Centre for Water Resources Management

Monday 15 June 2009
Macdonald Campus of McGill University

McGill

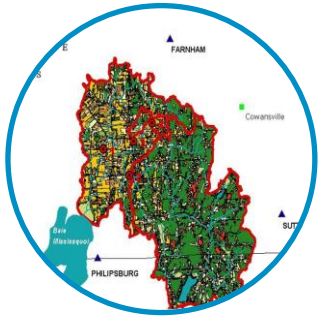
Current Areas of Research

Water Quantity

- Water availability
- Water table management
- Water use efficiency
- Irrigation scheduling
- Developing drought indices

Water Quality

- Decision-making tools
- Computer modelling
- Nutrient management
- Cyanobacteria
- Point-of-use treatment



Climate Change

- Modelling
- Impact on water availability
- Impact on water quality
- Sensitivity analyses
- Downscaling

Brace Centre for Water Resources Management

The Brace Team

- **Catherine Senecal,** CARIWIN
- **Marie-Claire St-Jacques,** Community water strategies
- **Ajay Singh,** Water table management interactions with water and nitrogen use efficiency
- **Rufa Doria,** Impact of a changing climate on water availability for crop production in Eastern Canada
- **Sajjad Ali,** Evaluation of soil moisture sensors for irrigation scheduling of strawberries
- **Felix Jaria,** Increasing water use efficiency and improved nutrient management for processing tomatoes
- **Olanike Aladenola,** Development and application of an agricultural water demand model
- **Johanna Richards,** Development of drought indices for Jamaica
- **Mohamed Chikhaoui,** Decision-making tools, water quality management
- **Colline Gombault,** Climate change impacts on the water quality of the Pike River
- **Frank Ferber ,** Sensitivity analysis of climate data using SWAT
- **Felexce Ngwa,** Developing approaches for early detection and quantification of toxigenic cyanobacteria in freshwater bodies
- **Candice Young,** Development of appropriate point-of-use water treatment systems for an Amerindian community in Guyana
- **Ahmed Nafea, Yong Liu,** MSc interns
- **Emily McGill, Simone Bourke and Eddy McKyes,** Summer students

Community Water Strategies

Marie-Claire St-Jacques, M.Sc. IWRM

Main Objective:

To establish a framework to guide the development and implementation of Community Water Strategies (CWS) in the Caribbean

Based on:

- International IWRM Best Management Practices for community-level applications
- Lessons learned from case studies

Examples of Applications

- Water Supply and Sanitation
- Capacity Building
- Watershed Management
- Agricultural Practices
- Environmental Sustainability
- Rainwater Harvesting
- Flood and Drought Management

IWRM & Community-based Management

Identify the necessary conditions for successful community empowerment and participatory management

- Integration
- Ownership & accountability
- Capacity & empowerment
- Transparency & information
- Adaptation & flexibility
- Gender mainstreaming

A Quick Overview of the Framework:

Phases	Components
Assessment	A1. Stakeholder analysis A2. Socio-economic context A3. Governance framework A4. Environmental assessment A5. Information management A6. Awareness-raising
Planning	B1. Priority setting B2. Detailed plan development B3. Creation/reform of decision-making body B4. Definition of roles & responsibilities B5. Enabling environment B6. Financing & cost recovery B7. Conflict management
Implementation	C1. Plan implementation C2. Process monitoring and documentation C3. Information sharing & communications
Monitoring	D1. Development of indicators D2. Monitoring system D3. Sharing & learning

Water Table Management Interactions with Water and Nitrogen Use Efficiency

Ajay Kumar Singh, PhD Candidate

OBJECTIVES

- Investigate the water and nitrogen use efficiency of corn under water table management scenarios
- Predict crop growth response to various water table and nitrogen management scenarios using a coupled water management and a crop growth model

Research Sites

Controlled Environment

- Greenhouse, Macdonald campus 2007

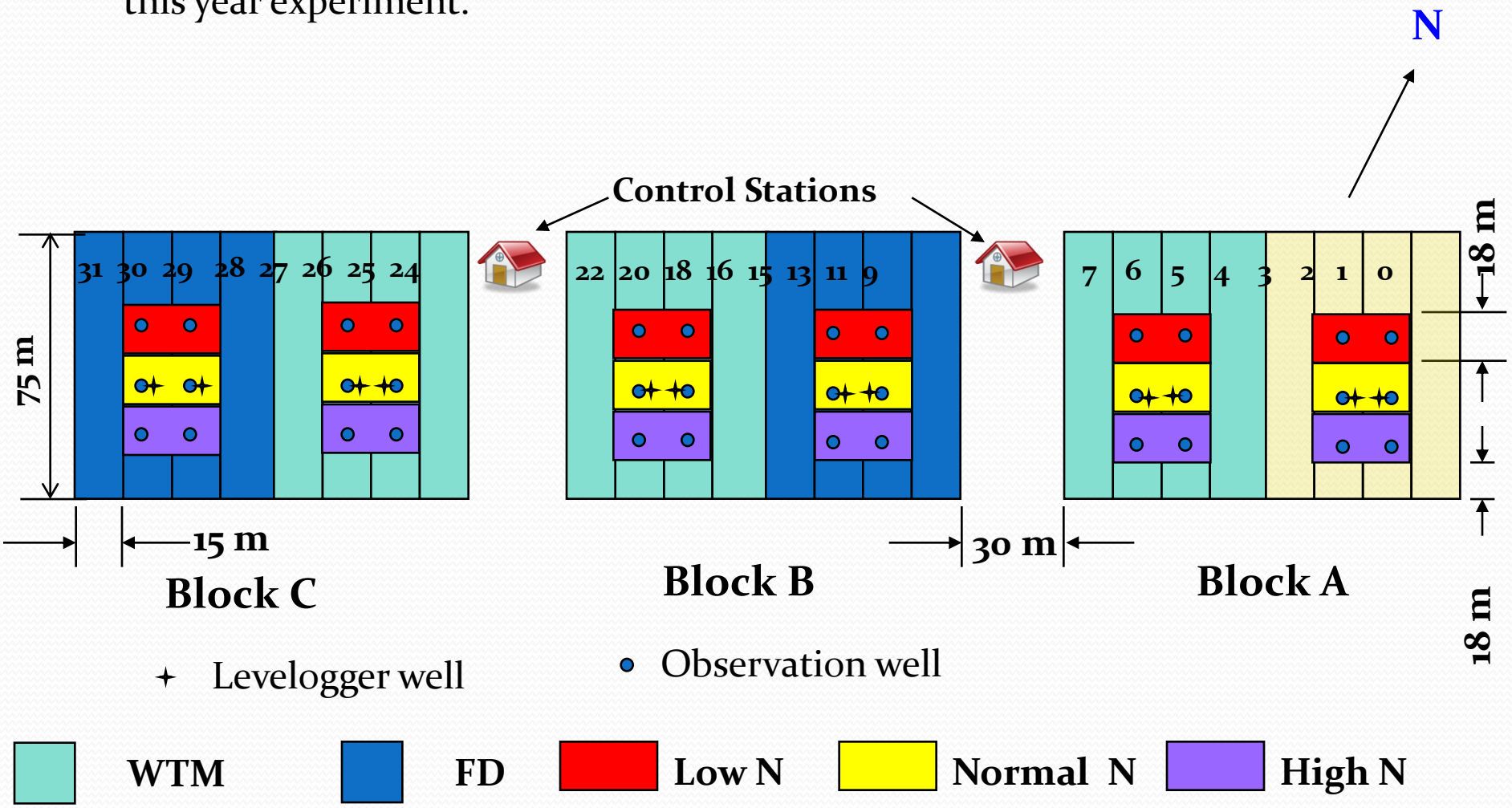
Field Sites

- Bedford, QC 2007
- St. Emmanuel, Coteau-du-lac, QC (2008 & 2009)

Greenhouse Layout

St. Emmanuel Field Layout - 2008

1. The numbers indicates drainage pipes in the control station linked to plots.
2. 8, 10, 12, 14, 17, 19, 21 and 23 are outlets for surface runoff plots and not used in this year experiment.



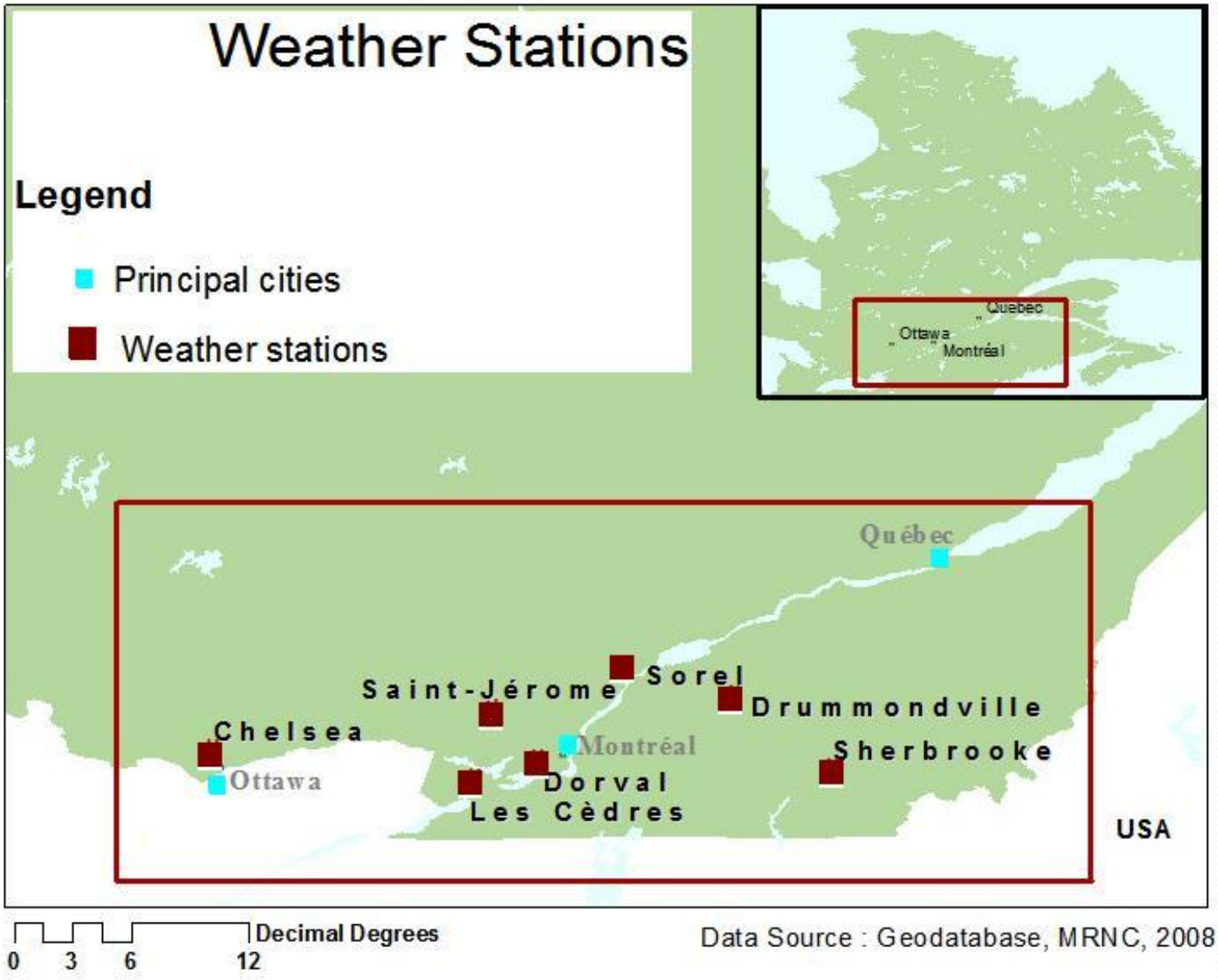
Impact of a changing climate on water availability for crop production in Eastern Canada

Rufa Doria, PhD Candidate

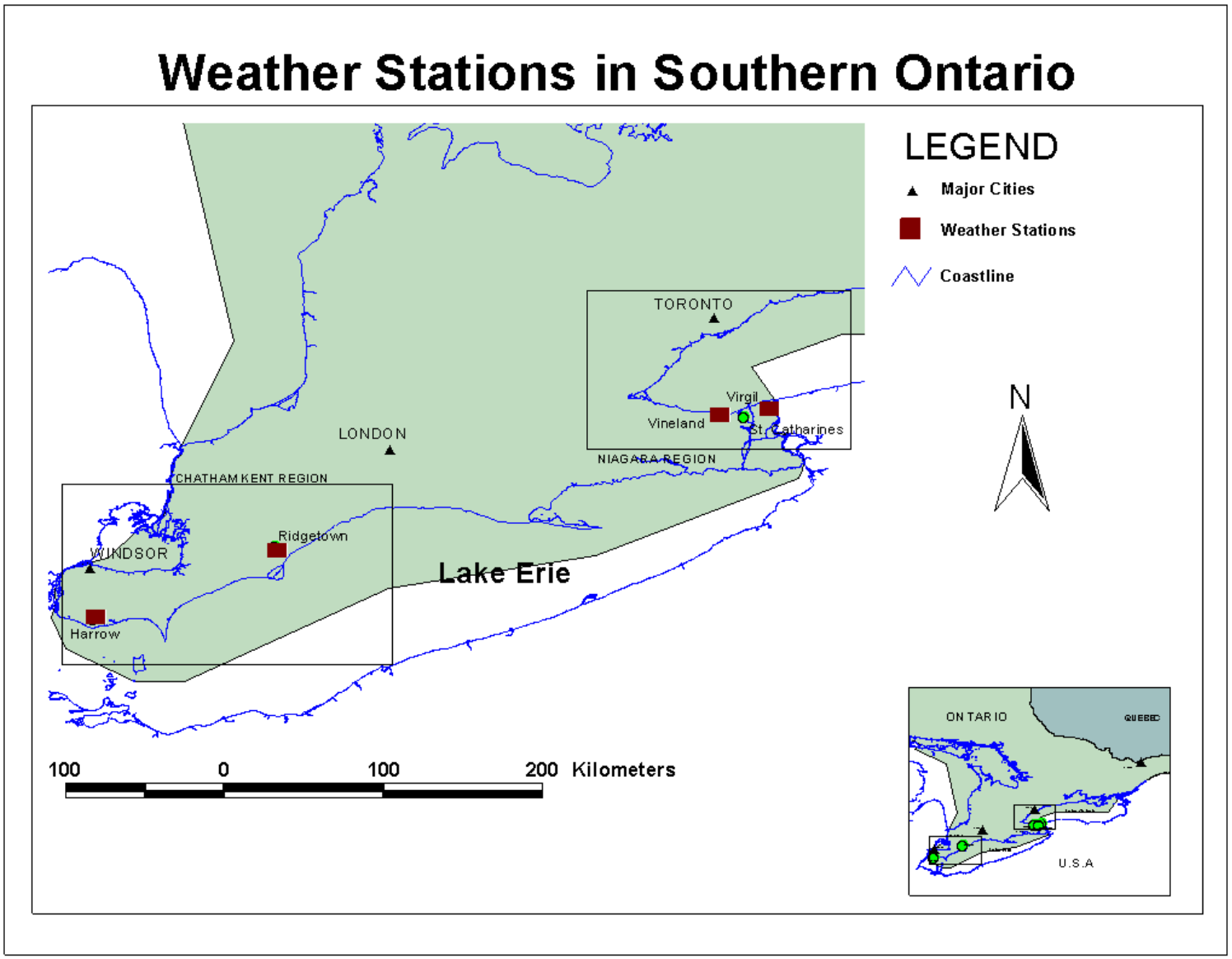
OBJECTIVES

- To investigate the impacts of a changing climate on water requirements of crops for future periods of 2020, 2050 and 2080
- To define effective strategies for crop producers to adapt to climate change.

Study areas


Weather Stations
Legend
Principal cities
Weather stations
Quebec
Ottawa
Montréal
Québec
Saint-Jérome
Sorel
Drummondville
Chelsea
Montréal
Sherbrooke
Ottawa
Dorval
Les Cèdres
USA
Decimal Degrees
0 3 6 12
Data Source : Geodatabase, MRNC, 2008

Study areas


Weather Stations in Southern Ontario
LEGEND
Major Cities
Weather Stations
Coastline
N
TORONTO
Virgil
Vineland
St. Catharines
NIAGARA REGION
LONDON
CHATHAM KENT REGION
Ridgetown
WINDSOR
Lake Erie
Harrow
100 0 100 200 Kilometers
ONTARIO
QUEBEC
U.S.A

Expected output on this research (in manuscripts form)

- Climate change impacts on irrigation water requirements of peach and grape crops in Southern Ontario (Transactions of the ASABE)
- Estimation of irrigation requirements for some crops in Southern Quebec using CROPWAT (Irrigation and Drainage Journal)
- Development and application of an irrigation requirements model for peaches and grapes in Southern Ontario under climate change scenarios (ASABE Meeting Presentation Paper No. 083755)
- Estimation of future crop water requirements for 2020 and 2050, using CROPWAT (EIC Climate Change Technology Conference Article No. 4057324)

Evaluation of soil moisture sensors for irrigation scheduling of strawberries in Southern Ontario

Sajjad Ali, MSc Candidate

OBJECTIVES

- Monitoring soil moisture - *in situ* evaluation of two sensors as tools for irrigation scheduling.
- Comparison of water use for open field and plastic high tunnel strawberries
- Validate soil moisture sensor data using gravimetric soil moisture measurements as a standard

Soil Water Sensors

Time domain reflectometry	Frequency domain reflectometry	Tension-based

Recommendations

- The study highlighted the following key findings:
  - The importance of sensor installation location for accurate monitoring of soil moisture.
  - Appropriate soil depth for monitoring, based on crop type and growth stages, maybe by varying depth of monitoring with growth stage.
  - Site-specific sensor calibration helps in identifying the right triggers for turning irrigation on and off.
  - Irrigation schedules needed to be monitored more closely to be able to compare water use between the two management systems.
  - Capacity building of the growers, to interpret soil moisture data, setting triggers for irrigation scheduling.

Increasing water use efficiency and improved nutrient management for processing tomatoes

Felix Jaria, PhD Candidate

OBJECTIVES

- Develop a web-based irrigation scheduling model for use by tomato growers in southern Ontario
- Determine optimal soil moisture trigger levels for irrigation
- Ascertain the effects of soil moisture uniformity on crop yield and quality

Experimental design (buried and surface drip)

Block I (FDR)	**60%**	**80%**	**70%**	**-0.3 bar**
Block 2 (TDR)	**70%**	**-0.3 bar**	**60%**	**80%**
Block 3 (TDR)	**80%**	**60%**	**-0.3 bar**	**70%**
Block 4 (FDR)	**-0.3 bar**	**70%**	**80%**	**60%**

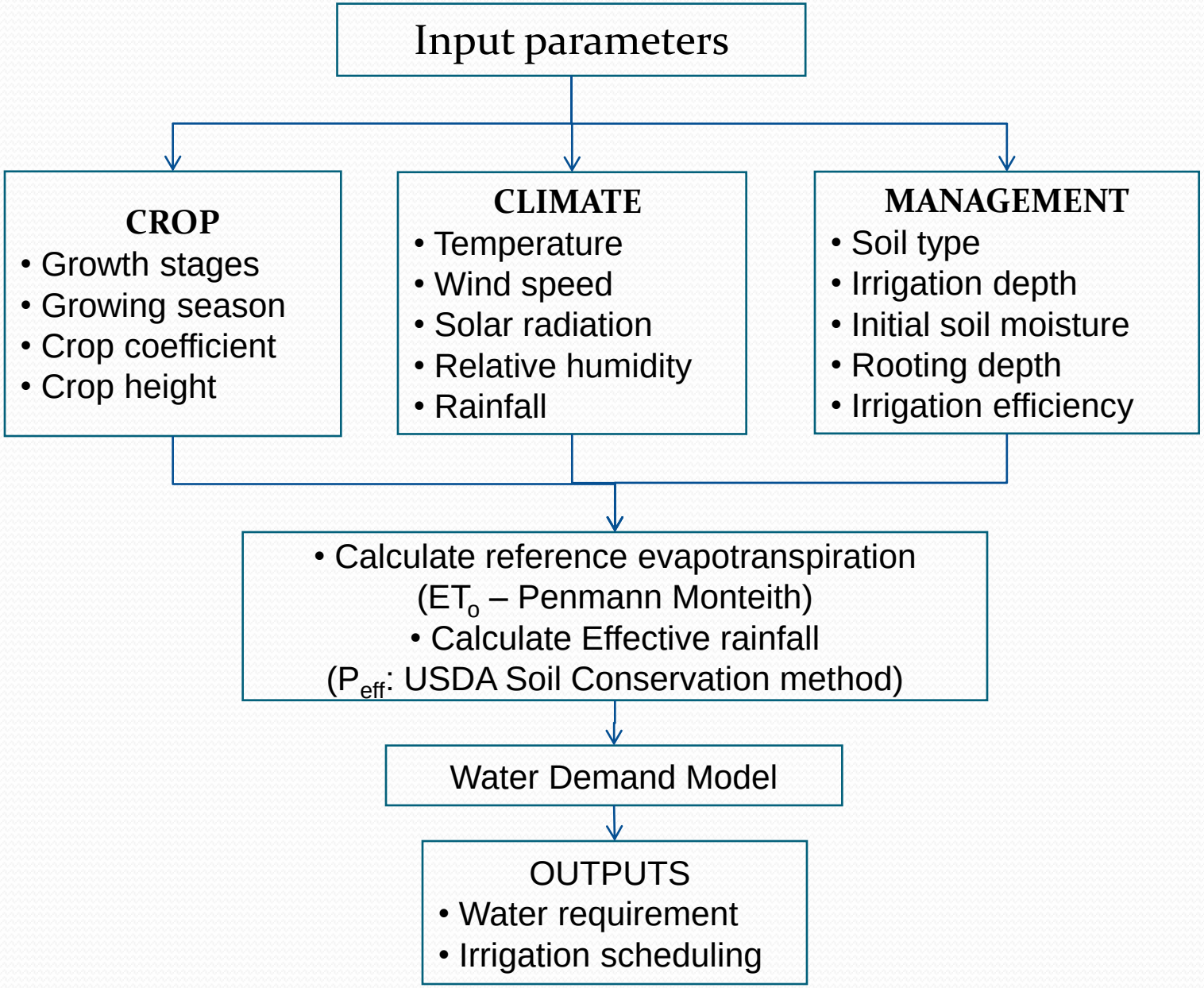
Development and application of an agricultural water demand model

Olanike Aladenola, PhD Candidate

OBJECTIVES

- To develop a model for estimating agricultural water demand based on
  - projected changes in irrigated area
  - precipitation variability due to climate change
  - introduction of more efficient water application technology and practices

Model Development Framework



Development of Drought Indices for Jamaica

Johanna Richards, MSc Candidate

OBJECTIVES

- Develop Standard Precipitation Indices (SPI) for Jamaica
- Improve the performance of the Aggregated Drought Index (ADI) by making it spatially variable over small areas
- Predict the behaviour of the Rio Nuevo sub-watershed under future urbanization scenarios

Methodology

- The Rio Nuevo sub-watershed, St. Mary, is the study area for this research
- SWAT has been used in order to simulate the soil moisture conditions over small land areas (10 km^2)
- Inputs include land use, soil types, Digital Elevation Model (DEM), daily rainfall and temperature.
- SWAT calibrated over 2005-2007 and validated over 2003-2004

Development of Appropriate Point-of-Use Water Treatment Systems for A Rural Amerindian Community in Guyana

Candice Young-Rojanschi, PhD Candidate

GOALS

- Water use
  - Identify water uses, sources, gender roles
- Water quality
  - Characterize water sources, quality, changes over time
- Water treatment
  - Test PoU technologies in households

http://www.handpump.org/kisii/index.htm

Point of use treatment technologies

- Biosand filters (bottom left)
- Ceramic filters (top)
- Chlorine addition (top left)