

National Aeronautics and Space Administration



New Hampshire Ecological Conservation

Predicting Future Conflicts between Loon Habitats and Human Development in New Hampshire using NASA Earth Observations

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A N N I V E R S A R Y

Outline

INTRODUCTION

The team, partners, and study area



OBJECTIVES Translating community

concerns to project goals

Incorporating Earth observations

METHODOLOGY



CONCLUSIONS

Future work and acknowledgments



RESULTS

Findings, uncertainties, and errors



INTRODUCTION





The Team





Loon Preservation Committee (LPC)



"Restore and maintain a healthy population of loons throughout NH; to monitor the health and productivity of loon populations as sentinels of environmental quality; and to promote a greater understanding of loons and the larger natural world."

- LPC



The Common Loon (Gavia immer)













An Indicator Species





Economic



Ecological

Community Concerns



Community Concerns



Recreational activity



Community Concerns



Study Area

New Hampshire & Case Study Lakes

- 1. First Connecticut Lake
- 2. Umbagog Lake
- 3. Newfound Lake
- 4. Squam Lake
- 5. Lake Winnipesaukee
- 6. Lake Massabesic
- 7. Onway Lake
- 8. Canobie Lake



Study Period



Credit: NASA

Objectives



Analyze temperature



Assess land use change

METHODOLOGY







Land Use Land Cover





Landsat 8 OLI/TIRS

ACOLITE





Land Surface Temperature













Land Use Land Cover



Ex. Lake Winnipesaukee







LS8 Average Turbidity Estimates and NLCD 2019 Development



LS8 Average Turbidity Correlation to NLCD 2019 Development







LS8 Average Turbidity Correlation to Nesting Pair Density





Temperature Anomalies







Average Change in Temperature from 2000–2022 of Highest Total Population

Average Change in Temperature from 2000–2022 of Largest Population Growth

Urban Development and Land Surface Temperature



Surface Temperature





Extreme temperature change is 2.7 °F and above

42% of nests located in areas with greater than average urban development

Continued presence despite increasing temperatures

Conclusions









Back to the Objectives...



Variations in development patterns; overall small increases in shoreline development between 2001–2019

Lakes with surrounding protected lands have low overall development



Least turbid waters observed on most developed, lowest latitude lakes



Average land surface temperature **increase** of 1.77 °F

Despite increasing temperatures, **loons continue to be present**, even in extreme temperature change



Errors and Uncertainties







per year, no consistent total pixels recalculated per year, no consistent total pixel value	D	ifferent scenes f	nun or e
pixel value		sce	nes to

Different number of Landsat scenes for each lake/year

Resolution and frequency differences in MODIS and Landsat

NLCD 30m resolution, inaccuracies in pixel classification

Potential protected lands excluded

Water quality ≠ water clarity

MATLAB

Extreme values in Landsat Land Surface Temperature from mosaicking errors

Did not find Lake Water Surface Temperature



Uncertainties: Water Quality



Future Work



Incorporate data from other sensors

- Increased observations
- Topographic considerations



Lake Water Surface Temperature



Add bird band ID into analysis





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- John Cooley, Senior Biologist, Loon Preservation Committee
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