Irrigation in Canada: Improving Water Productivity through Research and Development

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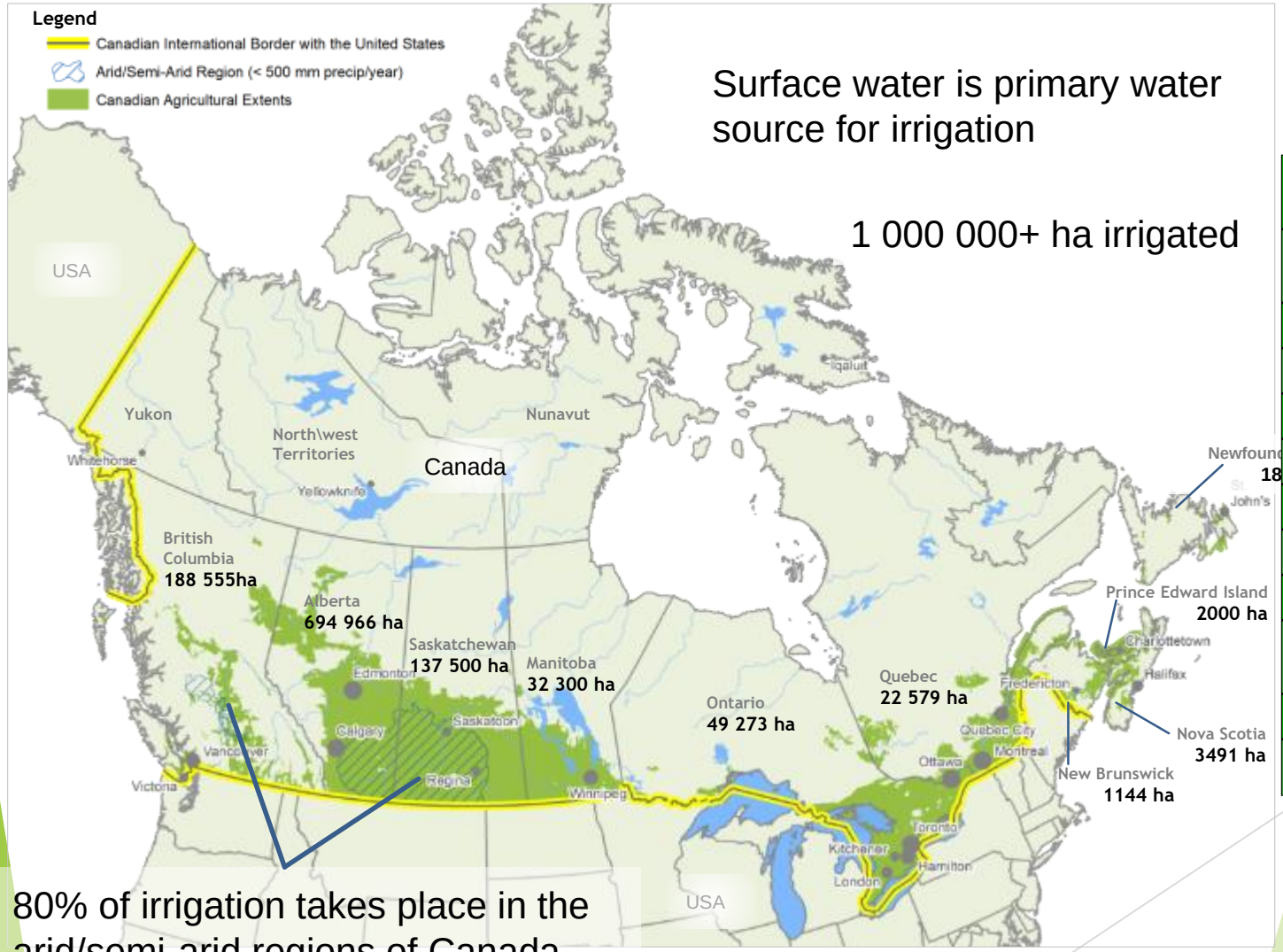
Agriculture and Agri-Food Canada

Virtual Experts Meeting on Promoting Sustainable Agricultural Development in Drylands

August 10, 2020

Agriculture and Irrigation in Canada



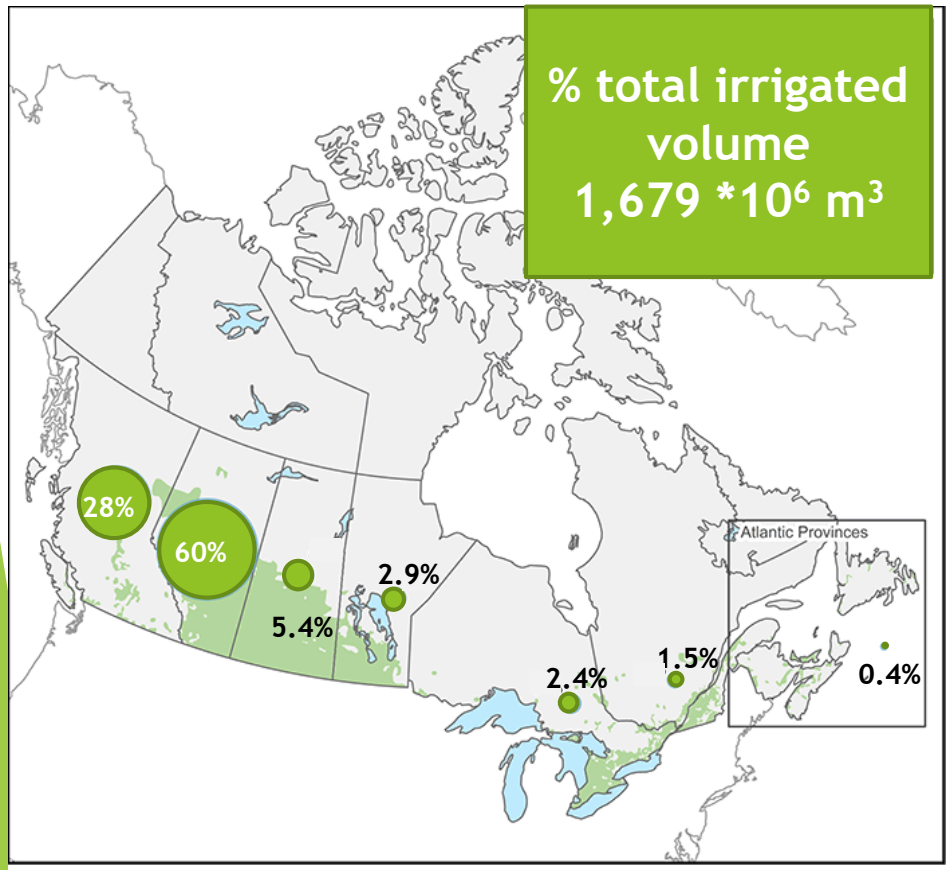
Surface water is primary water source for irrigation

1 000 000+ ha irrigated

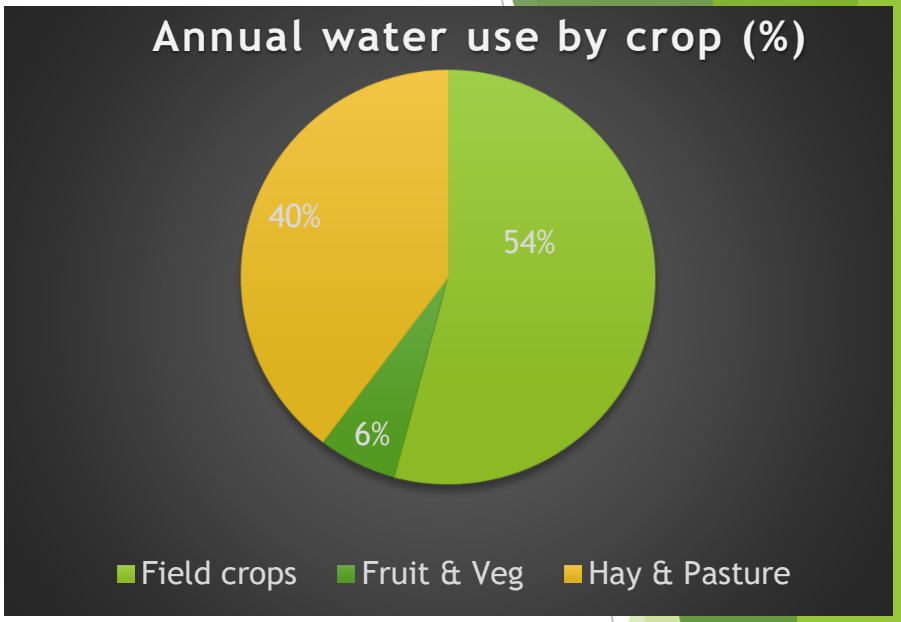
Province	Estimated Irrigated Area (ha)
British Columbia	188,555
Alberta	639,887
Saskatchewan	137,500
Manitoba	32,300
Ontario	49,273
Quebec	22,579
New Brunswick	1,144
Nova Scotia	3,491
Prince Edward Island	2,000
Newfoundland	188
Total	1,076,917

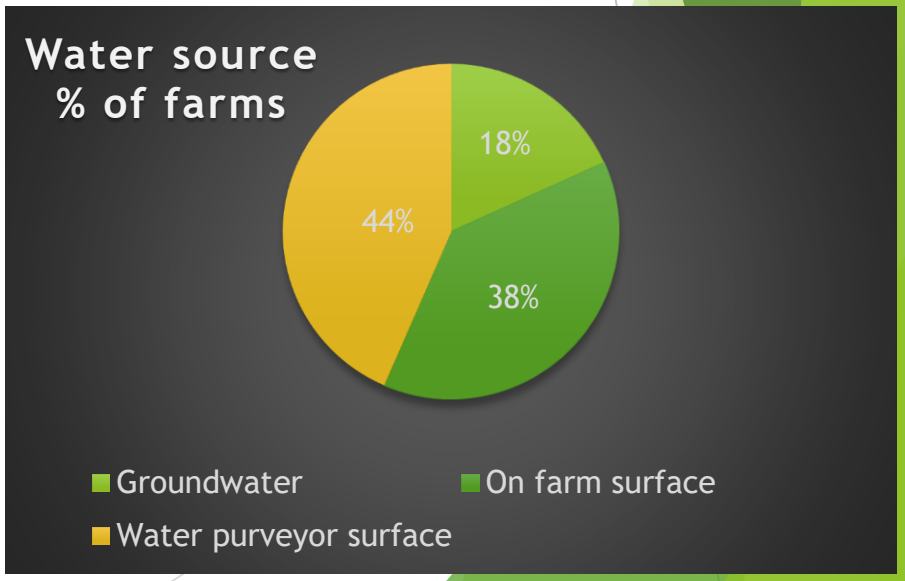
80% of irrigation takes place in the arid/semi-arid regions of Canada

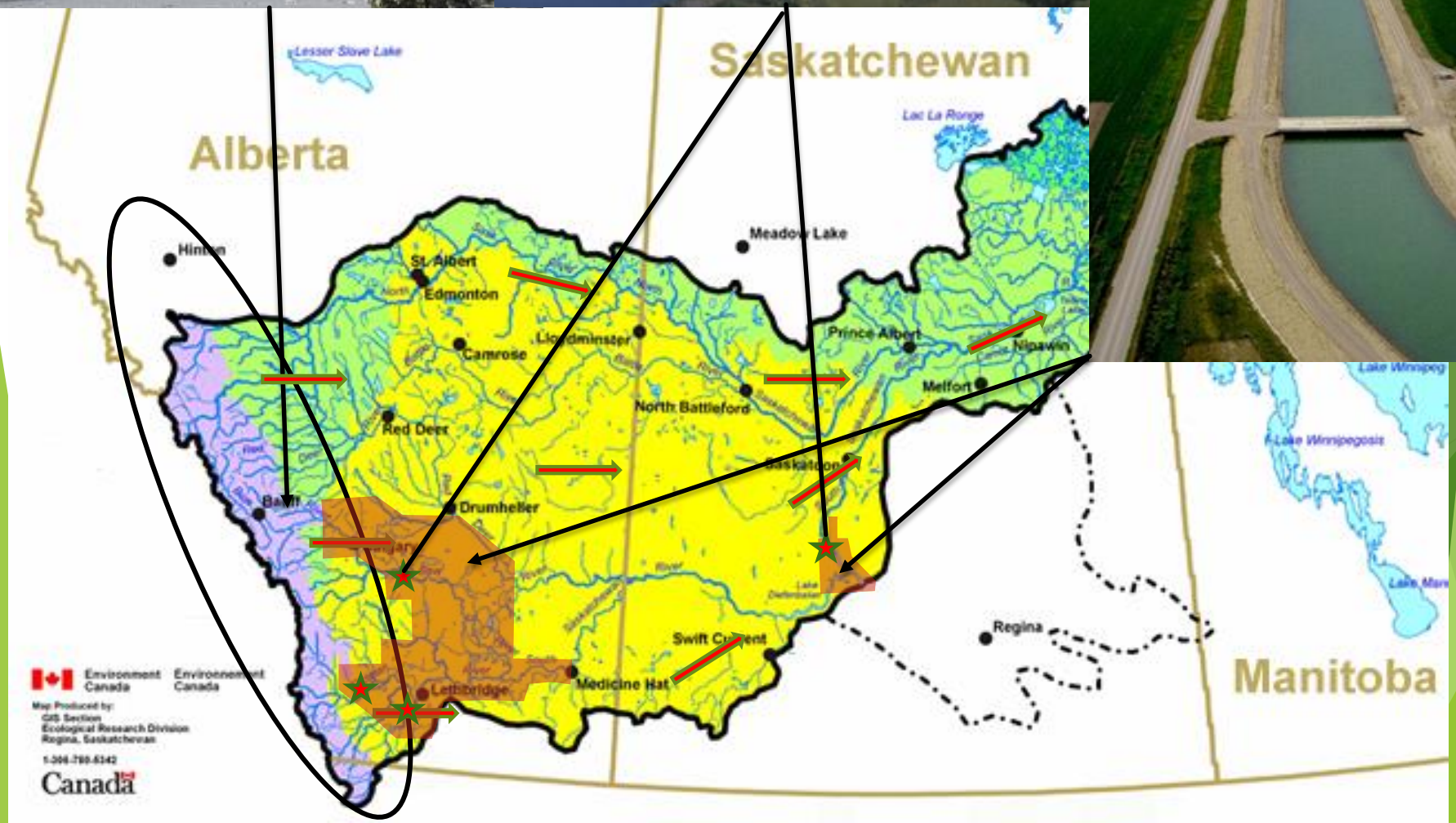
Water use in Canada by province, crop and source



Note(s): Excludes Yukon, Northwest Territories and Nunavut.
Totals may not add up to 100% because of rounding.
Source(s): Statistics Canada, 2011, Environment Accounts and Statistics Division, Agricultural Water Survey (survey number 5145).



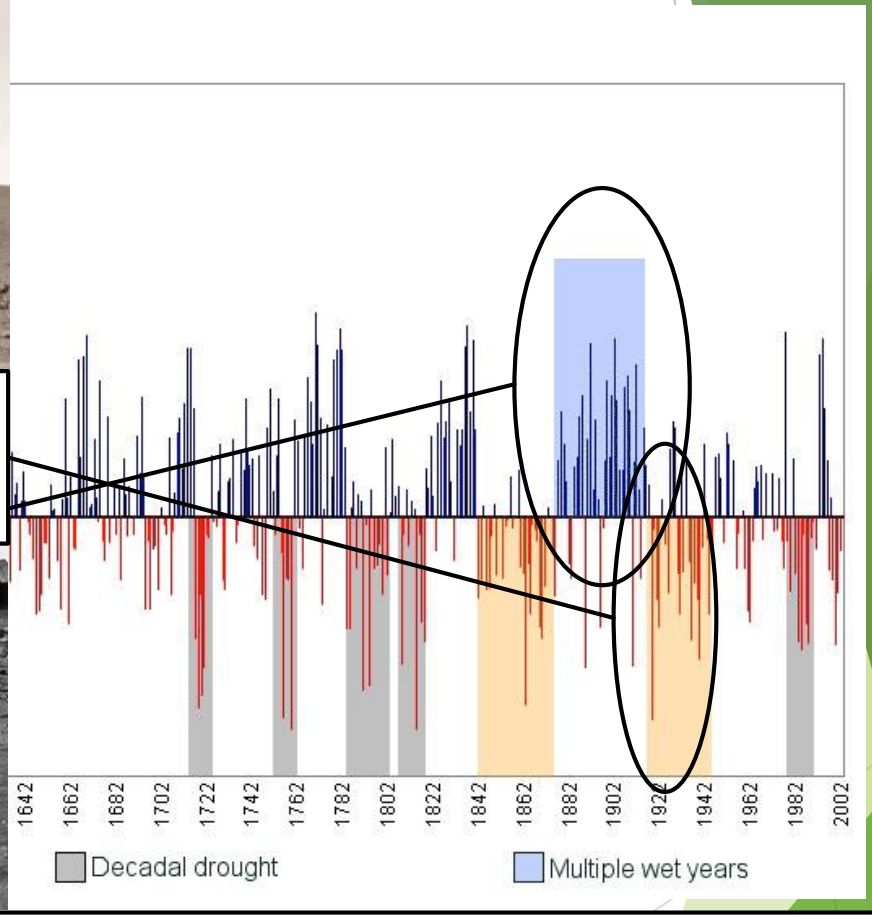



Lesser Slave Lake
Saskatchewan
Lac La Ronge
Alberta
Meadow Lake
St. Albert
Edmonton
Lloydminster
Camrose
Prince Albert
Nipawin
Melfort
North Battleford
Red Deer
Saskatoon
Drumheller
Lake Winnipegosis
Regina
Swift Current
Medicine Hat
Lethbridge
Manitoba
Environment Canada
Environnement Canada
Map Produced by:
GIS Section
Ecological Research Division
Regina, Saskatchewan
Canada

Irrigation in Canada - History

Settlem

Historic drought in Western Canada
'Dirty 30's'



- Western Canada settled during period of adequate rainfall
- Change in precipitation caused failure of crops and loss of productivity
- Cycle to become more extreme as a result of climate change

Research by D. Sauchyn correlating tree ring data to river flow in South Saskatchewan River Basin (Western Canada)

- Decadal drought of the 30's forced government to act
- Agriculture & Agri-Food Canada worked with farmers to:
  - Implement conservation practices
  - Research new varieties
  - Develop irrigation networks

Irrigation Expansion → Water Productivity

- Irrigation expansion occurring in some areas (Saskatchewan 2020-2030)
- Irrigation in some basins accounts for 85% of licensed volume (Southern Alberta)
- Shift in Government role: expansion/development → productivity

Water Productivity – marketable yield per unit of water input.

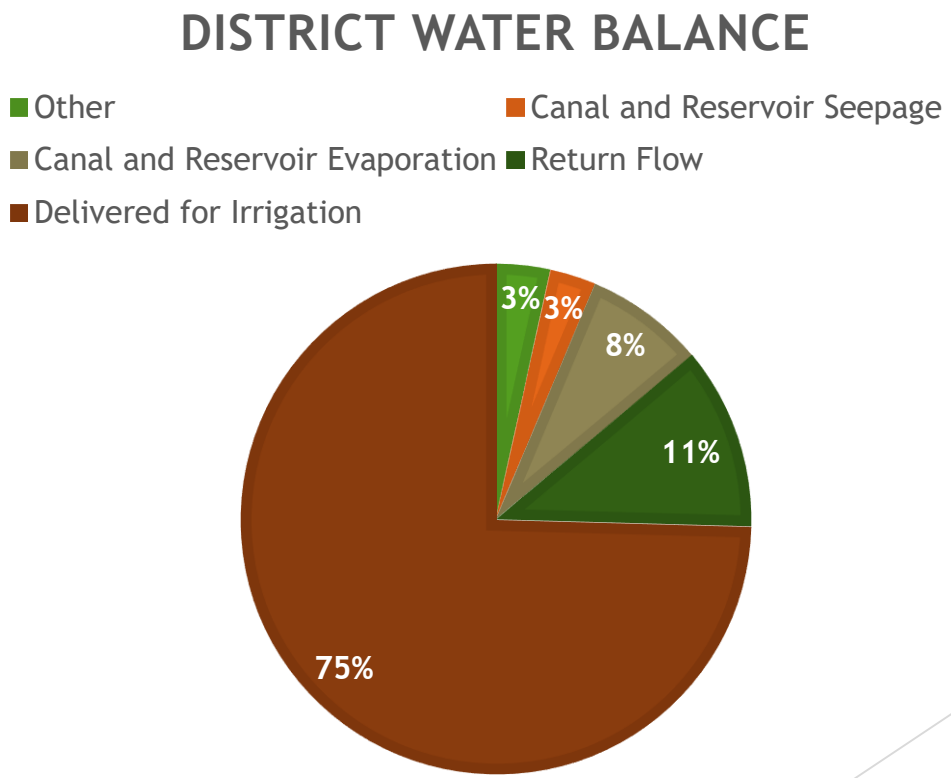
How Do we Accomplish:

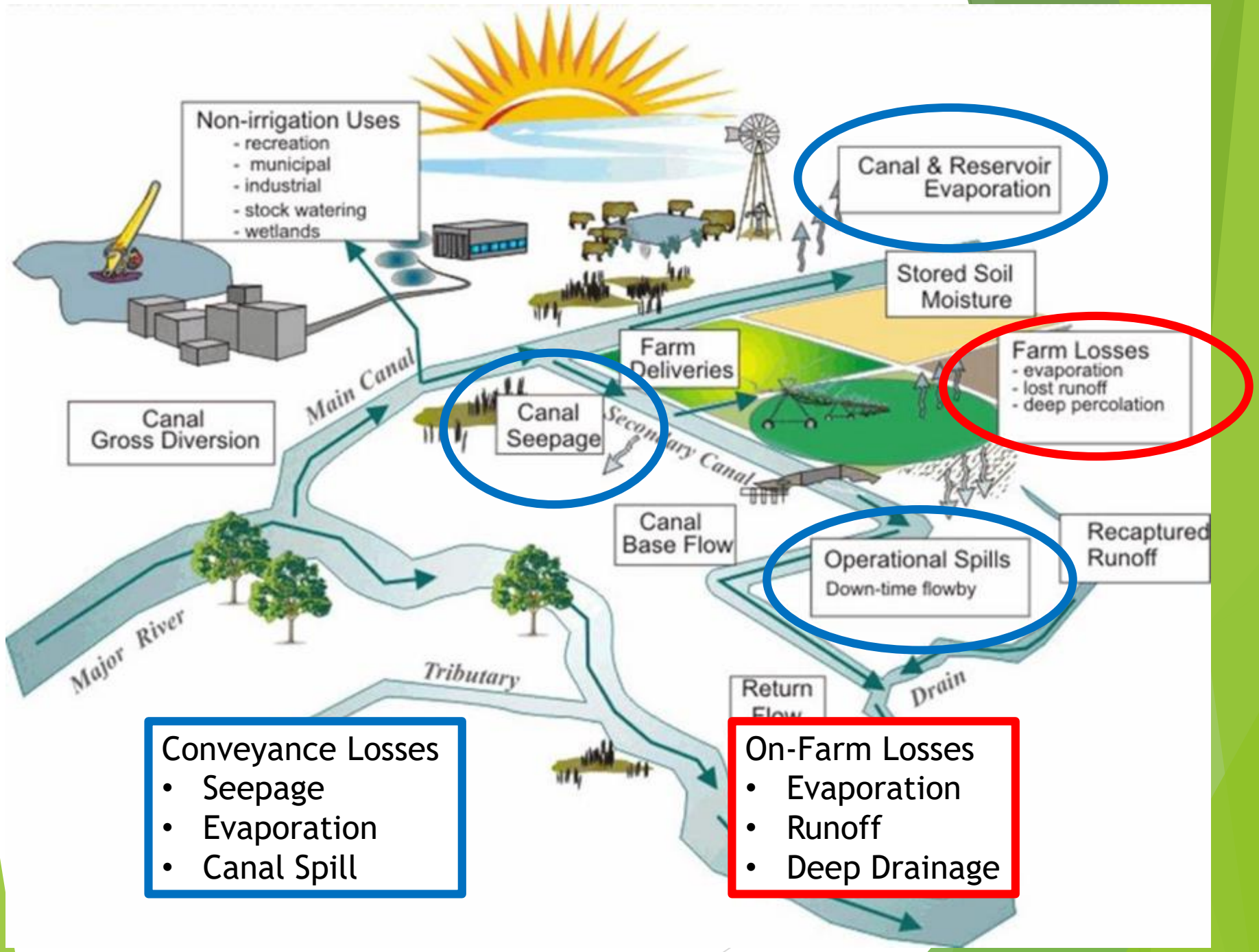
- Genetics – Breeding
- System efficiency – conveyance and application
- Management efficiency - scheduling

"More Crop Per Drop"

Case Study: Alberta Irrigation District 10-yr plan

- Alberta water allocation volume is nearing capacity in some basins
- New allocation must come from internal efficiency
- Alberta developed 10-yr plan




Non-irrigation Uses
- recreation
- municipal
- industrial
- stock watering
- wetlands
Canal & Reservoir Evaporation
Stored Soil Moisture
Farm Deliveries
Farm Losses
- evaporation
- lost runoff
- deep percolation
Main Canal
Canal Gross Diversion
Canal Seepage
Secondary Canal
Canal Base Flow
Operational Spills
Down-time flowby
Recaptured Runoff
Major River
Tributary
Return Flow
Drain
Conveyance Losses
• Seepage
• Evaporation
• Canal Spill
On-Farm Losses
• Evaporation
• Runoff
• Deep Drainage

Conveyance Efficiency

Conveyance Efficiency

- Main Supply Canals → Lined Canal (2 – 3% Water Savings)
- Secondary Canals → Pipeline
  - Reduced Seepage, Evaporation, Maintain Capacity

Main Canal

Secondary Canal

Conveyance Efficiency

- Canal return flow accounts for 11% of water diverted
- SCADA – Supervisory Control and Data Acquisition
  - On demand systems reduces flow losses through diversions

Irrigation System Application Efficiency

55%

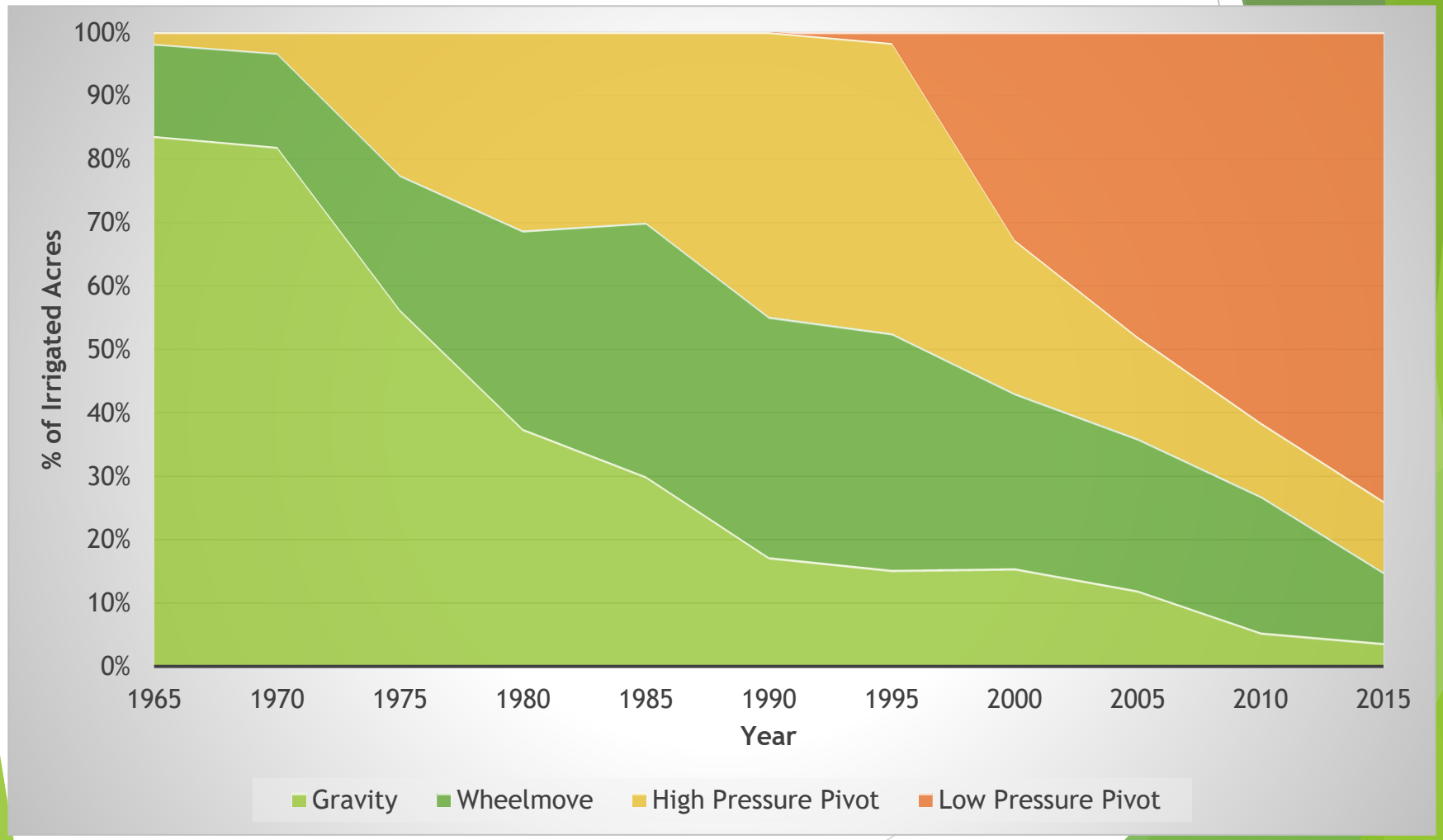
66%

72%

82%

Improved Efficiency
Improved Productivity

Irrigation System Conversion

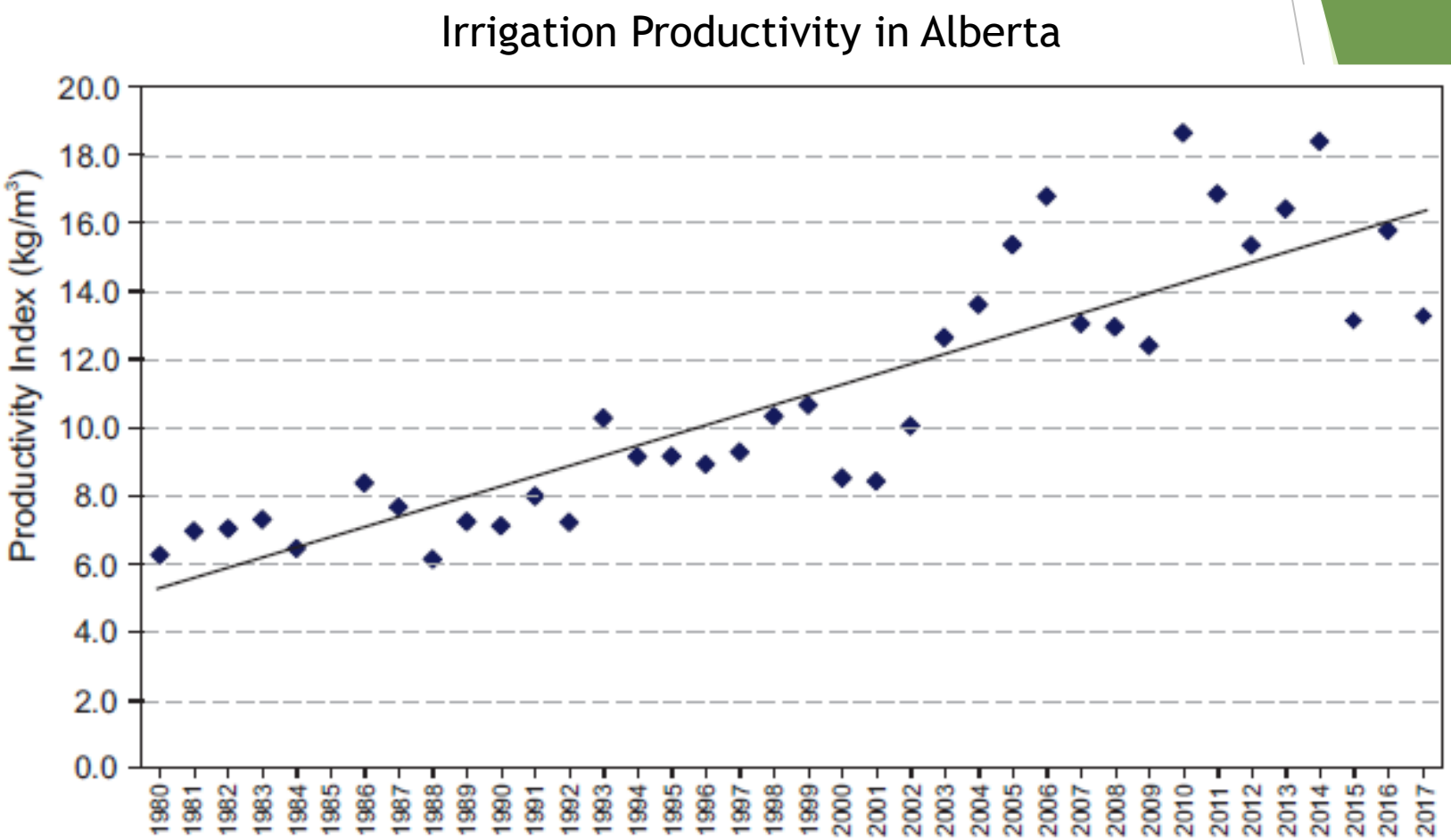


Net Result of On-Farm System Improvements

System Type	Efficiency Range	Average Efficiency	Gross Delivery	Water Saving*
Contour Flood	25% – 35%	30%	1000 mm	n/a
Levelled Surface	40% - 65%	55%	545 mm	455 mm
Hand-Move	55% - 65%	60%	500 mm	45 mm
Wheel-Roll	60% - 70%	66%	455 mm	45 mm
Hi Nozzle Ctr. Pivot	70% - 75%	72%	415 mm	40 mm
Drop Tube Ctr. Pivot	75% - 85%	82%	380 mm	35 mm

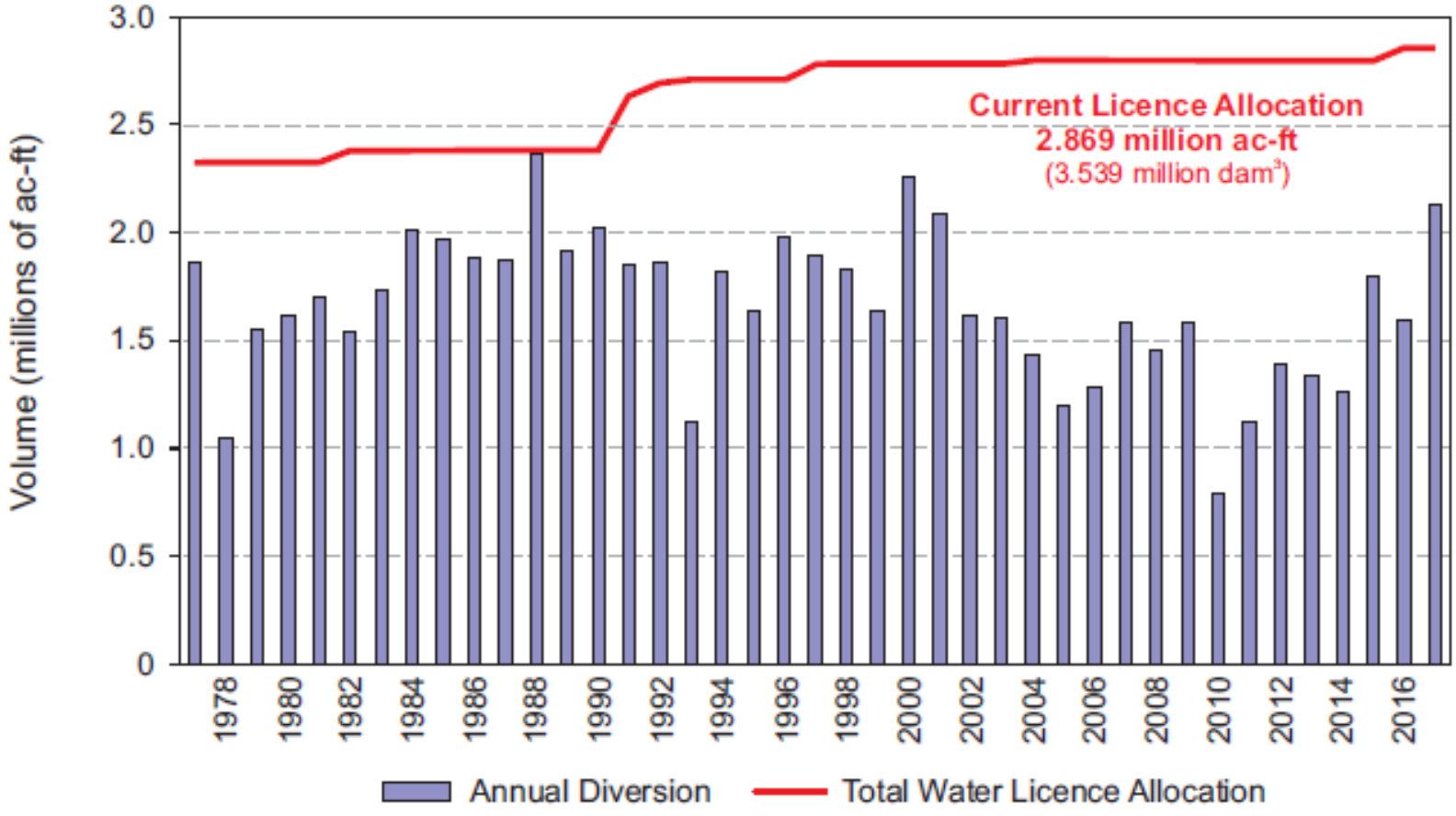
* Assumes an average NET application of (300mm)

Case Study: Alberta Irrigation District 10-yr plan

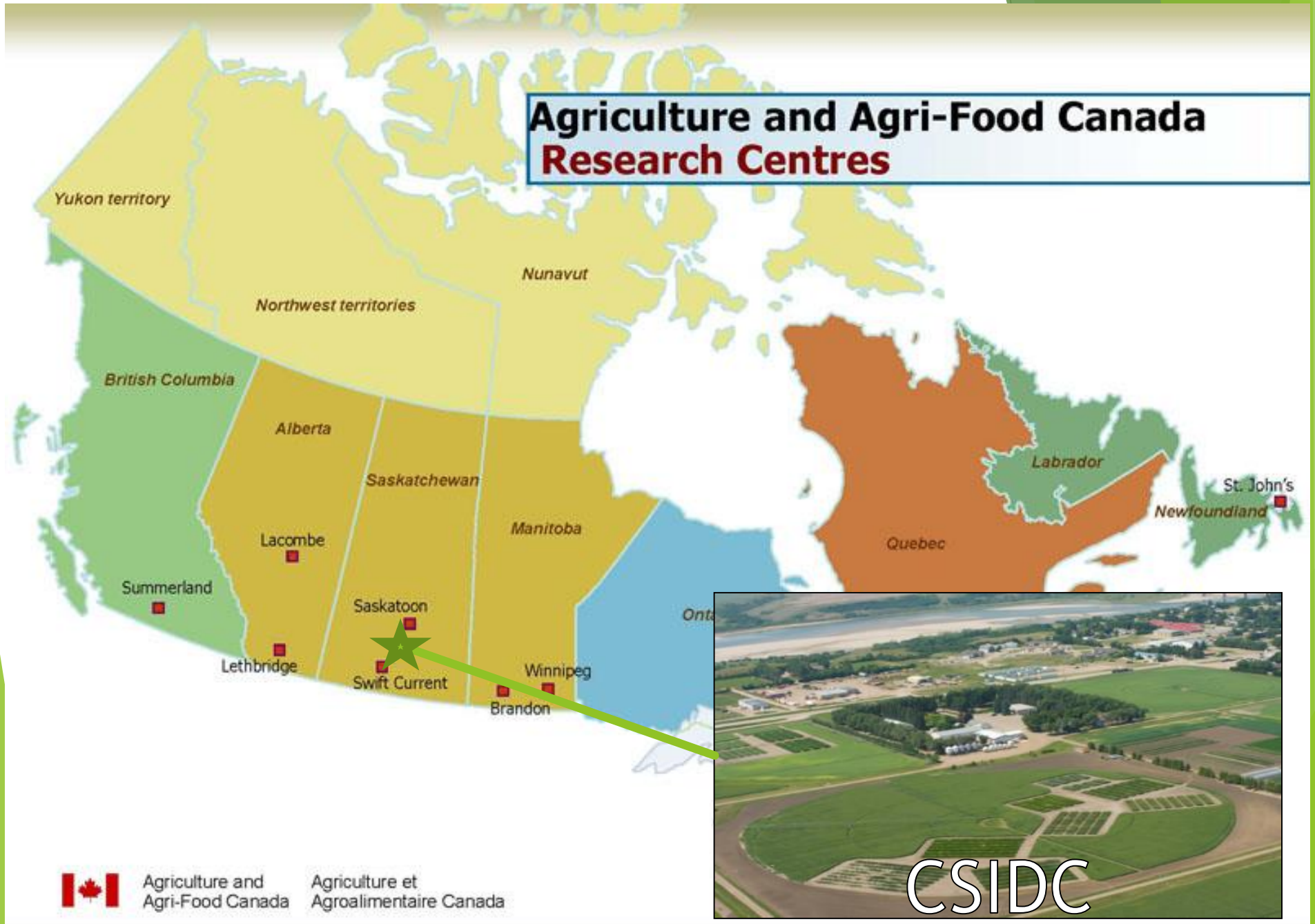


Case Study: Alberta Irrigation District 10-yr plan

Irrigation Licenses vs Annual Diversion in Alberta



Agriculture and Agri-Food Canada
Research Centres



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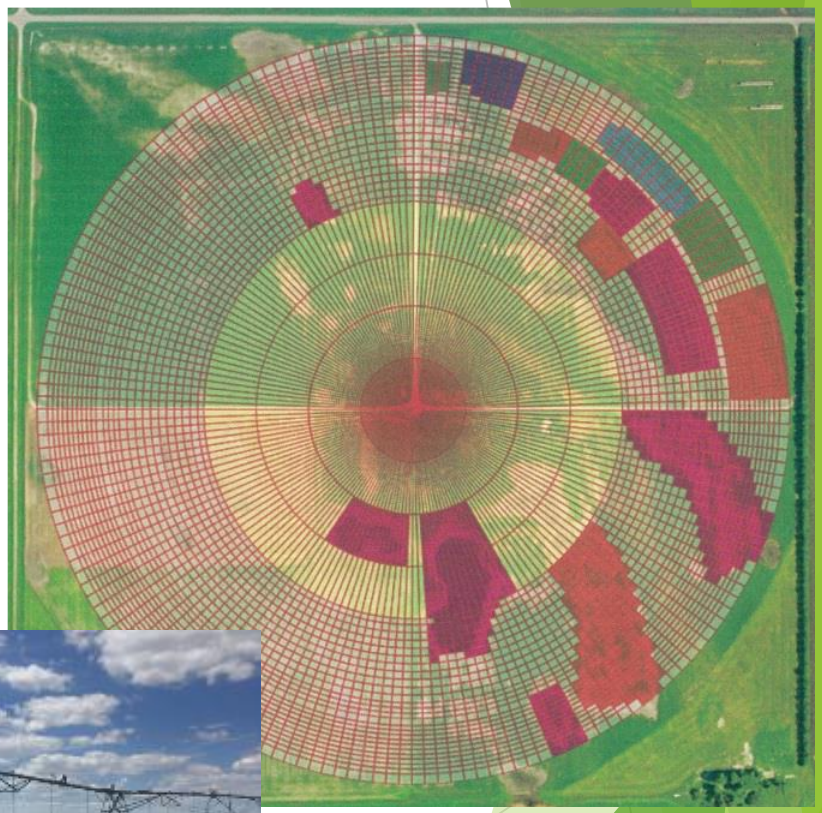
CSIDC

- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Federal/provincial/industry/university partnership dedicated to sustainable irrigated production practice
- Conducts, funds and facilitates irrigated research, demonstration, technology transfer and education in support of this goal

Canada SIPA University of Saskatchewan ICDC Saskatchewan

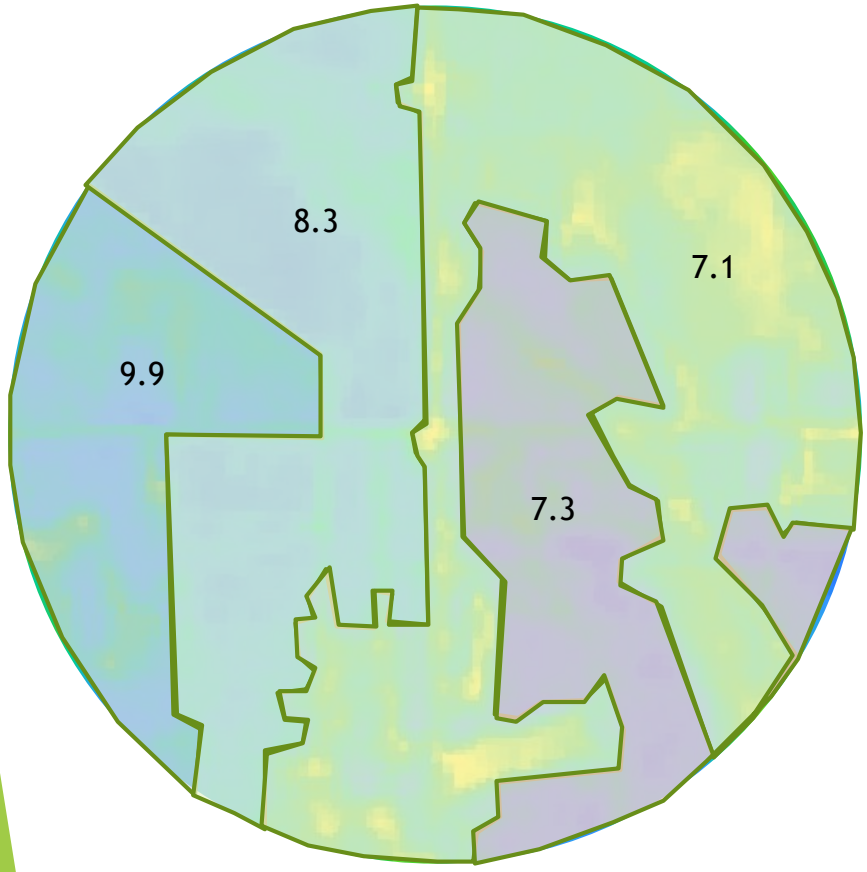
CSIDC: Variable Rate Irrigation

- Precision Agriculture applied to irrigation
- Irrigation rates are adjusted by ‘pulsing’ flow to each sprinkler using a electric/pneumatic water valve,
- Rates are adjusted to meet crop water demand

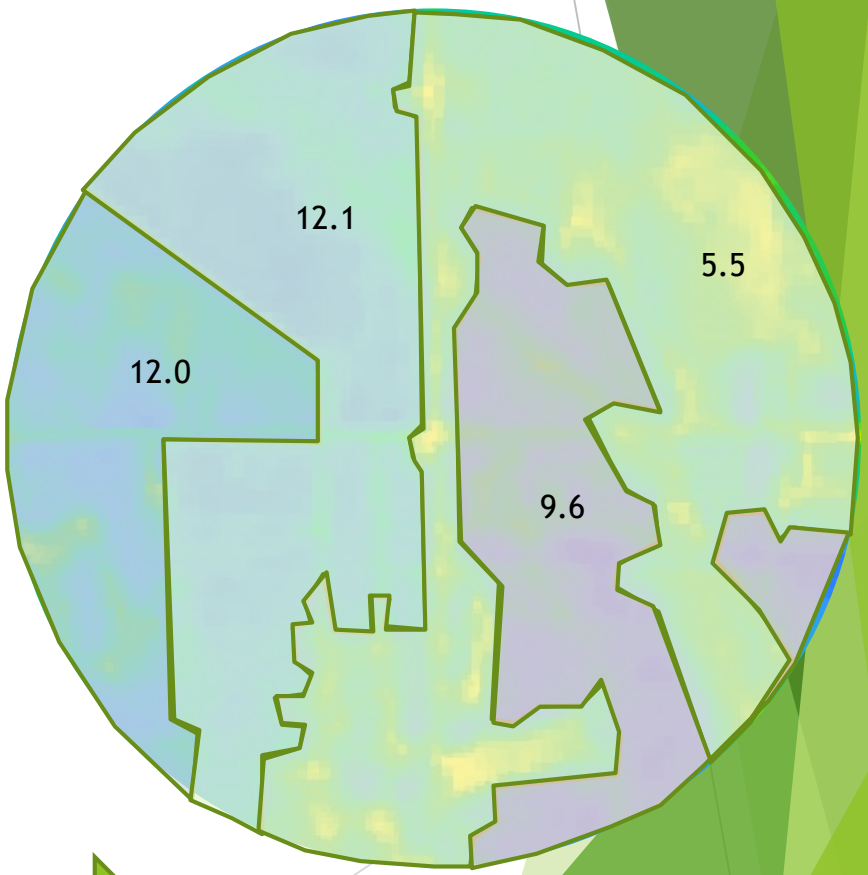


Variable Rate Irrigation (VRI)

Uniform Rate Irrigation
Total Applied = 175mm



Variable Rate Irrigation
Total Applied = 125 - 200mm



15% Increase in Water Use Efficiency

For Purposes Illustration Only

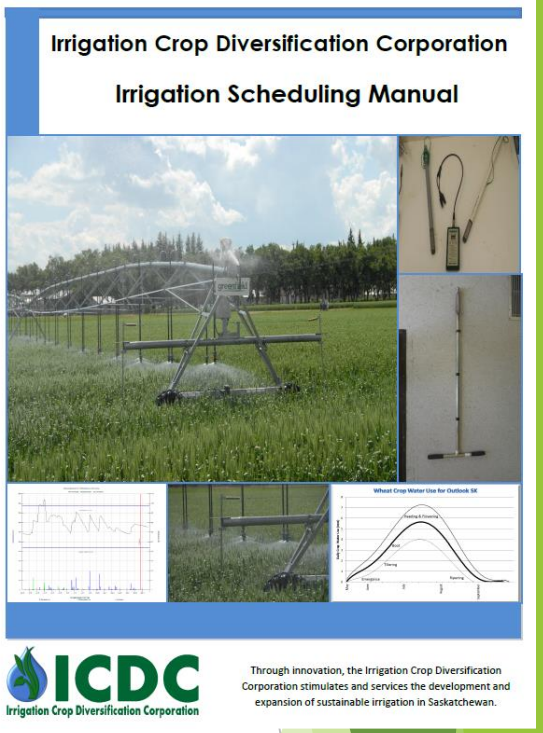
Management: Irrigation Scheduling

<u>Irrigation scheduling</u> – management of the **timing** and **application** depth of irrigation events.

- Improves crop yield and quality;
- decreasing nutrient loss;
- improves water use efficiency;

CSIDC promotes adoption through:

- Awareness/demonstration
- Training
- Research into new methods

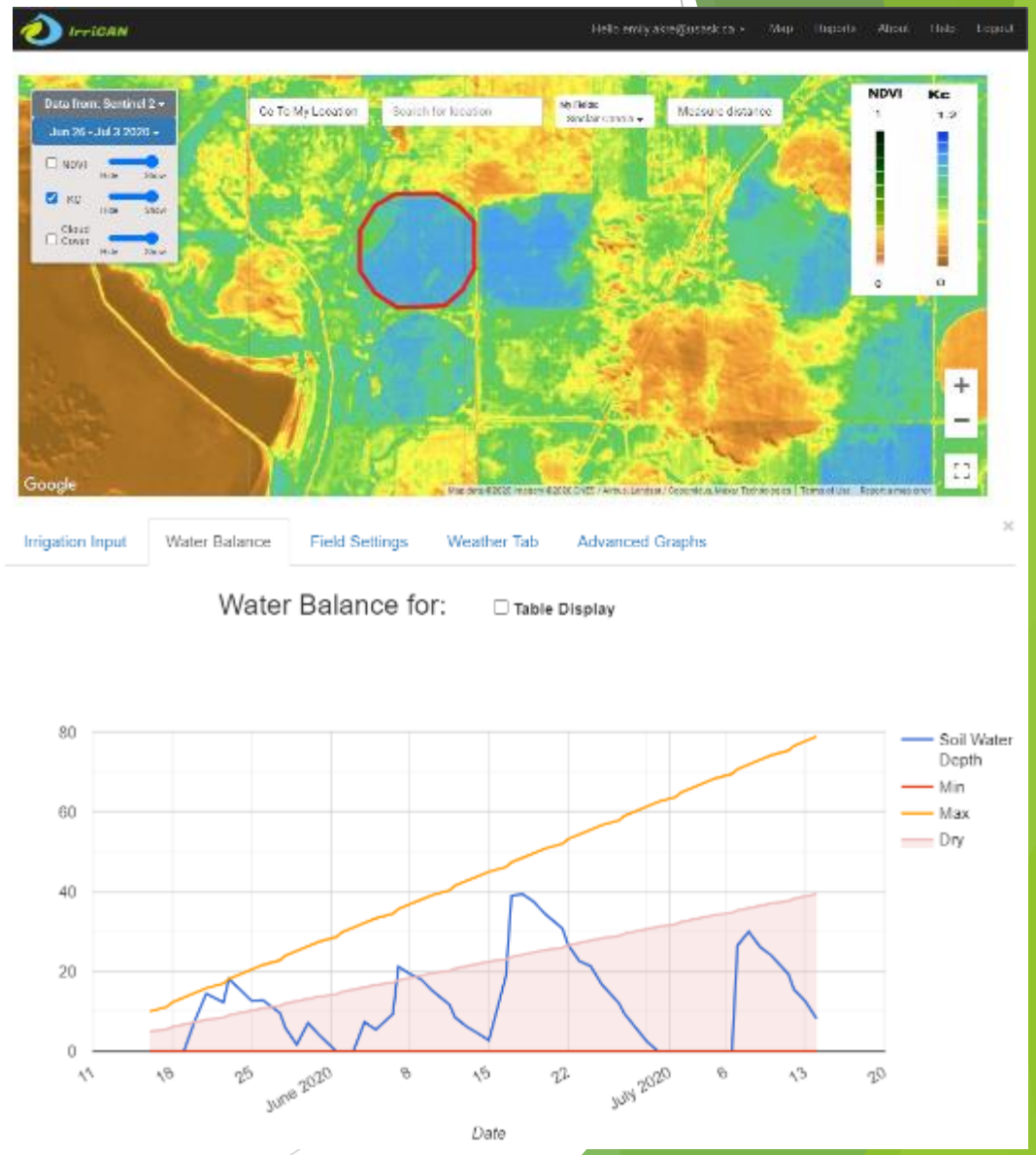


Management: Remote Sensing

- Remote sensing methods use crop response/measurement as a trigger for irrigation,
- Requires crop canopy to be measured – post emergence,
- Requires additional info – only provides trigger, not measure of irrigation depth,
- Used for spatial management – VRI prescriptions

Management: Remote Sensing

- Agriculture & Agri-food Canada currently developing tools,
- Allow irrigator to view data in form to make informed decisions,
- Simple, cost effective tools to improve productivity and increase adoption.



CSIDC: Solar Power

- Where electrical infrastructure lacking, systems typically use diesel combustion generators,
- Research into optimizing management to maximize productivity and minimize cost of power system.

CSIDC: Extension

Research → Development → Knowledge Transfer

- CSIDC plays role on all phases of the RDT continuum.
- Knowledge Transfer occurs in collaboration with industry and provincial government partners. Through:
  - Training sessions,
  - Field Days,
  - Demonstration,

CSIDC: Collaboration

International Work

- Conduct International training and exchanges in support of AAFC mandate,
- Facilitated through CSIDC

ICID: International Commission on Irrigation and Drainage

International Work

- Canada hosted ICID Conference 2018
- ICID - *is a leading scientific, technical, and professional not-for-profit international organization working in the field of irrigation, drainage, and flood management to the promote and achieve sustainable agriculture water management.*

Questions

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Thank-you