

A banner for the Indian River Lakes Conservancy featuring a scenic view of a lake with a rocky shoreline and trees. The text is overlaid on the left side of the image.

Indian River Lakes
CONSERVANCY

Protect • Learn • Enjoy • Forever

Watershed Management for Water Quality Protection & Restoration

Holly Waterfield, CLM

**SUNY
ONEONTA**

Biological Field Station
Cooperstown, NY



Presentation Overview

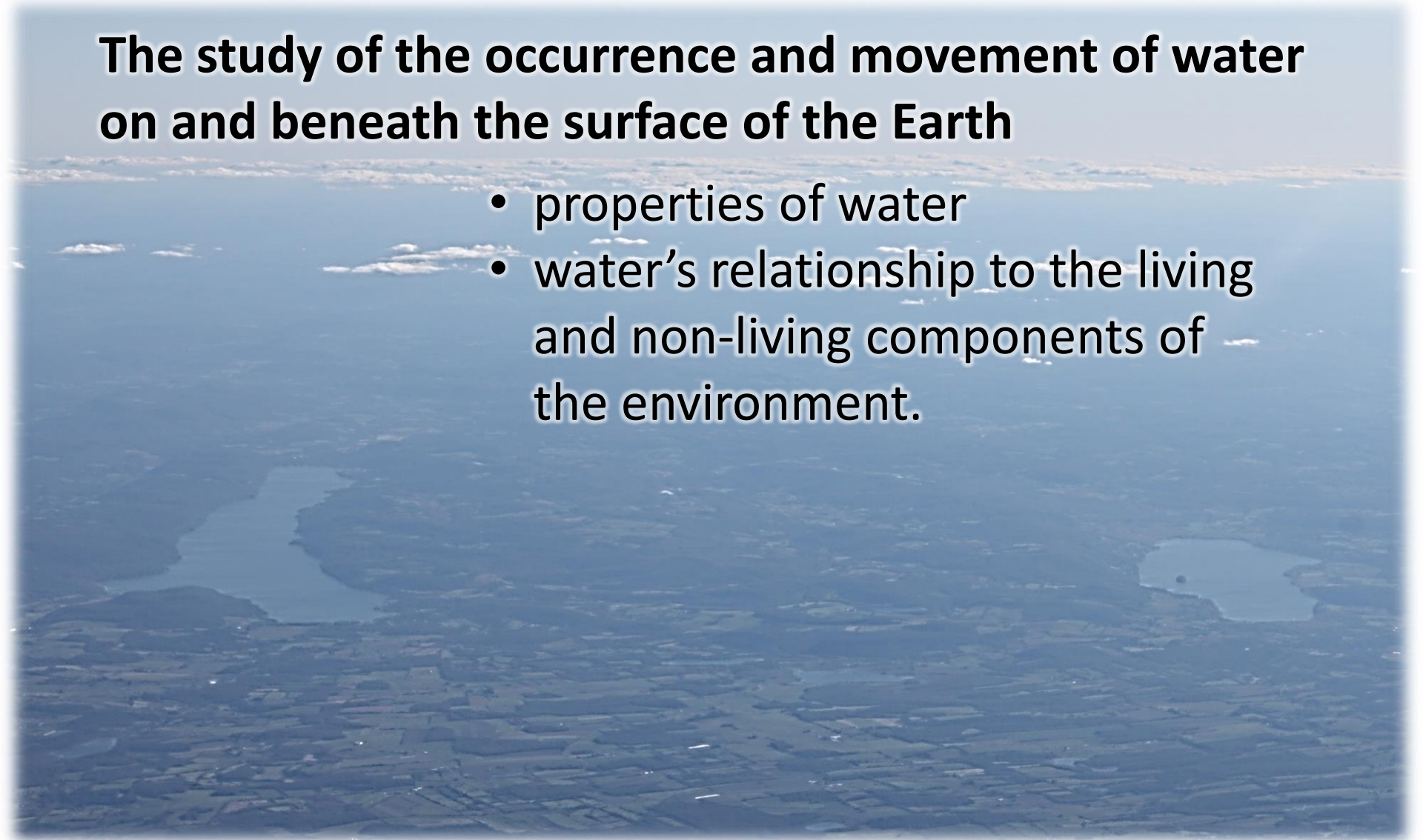
What is watershed management?
Hydrology: The Science of Water
Land Use and Water Quality
Best Management Practices
Implementing BMPs
Drafting Watershed Plans



Hydrology: Science of Water

The study of the occurrence and movement of water on and beneath the surface of the Earth

- properties of water
- water's relationship to the living and non-living components of the environment.



Lakes, ponds, and wetlands store water on the landscape

The character of these water bodies is determined by many factors

- Geology: basin size, shape, depth
- Quality of the water coming in
 - stream flow
 - groundwater flows
 - Precipitation & atmospheric
- Food web



What are Watersheds and why they are important to those who live, work and play on the Indian River Lakes?

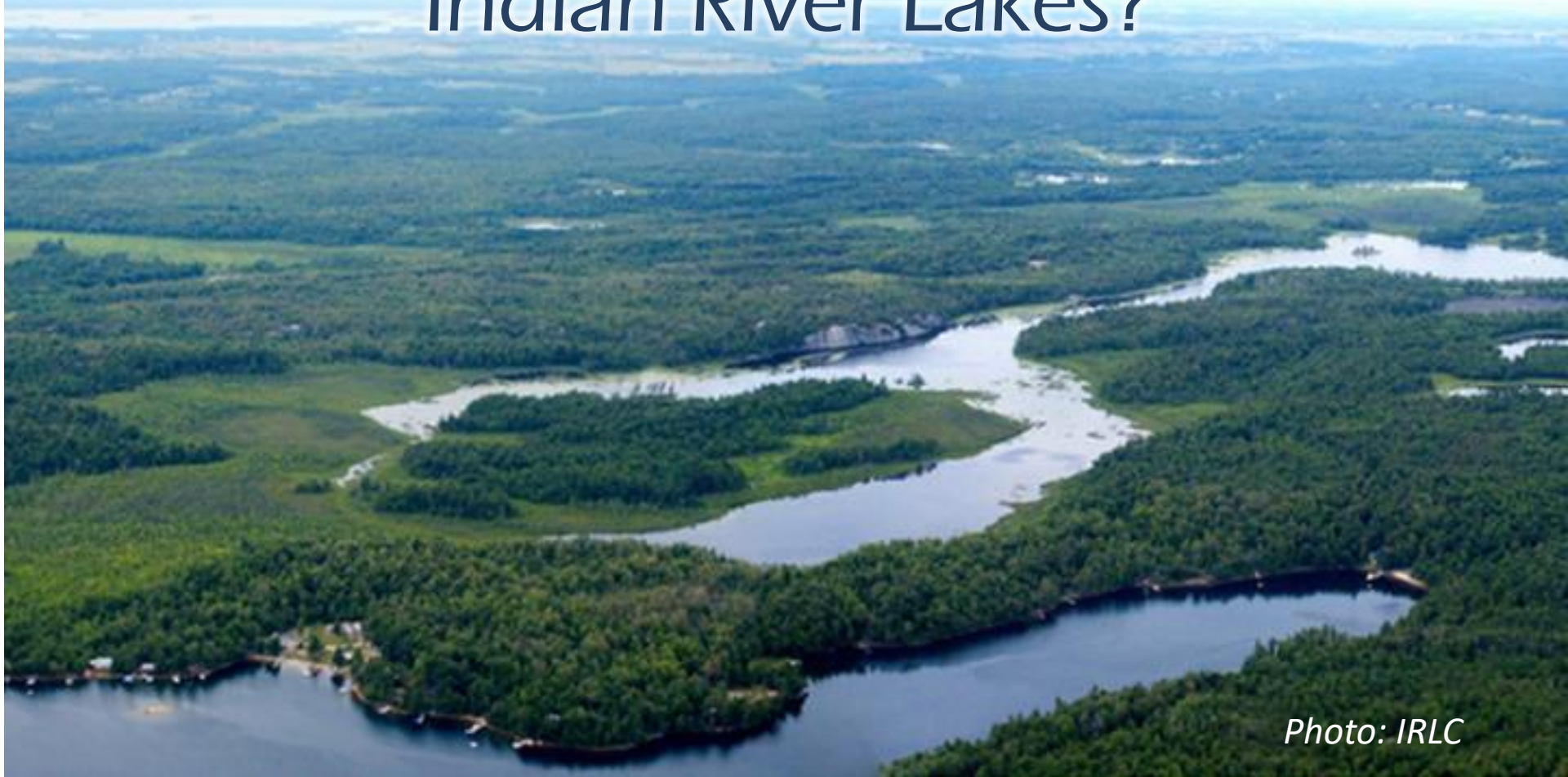


Photo: IRLC

North America's Major Watersheds

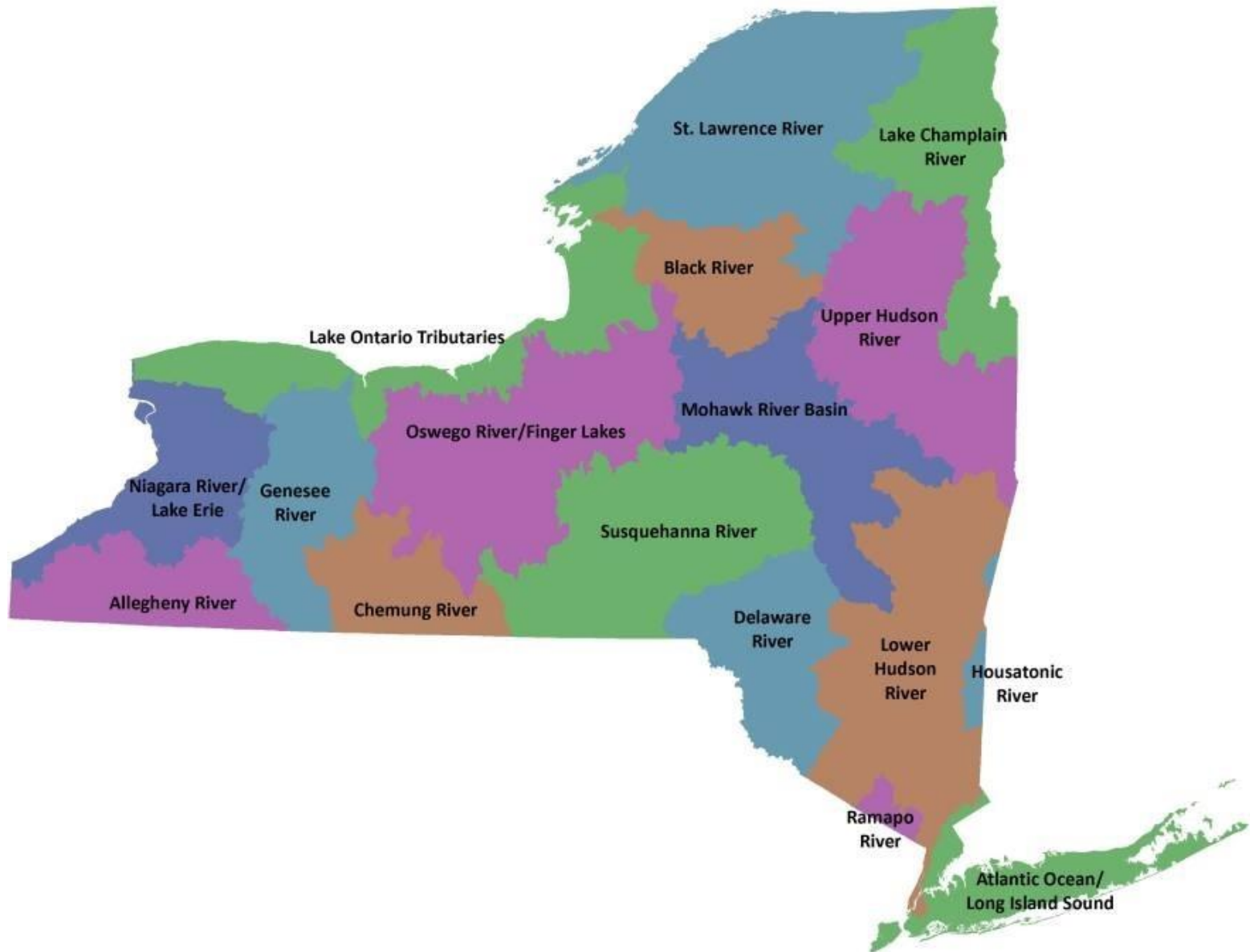


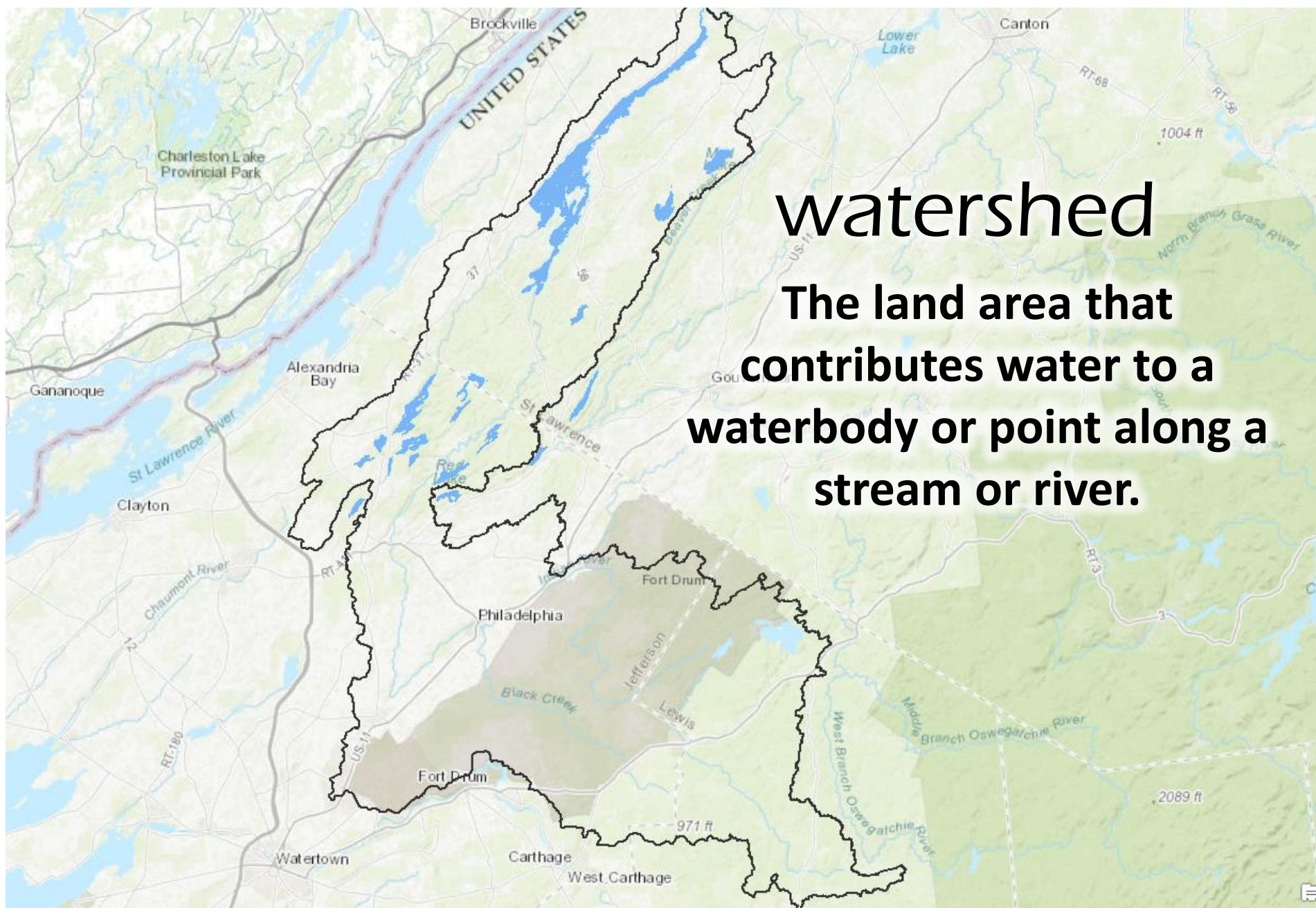
United States Major Watersheds



A region or area bounded by a divide and draining ultimately to a particular watercourse or body of water

New York State Watersheds





watershed
**The land area that
contributes water to a
waterbody or point along a
stream or river.**

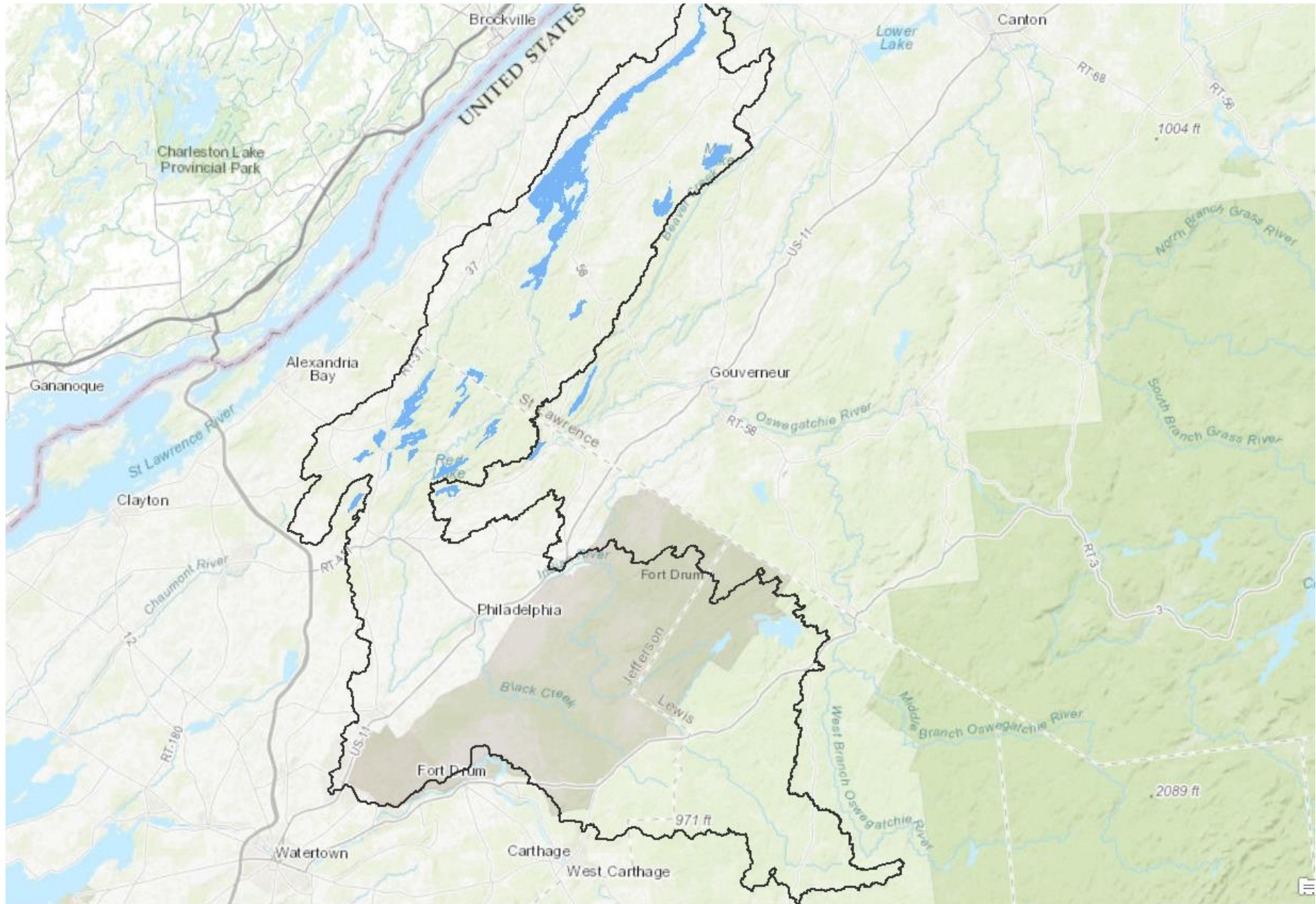


watershed

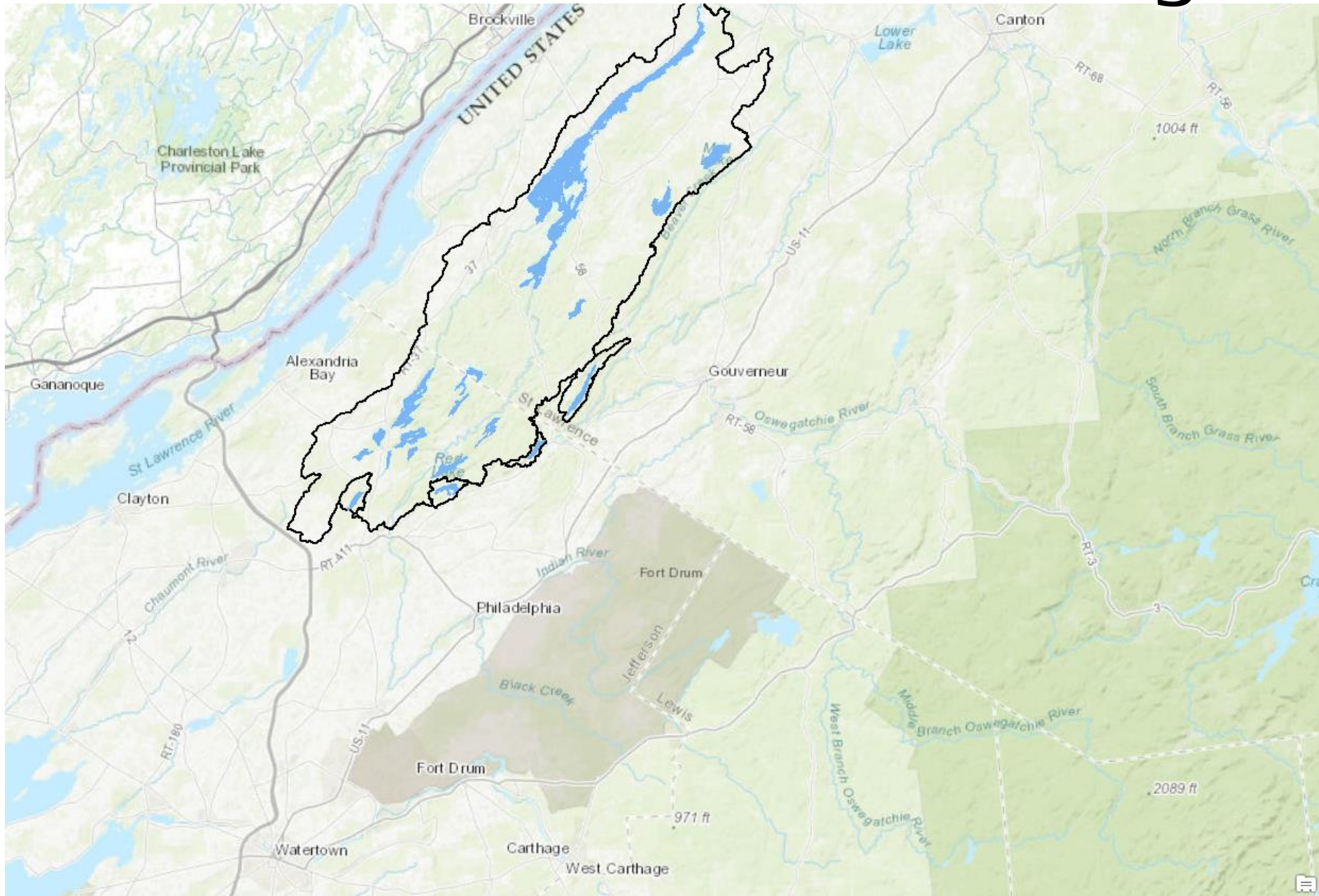
The land area that contributes water to a waterbody or point along a stream or river.

Precipitation flows downhill to the lowest point on the landscape and eventually makes its way to the ocean.

Indian River Watershed



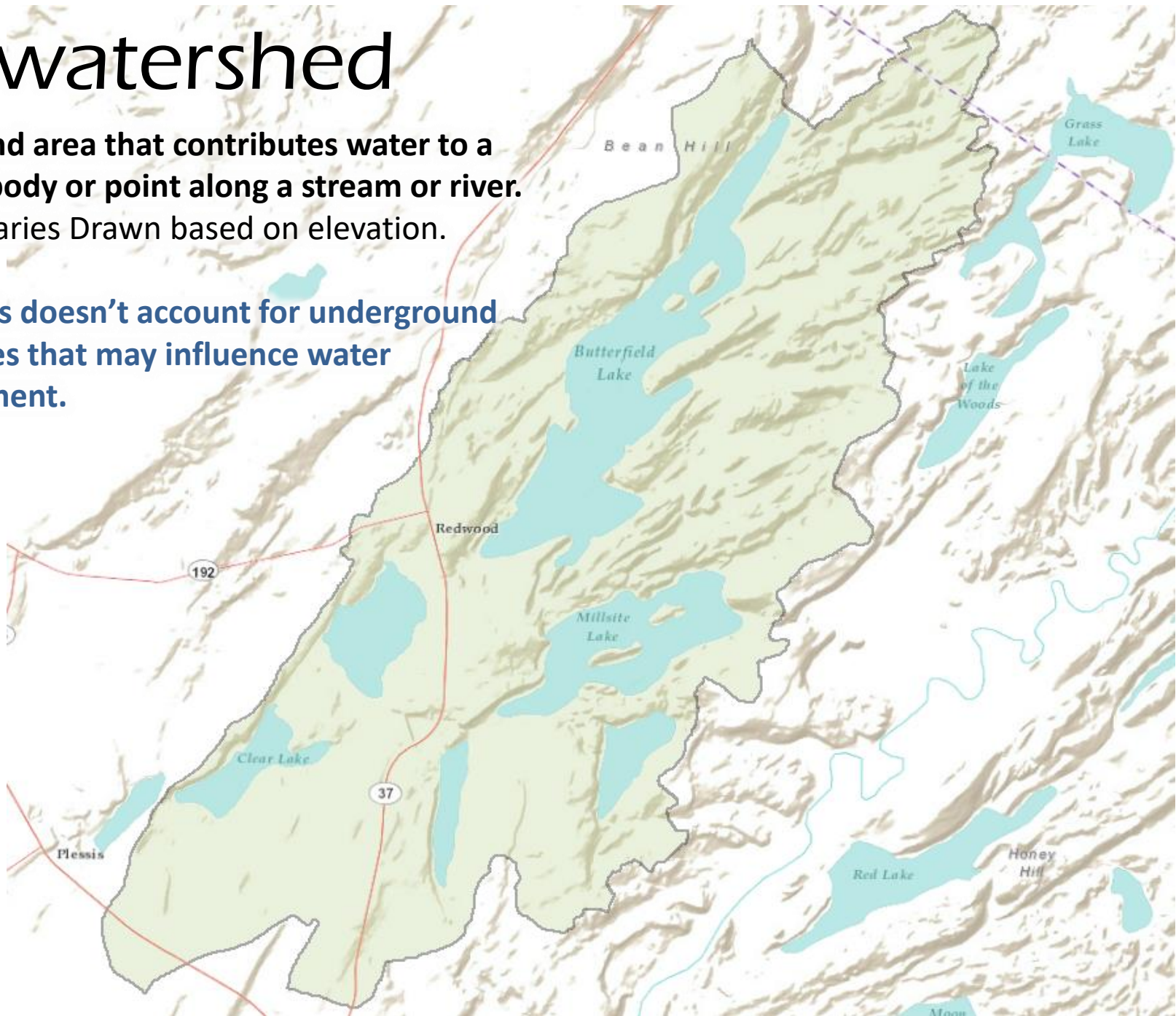
Indian River Lakes Region



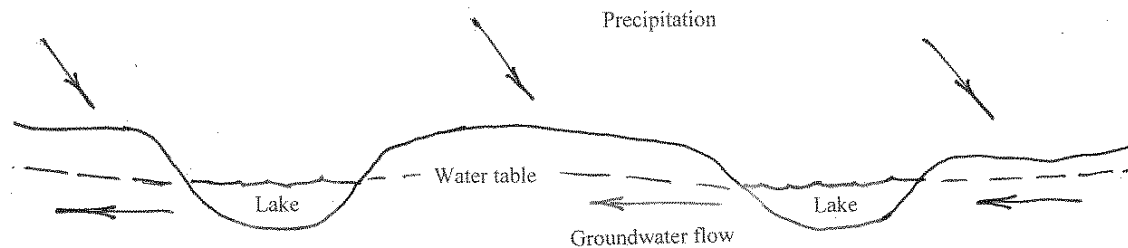
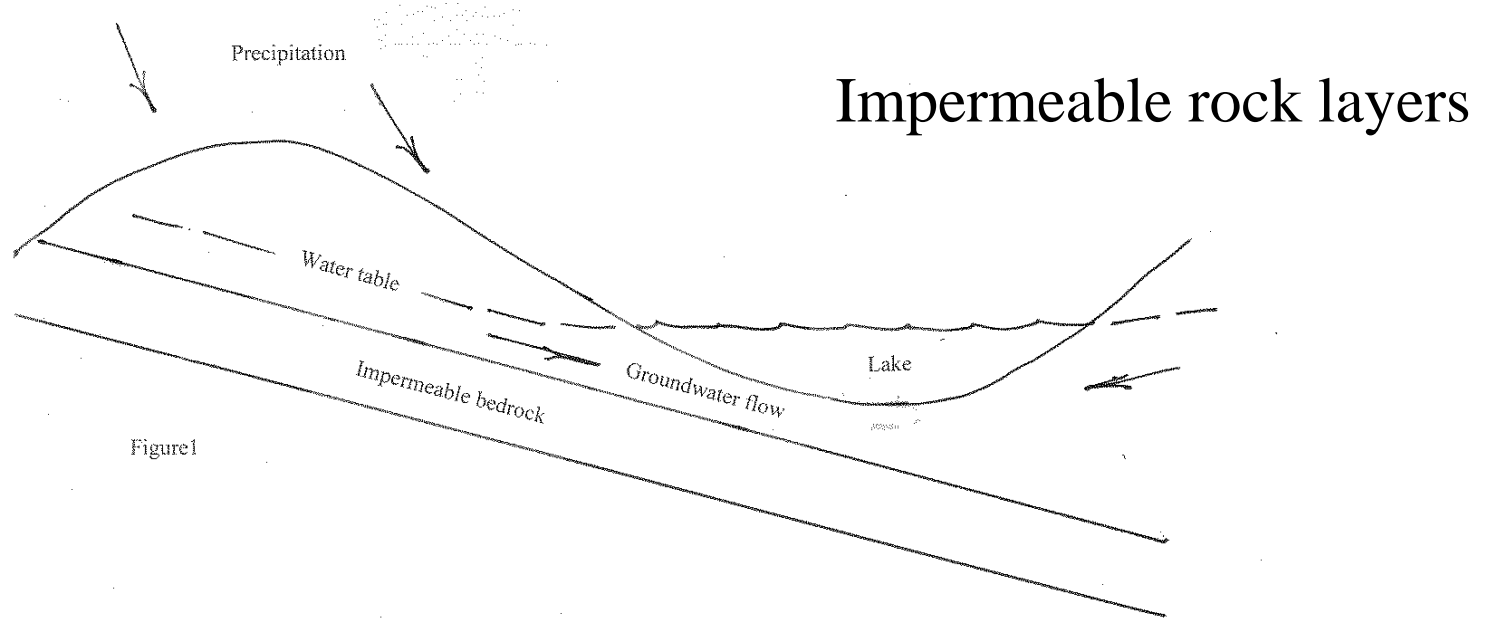
watershed

The land area that contributes water to a waterbody or point along a stream or river.
Boundaries Drawn based on elevation.

But this doesn't account for underground features that may influence water movement.



Why the usual delineation of watershed boundaries may not be accurate



Glacial Till

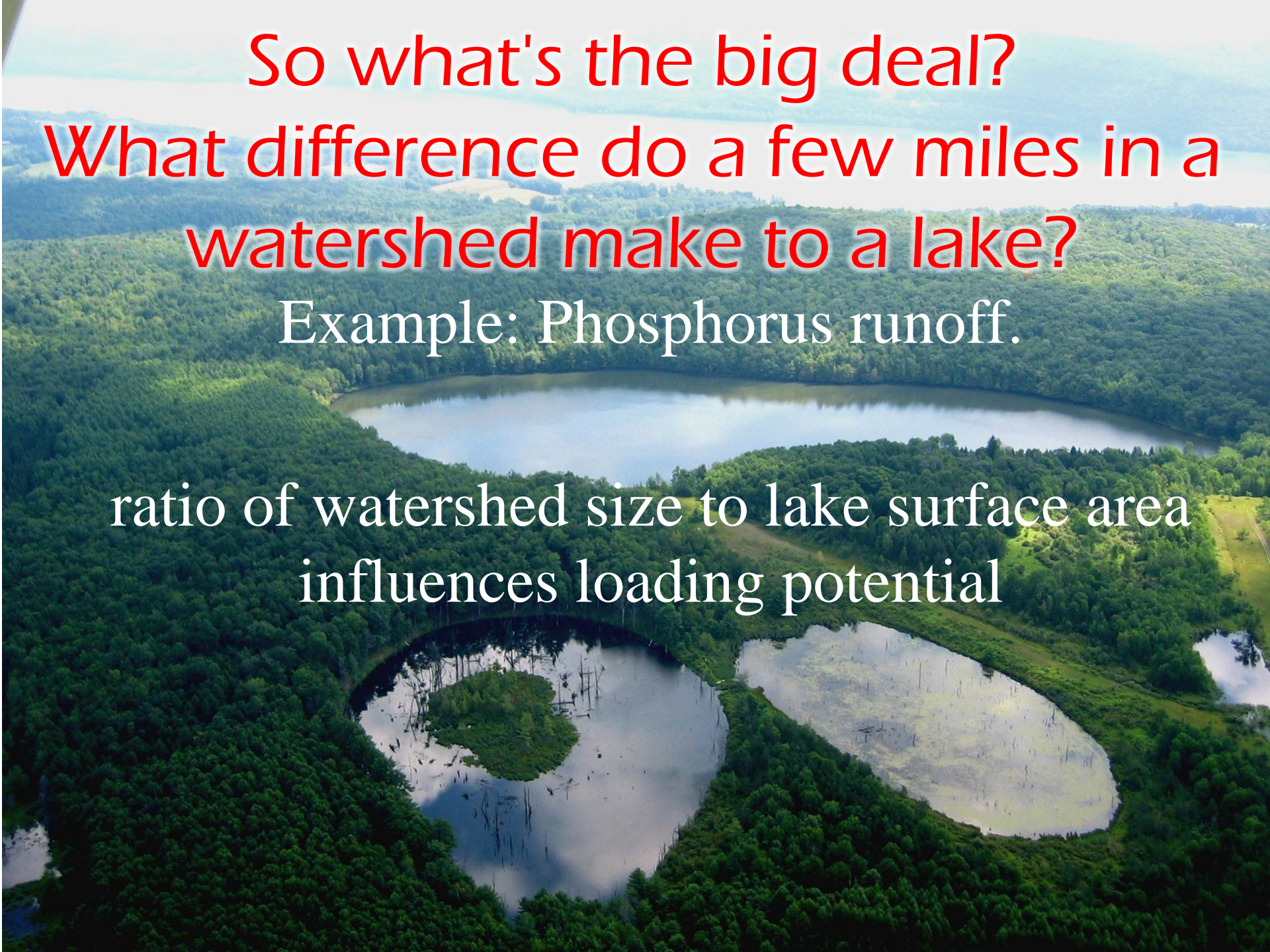
groundwater flow regulated by other than surficial characteristics

So what's the big deal?

What difference do a few miles in a watershed make to a lake?

Example: Phosphorus runoff.

ratio of watershed size to lake surface area
influences loading potential



What usually needs managing?



Pollution stems from Point and Non-point Sources

Non-Point Source Pollution

Difficult to trace back to a specific place on the landscape

- can be expensive to mitigate
- difficult to regulate
- cumulative effects can be detrimental

Interacting effects of activities that contribute to NPSP:

- production of a pollutant
- alteration of the land surface in a way that increases pollutant loading to receiving waters

Streams are the conduits for water that falls on the landscape.



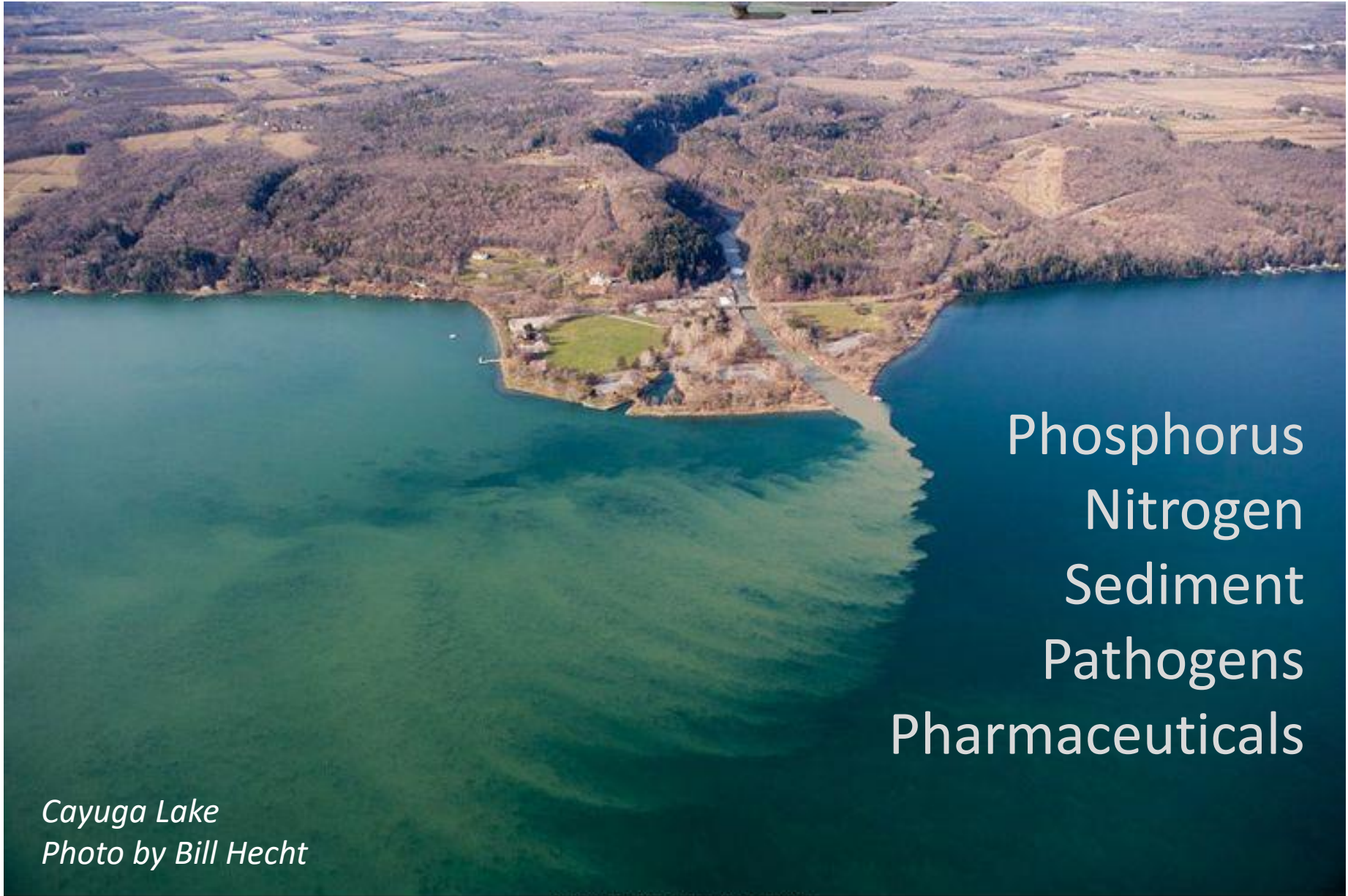
carry water, sediment, nutrients and organic matter downstream.

Ditches intercept flow and direct it to streams

Highway infrastructure and its maintenance – culverts, ditches, stormwater collection move water quickly to waterways



Pollutants of concern



Phosphorus
Nitrogen
Sediment
Pathogens
Pharmaceuticals

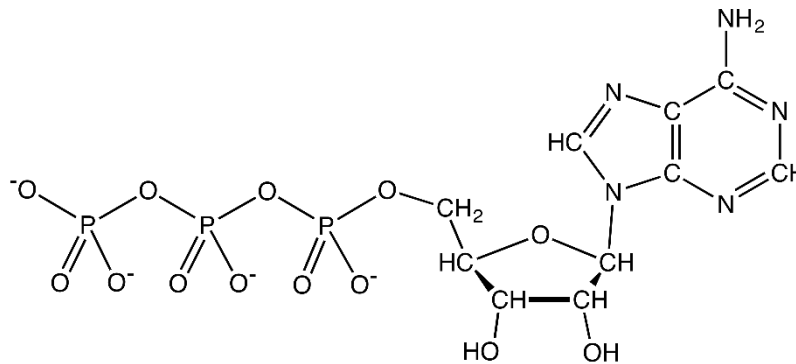
*Cayuga Lake
Photo by Bill Hecht*

Phosphorus

limiting factor to aquatic plant,
algal and cyanobacteria population sizes
in most inland lakes

(a fertilizer that increases garden productivity)

*Adenosine triphosphate
found in all foods*

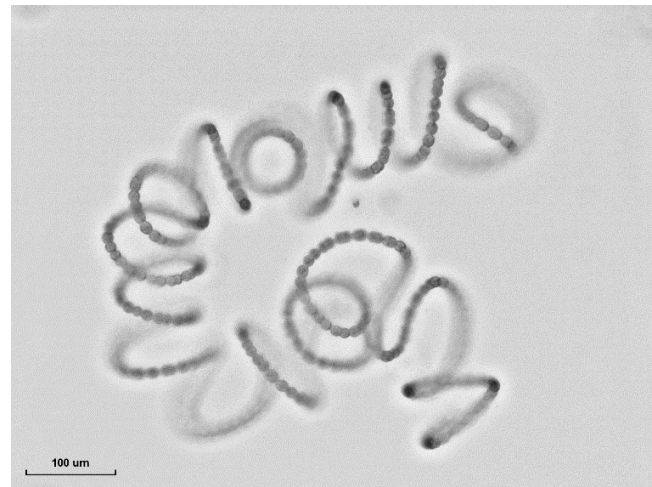


But can lead to excessive plants and algae in lakes

Too much **Phosphorus** =

Too many plants and/or algae for optimal recreational use

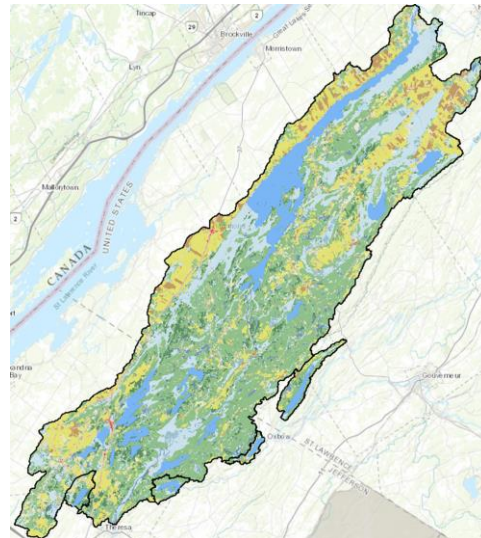
The worst case: Too many cyanobacteria = **HABs**



Problem Solving

Start by understanding the lake and watershed

- assess the problems
- compare to estimated reference conditions
 - what can you expect to achieve?
- Has the system passed critical thresholds?



Problem Solving

Long term: reduce nutrient (phosphorus) runoff by protecting sensitive areas and implementing watershed BMPs

Emergency short term solutions may require in-lake management which get extremely expensive over time

Protect high priority areas



Protect Sensitive Areas

Groundwater Recharge Areas

Steep Slopes

Wetlands, Vegetated Bays of lakes

Sensitive Soils (Over-permeable, Impermeable)



Prioritize Impacted Areas

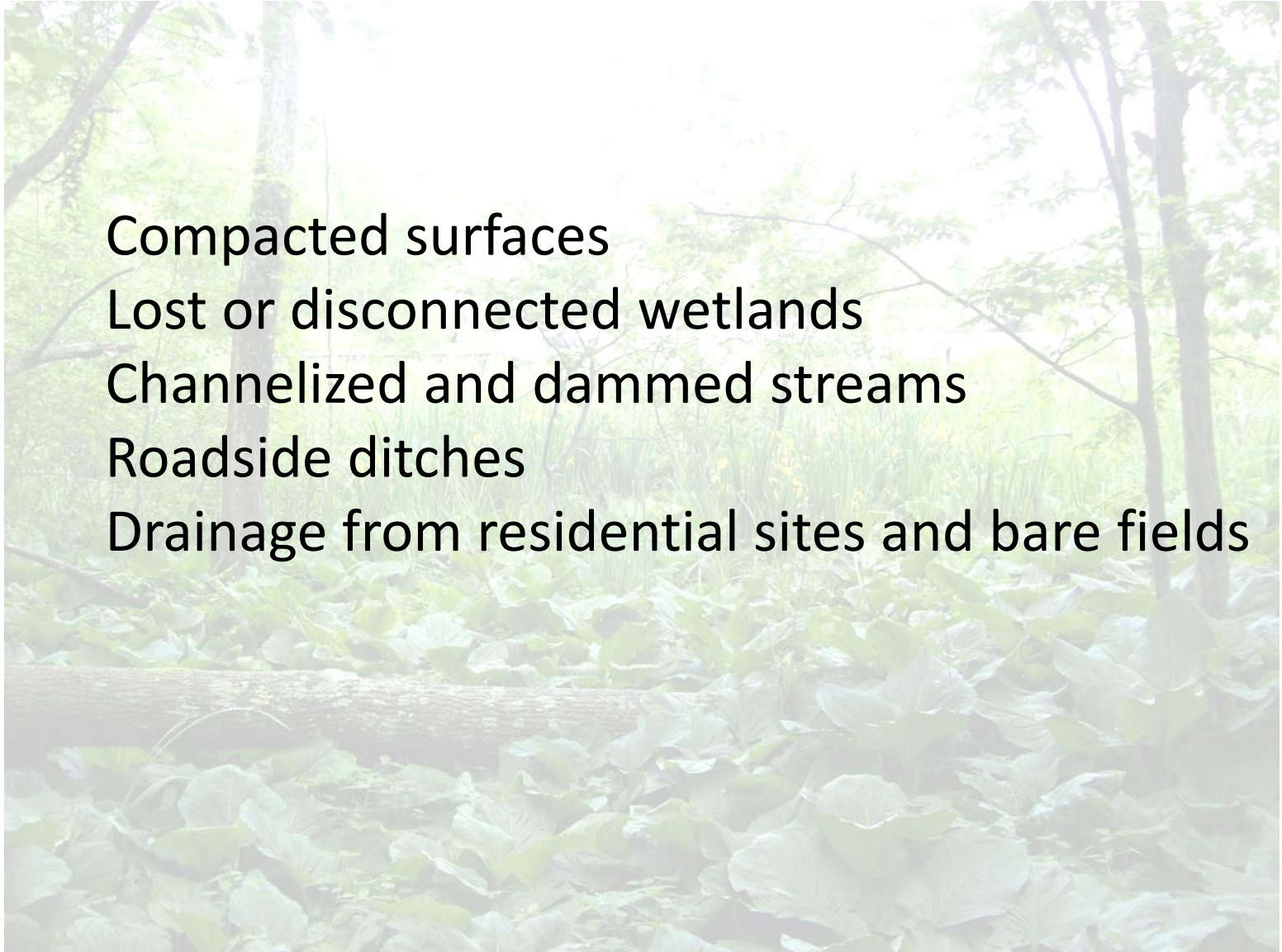
Compacted surfaces

Lost or disconnected wetlands

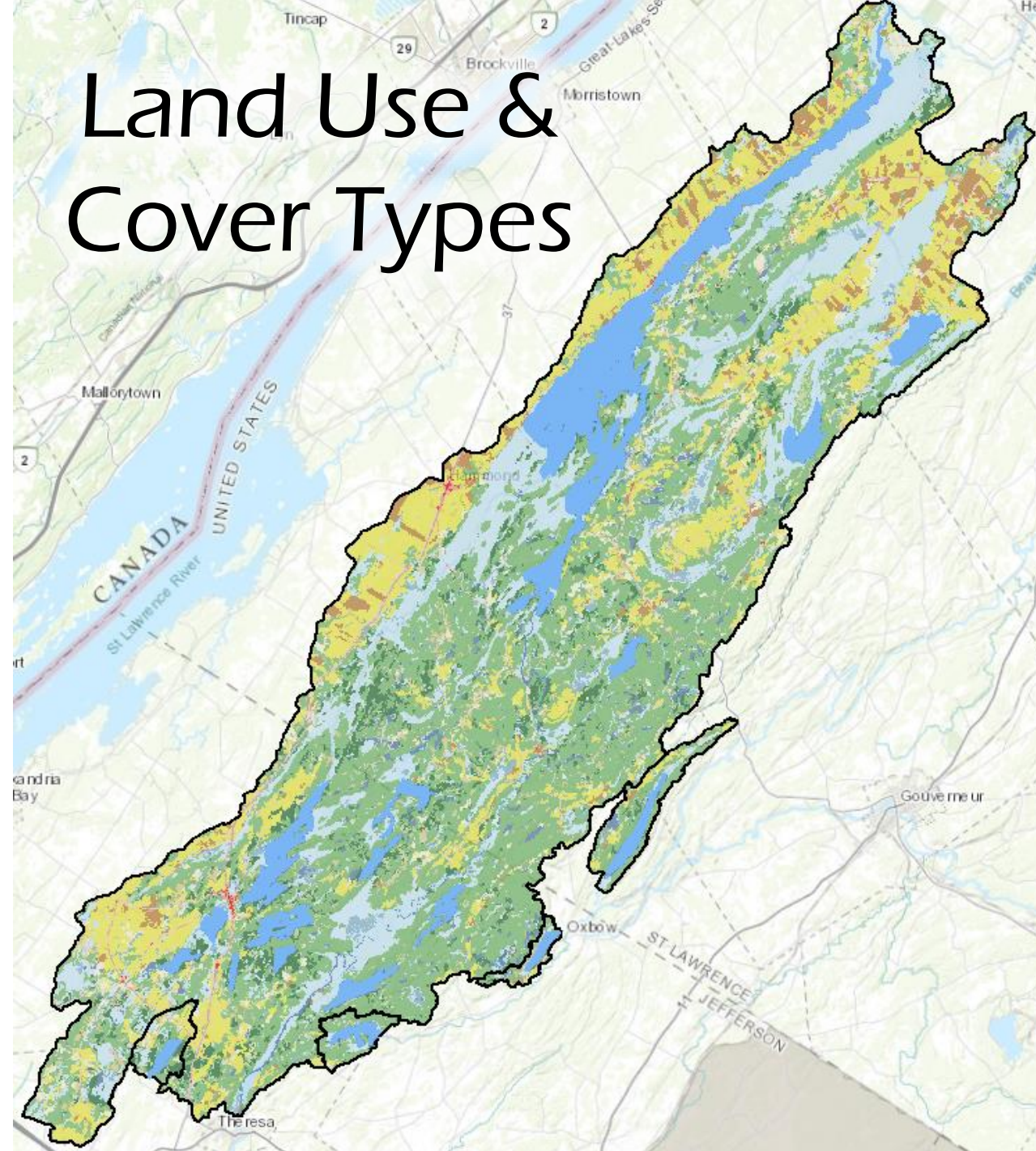
Channelized and dammed streams

Roadside ditches

Drainage from residential sites and bare fields



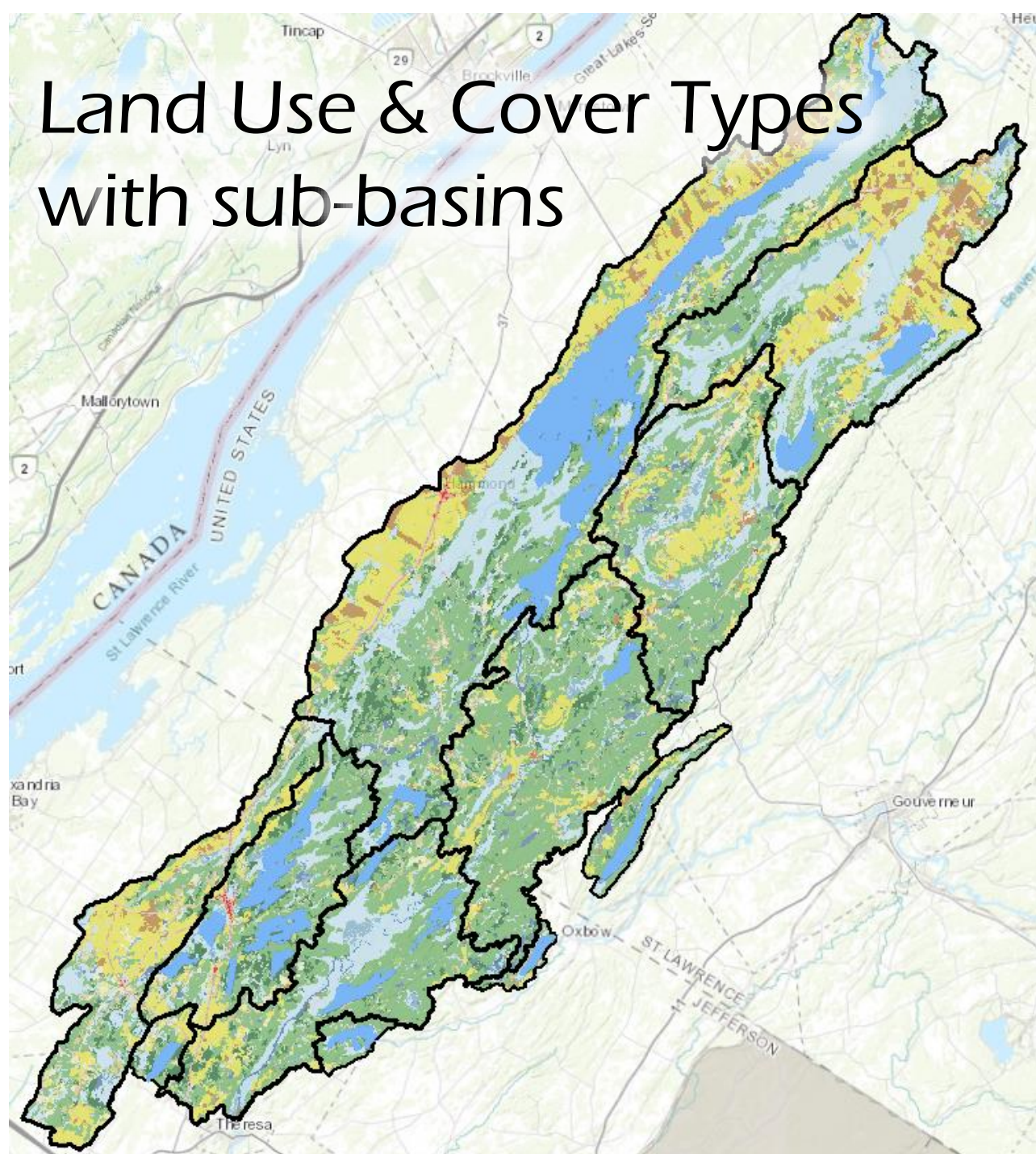
Land Use & Cover Types



- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Herbaceous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

Land Use & Cover Types with sub-basins

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Herbaceous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands



Best Management Practices

- BMPs -

Goals of NPS pollution BMPs

- maintain or restore the ability of the land to remove pollutants by slowing the flow of water
- limit production of the pollutant

Best Management Practices

- BMPs -

Technical manuals available to engineers, planners, highway superintendents, agribusinesses, contractors, foresters, etc.

agricultural
silvicultural
construction

residential
stormwater

Residential Development



- Onsite wastewater treatment systems
- Impervious surfaces
- Buffers along shorelines and banks
- Altered site drainage

Highway Maintenance

- Ditching & culverts
- Stormwater collection
- Winter road treatments
- Snow disposal



Photos Courtesy of Rebecca Schneider, Cornell University

Highway Maintenance

- Ditching & culverts
- Stormwater collection
- Winter road treatments
- Snow disposal



Ditching networks

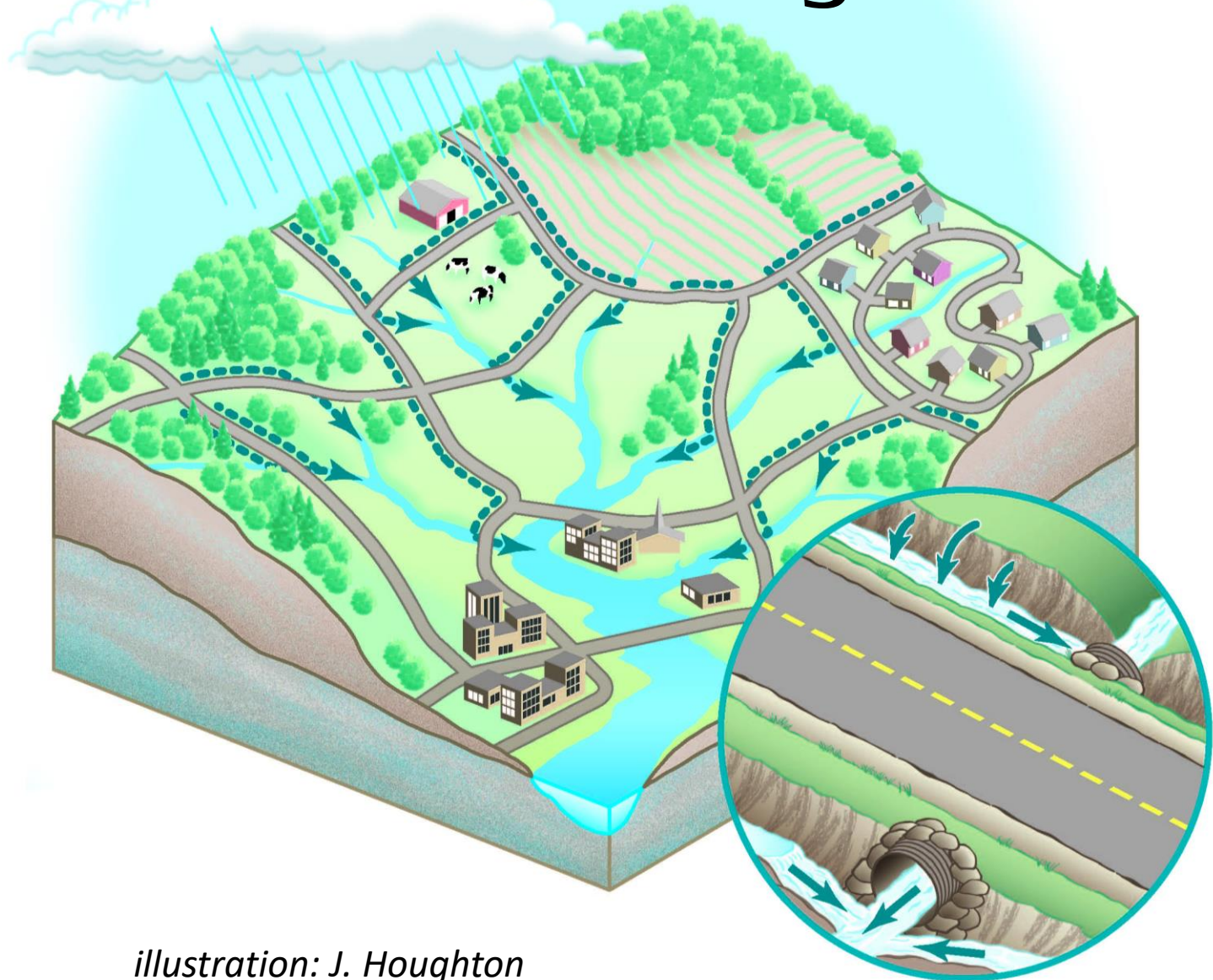


illustration: J. Houghton

Source: Cornell University FactSheet "Roadside Ditches"

Ditching networks

Capture ~20% of runoff, shunt it rapidly to streams

Contribute to stream flooding
increasing peak stream heights by
as much as 300%

Act as rapid conduits of pollutants
sediments, nutrients, fecal coliforms, others
from farm fields, lawns,
parking lots and other land surfaces

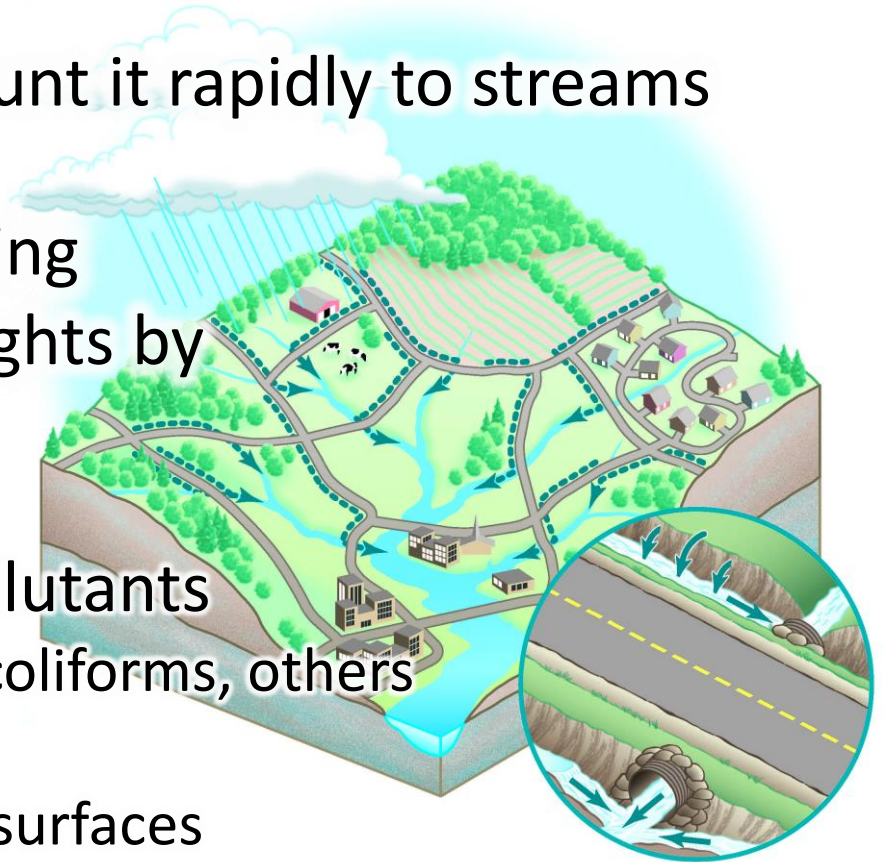


illustration: J. Houghton

*Source: Cornell University Fact Sheet
"Roadside Ditches"*

Agricultural Practices

- Drainage of crop fields
- Stormwater around the farm yard
- Manure storage & field spreading
- Livestock grazing – rotation, fencing
- Stream corridor (riparian) buffers



Implementing Agricultural BMPs

Federal monies for Agricultural BMPs via
Soil and Water Conservation Districts
working with the FSA and NRCS.

Voluntary Programs

Matching funds often required

Creative solutions for funding sources

Lake Associations
and other
conservation groups
can provide
incentives or
fundraising for
matching funds



Implementing watershed BMPs

- Develop a Watershed Plan
- Collaboration!
- Town Law and/or local Land Use Regulations
- Because the latter often require educational efforts and life style changes, implementation can be a long and frustrating process

Developing a Plan

1. Building Partnerships
2. Characterize the Watershed
3. Finalize Goals & Identify Solutions
4. Design an Implementation Program
5. Implement the Watershed Plan
6. Measure Progress & Adjust



Handbook for Developing Watershed Plans to Restore and Protect Water Quality
US Environmental Protection Agency

Developing a Plan

1. *Build Partnerships*

- Identify key stakeholders
- Identify issues of concern
- Set preliminary goals
- Develop indicators
- Conduct public outreach

2. *Characterize the Watershed*

- Gather existing data and create a watershed inventory
- Identify data gaps and collect additional data if needed
- Analyze data
- Identify causes and sources of pollution that need to be controlled
- Estimate pollutant loads

3. *Finalize Goals and Identify Solutions*

- Set overall goals and management objectives
- Develop indicators/targets
- Determine load reductions needed
- Identify critical areas
- Develop management measures to achieve goals

4. *Design an Implementation Program*

- Develop implementation schedule
- Develop interim milestones to track implementation of management measures
- Develop criteria to measure progress toward meeting watershed goals
- Develop monitoring component
- Develop information/education component
- Develop evaluation process
- Identify technical and financial assistance needed to implement plan
- Assign responsibility for reviewing and revising the plan

Characterization and Analysis Tools

- GIS
- Statistical packages
- Monitoring
- Load calculations
- Model selection tools
- Models
- Databases (environmental and social tools)

Developing a Plan: Stakeholders

Local Government Officials
Town Planning Boards
County Planning Depts.
Soil & Water Cons. Districts
IRLC
Lake Associations
NYS DEC & DOH
Residents
Business, Industry, Farmers...
Identify ALL stakeholders



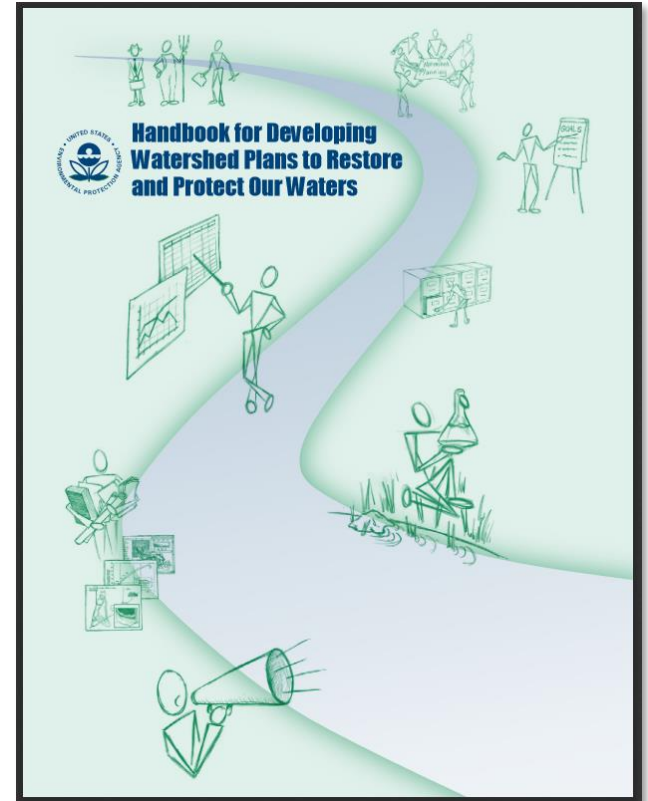
Developing a Plan: Key Elements

Problem Descriptions

Prioritized Action Areas

- Lead Agencies Identified
- Measurable Action criteria
- Monitoring & Assessment
- Measureable outcomes to assess progress and define success

Implementation Schedule



Local Government Support of Conservation Efforts

1. Education and a strategy to move forward to implement lake friendly regulations
2. First, get those approved that do not impact watershed stakeholders such as engine size, boat speed, noise levels
3. Then lakeside strategies such as lakescaping, on-site wastewater system inspections, lake protection districts, response to crises
4. Then tributary BMPs
5. Then aquifer protection districts



**SUNY
ONEONTA**

Biological Field Station
Cooperstown, NY

Holly Waterfield CLM
Holly.Waterfield@oneonta.edu

Additional Resources

US Environmental Protection Agency

Handbook for Developing Watershed Plans

Watershed Academy

Watershed Management Toolkits

Rebecca Schneider, Cornell University

'Re-plumbing' our watersheds

Local Roads Program

