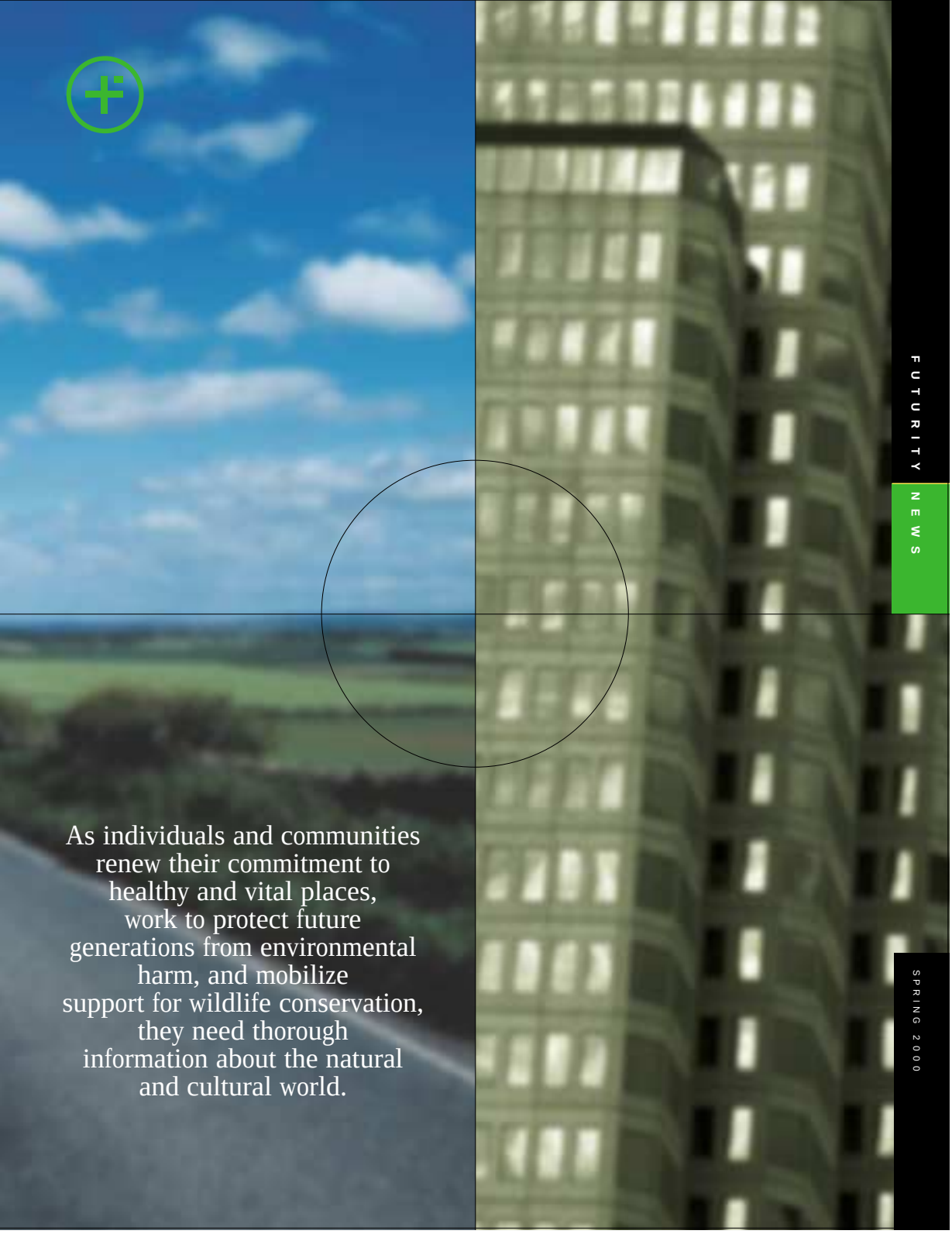


As individuals and communities renew their commitment to healthy and vital places, work to protect future generations from environmental harm, and mobilize support for wildlife conservation, they need thorough information about the natural and cultural world.

FUTURITY NEWS

SPRING 2000

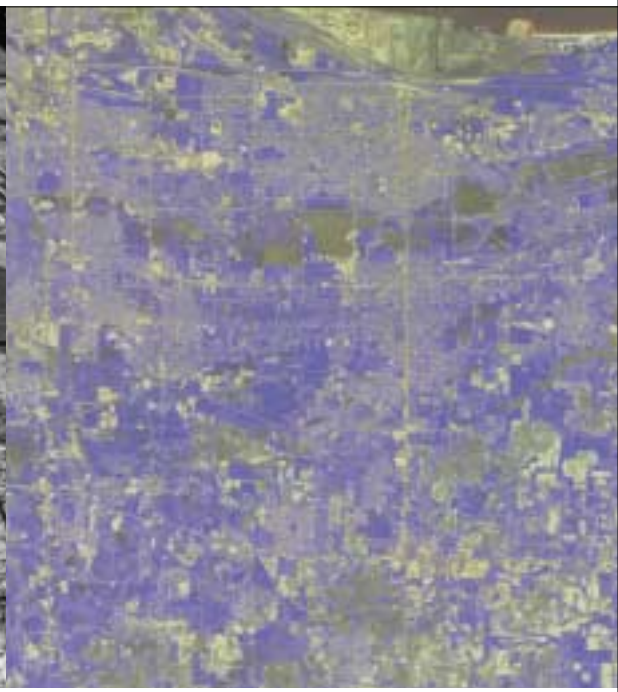
TOOLBOX

The geographic extent and imperceptible nature of many environmental relationships complicates their integration into land planning. Earth-sensing satellites, with their ability to detect discrete land-cover conditions, can provide the information needed to facilitate this connection.

Thermal infrared (IR) and near IR detectors carried on some satellites record data invisible to the human eye. Thermal IR data enables the amount of heat radiated by surface features to be measured and analyzed. This allows for identification of the specific land-cover types contributing to increased surface temperatures.

Near IR data can be used for studying vegetation. For example, stressed vegetation, a condition often only visible during advanced stages, has relatively low near IR reflectance compared to healthy vegetation. Futurity analyzes near IR data to identify regional trends in vegetation coverage.

Satellite imagery provides the information needed to pinpoint the diffuse effects of many land-use decisions. This perspective is an effective starting point for crafting and implementing successful resource protection strategies.



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MAP 1: LANDSAT THEMATIC MAPPER (TM) SATELLITE IMAGE OF CHICAGO, ILLINOIS; DATE OF IMAGE: JUNE 7, 1989; IMAGE BANDS DISPLAYED: 4,3,2 IN RGB (RED, GREEN, BLUE); SPATIAL RESOLUTION: 28.5 METERS.

CASE STUDY 1: MITIGATING URBAN HEAT ISLAND

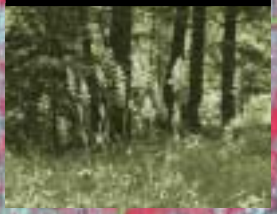
CASE STUDIES

As our ability to affect the environment has become evident, the need for resource-based planning has grown. This issue of Futurity News explores the diverse environmental effects of land-use conditions and the need for resource protection strategies. Through two case studies, we highlight the importance of land-cover information as a foundation for sustainable urban design and land planning.

The first of two case studies illustrates Futurity's ability to analyze land-cover conditions and communicate cause-and-effect relationships. In this instance, a phenomenon known as "Urban Heat Island" is studied to determine how the urban environment modifies the local climate.

The second case study demonstrates how land-cover analyses can help protect natural resources. Futurity uses remote sensing and Geographic Information Systems (GIS) to identify species habitat, assess habitat quality, and guide the formation of land acquisition plans.

CASE STUDY 2: LAND ACQUISITION STRATEGIES FOR HABITAT PROTECTION.



FUTURITY ANALYZES SATELLITE IMAGES TO ISOLATE SPECIFIC, CRITICAL LAND-COVER CONDITIONS AND TO FACILITATE THE INTEGRATION OF ENVIRONMENTAL RELATIONSHIPS INTO LOCAL PLANNING AND DESIGN DECISIONS.

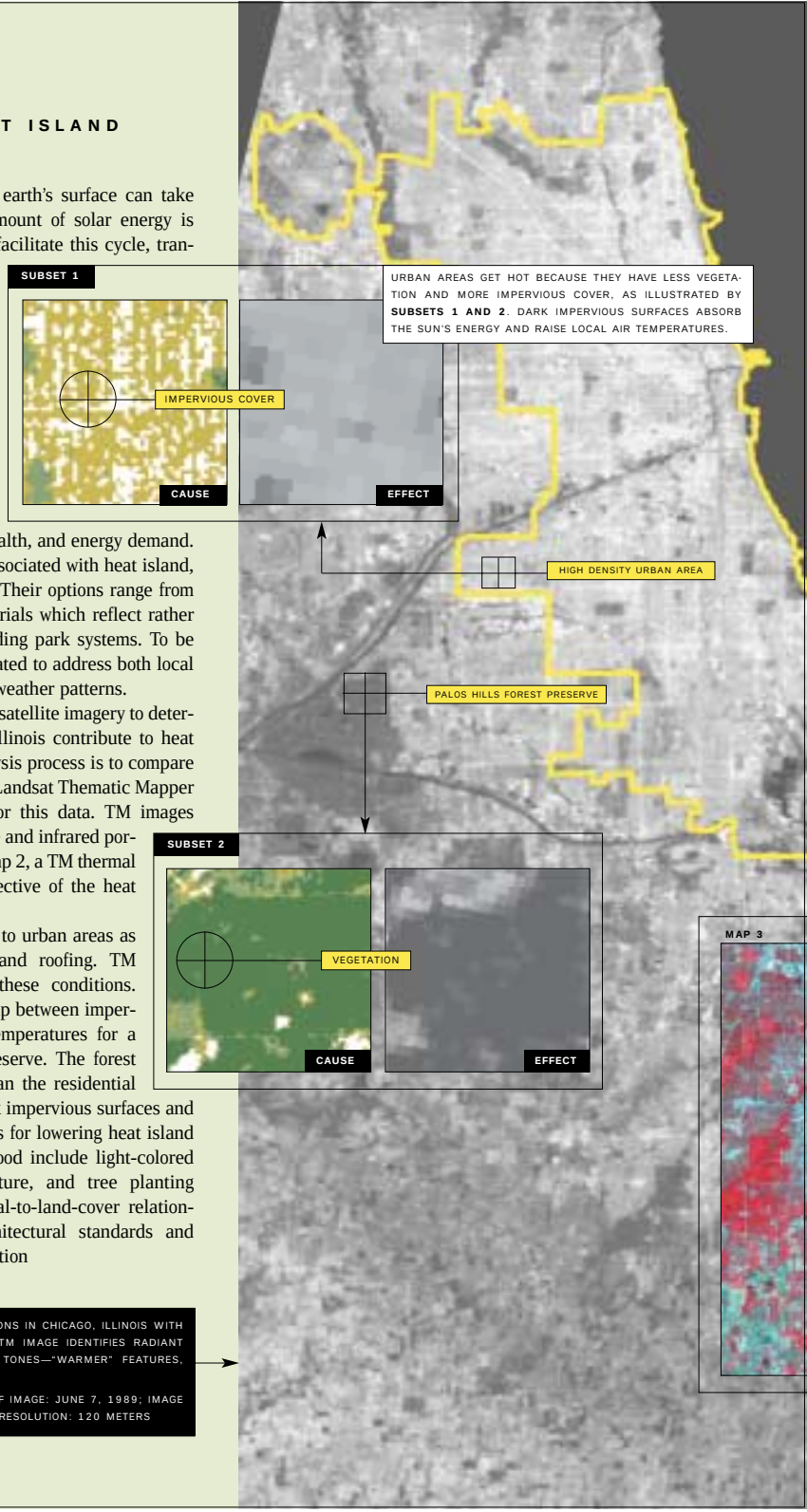
MITIGATING URBAN HEAT ISLAND

The effect of solar energy striking the earth's surface can take many forms. In rural areas, a large amount of solar energy is expended on evaporating water. Plants facilitate this cycle, transpiring water through their leaves and cooling the surrounding air. In urban areas, impervious cover produces a different transformation. Dark materials absorb solar energy and radiate it as heat. These conditions have caused temperatures in some urban areas of the United States to be as much as eight degrees Fahrenheit hotter than surrounding rural areas.[1] Known as "Urban Heat Island," this phenomenon is affecting environmental conditions, human health, and energy demand.

Faced with the hazards and costs associated with heat island, many cities are searching for solutions. Their options range from advocating the use of construction materials which reflect rather than absorb the sun's energy, to expanding park systems. To be effective, these options must be coordinated to address both local and regional land-cover conditions and weather patterns.

In this case study, Futurity analyzes satellite imagery to determine how and why areas in Chicago, Illinois contribute to heat island. One of the first steps in the analysis process is to compare thermal and land-cover conditions. The Landsat Thematic Mapper (TM) satellite was used as a source for this data. TM images include information from both the visible and infrared portions of the electromagnetic spectrum. Map 2, a TM thermal infrared image, offers a regional perspective of the heat island phenomenon in Chicago.

Thermal values increase from rural to urban areas as vegetation is replaced by pavement and roofing. TM images can be analyzed to identify these conditions. Subsets 1 and 2 illustrate the relationship between impervious cover, vegetation, and radiant temperatures for a residential neighborhood and forest preserve. The forest preserve has lower air temperatures than the residential neighborhood due to the absence of dark impervious surfaces and the cooling effects of vegetation. Options for lowering heat island conditions in the residential neighborhood include light-colored roofing materials, green-roof architecture, and tree planting programs. Futurity's analyses of thermal-to-land-cover relationships guide the development of architectural standards and planning strategies for heat island reduction



MAP 2: FUTURITY ANALYZES HEAT ISLAND CONDITIONS IN CHICAGO, ILLINOIS WITH LANDSAT TM SATELLITE IMAGERY. BAND 6 OF A TM IMAGE IDENTIFIES RADIANT TEMPERATURES AS TONAL VARIATIONS: LIGHTER TONES—"WARMER" FEATURES, DARKER TONES—"COOLER" FEATURES

LANDSAT TM SATELLITE IMAGE OF CHICAGO; DATE OF IMAGE: JUNE 7, 1989; IMAGE BAND DISPLAYED: 6 (THERMAL INFRARED); SPATIAL RESOLUTION: 120 METERS

LAND ACQUISITION STRATEGIES FOR HABITAT PROTECTION

Urban growth, once characterized by the gradual development and expansion of suburbs, has taken on a new form. Today's "cities" have become boundless metropolitan regions. For example, between 1970 and 1990, the metropolitan region of Chicago expanded by 47 percent and now extends into eight counties and three states. Surprisingly, the actual regional population increased only four percent.[2]

As the quantitative area of natural and agricultural landscape surrounding our cities decreases, so too does habitat quality. Habitats have become reduced, altered, and isolated; native plant communities are disappearing, wetlands are being displaced, and impervious cover is causing flooding. These conditions warrant the use of strategies that manage and protect remnant habitats.

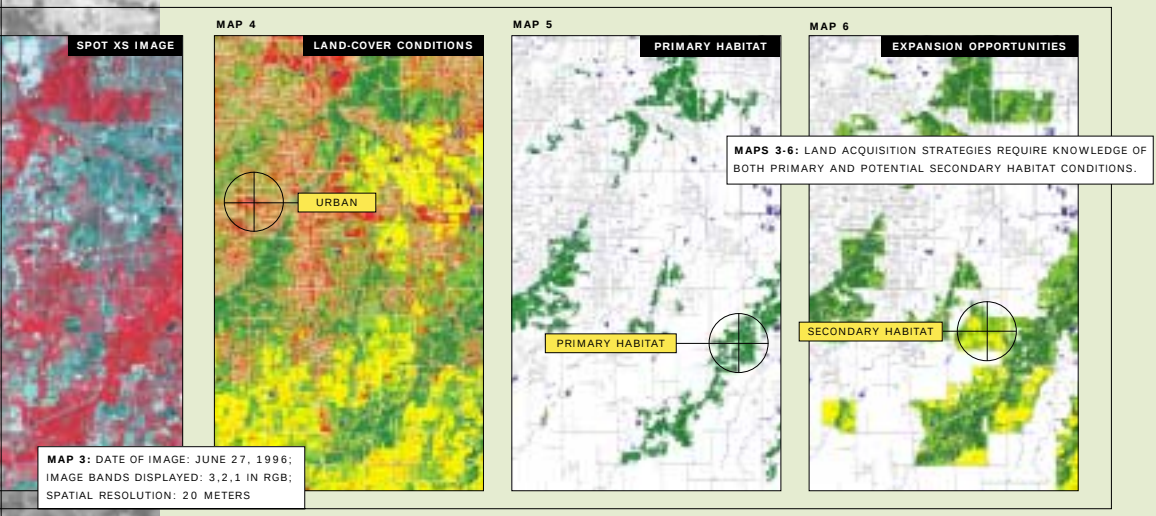
Land acquisition strategies seek to improve habitat quality and reduce fragmentation. The process requires knowledge of species habitat requirements, land-cover conditions, and land availability. Life requirements are used to assess the quality of primary habitats and suitability of land-cover conditions as secondary habitats.

Habitat quality can be degraded by a number of factors. For example, the physical barriers imposed by roads can have a significant impact on many species. Less obvious are other sources of stress such as noise, contaminated runoff, and lights.

The first step in developing a land acquisition strategy is to produce a land-cover map that identifies conditions indicating actual or potential degradation of a habitat. Map 4 is a land-cover map produced from a SPOT XS satellite image (Map 3). It shows an area in transition from rural to urban land-cover conditions. In this case study, Futurity uses the information provided by the map to assess different habitat options and the effects of stressors on Neotropical migratory bird populations.

Many Neotropical migratory birds require significant interior forest area for primary habitat. The integrity of these habitats is affected by edge conditions and intrusions such as road noise. Based on species life requirements for this case study, forestland areas greater than ten hectares are isolated on Map 5.

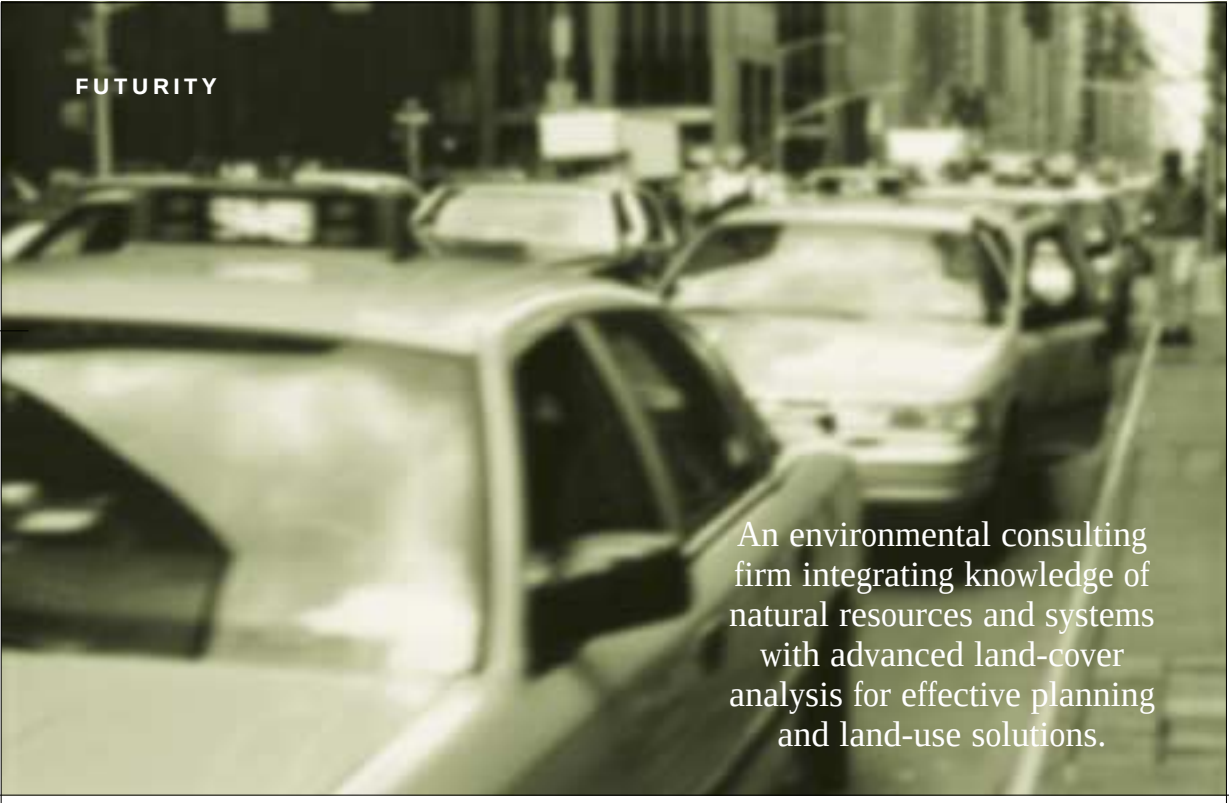
Secondary habitats act as buffers, reducing fragmentation and edge effects by increasing preserve size and sometimes increasing connectivity between individual habitats. In Map 6, potential secondary habitats adjacent to primary habitat forest patches are identified as land-cover conditions that can provide resources for target species. Land acquisition strategies seek to improve the quality of primary habitat and identify areas of potential secondary habitat. A resource protection plan that uses remote sensing can more clearly identify these areas and provide direction for future planning.



MAPS 3-6: LAND ACQUISITION STRATEGIES REQUIRE KNOWLEDGE OF BOTH PRIMARY AND POTENTIAL SECONDARY HABITAT CONDITIONS.

MAP 3: DATE OF IMAGE: JUNE 27, 1996; IMAGE BANDS DISPLAYED: 3,2,1 IN RGB; SPATIAL RESOLUTION: 20 METERS

[1] ENVIRONMENTAL PROTECTION AGENCY. "COOLING OUR COMMUNITIES—A GUIDEBOOK ON TREE PLANTING AND LIGHT-COLORED SURFACING." JANUARY 1992.
[2] CHICAGO WILDERNESS. "CHICAGO WILDERNESS, EXPLORING NATURE AND CULTURE." FALL 1999.



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