

Hierarchical ecosystem description

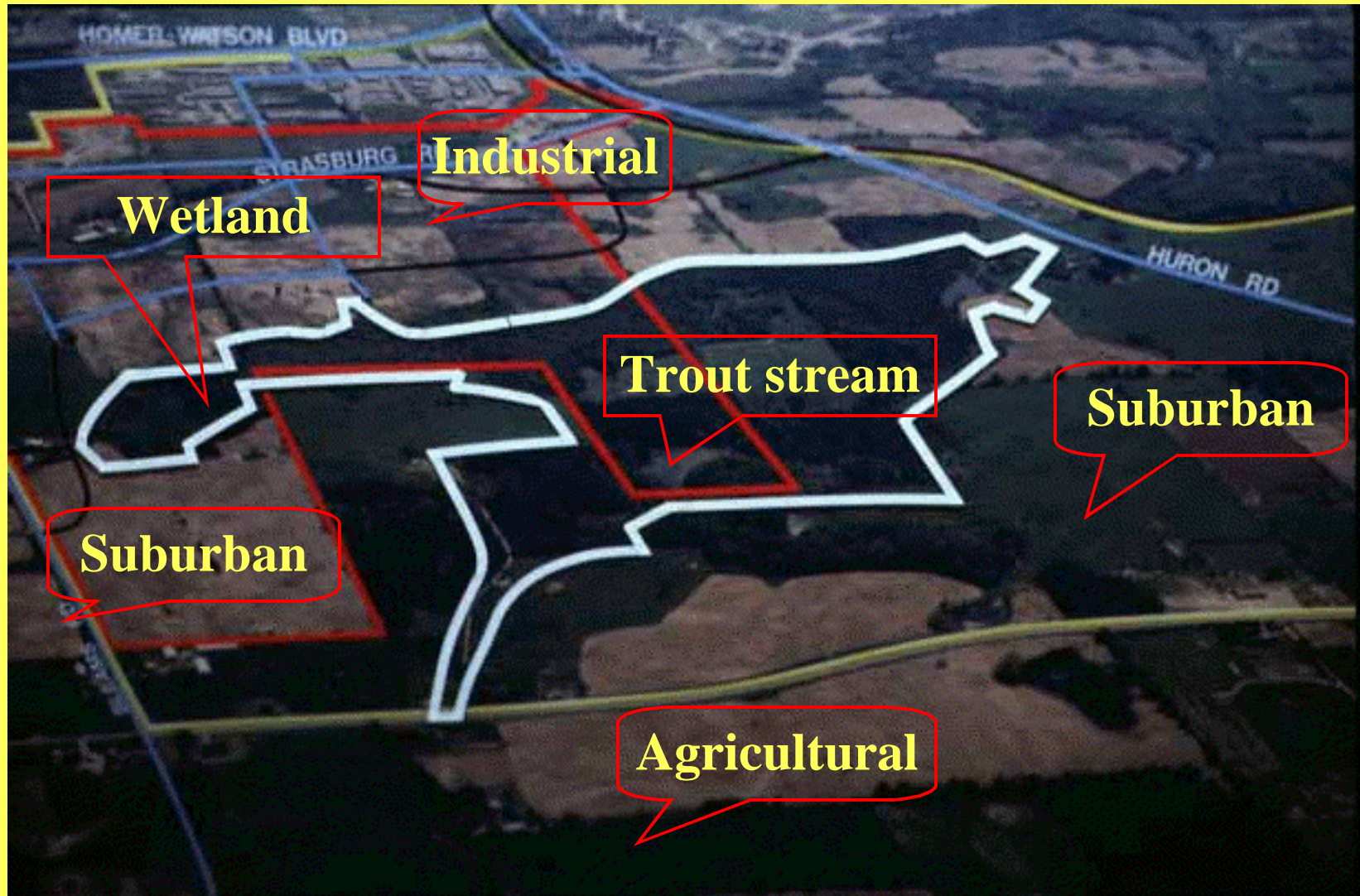
The Huron Natural Area

The Huron Natural Area



- **The city of Kitchener and the Waterloo County school boards are in the process of purchasing a property which contains a mixture of wetlands, trout streams, ponds, fields, and lowland and upland forest which are both plantations and natural regeneration.**
- **It is a rich mix of the ecosystem types found in south western Ontario.**
- **The property is bounded by suburbia, industrial and agricultural land.**

Huron Natural Area



Communities in the HNA

Site Type	# of hectares	% of area
Natural Forests		
upland hardwoods	21.2	14.4
soft maple swamp	6.5	4.4
conifer swamp	1.4	1.0
coniferous and mixed woods	13.8	9.4
other wetlands	49.5	33.6
sub-total	92.4	62.6
Modified Communities		
conifer plantation	3.0	2.0
old fields and second growth	26.1	17.7
active agriculture	3.7	2.5
anthropogenic (gravel pits etc.)	13.7	9.2
open water	8.3	5.8
sub-total	55.1	37.4
Total	147.5*	100.0

Boundaries

- Our ecosystem **boundaries** are set by the property lines on the site which is determined by the City of Kitchener in conjunction with the school board.
- Our temporal focus is long term.

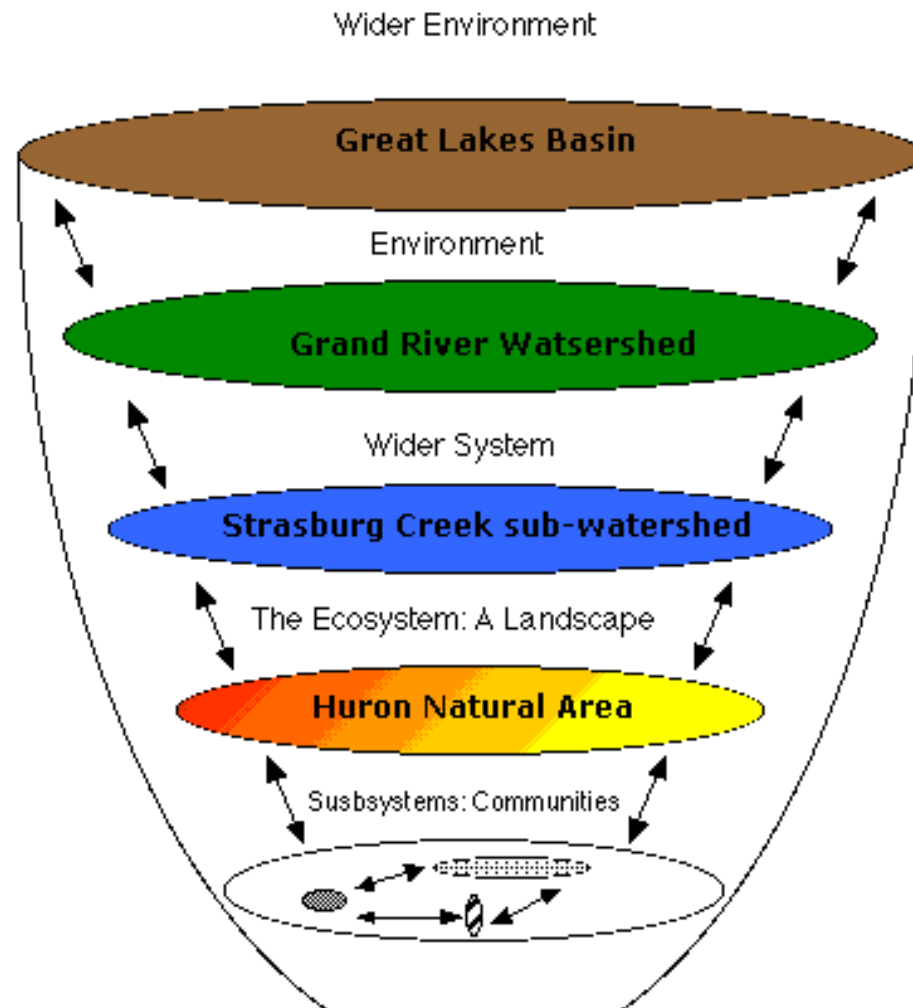
Levels of scale (within)

- **We choose four levels to focus on inside the ecosystem:**
 - the landscape,
 - the communities,
 - the populations,
 - the individuals.

Levels of scale (outside)

- The park is part of:
 - a **wider system**, the Strasburg Creek sub watershed,
 - whose **environment** is the Grand River watershed
 - which is part of the **wider environment** of the Great Lakes Basin, particularly southwestern Ontario.

Nested Holons



Types of Perspective

Organizing Principle	System Perspectives
ABIOTIC	Air Sheds Water Sheds Geomorphology
BIOTIC	Wildlife (Species) Communities Landscape
CULTURAL	Human Use of Land Cultural and Historical Significance
ENERGETICS	Energy Flows Nutrient Flows

Inside the ecosystem

- **the characteristics which determine/describe the organization and thus the integrity of the ecosystem at each level and from each perspective (scale and type)**

Landscape

Organizing Principle	System Perspectives	Characteristics / Activities
Abiotic	Air flows	patterns of air flow micro climate issues
	Water flows	surficial (energy/nutrients) ground (energy/nutrients)
	Geomorphology	soils/landforms
Biotic	Wild life	movement patterns breeding grounds or wintering grounds existing exotics
	Communities	spatial and temporal relationship (annual and longer term ∞)

Landscape

Organizing Principle	System Perspectives	Characteristics / Activities
Cultural	Human Use	compaction of soils littering transportation routes and paths people walking pets/wandering pets
	Cultural Value	education recreation hunting/fishing resource extraction speculation/profit
	Historical	land use patterns habitation resource extraction hunting archaeological sites
Energetics	Energy	productivity, respiration, biomass
	Nutrients	nutrient flows

Communities

Organizing Principles	System Perspectives	Characteristics / Activities
Energetics	Energy and Nutrients	overall energy balance the food web/ trophic structure nutrient cycles
Biotic	Wild Life	major populations and their niche interactions (∞) -competition -symbiosis spatial and temporal distribution (∞) existing exotics

Communities

Organizing Principles	System Perspectives	Characteristics / Activities
Abiotic	Air flows	patterns of air flow micro climate issues
	Water flows	surficial (energy/nutrients) ground (energy/nutrients)
	Geomorphology	soils erosion
Cultural	Human Use	student study of community transportation routes and paths compaction of soils people walking pets/ wandering pets littering vandalism harvesting of wildlife

Population

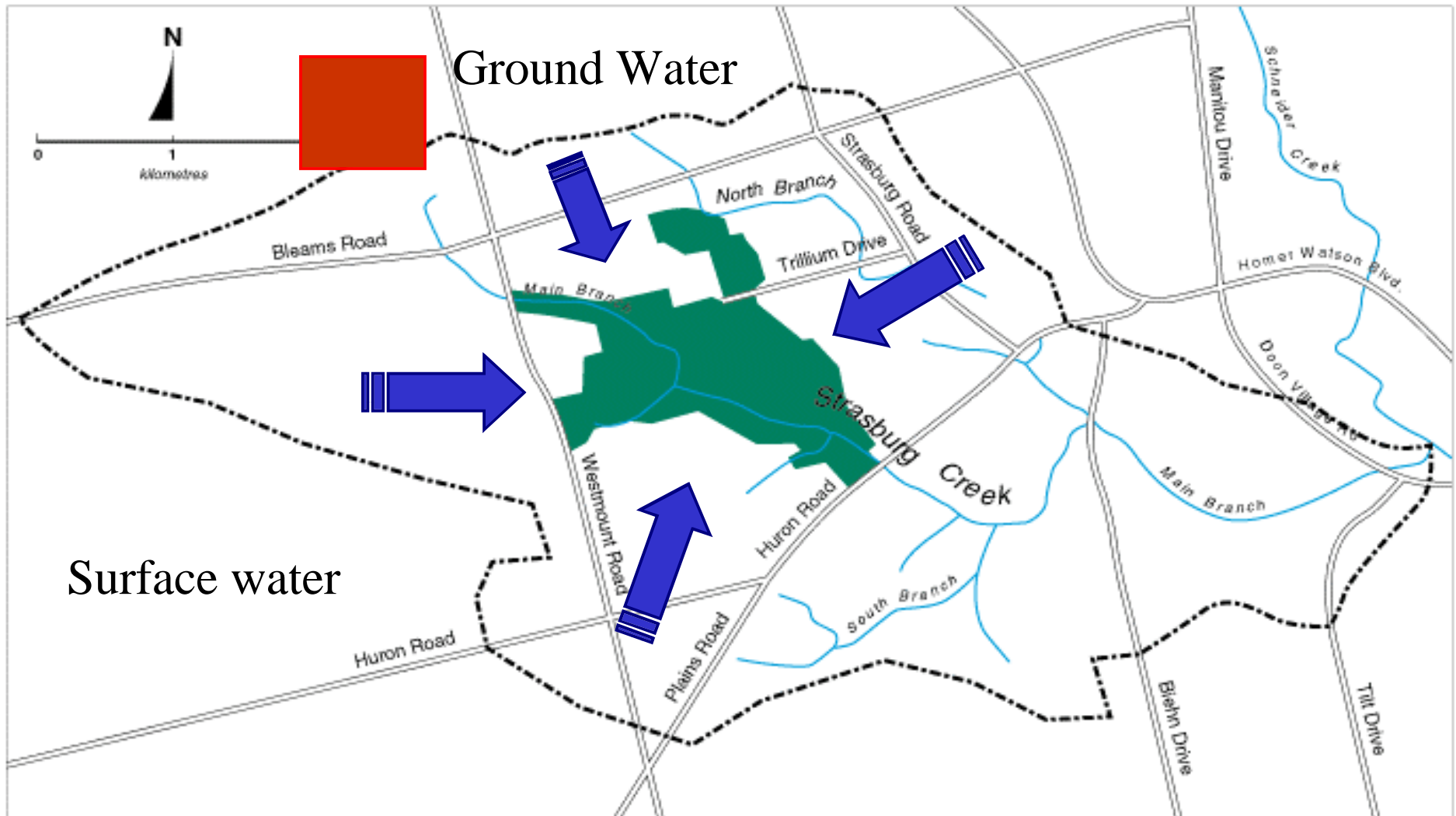
Population Dynamics



population density
minimum viable population size
interspecific competition
intraspecific competition
demographics of population
predator prey relations
growth and reproductive rates
realized niche

Environment

- **For each hierarchical level, outside the ecosystem, an analysis of factors which effect self-organization within the ecosystem is undertaken.**

Subwatershed holon



-  Huron Environmental Area
-  Strasburg Creek Watershed Boundary

STRASBURG CREEK SUBWATERSHED

The wider system

Organizing Principle	System Perspective	Influences
Abiotic	Airshed	pollution sources <ul style="list-style-type: none">- point sources (industrial)- non point sources (agricultural, automobiles, etc.) weather patterns - (micro climate)
	Watershed	surficial <ul style="list-style-type: none">-Strasburg Creek itself-run off ground water <ul style="list-style-type: none">-hydraulic head-recharge areas-aquifers precipitation <ul style="list-style-type: none">-quantity-quality (chemical composition) pollution - point and non point sources

STRASBURG CREEK SUBWATERSHED

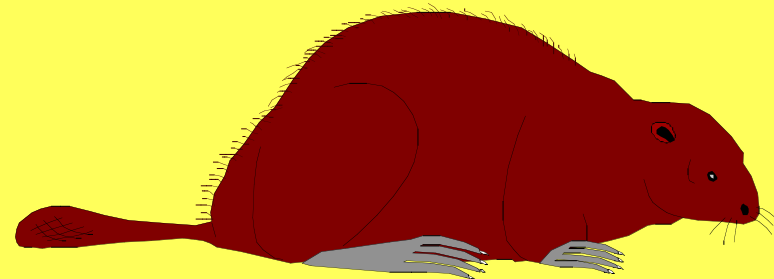
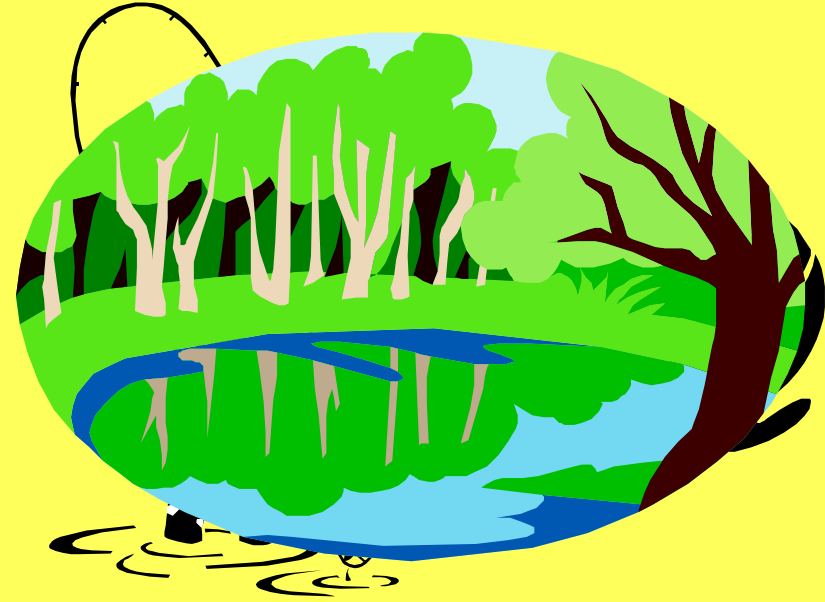
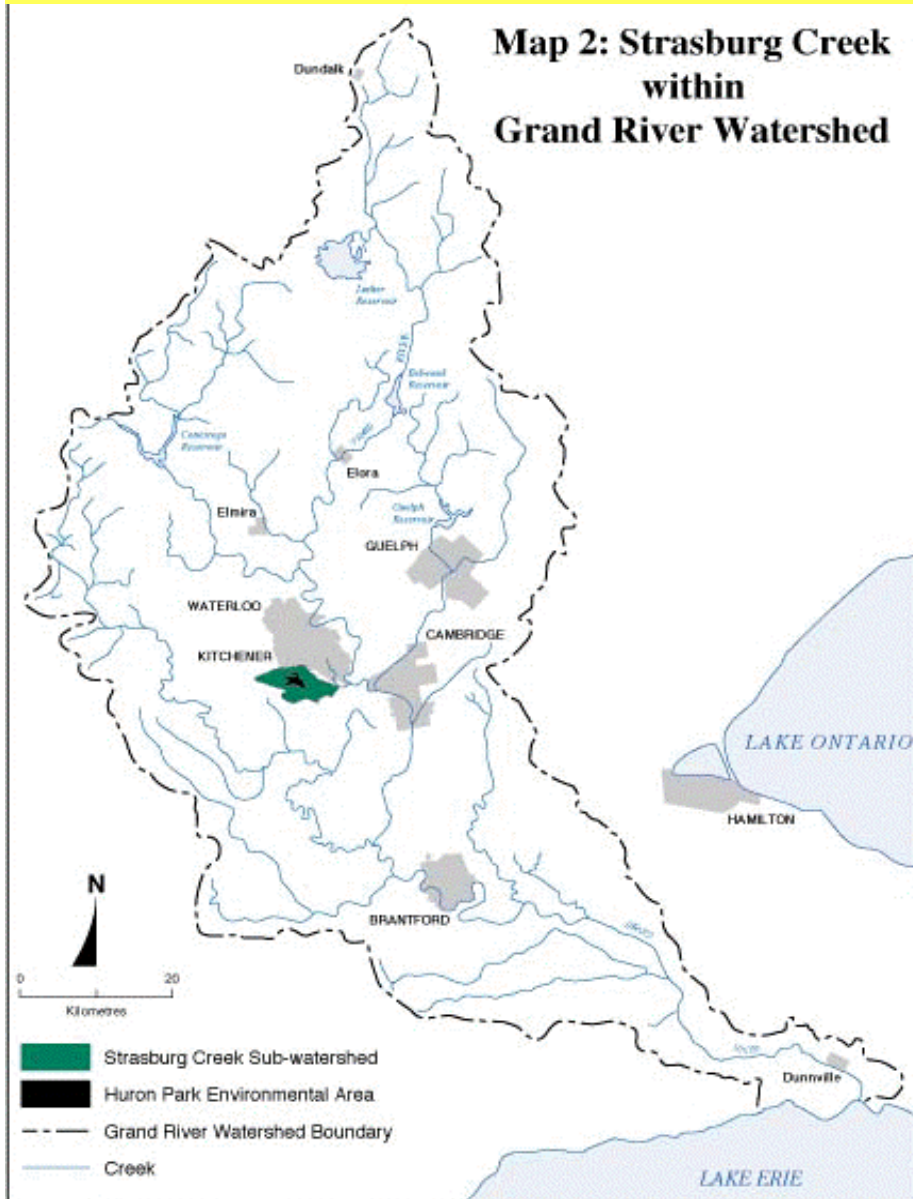
The wider system

Organizing Principle	System Perspective	Influences
Biotic	Wildlife	local - species move in and out of the Strasburg Creek Watershed migratory species inundation of exotic species local pets can be very destructive (especially cats to bird populations)
	Communities	Identification of surrounding communities and their interaction with the park (∞)
	Landscape	All interactions provided by the structure or isolation of corridors and patches
Cultural	Human Use	Rural, Suburban, Urban, Industrial interactions with the park
Energetics	Energy	detrital matter flow via water detrital matter flow via wildlife

Context

- **The influences outside a system which shape its behaviour.**
- **Potentials and constraints**
- **Get the context right and things will sort themselves out**

Watershed holon



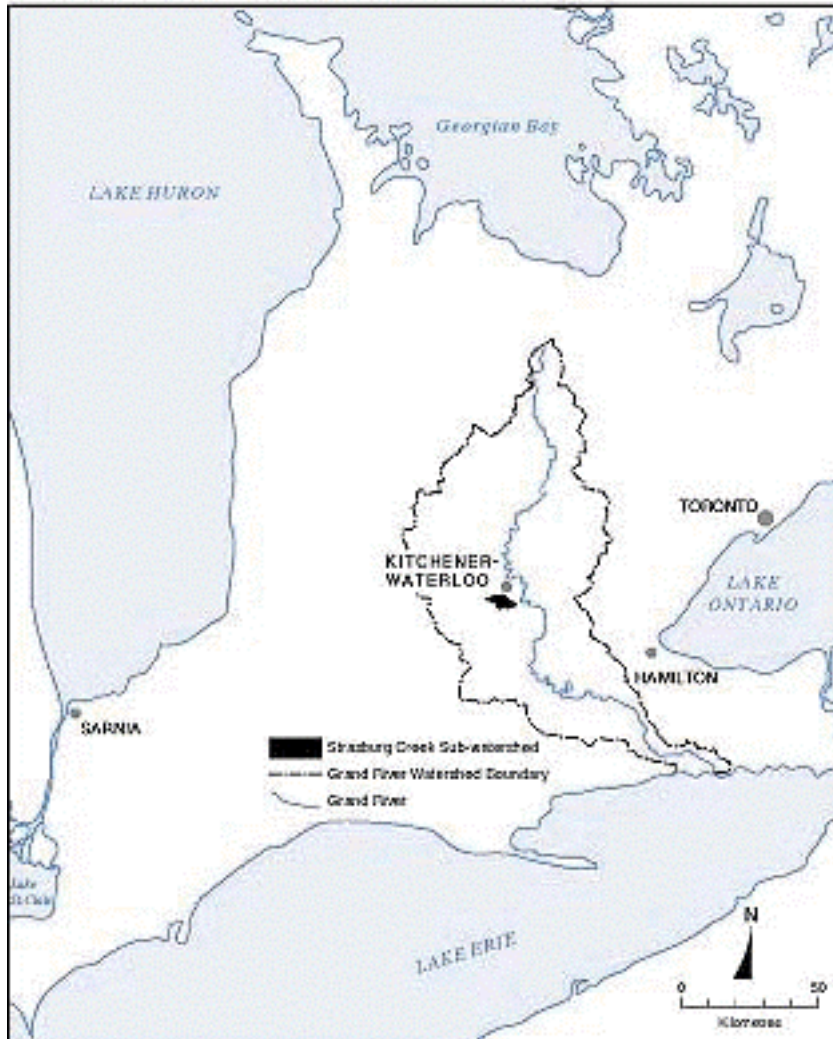
GRAND RIVER WATERSHED

The Environment

Organizing Principle	System Perspective	Influences
Abiotic	Airshed	<p>pollution sources</p> <ul style="list-style-type: none"> - point sources (industrial) - non point sources (agricultural, automobiles, etc.) <p>weather patterns</p> <ul style="list-style-type: none"> - heat island effect from Tri-City area
	Watershed	<p>ground water</p> <ul style="list-style-type: none"> -hydraulic head -recharge areas <p>surficial</p> <ul style="list-style-type: none"> -flooding -runoff
Biotic	Wildlife	<p>local - species move in and out of the Strasburg Creek Watershed from the Grand River Watershed (i.e. deer, coyote's, etc.)</p> <p>migratory species (fowl, deer, etc.)</p> <p>inundation of exotic species</p>
	Landscape	<p>All interactions provided by the structure or isolation of corridors and patches</p>
Cultural	Human Use	<p>rural, suburban, urban, industrial interactions</p>

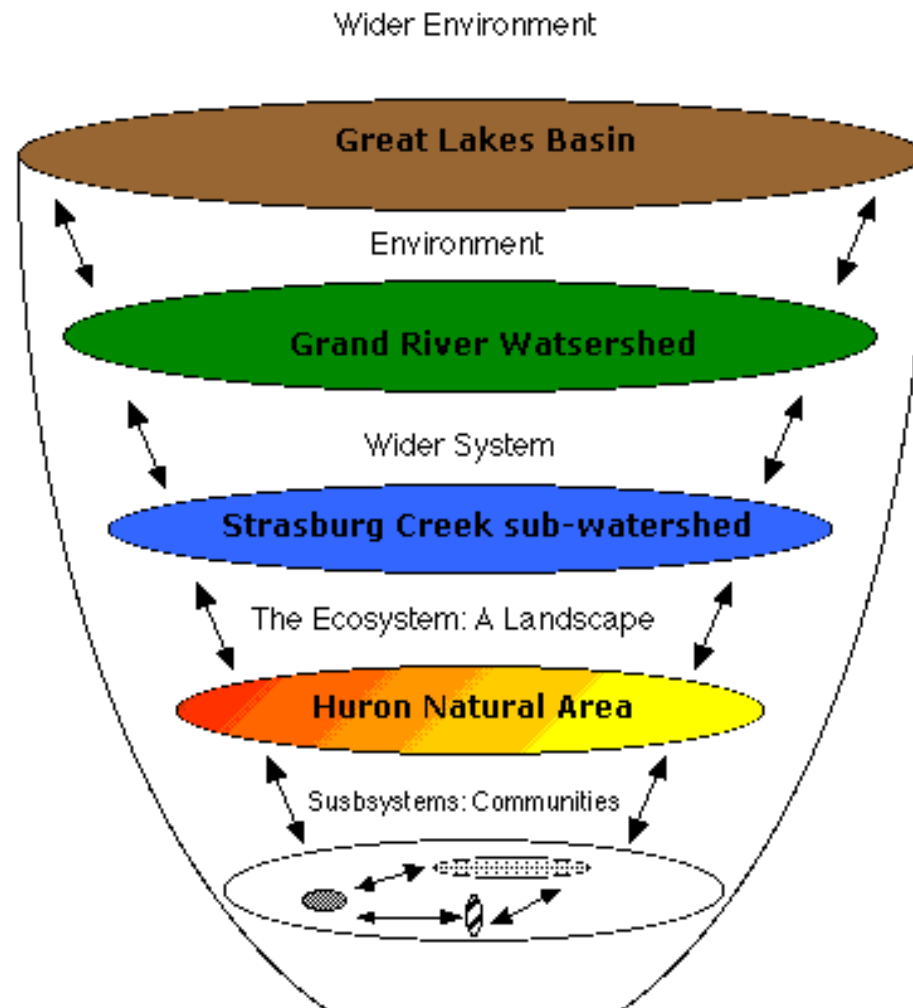
Wider environment

Map 1: Grand River Watershed within Central Southwestern Ontario

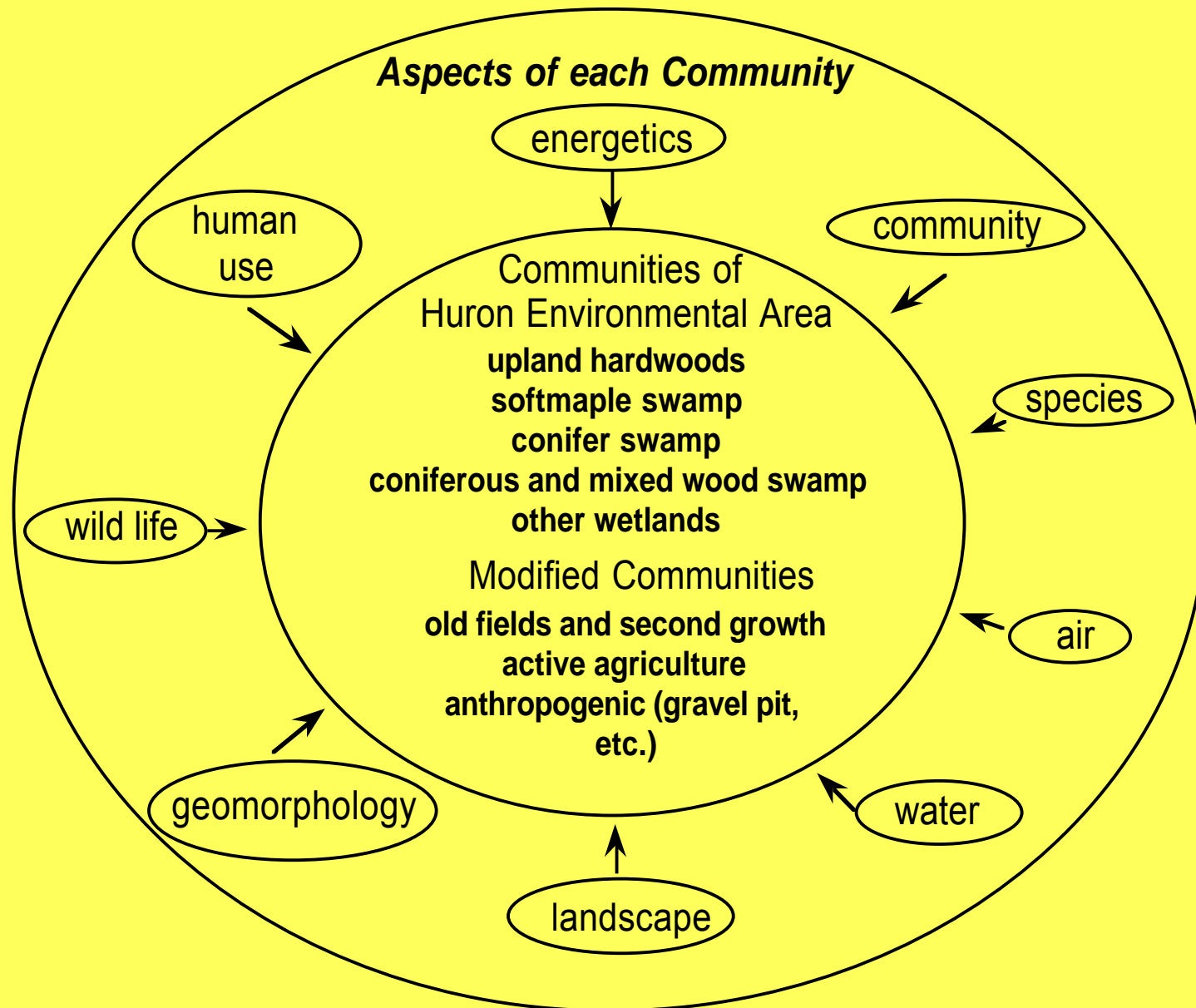


Organizing Principle	System Perspective	Influences
Abiotic	Airshed	pollution sources - point sources (industrial) - non point sources (agricultural, automobiles, etc.) weather patterns
Biotic	Wildlife	migratory species (fowl, deer, etc.) exotic species (e.g. zebra mussels, purple loose strife)
	Landscape	All interactions provided by the structure or isolation of corridors and patches

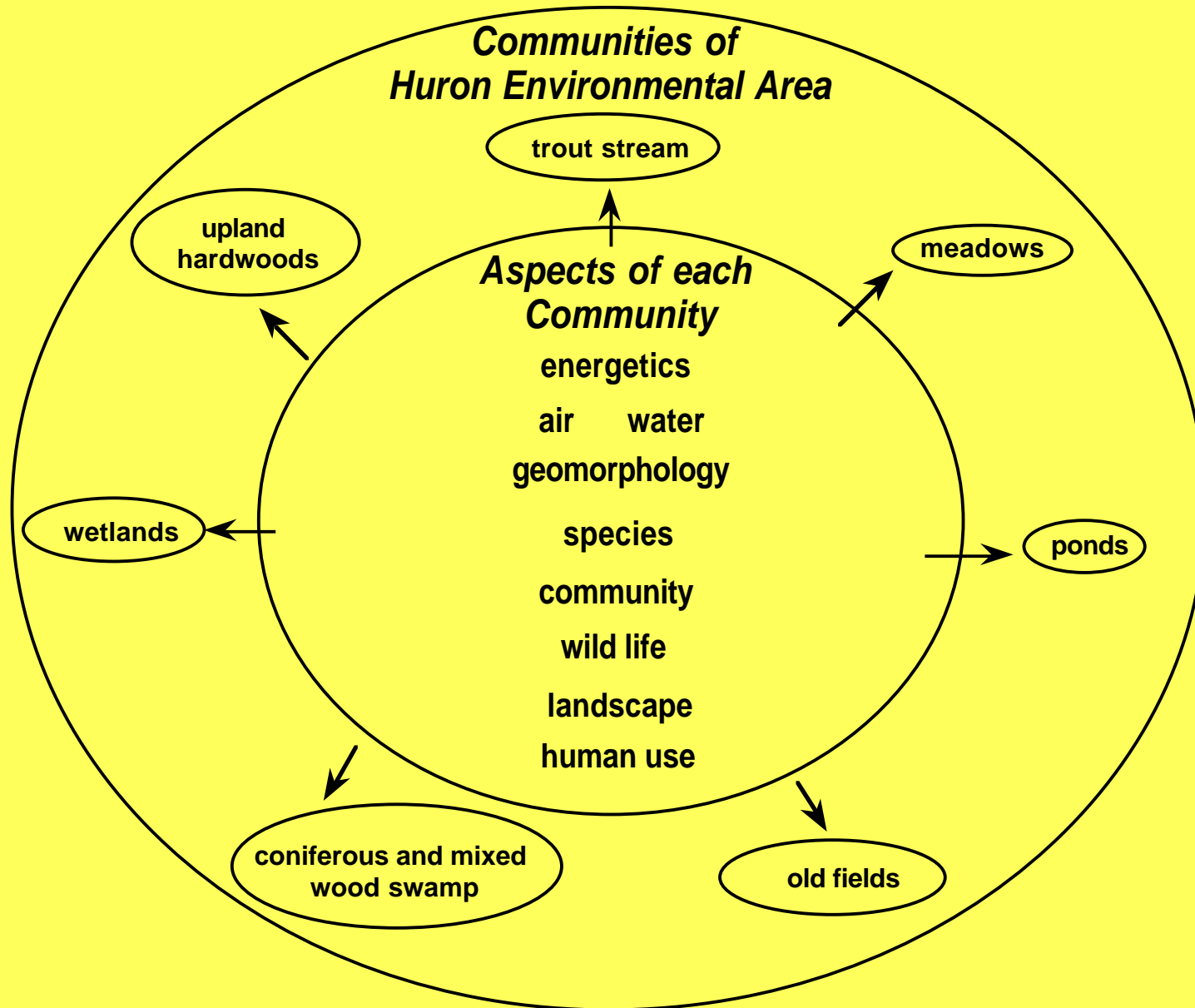
Nested Holons



Analysis (multiple models)



Synthesis of models



Elements of a system description

- **Components**
- **Structure**
- **Boundaries**
- **Environment**
- **Scale**
- **Type**
- **Nesting**
- **Hierarchical description**