundreds of species!

above: Moss and lichen on limestone

Claudia Schaefer

Alvar Birds

The

The open grasslands and scattered small trees that characterize some alvar communities are home to most of Ontario's remaining populations of the endangered loggerhead shrike. Alvar grasslands on Manitoulin Island support prairie sharp-tailed grouse; and alvar shrublands are home to rufous-sided towhees, indigo buntings, brown thrashers and clay-coloured sparrows. Because most of these species are undergoing long-term population declines across eastern North America, the conservation of these habitats is especially important.

top: Eastern bluebird
below: Brown thrasher
right: Loggerhead shrike
insets: Upland sandpiper, Bobolink

fauna of alvars is just as distinctive as the flora.

Robert McCaw

Chris Grooms

Alvar grasslands are home to sharp-tailed grouse seen here performing their mating dance.

Ron Erwin

Robert McCaw

Vesper sparrow
Clay-coloured sparrow
Sharp-tailed grouse

A World of Tiny Creatures

Carol Reschke

Alvars are particularly remarkable for their diversity of invertebrates. Butterflies that are rare in the Great Lakes region can be found on alvars; for example, the Garita skipper on LaCloche Island north of Manitoulin, a site located over 1,000 kilometres east of the next closest population, or the olive hairstreak on Ontario's Napanee Plain. Many insects more common to the grasslands of the western plains also live on alvars, including rare ground beetles, sawflies and flightless leafhoppers. As well, some 26 species of land snails thought to be new to science have been found on alvars and are in the process of being

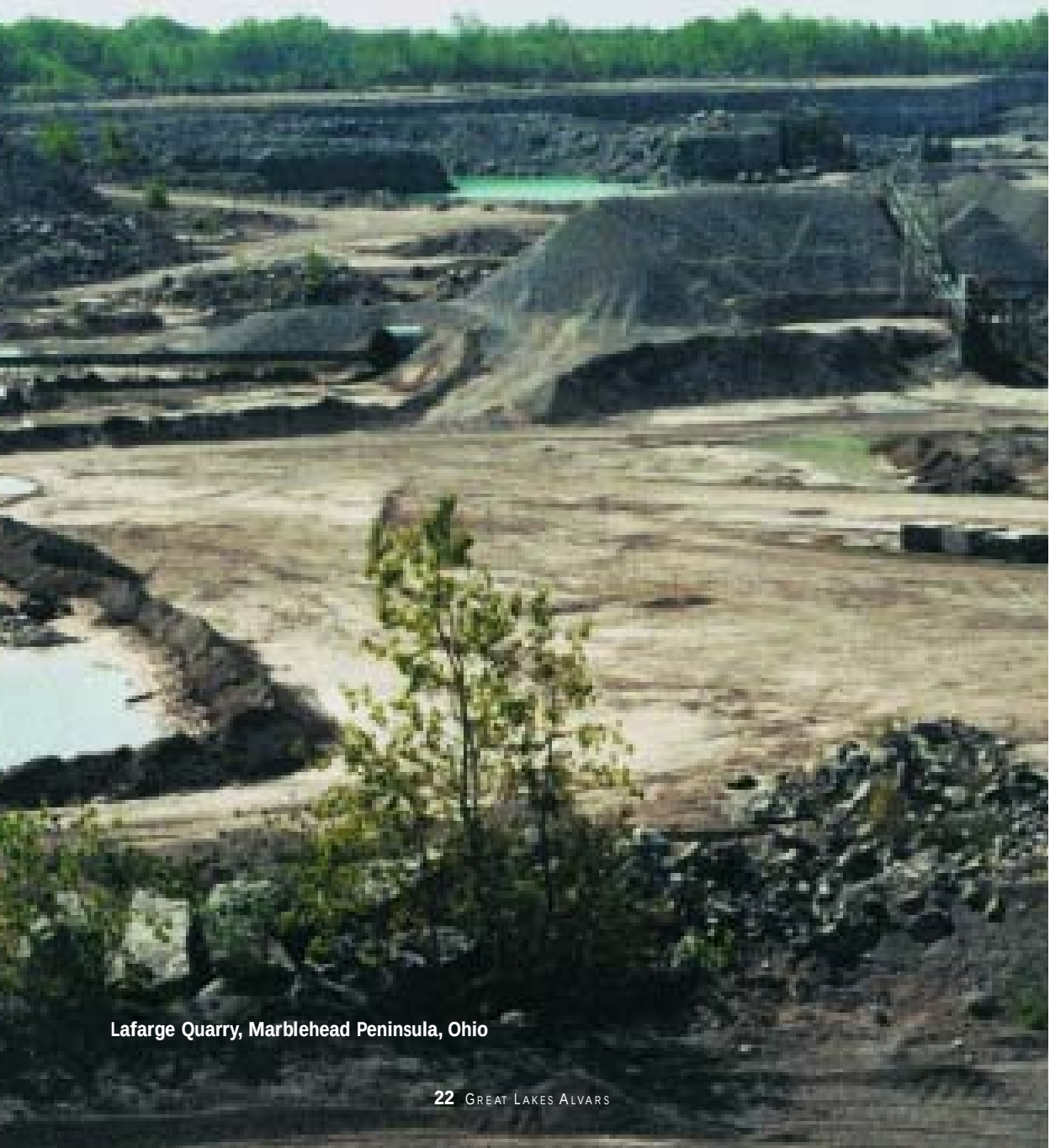
olive hairstreak

The most notable of the threats to Great Lakes alvars include quarrying, land development, certain recreational activities, cattle grazing, invasion of exotic species, and forestry.

Anthony Goodban

Quarrying

Loss of alvar habitats to rock quarries has taken place across the Great Lakes basin and continues to be the number one threat to alvars in many places. Almost any alvar within trucking distance of a major urban market is threatened.



Lafarge Quarry, Marblehead Peninsula, Ohio

Alvars at Risk

While alvar habitats might be harsh and inhospitable places for trees and many other plants, they are also fragile and vulnerable to the threats posed by a growing human population in the Great Lakes basin.

Development. The construction of rural residences, cottages and second homes, trailer parks and other forms of low-density rural development is an ongoing threat to many alvar habitats. Shoreline alvars are especially at risk.

Recreation. The disparate activities of gardening and off-road motoring both pose threats to alvar habitats. The flat, open terrain and remoteness of some alvar areas attract trail bike, off-road truck, and ATV enthusiasts, whose vehicles cause ruts that disrupt critical water flow patterns and create conditions suitable for the invasion of exotic species. As well, the removal of stunted old-growth cedars and other trees by bonsai collectors is a serious management problem on Bruce Peninsula alvars; and showy wildflowers such as dwarf lake iris are at risk from gardeners who try to transplant them.

Exotic Species. An array of foreign plants and animals have become established on some Great Lakes alvars. Problematic species include common buckthorn, honeysuckles, dog-strangling vine and mossy stonecrop. These exotic or foreign species compete for space and nutrients on alvars and can become dominant at the expense of the native species.

Forestry. The logging of mature trees from alvar woodland communities can significantly alter the vegetation structure of a site. Some alvar areas have been used as skidways and log assembly areas, resulting in serious damage from ruts and debris accumulation. The establishment of conifer plantations and Christmas tree farms has also destroyed some alvar habitats.

J. Shore

inset: Dog-strangling vine
below: Cattle grazing at Carden alvar

Janet Grand

Scattered across the Great Lakes basin are a small number of alvar sites that are presently protected, either as publically owned parks or private reserves.

Protected Places

In New York state, The Nature Conservancy (TNC) owns parcels of alvar habitat at Limerick Cedars and Chaumont Barrens. Both sites have supported research on aspects of alvar ecology as diverse as hydrology, frost heaving and invasion of non-native species. Chaumont features a self-guided interpretive trail, an interpretive kiosk and an excellent trail-guide brochure.

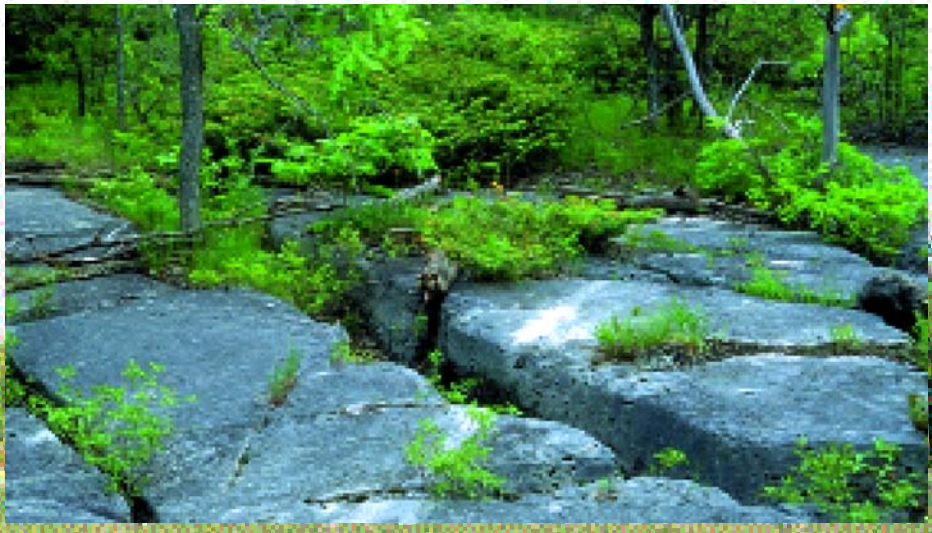
Maxton Plains, on Michigan's Drummond Island, covers 3,200 hectares and ranks as one of the largest and least disturbed alvars in the world. Most of the site is owned by the state, but TNC also has two preserves in the area. Maxton Plains is the best representative alvar in Michigan, with prairie dropseed, prairie smoke and other unusual plants growing in profusion.

Ron Erwin

D. Albert

Ram's head lady's slipper orchid

Maxton Plains: shallow water covers most of the alvar in late spring.



top: Chaumont pavement barrens ; bottom: fissures at Chaumont Barrens

The Nature Conservancy, Central & Western New York Chapter

Heather Potter

Bruce Peninsula National Park

One of the best places to see lakeside daisy (or whatever you may call it) is in an Ohio State Nature Preserve on Kelley's Island, where a historic quarry has regenerated into an interesting plant community with several alvar species. Lakeside daisy is also abundant at the Federation of Ontario Naturalists' Bruce Alvar Nature Reserve on the upper Bruce Peninsula. This 68-hectare site, purchased by the FON in 1993, includes alvar pavements dominated by a ground cover of moss and herbaceous plants and coniferous woodlands dominated by jack pine. It provides habitat for the threatened eastern Massassaga rattlesnake and many provincially rare plants. Several other alvar areas are protected within the Bruce Peninsula National Park and provincial nature reserves on the upper Bruce Peninsula.

On Ontario's Manitoulin Island, spectacular alvar landscapes can be found in a remote, lonely wilderness setting at the Misery Bay Provincial Nature Reserve. Here you will find lakeside daisy, jack pine alvar savannas and alvar pavements with a complement of arctic-alpine plant species. In eastern Ontario, a provincial nature reserve and lands acquired by the Nature Conservancy of Canada protect significant sections of the Burnt Lands Alvar.

above left: Burnt Lands Alvar; above right: Massassaga rattlesnake, Bruce Alvar Nature Reserve
below: Lakeside daisy transplant site on Kelley's Island, Ohio

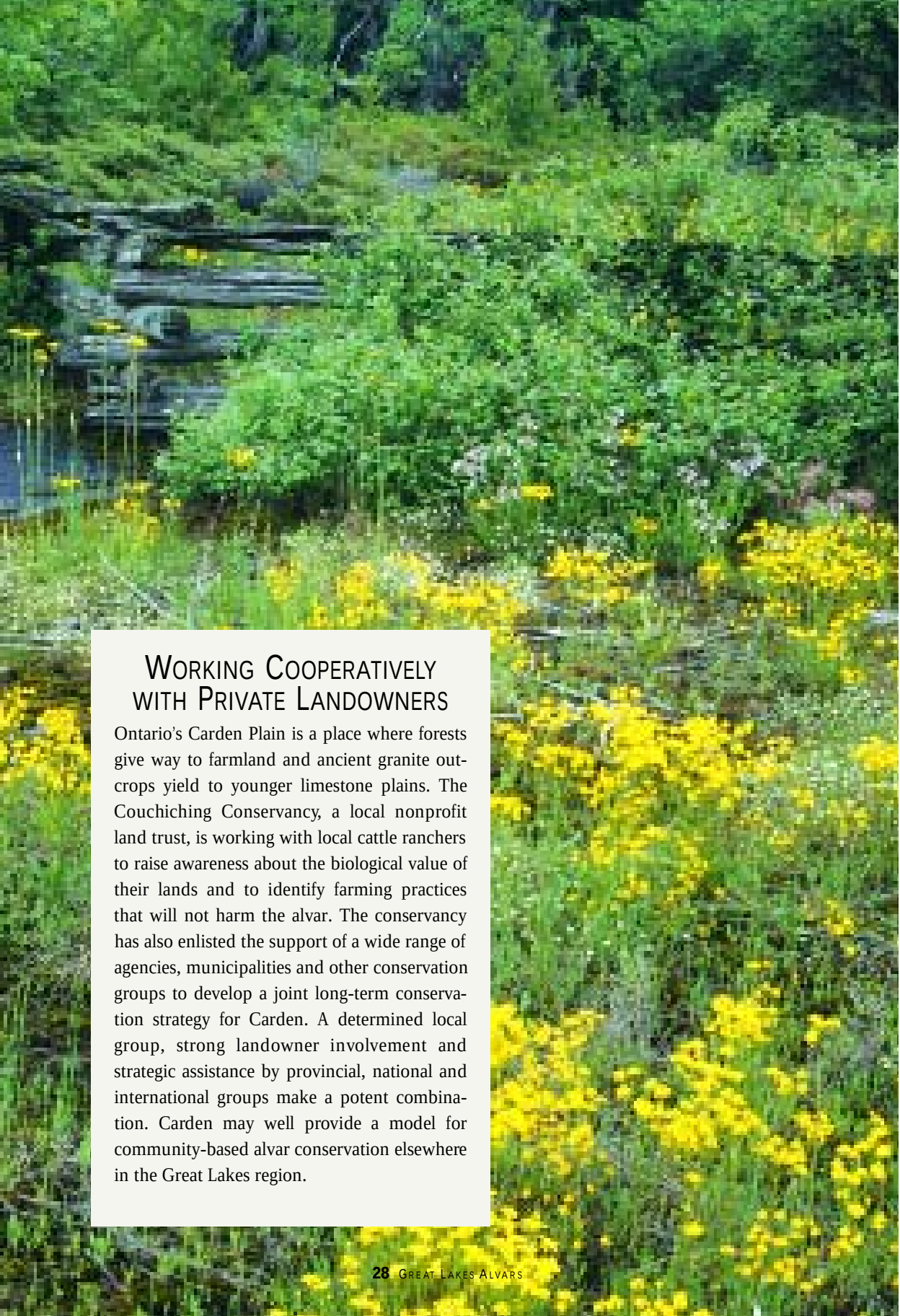
Ron Erwin

Allison W. Cusick

Don Kirk

Boardwalk at FON's Bruce Alvar Nature Reserve
Misery Bay

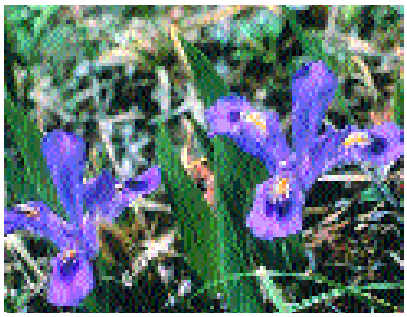
Ron Erwin



Working Cooperatively with Private Landowners

Ontario's Carden Plain is a place where forests give way to farmland and ancient granite outcrops yield to younger limestone plains. The Couchiching Conservancy, a local nonprofit land trust, is working with local cattle ranchers to raise awareness about the biological value of their lands and to identify farming practices that will not harm the alvar. The conservancy has also enlisted the support of a wide range of agencies, municipalities and other conservation groups to develop a joint long-term conservation strategy for Carden. A determined local group, strong landowner involvement and strategic assistance by provincial, national and international groups make a potent combination. Carden may well provide a model for community-based alvar conservation elsewhere in the Great Lakes region.

Priorities for Protection



S. R. Crispin

While several fine examples of alvar habitats are in parks and reserves, the vast majority of alvars in the Great Lakes region are not protected. The International Alvar Conservation Initiative, a three-year study involving over 50 collaborators from Canada and the United States, identified high priority sites for protection. Almost one-third of the highest-priority alvar sites occur on Manitoulin Island, highlighting its importance as the epicentre of North American alvar diversity. The results of this study are summarized in a technical report, *Conserving Great Lakes Alvars*, which is available from The Nature Conservancy.

Each of the state and provincial jurisdictions within the Great Lakes basin have also produced summary reports on their alvars, highlighting important sites. The FON has sponsored an Alvar Theme Study for Ontario, which describes sites that should be protected in future land-use planning decisions.

The Belanger Bay alvar site on Manitoulin Island boasts thousands of specimens of lakeside daisy as well as other rarities such as dwarf lake iris and Houghton's goldenrod.

Don Kirk

Phil Kor

Don Kirk

Alvar Management

Just because a site is owned by a public agency or conservation organization does not mean that it is entirely protected. Many protected alvar sites require ongoing management in order to preserve their natural heritage values. TNC preserves in Michigan and northern New York have been used as sites for a range of research projects, including experimental treatments of invasive plant species to evaluate potential control methods. Interpretive signs and materials, along with boardwalks and parking facilities, have been developed to increase the educational dimension of these sites and to control access. The FON's Bruce Alvar Nature Reserve includes an interpretive boardwalk designed to minimize pedestrian damage to the site.

Prescribed burn at Stone Road Alvar, Pelee Island

Prescribed burns have been used to renew Stone Road Alvar on Pelee Island, and experimental transplanting and seeding of lakeside daisy have been successfully carried out on Ohio's Kelley's Island nearby.

Private Stewardship

With so much of the Great Lakes' limestone plain in private ownership, private stewardship is an essential means of conserving alvar habitats. Interested landowners can make important contributions to alvar conservation by not overgrazing areas, by restricting recreational vehicles, and by minimizing other disturbances. Several landowners are participating in research projects to help further clarify alvar ecology and management questions; others allow access to naturalists and scientists to gather field data. Stewardship information can be obtained from the contact groups listed opposite.

Protecting the Great Lakes' Limestone Legacy

We now know that alvars are special places that form a valuable part of the natural legacy of the Great Lakes region. We also know that their future is in jeopardy. Conservation groups and government agencies, from the local to the international, have begun working to preserve alvar habitats, but they need your help. If you are fortunate enough to be an alvar landowner, take the time to learn about their ecology and how they can be protected. But even if you are not a landowner, you can still be involved by supporting the projects of conservation organizations and enlisting the support of others. By working together, we can ensure that this unique limestone legacy will be passed on undamaged to future generations.

For more information about alvars and their natural heritage values, please contact:

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Early saxifrage / Robert McCaw

FEDERATION OF
Ontario Naturalists

The Nature Conservancy *Great Lakes Program*