



Southern Forests Water Futures

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GWF Inception Meeting, Waterloo
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Objectives

- To enhance our knowledge of eco-hydrological and biogeochemical processes in southeastern Canadian forests by integrating data sets from eddy covariance flux towers, forest inventory plots, dendrochronology, stable isotopes (^{12}C , ^{13}C , ^{16}O , ^{18}O) and ground and airborne remote sensing.
- To develop management strategies that can enhance water use efficiency and sustainable development of water resources in these forests and improve their resilience to negative impacts of future climate change.
- Develop and test the next-generation of land surface models to more accurately account for cold region eco-hydrological processes and improve predictive capabilities of Canadian regional and global climate models.



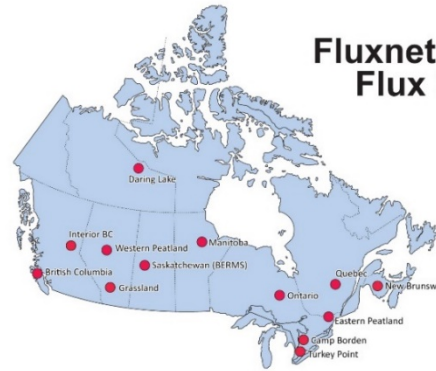
Turkey Point Observatory

Age –Sequence Forest Sites

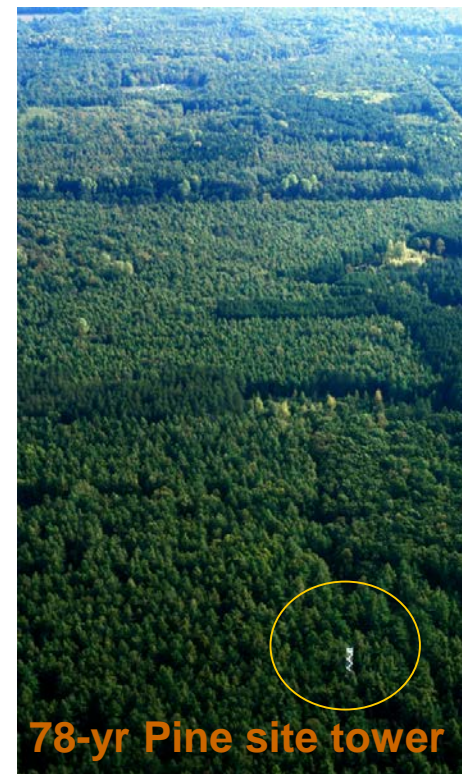
-Turkey Point Flux Station
(42° 42' 55" N, 80° 22' 20" W)
about 20 km southwest of Port Dover,
near Lake Erie in Southern Ontario.

- White Pine Plantation Age-sequence
(12, 40, 36, 75 years old);
- Carolinian forest, 80 year old
- All four sites within 20 km radius

- Mean annual temperature: 8.0 °C
- Mean annual precipitation: 1036 mm



Fluxnet-Canada
Flux Stations



78-yr Pine site tower

Deciduous Forest



'80-year-old' – TPD



2004 photo

'15-year-old' - TP02

Base diameter: 11.6 cm
Height: 5.8 m
~ 1567 trees/ha



'43-year-old' – TP74

DBH: 17.9 cm
Height: 16.2 m
~ 1600 trees/ha



'78-year-old' – TP39

DBH: 37.2 cm
Height: 22.9 m
~ 413/321trees/ha

DBH: 23.1 cm
Height: 25.7 m
~504 trees/ha

Turkey Point Observatory Study Components

Four Eddy Covariance Flux Systems and Weather Stations

TP02 (15 year-old)



TP74 (43-year-old)



(Bruce Whitside)



(OMNRF-SWCRCC)

TP39 (78-year-old)



(OMNRF-SWCRCC)



TPD (>80 year-old)

Initiated in 2012



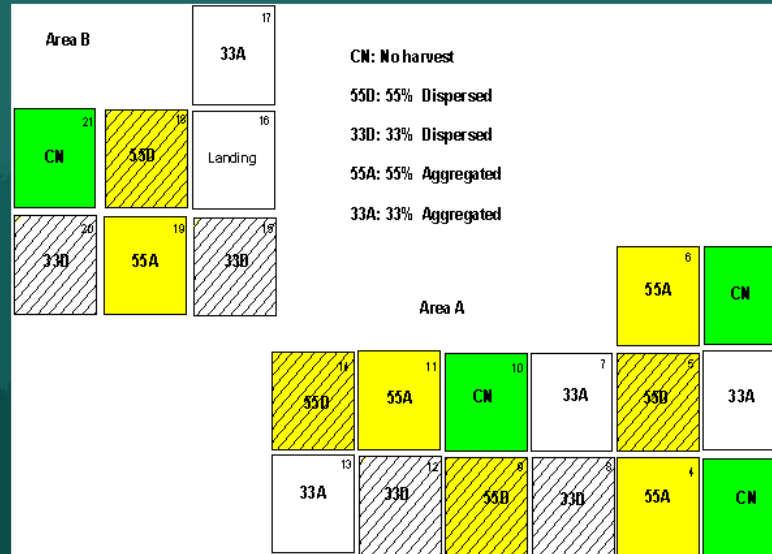
(LPRCA)



Turkey Point Observatory Study Components

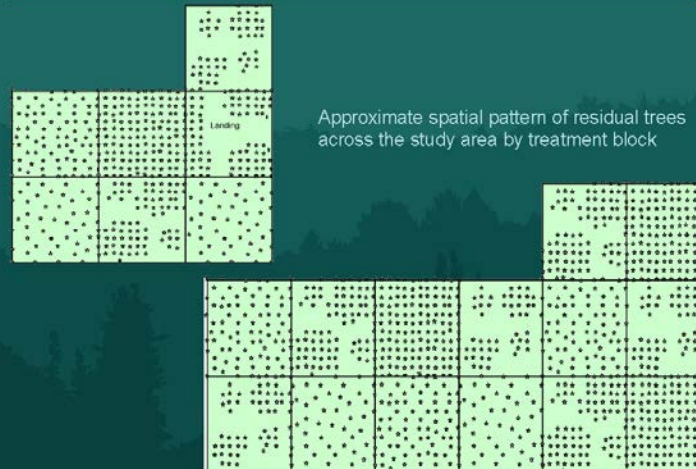
Variable Density Thinning Experiment

SWCR study area and experimental VDT treatment layout



- Completely randomized design
- 4 replicates per treatment
- ~0.90 ha treatment plots
- Testing of individual treatment, retention, and spatial pattern effects.

VDT treatments creates spatial and structural heterogeneity across the study area



(William Parker, Ken Elliott, and Steve Williams, OMNR Researchers)



Turkey Point Observatory - Study Components



Biometric and Ecophysiology Studies (J. Chen)



Sapflow/WUE Studies



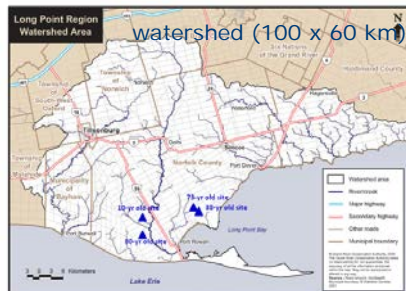
Soil Processes



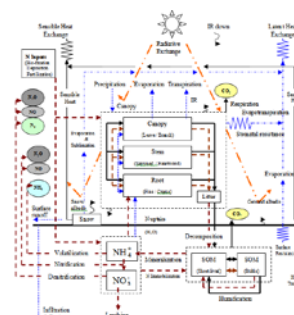
Nutrient Elemental Analysis (X-ray Fluorescence, Boyce)



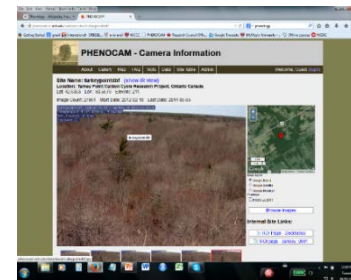
Thinning Impacts (TP39, Winter 2012)



Hydrologic/Interflow modelling (Davison)



Ecosystem Modelling (CLASS-CTEM, Bartlett/Melton, BEPS)



Phenocams (A. Richardson)



Drone and Radar Imagery (Chen/Wang)



ABove-PRI/NDVI (I. Ensminger)



GPR Studies (J. Boyce)



Dendrochronology/Isotopic (Pisarcic, Slater, Kim Labs)



Funded HQP

- 1 PDF
(Dendrochronology/Isotopic studies)
- 4 PhD students
(i) Flux Towers, (ii) Management/VDT,
(iii) Ecology/remote sensing and (iv) Ecosystem Modelling
- 2 MSc students
(i) Nutrients studies and (ii) Hydrologic modelling
- 5-6 UG Thesis students
- 4 Shared technical members



Supporting Organizations

- Environment and Climate Change Canada (ECCC) – CRD and CCIW
- Canada Centre for Remote Sensing, Natural Resources Canada (NRCan)
- Ontario Ministry of Environment and Climate Change (OMECC)
- Ontario Ministry of Natural Resources and Forestry (OMNRF)
- Long Point Region Conservation Authority (LPRCA)
- Ontario Climate Consortium (OCC)
- Toronto Region Conservation Authority (TRCA)
- St. Williams Conservation Reserve Community Council (SWCRCC)
- The James Hutton Institute, Aberdeen, Scotland, United Kingdom
- United Nations Univ. - Institute for Water Environment & ealth (UNU-INWEH)
- Global Fluxnet and Ameriflux synthesis initiatives



Environment
Canada

Environnement
Canada



Natural Resources
Canada

Ressources naturelles
Canada

Canada



Ontario



UNITED NATIONS
UNIVERSITY

UNU-INWEH

Institute for Water,
Environment and Health



The James
Hutton
Institute



Long Point Region
Conservation Authority



Toronto and Region
Conservation
for The Living City



ONTARIO CLIMATE CONSORTIUM



ST. WILLIAMS
CONSERVATION RESERVE
COMMUNITY COUNCIL



Collaborators

- Paul Bartlett, Joe Melton (ECCC, CRD)
- Al Pietroniro, Bruce Davison, Luis Leon (ECCC, CCIW)
- Shusen Wang, Canisius Francis, Junhua Li (CCRS, NRCan)
- Bill Parker (OMECC), Ron Drabick (OMNRF),
- Paul Gagnon (LPRCA), Audrey Heagy (SWCRCC), Ian McVey (OCC)
- Nidhi Nagabhatla (UNU-INWEH)
- Myroslava Khomik (James Hutton Inst. UK/U. of Waterloo)

Potential GWF Collaborators:

- Northern Water Futures (Jennifer Baltzer/Oliver Sonnentag)
- Boreal Water Futures (Mike Waddington/Rich Petrone)
- Mountain Water Futures (Sean Carey)
- Agricultural Water Futures (Merrin Macrae)
- Lakes Futures (Nandita Basu)
- Climate Precipitation extremes (Francis Zwiers & Ron Stewart)
- Co-creating of Indigenous Water Quality Tools (Dawn Martin-Hill)
- Modelling and Forecasting, Core Data Management, Technical, Knowledge Mobilizations Teams



Communications and Outreach

- Canadian Geophysical Union (CGU) –
GWFF Session on Forest Hydrology & Biogeochemistry
(June 10-14, 2018, Niagara Falls)
- Turkey Point Observatory – CGU Field Tour
(9 June, 2018)
- Public Outreach - McMaster Climate Centre