

The Institute for the Application of Geospatial Technology

# Using GIS for Watershed Protection and Management

New York Federation of Lake Association 2014 Conference, "Celebrating Lake Stewardship May 2-4, 2014 Robert N. Brower, CEO IAGT



- A Brief Description of GIS and GIT
- The Watershed Protection and Management Process and Stewardship
- Managing the Lake and Watershed with GIS/GIT
- A Range of Applications



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## IAGT Mission – Quick Review

"...help communities and society realize the benefits of Geospatial Information Technologies (GIT) through education, outreach and innovative applications."



'IAGT meshes the strengths of GPS, remote sensing, aerial photography digital mapping, geospatial data, visualization applications, and web-based technologies into customized solutions and decision support tools for business, educators, and government agencies.'



- A Brief Description of GIS and GIT
- Geospatial data is information that identifies the geographic location and characteristics of natural or constructed features and boundaries on the earth, typically represented by points, lines, polygons, and/or complex geographic features.
- http://www.epa.gov/





### A Brief Description of GIS and GIT

About 770,000 results (0.78 seconds)

#### 1. tableausoftware.com

Adwww.tableau**software**.com/

has 2,641 followers on Google+

2.. GPSNavX for Mac - gpsnavx.com

3. Welcome to the QGIS project!

www.q**gis**.org/

A Free and Open Source Geographic Information System ... Create, edit, visualise, analyse and publish geospatial information on Windows, Mac, Linux, BSD ...Download - Documentation - QGIS Plugins planet - Discover QGIS 4. GRASS GIS - Home

5. http://www.mapwindow.org/



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 The Watershed Protection and Management Process

## What is a watershed?

A watershed is an area of land that drains into a body of water, such as a lake, river, reservoir, estuary, sea or ocean. The watershed includes both the streams and rivers that convey the water, and the land from which the water runs off. Watersheds are separated from adjacent watersheds by high points such as ridges, hills and mountains.





### Watershed/Landscape Model





 The Watershed Protection and Management Process





<u>Watershed Stewardship</u> - Taking action to help preserve and protect our water resources.

NYSDEC website

## <u>Stewardship</u> - protectorship, guardianship, custodianship

Under the noun "Protection" in Roget's Thesaurus, 1817-2007



The Penn State Master Watershed Steward program was established to strengthen local capacity for management and protection of watersheds, streams, and rivers, by educating and empowering volunteers across the commonwealth.

http://extension.psu.edu/



## Example projects include:

Organizing educational and informational workshops for the public, students and municipal officials on topics such as rain barrels, wildlife, pollution prevention, stormwater management, and invasive plant control

Organizing and executing stream clean ups Designing and installing demonstration rain gardens Monitoring streams for bacteria Carrying out stream bank restoration projects http://extension.psu.edu/



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- The Watershed Protection and Management Process
- Assessment
  Planning & Management
- Monitoring

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The Division of Water, "Watershed Management Cycle", NYSDEC



- The Watershed Protection and Management Process
- Assessment
- 1. Nutrient Allocation Models
- 2. Invasive Species
- Survey
- 3. Watershed Land Value Assessment



The Division of Water, "Watershed Management Cycle", NYSDEC



# Estimation of Nutrient Loads to Owasco Lake

## Barry M. Evans

Penn State Institutes of Energy and the Environment University Park PA



Source	Ca. 1990	Ca. 2000	Ca. 2007	Avg. Load	Avg. % of Total
Forest/wetlands	110	129	143	127	1.0
Agricultural land <sup>1</sup>	6,341	7,393	7,615	7,117	56.9
Developed land	409	443	474	442	3.5
Farm animals	362	551	646	519	4.2
Point sources	776	1,892	1,691	1,453	11.6
Golf courses	61	145	93	100	0.8
Groundwater <sup>1</sup>	2,338	2,057	2,374	2,256	18.1
Streambanks	481	460	522	487	3.9
Totals	10,879	13,070	13,556	12,501	100

Table 7. Estimated phosphorus loads (kg/yr) delivered to the lake by source.

<sup>1</sup> A significant part of the "groundwater" load is from agricultural sources

Barry M. Evans

www.erh.noaa.gov/nerfc/basin\_info/OWSN6.htm

Owasco Lake / Watershed Water Quality – Trophic Status Owasco Lake ... OWN IT ... State of the Lake Conference March 1, 2014

> John D Halfman Environmental Studies Program Department of Geoscience Finger Lakes Institute



Year	Stream Input (tons/year)	Output (t/y)	Net (t/y)
2011	15	2.4	12
2012	1.9	1.6	-1.8
2013	3.1 (8.4)	5.9	-2.8 (3.5)

# Summary

- Rain Intensity/Totals Critical to Stream Delivery of:
  - Phosphates
  - Suspended Sediments

#### Sources

- Agricultural
  - Runoff Events
- Stream Bank Erosion
  - More Effort Required
- Wastewater Treatment Facilities
  - Continuous
- Septics







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# Community Mapping and The Land Value Analysis

Some Preliminary Findings Based on Student GIS Analysis of the Land Value of the Cayuga County Portion of the Owasco Lake Watershed





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# The Community Mapping Program

- Mike Gordon, SUNY Cortland
- Tim McKillen, SUNY Cortland
- Rusty Ingerson, CCC
- Corrine Murray, LaMoyne
- Nick Topichak, CCC, Virginia Tech
- Jason MacLeod, Festa Fellow, SUNY Oswego



## **Assessed Land Value of the Parcels**



















## **Assessed Land Value and HUC's**





Tax Parcel Findings on "land" taxes

- 52% of all parcels in the Cayuga County Portion of the Owasco Lake Watershed are Agricultural
- There is one land based exemption in the data: Agricultural Land Exemption
- Lowest agricultural land exemption \$569.00
- Highest agricultural land exemption \$528,339.00



Tax Parcel Findings on "land" taxes

- Total agricultural land exemptions for parcels in the Cayuga County Portion of the Owasco Lake Watershed \$37,578,064 (53% annually)
- Average Agricultural exemption amount for area studied \$51,975.19
- Total taxes paid on land in area studied \$31,659,214.48 (47% annually)
- There is \$5,918,849.52 more in land exemptions than taxes paid in the area studied. (annually)







- The Watershed Protection and Management Process
- Planning & Manage.
- 1. Nutrient and Sediment Reduction Efforts
- 2. Wetlands Planning and Stakeholder Survey



The Division of Water, "Watershed Management Cycle", NYSDEC



## Sediment and Nutrient Loading Goal, Objective, and Strategies

Report to the Cayuga County Water Quality Management Agency by the Sediment and Nutrient Loading Reduction Working Group



March 7, 2013





**Goal:** Reduce sediment and nutrient loadings in waterbodies where problems or impacts caused by sediment and nutrients are apparent, and prevent excess loadings in all other waterbodies across the County

**Objective:** Support the application of best management practices to treat or reduce causal factors of sediment and nutrient loading in areas and situations where they will have the greatest effect.







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### **Nutrient Loading Potential of**

#### **Subwatersheds**

Relative differences in the nutrient loading potential of hydrological units at a certain scale may be reliably estimated on the basis of what is known about the quantities of nutrients that are generated by the different types of **land cover** present.





CLASS NAME	P COEFF (kg/ha/yr)*	Coeff Source
Developed, High Intensity	0.70	1
Developed, Medium Intensity	0.40	1
Developed, Low Intensity	0.10	1
Developed, Open Space	0.10	1
Cultivated Crops	2.10	1
Pasture/Hay	0.45	1
Grassland/Herbaceous	0.28	1
Deciduous Forest	0.07	1
Evergreen Forest	0.20	1
Mixed Forest	0.14	1
Scrub/Shrub	0.28	1
Palustrine Forested Wetland	0.09	1
Palustrine Scrub/Shrub Wetland	0.09	2
Palustrine Emergent Wetland	0.10	1
Unconsolidated Shore	0.19	2
Bare Land	0.28	1
Palustrine Aquatic Bed	0.10	2
Open Water (ignored in the analysis)		

\*1 kg/ha/yr = 0.892 lbs/ac/yr





#### Average Export Coefficient (kg/ha/yr)\*



\*1 kg/ha/yr = 0.892 lbs/ac/yr



- 1 Eightmile Creek-Frontal Lake Ontaric
- 2 Ninemile Creek
- 3 Amherst Island-Frontal Lake Ontario
- 4 Sterling Valley Creek
- 5 Sterling Creek
- 6 Headwaters Sterling Creek
- 7 Ox Creek
- 8 Red Creek
- 9 Muskrat Creek
- 10 Cross Lake-Seneca River
- 11 Howland Island-Seneca River
- 12 Stark Pond Seneca River
- 13 Skaneateles Creek
- 14 Owasco Outlet
- 15 Cold Spring Brook
- 16 Putnam Brook
- 17 Kipp Island-Seneca River
- 18 Crane Brook
- 19 Demont Creek-Cayuga Lake
- 20 Owasco Lake
- 21 Outlet Skaneateles Lake
- 22 Yawger Creek
- 23 Dutch Hollow Brook
- 24 Grout Brook-Skaneateles Lake
- 25 Red Creek-Cayuga Lake
- 26 Big Salmon Creek
- 27 Mill Creek
- 28 Hemlock Creek-Owasco Inlet
- 29 Paines Creek-Cayuga Lake
- 30 Shelldrake Creek-Cayuga Lake
- 31 Upper Fall Creek
- 32 Lively Run-Cayuga Lake
- 33 Headwaters Owasco Inlet
- 34 Salmon Creek



#### FINAL REPORT of the OWASCO FLATS Conservation Planning and Stakeholder Survey Project June 2007

#### By Mark Whitmore and the Finger Lakes Land Trust

Funding for this project was provided by the Central New York Regional Planning and Development Board under a grant secured through the United States Department of Housing and Urban Development for the Finger Lakes Water Resources, Agriculture, and Open Lands Conservation Project.





















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- The Watershed Protection and Management Process
- Monitoring
- 1. Aquatic Invasive Species
- 2. Citizen Monitoring Program (OWLA CCWQMA)
- <u>OWN</u>
   FIMS



# The Division of Water, "Watershed Management Cycle", NYSDEC





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New York Federation of Lake Association 2014 Conference, "Celebrating Lake Stewardship WWW.iagt.org WWW.owla.org bbrower@iagt.org WWW.owascolake.org

Robert N. Brower, CEO November 15, 2013 Finger Lakes Research Conference, The Finger Lakes Institute at Hobart and William Smith



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