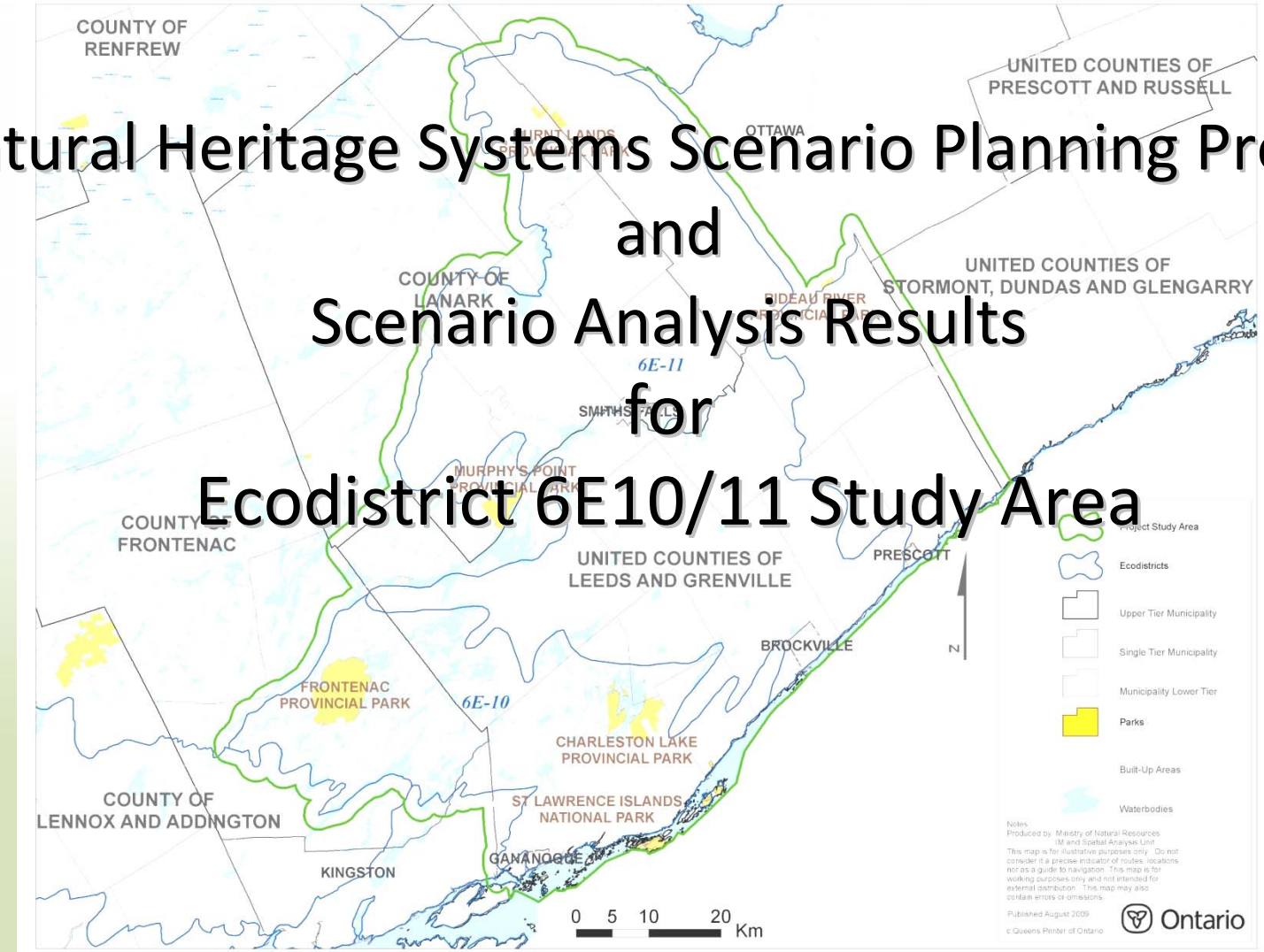
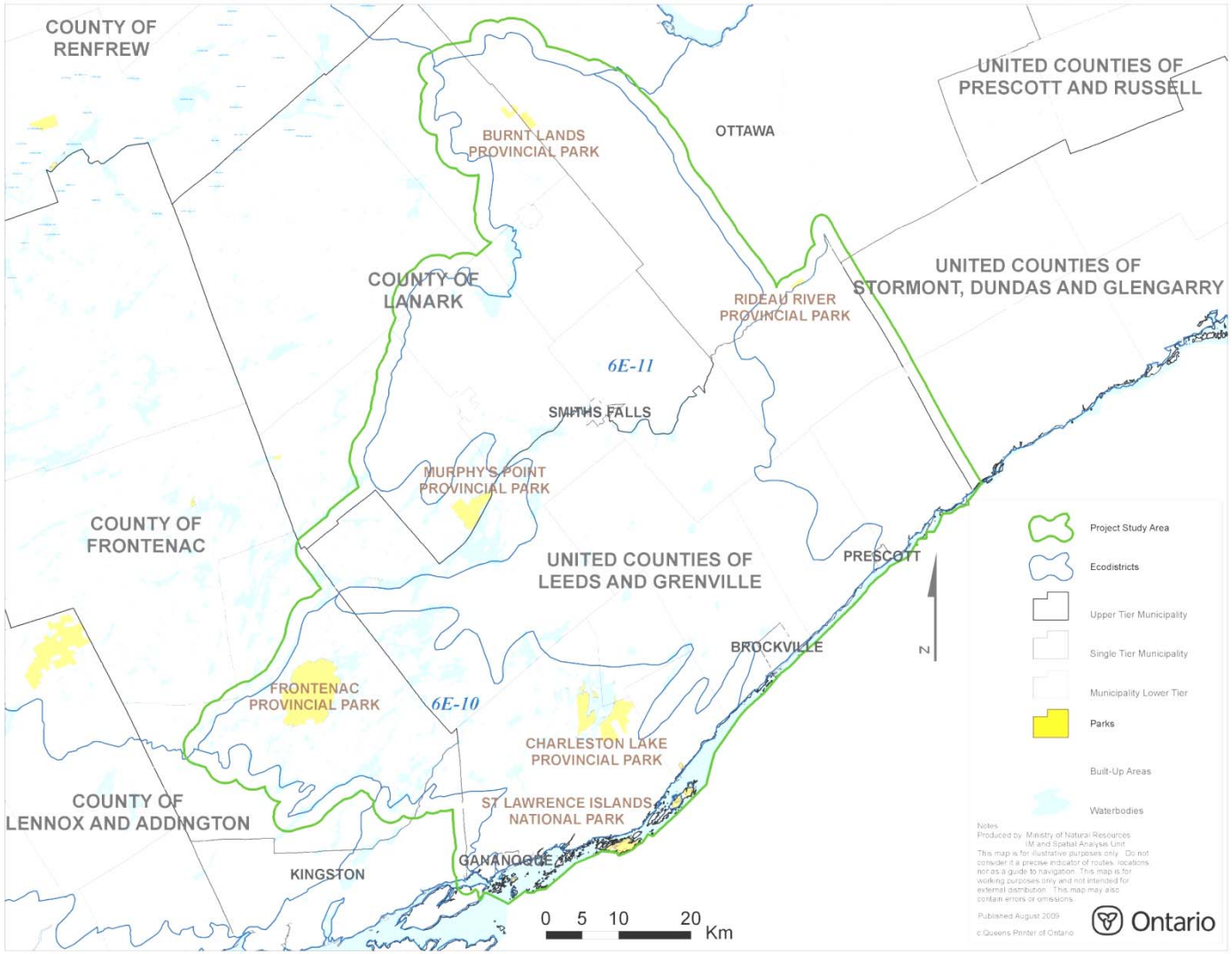
Natural Heritage Systems Scenario Planning Process and Scenario Analysis Results for Ecodistrict 6E10/11 Study Area



sustaining what we VALUE

An Integrated Landscape Management Planning Approach for the Communities of South Frontenac, Lanark, and Leeds and Grenville Counties



Integrated Landscape Management Project: Ontario

*ILM Project Partners **

- St Lawrence Islands National Park
- Eastern Ontario Model Forest *
- Frontenac Arch Biosphere Reserve
- United Counties of Leeds & Grenville
- Ministry of Natural Resources
- Ontario Nature
- Environment Canada
- Centre for Community Mapping
- Geoconnections, Natural Resources Canada

United Counties of Leeds & Grenville

Frontenac Arch Biosphere

Eastern Ontario Model Forest

Ontario Nature
Federation of Ontario Naturalists

GeoConnections / GéoConnexions Canada

Ontario

Environment Canada / Environnement Canada

Parks Canada / Parcs Canada

comap.ca

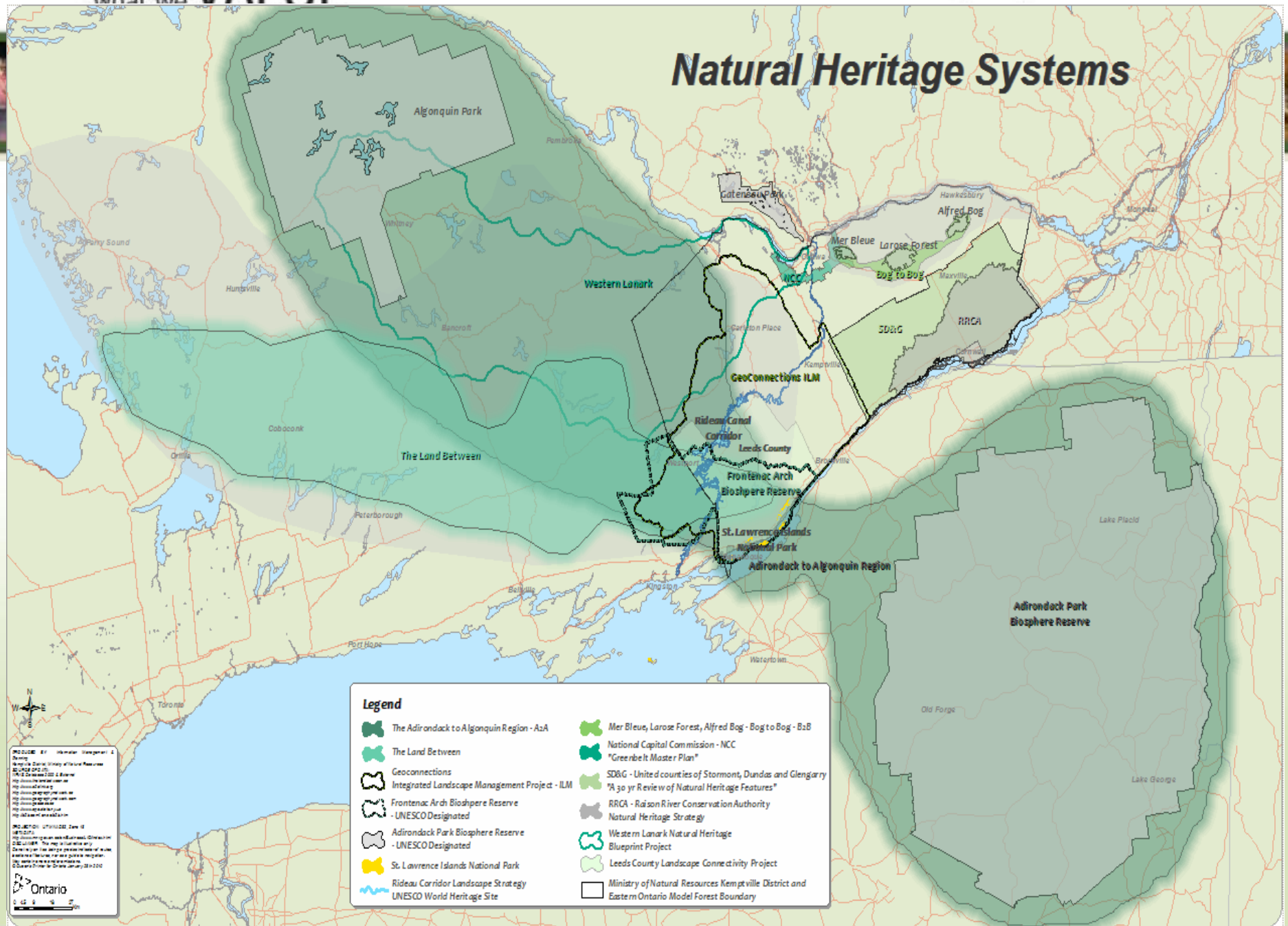
Presentation Outline

- Study Area Overview
- Review Of The Natural Heritage System Scenario Planning Process
- Review Key Components of the Project Terms of Reference
- About the MARXAN model
- Review Values, Baseline Targets and Constraints identified by the Scenario Planning Team
- Scenario Outcomes

What is a Natural Heritage System?

- Includes features and areas:
  - Wetlands
  - Woodlands
  - Lakes
  - Streams
  - Meadows
  - Plants and animals they contain
  - Respects cultural features and agricultural activities
- Links these features and areas with natural connections and corridors
- …natural infrastructure

Natural Heritage Systems



sustaining what we VALUE

An Integrated Landscape Management Planning Approach for the Communities of South Frontenac, Lanark, and Leeds and Grenville Counties

Total Area is 635,425 ha

of which

92% is Land

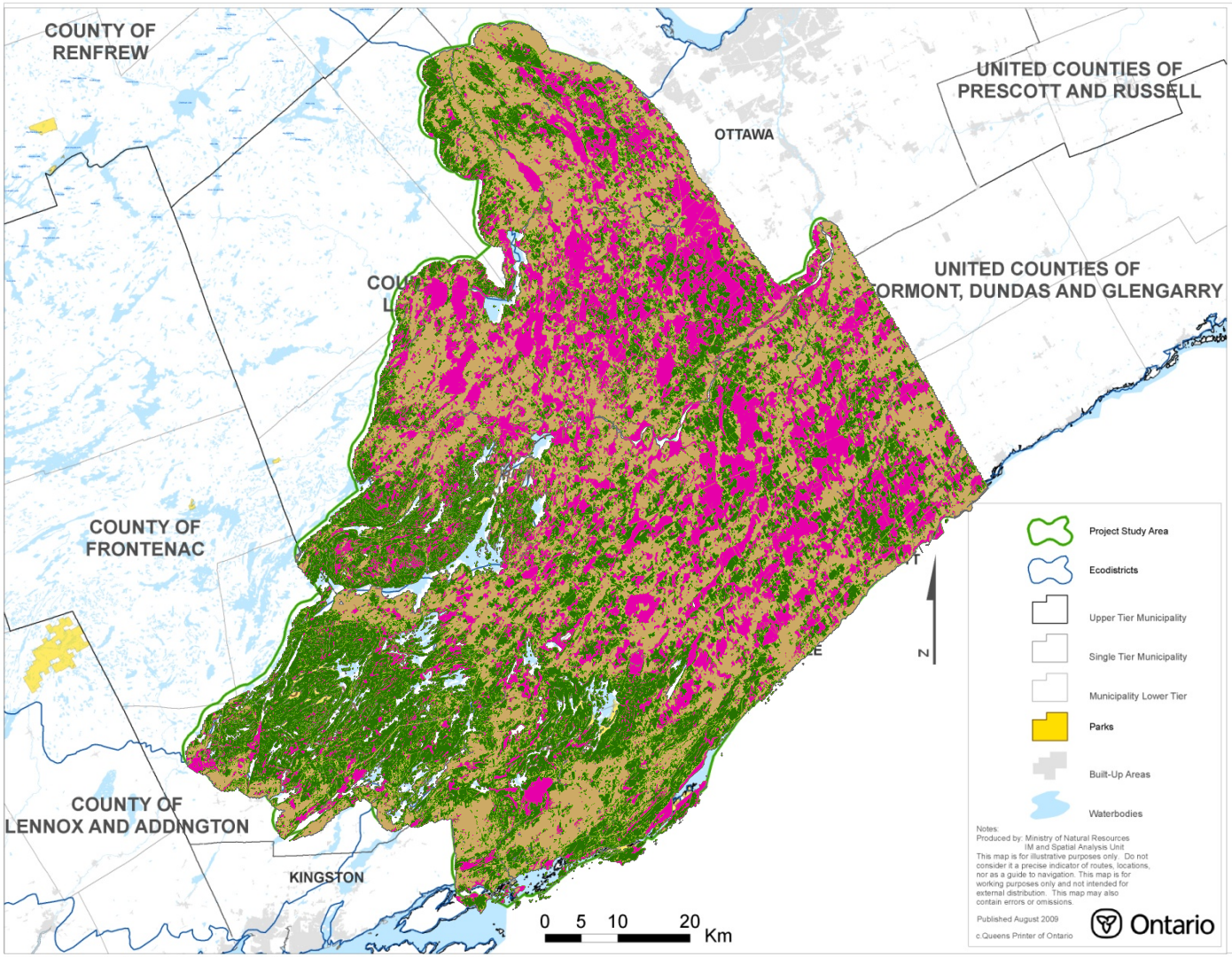
of which

60% is in Natural Cover

of which

45% consists of Wetlands

55% consists of Upland Forests



COMPONENTS *of* COLLABORATIVE NATURAL HERITAGE SYSTEMS DESIGN

In collaborative natural heritage systems design, a diverse group of local stakeholders come together to discuss the values included in a natural heritage system.

Together they set targets for each value using the best available science and information,and based on ecological boundaries.

ECOLOGICAL FUNCTIONS – COARSE SCALE WILDLIFE HABITAT

These landscape features, or attributes of features,contribute to ecosystem functions such as the movement of species. Stakeholders set targets for the number and size of patches and for how close together the patches should be in order to sustain healthy plant, animal and fish populations. Coarse scale features, such as patch size and forest interior, ensure that habitats are included for a broad range of species.

Example Values:

- Broad Forest, Wetland and Grassland Habitat Types
- Size and Distribution of Natural Areas
- Areas with Forest Interior Conditions
- Natural Area next to wetlands, streams, rivers and lakes

BIODIVERSITY REPRESENTATION

The values in this category represent unique vegetation communities, the foundation of ecosystems that contribute to the biodiversity of Ontario. The targets set for these values ensure that all native forests, wetlands, grasslands and other vegetation communities are represented appropriately in a natural heritage system.

Example Values:

- Forest Types
- Wetland Types
- Old Growth Forest
- Rare Vegetation Communities and Ecosystems

FINE SCALE SPECIES HABITAT

The values and targets in this category address individual species and their habitat needs.This finer level of detail ensures that species specific habitat requirements are represented in the natural heritage system.

Example Values:

- Habitats for Species at Risk
- Life cycle specific habitat needs for indicator plant, animal and fish species

SCENARIO MODELLING & ANALYSIS

SOCIO-POLITICAL CONSTRAINTS

These values recognize the existing land use and management decisions that have already been made. Accounting for these areas will ensure the design of a realistic and implementable natural heritage system. Natural areas that are permanently protected by legislation act as the building blocks for a system. Through constraint setting, stakeholders decide together which areas, such as urban greenspace and prime agricultural land, should be included within the natural heritage system to contribute to ecological targets.

Example Constraints:

- Parks and Protected Areas
- Agricultural Lands
- Aggregate Resources
- Urban Areas

HYDROLOGIC FUNCTIONS

These landscape features, or attributes of features, regulate the quality and quantity of water to maintain healthy watersheds. Targets are set based on hydrological boundaries to protect streams, rivers and lakes from erosion and contaminants, maintain groundwater levels and minimize flooding.

Example Values:

- Amount of Forest and Wetland Cover
- Size and Distribution of Natural Areas
- Amount of Natural Cover in Headwater and Groundwater Recharge Areas
- Amount of Natural Vegetation (next to wetlands,streams, rivers and lakes)

LEARNING SCENARIOS

Stakeholders examine several options for the natural heritage system based on the targets they have selected. Targets can be refined to ensure that the natural heritage system meets their objectives.

OVERLAYS

These values are placed on top of proposed options to provide further information to support the choice between various natural heritage system scenarios. This information is used at this stage in the process because there is uncertainty in the information or it is too difficult to represent properly inside a model.

- Cultural and Historic Sites
- Local Community Values
- Ecosystem Services Values

PREFERRED SCENARIO

Stakeholders come to consensus on their preferred natural heritage system design.

REFINEMENT OVERLAYS

When a preferred scenario has been selected, additional information that is available for only a portion of the landscape can be overlaid to refine the natural heritage system in that area.

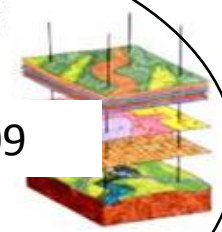
- Best Fine Scale Available Mapping

1

Pre-planning and Terms of Reference

Sept 08 to Oct 09

2

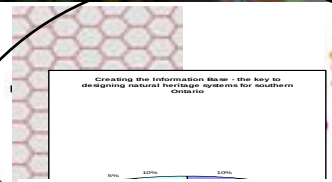


Compile data

Oct 09 to Mar 2010

Stakeholders set targets for initial scenarios

4



May to Oct 2010

Produce scenarios for comparison

5

Stakeholders review and discuss scenarios. A preferred scenario is developed

Oct 2010 to Feb 2011

7

Stakeholders rev map and finalize result through consensus

8

Final mapping of priority features, areas and linkages

First Draft Complete

9

Integrated stakeholder team establishes goals together, shares knowledge and understanding, builds trust and achieves consensus

Sustaining What We Value: An Integrated Landscape Management Project

Final
Terms of Reference
For the
Scenario Planning Team and
ILM Steering Committee

Endorsed on:
November 2, 2009
Brockville, Ontario

2.1 Vision Statement

A sustainable quality of life for the communities within and adjacent to the study area is supported by a balance of environmental, economic, cultural, and social land uses that includes a system of connected natural areas capable of conserving indigenous biodiversity, ecological functions and species habitats.

2.2 Goal

To identify, through engagement and agreement of local communities, a healthy natural heritage system (NHS) for the study area that will:

- Provide a focus for strategic land restoration to improve land sustainability, land securement, stewardship, and the conservation of biodiversity.
- Inform and support sustainable land use planning and resource management decision-making.
- Support sustainable economic opportunities.
- Support social well-being.
- Maintain cultural heritage.

2.3 Objectives:

1. Identifying a system of natural heritage features and areas based on the best available science and information, that incorporates local knowledge and interest through engagement with area communities.

2. Protecting identified ecological priorities so that they may continue to provide the health, social, cultural, economic, and environmental benefits that we rely on.

3. Providing products that provide benefit in informing: land use planning and policy decisions, including the option for municipalities to use the NHS in their official plans; priorities for stewardship and restoration projects; priorities for conservation land acquitisitions; and priorities for inventory programs and research projects.

4. Promoting the use of the products developed by the project in support of maintaining a healthy and functional natural heritage system for the benefit and health of the communities and environment.

5. Providing a foundation for future iterations of NHS planning as our knowledge and information improve over time.

2.4 Guiding Principles

These principles express the fundamental values that will guide the development of a natural heritage system for the landscape.

The process of developing the natural heritage system will:

1. Be value-based
2. Engage stakeholders in its design and development
3. Consider ecological, economic, social, and cultural values
4. Be based on the best-available science and information
5. Be open and transparent in reporting on process, methods, outcomes and results
6. Be dynamic and adaptive
7. Be consistent with the Provincial Policy Statement (Appendix D) and all applicable legislation
8. Consider existing municipal official plans and existing areas of development
9. Recognise the many values of natural and developed areas
10. Consider valuation of ecological goods and services
11. Consider valuation of cultural heritage resources

2.5 System Design Goals

The system design goals outline the types of features and areas that the natural heritage system will include.

1. The natural heritage system for the study area will consist of a network of natural core areas, regional connections and local linkages, and include:

    a) The diversity of ecological communities and native species

    b) Areas for restoration and recovery including representative and threatened natural areas

    c) Significant natural heritage features as defined in the 2005 Provincial Policy Statement

    d) Known occurrences of species at risk and their habitats

    e) Protected areas and public lands, and

    f) Surface water and other aquatic habitats, and sensitive groundwater features

2.5 System Design Goals Continued

2. The natural heritage system respects existing and approved land uses, including but not limited to:

    a) agricultural lands

    b) urban development

    c) tourism and recreational development

    d) resource extraction and mining

    e) transportation and infrastructure

    f) energy production

Decision-Making and Conflict Resolution

It is desirable that recommendations of the Scenario Planning Team be arrived at through consensus decision-making.

Where consensus cannot be achieved, majority and minority view points will be noted.

Where decisions are required in order for the project to continue to move forward and meet its objectives, majority decision will provide direction.

Interests and Organizations Represented on the Scenario Planning Team:

- Algonquin to Adirondacks Conservation Association
- County of Leeds and Grenville
- County of Frontenac
- Stewardship Councils
- Landowner Associations
- Agricultural Associations
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources
- Municipal Heritage Committees
- Historical Societies
- Area Artists
- Cultural Heritage
- Township of Elizabethtown-Kitley
- Eastern Ontario Model Forest
- Conservation Authorities
- Canadian Land Trust Alliance
- Lanark, Leeds and Grenville Health Unit
- Leeds and Grenville Agricultural Advisory Committee
- St. Lawrence Islands National Park

Decision Support

About the MARXAN model

Some General Info About Marxan

- **Marxan is software that delivers decision-making support for reserve system design using a mathematical algorithm called Simulated Annealing.**
- **Simulated Annealing is a fancy mathematical term for a way of searching through many spatial possibilities in an effort to find some good solutions subject to targets, constraints and costs identified by a Scenario Planning Team.**
- **Developed by Ian Ball and Hugh Possingham, in 2000, at the University of Adelaide, Australia, to provide decision support for the Great Barrier Reef Marine Planning Authority.**
- **Funding provided from a wide range public and private organizations.**
- **Currently maintained and supported through The Ecology Centre, University of Queensland, Australia and available for download at:**

http://www.uq.edu.au/marxan/

- MARXAN has been scientifically proven and published and is internationally recognized and well understood by the global conservation community.

- As a result, MARXAN is globally, the most widely used conservation planning decision support tool out there

So How Does It Work?

Uses three things to figure out the most efficient combination of areas to include; subject to the targets and constraints chosen by the Scenario Planning Team.

1. **Land Unit Cost** – up to the Scenario Planning Team to decide what this should be, such as:
   - ✓ simply the amount of area
   - ✓ land market values
   - ✓ opportunity cost relative to the best alternative land use
   - ✓ or a combination of things, whatever makes the most sense to the Scenario Planning Team for this landscape

2. **Land Unit Boundary Cost** – controls how spread out across the landscape the land units can be. The higher this cost, the more clumped together the areas selected will be.
   - ➢ This is handled through calibration of the model by the analysts

3. **Cost of Not Meeting Targets** – the Scenario Planning Team decides how much of each existing value needs to be included through target setting. A land unit that does not contribute to a target incurs a penalty cost.

Therefore, the total cost of a NHS design equals the:

Land Unit Cost

+

Land Unit Boundary Cost

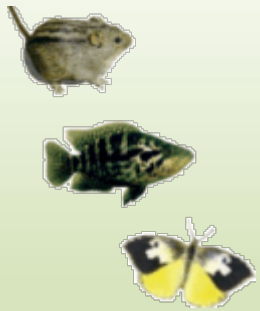
+

Cost of Not Meeting Targets

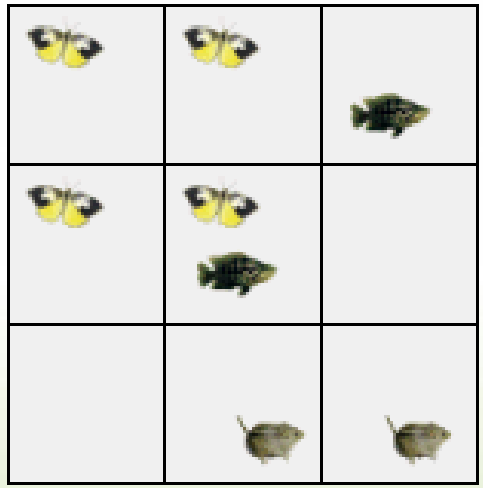
MARXAN searches through all the land units to find the cheapest possible combination

For Example

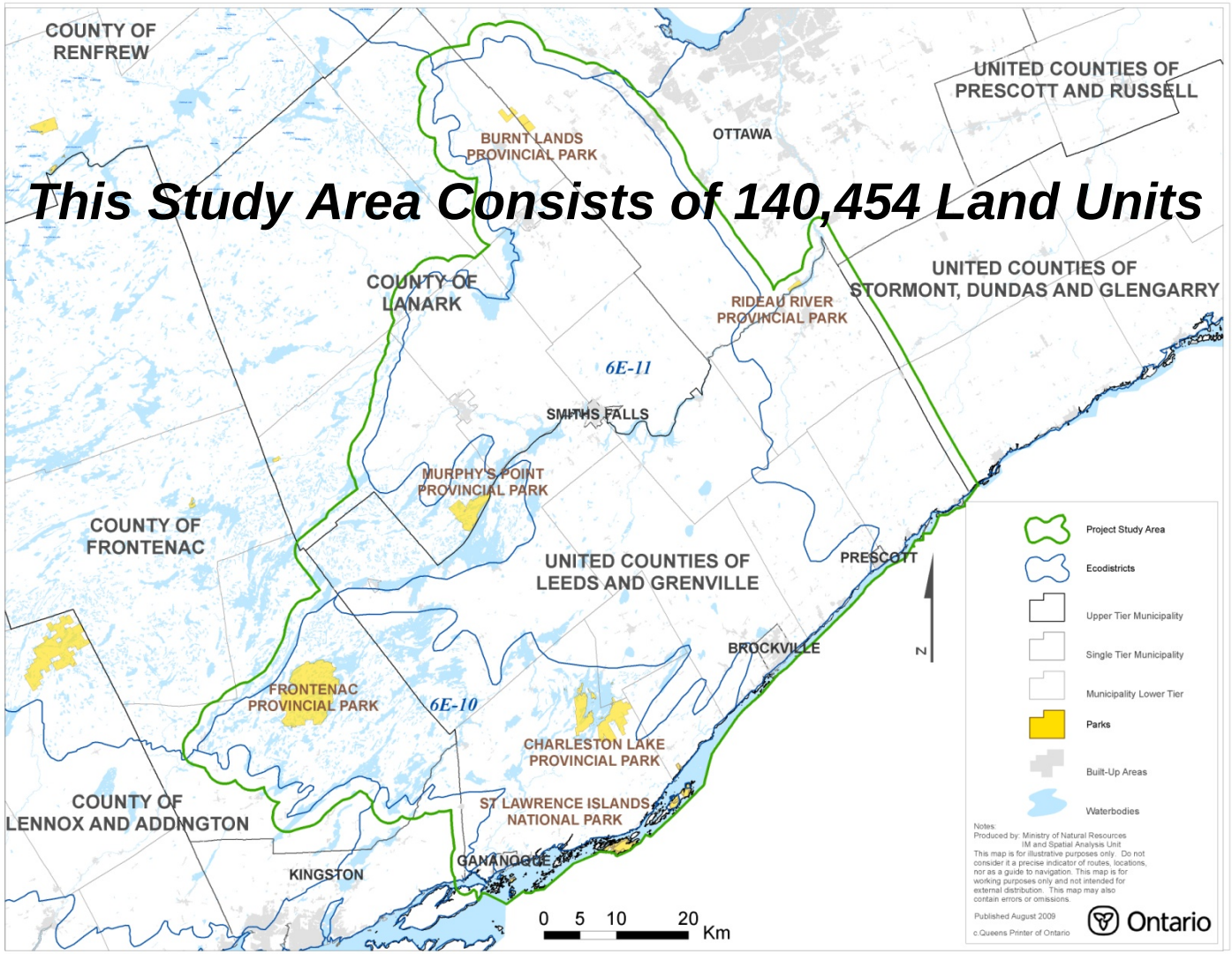
- Nine Land Units each 1 X 1 km so Land Unit Boundary length for each is 1 and Land Unit Cost based on area for each is 1Km^2 or simply 1
- To clump areas together as much as possible, we'll multiply the Land Unit Boundary length by 1.5
- Three values have been identified, mouse, fish and butterfly, each with a cost of 10 if they are not found in a Land Unit
- We'll set a target that each should be represented at least once in the system



Ecoland Landscape



Number of possible combinations to test in order to find the cheapest one = 2^9 or 512


COUNTY OF RENFREW
UNITED COUNTIES OF PRESCOTT AND RUSSELL
BURNT LANDS PROVINCIAL PARK
OTTAWA
This Study Area Consists of 140,454 Land Units
COUNTY OF LANARK
UNITED COUNTIES OF STORMONT, DUNDAS AND GLENGARRY
RIDEAU RIVER PROVINCIAL PARK
6E-11
SMITHS FALLS
MURPHY'S POINT PROVINCIAL PARK
COUNTY OF FRONTENAC
UNITED COUNTIES OF LEEDS AND GRENVILLE
PRESCOTT
BROCKVILLE
FRONTENAC PROVINCIAL PARK
6E-10
CHARLESTON LAKE PROVINCIAL PARK
COUNTY OF LENNOX AND ADDINGTON
ST LAWRENCE ISLANDS NATIONAL PARK
KINGSTON
GANANOQUE
0 5 10 20 Km
N
Project Study Area
Ecodistricts
Upper Tier Municipality
Single Tier Municipality
Municipality Lower Tier
Parks
Built-Up Areas
Waterbodies
Notes:
Produced by: Ministry of Natural Resources
IM and Spatial Analysis Unit
This map is for illustrative purposes only. Do not consider it a precise indicator of routes, locations, nor as a guide to navigation. This map is for working purposes only and not intended for external distribution. This may may also contain errors or omissions.
Published August 2009
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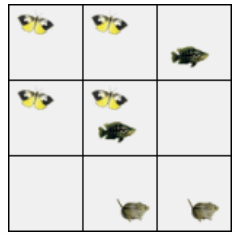
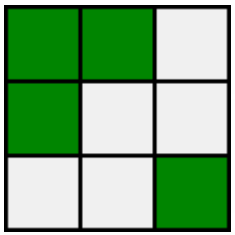
Ontario

Let's Look at 2 out of the 512 Possible Options



Option A



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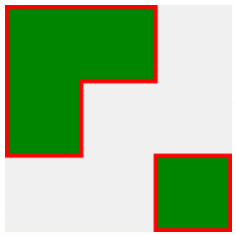


\+

= 32

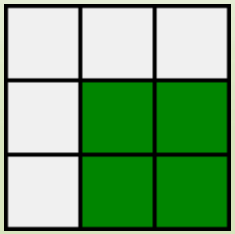
Total Land Unit Cost = **4**

Boundary cost = 12 * 1.5 = **18**

Target Cost = **10**

Total Cost of Option A

Option B



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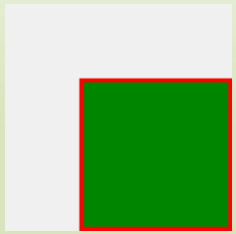


\+

= 16

Total Land Unit Cost = **4**

Boundary cost = 8 * 1.5 = **12**

Target Cost = **0**

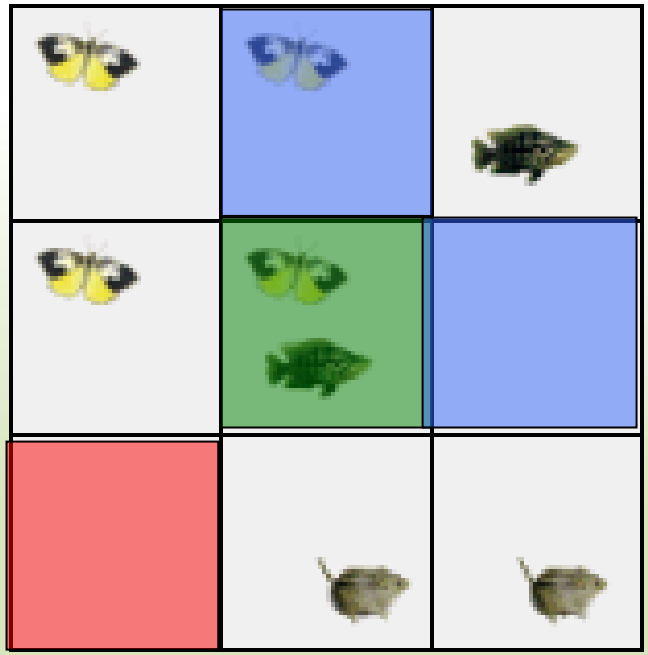
Total Cost of Option B

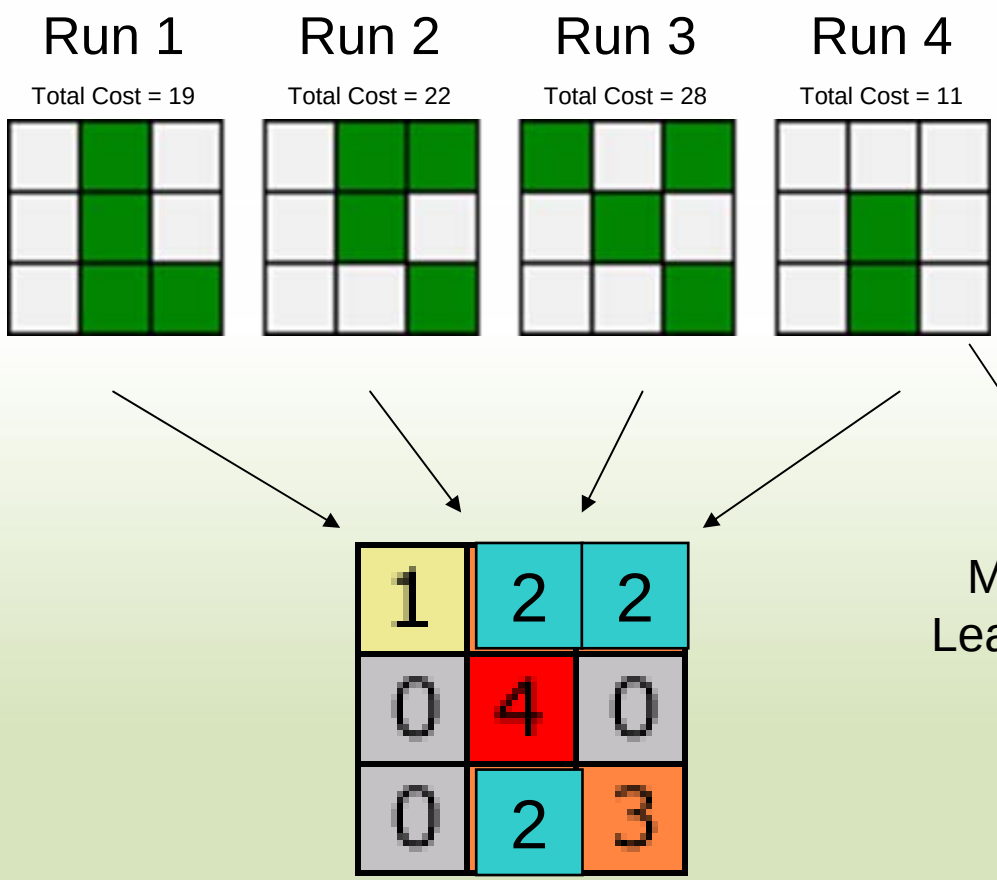
It's also possible to reduce the number of options through constraints usually to account for existing or approved land use decisions :

1. **Excluded** – can never be part of a system design
   - e.g. urban areas, approved development zones

2. **Conserved** – must always be part of any system design
   - e.g. existing protected areas

3. **Preferred** – all costs being equal, include this land unit over one that is simply available
   - e.g. publicly owned lands




Run 1
Total Cost = 19
Run 2
Total Cost = 22
Run 3
Total Cost = 28
Run 4
Total Cost = 11
1
2
2
0
4
0
0
2
3
Most Efficient or
Least Cost Solution
Summed Solution or Selection Frequency

- [illegible] fragmented in order to develop a connected system

•In this example GIS was used to identify areas between features that are within 300m and gaps/holes within features at least 300m wide

Values, Baseline Targets and Constraints identified by the

Scenario Planning Team

and

Scenario Outcomes