



Agriculture and  
Agri-Food Canada

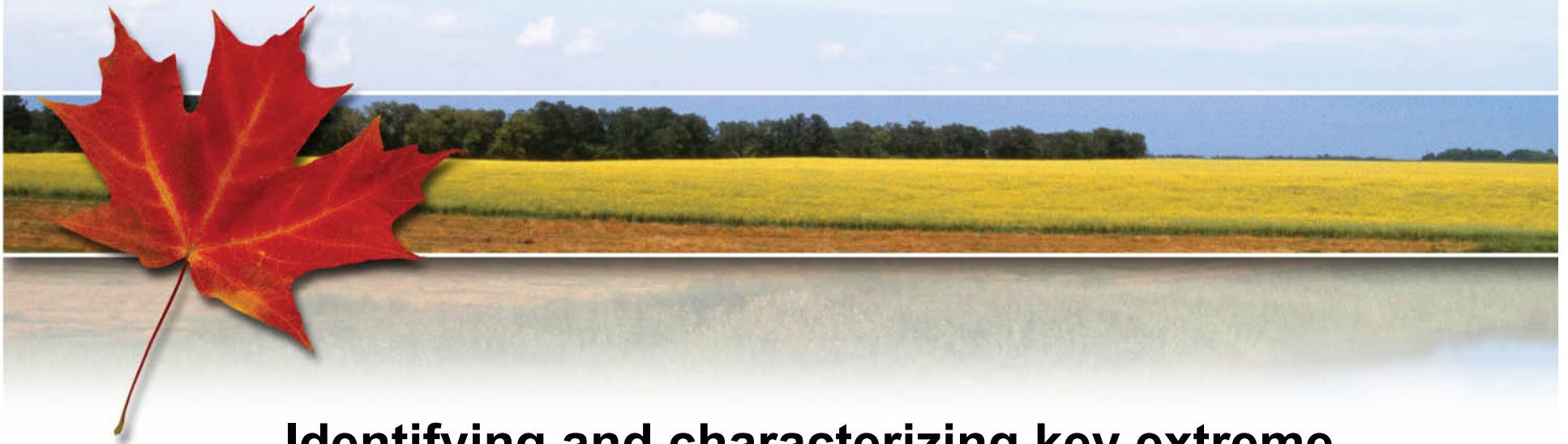
Agriculture et  
Agroalimentaire Canada



**Carleton**  
UNIVERSITY



**Ontario** Ministry of Agriculture,  
Food and Rural Affairs



## **Identifying and characterizing key extreme weather impacts to crops at the regional scale**

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Chesterville, ON  
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# Extreme weather and agriculture



Photo: Tim Smith, The Canadian Press



Photo: Bob Nichols; USDA



# Crop-specific weather extremes



Photo: Nati Harnik, AP

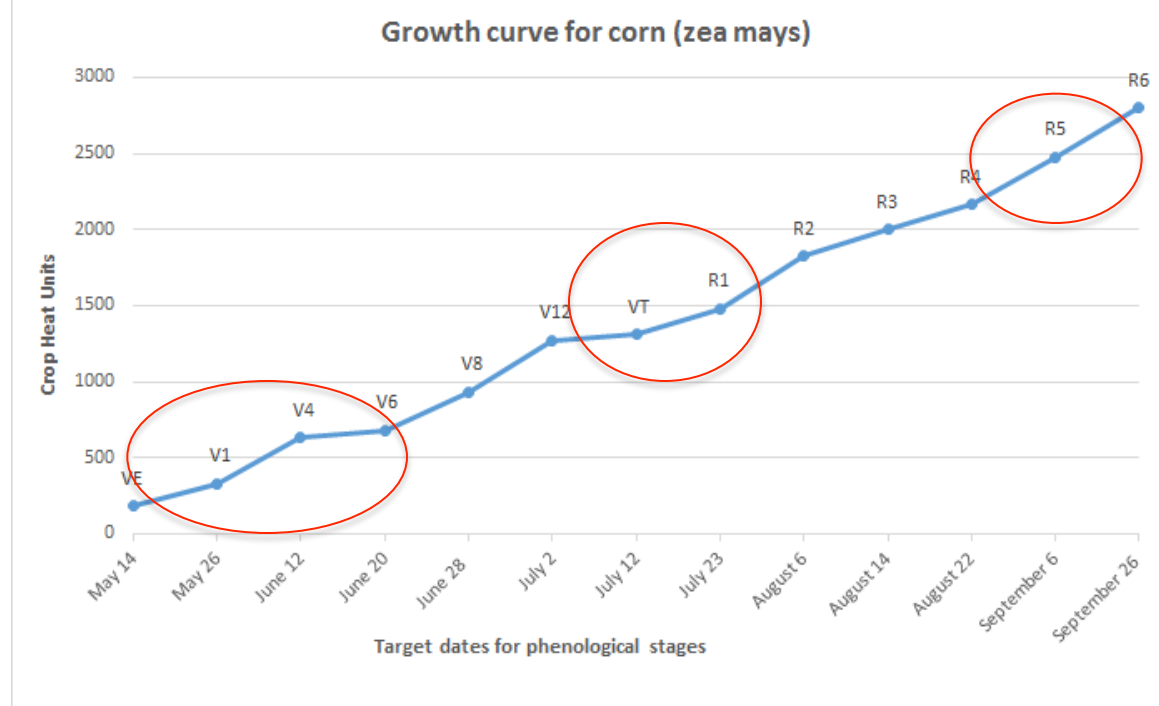


Photo: Oklahoma Farm Report

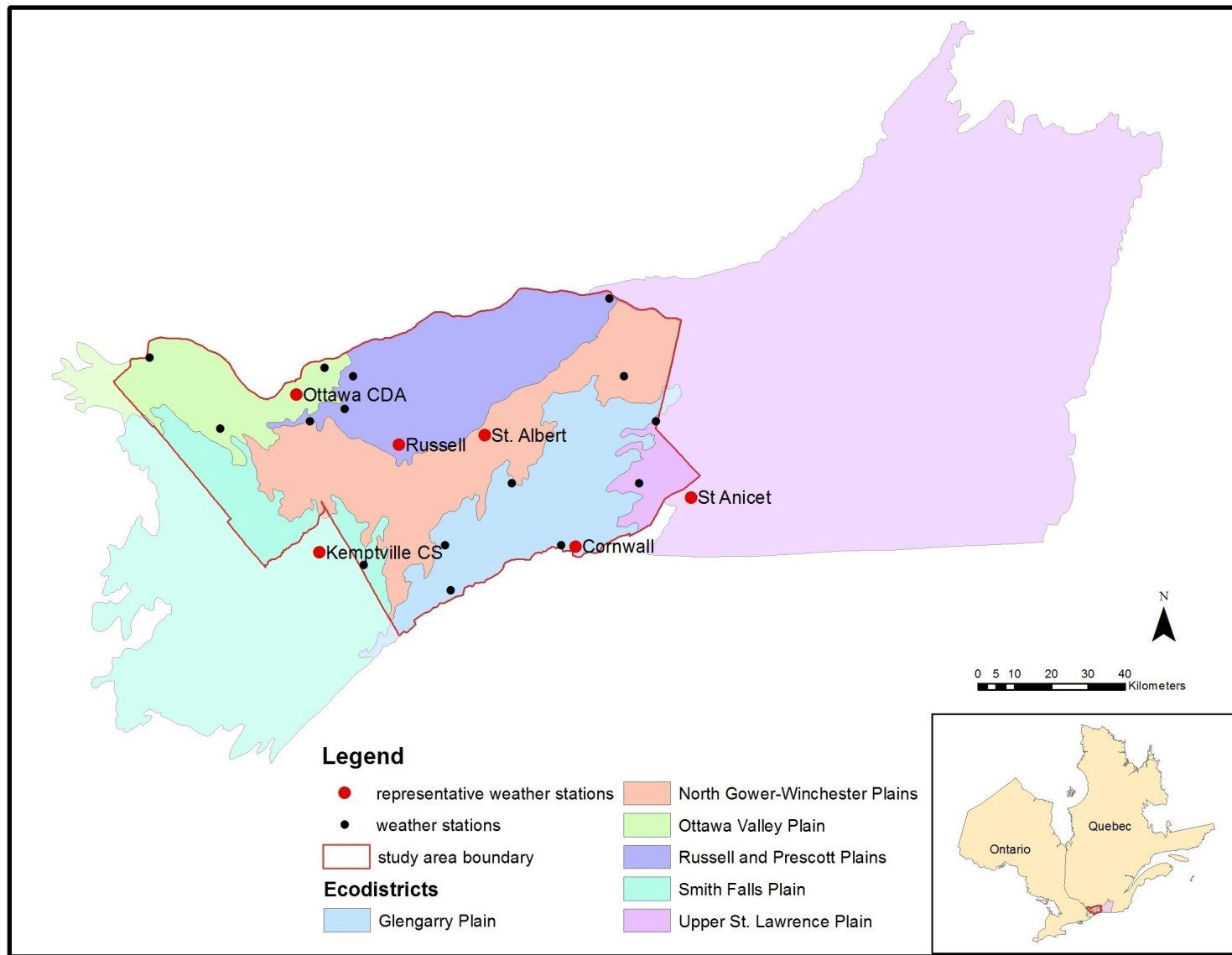


Photo: Howard F. Schwartz, CSU

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# Study area



# Indicator development

- Extensive literature review (close to 100 sources reviewed)
- Expert consultations (AAFC, OMAFRA)
- Crop tolerance thresholds to T and P conditions at various phenological stages were identified
- Yield loss percentages associated with threshold exceedance were studied

# Corn-specific indices

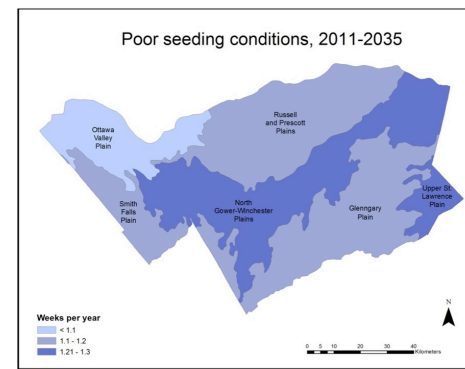
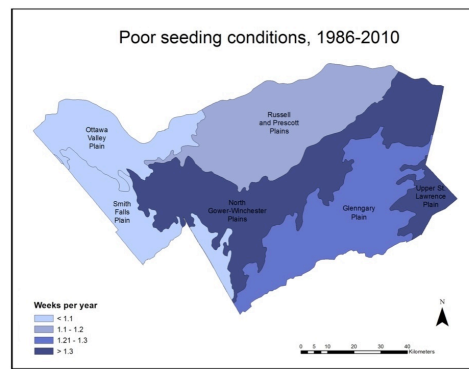
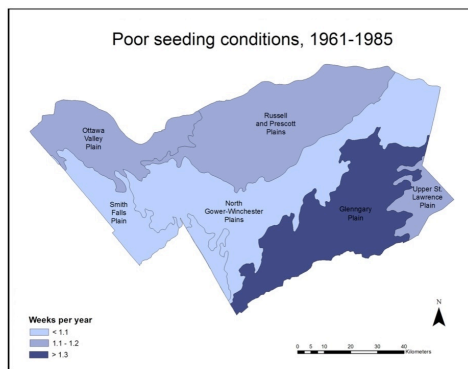
Index name	Definition	Units
<b>Corn:</b>		
Poor seeding conditions	Weekly precipitation 30% greater than weekly mean precipitation (between April 23 and May 20)	weeks/year
Early flooding	Weekly precipitation 30% greater than weekly mean precipitation with 1 to 780 accumulated CHUs	weeks/year
Pollination drought	CDD >10 with 1,301 to 1,600 accumulated CHUs	annual occurrence (Yes or No)
R2 (blister) drought	P<45mm with 1,601 to 1,825 accumulated CHUs	annual occurrence (Yes or No)
R3 (milk) drought	P<45mm with 1,826 to 2,000 accumulated CHUs	annual occurrence (Yes or No)
Early killing frost	Tmin <=-2°C with 2,165 to 2,475 accumulated CHUs	days/year
R4 (dough) drought	P<8mm with 2,001 to 2,165 accumulated CHUs	annual occurrence (Yes or No)
Fall killing frost	Tmin <=-2°C with 2,476 to 2,600 accumulated CHUs	days/year

# Soybean-specific indices

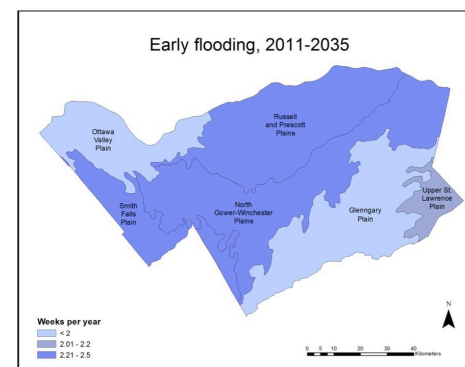
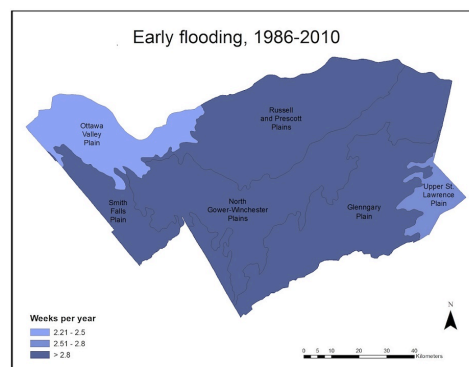
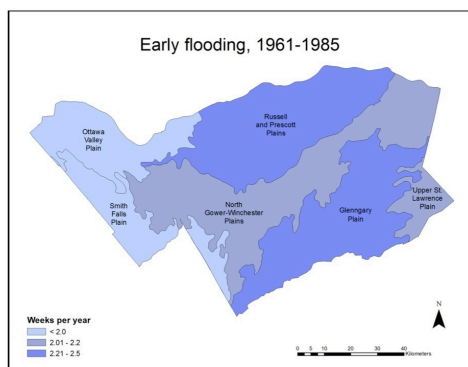
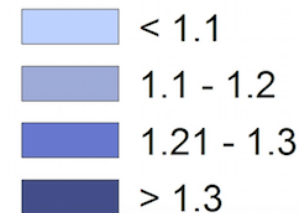
Index name	Definition	Units
<i>Soybeans:</i>		
<b>Poor seeding conditions</b>	<b>Weekly precipitation 30% greater than weekly mean precipitation (weeks between May 7 and June 10)</b>	<b>weeks/year</b>
Spring killing frost	Tmin <0°C 26 to 50 days after seeding	days/year
Early flooding	Precipitation 30% greater than weekly precipitation 25 to 45 days after seeding	weeks/year
Cool nights	Tmin <10°C for 5+ days 45-55 days after seeding	annual occurrence (Yes or No)
Warm nights	Tmin ≥ 24°C 55 to 100 days after seeding	days/year
Mid-season flooding	Precipitation >90mm 60 to 80 days after seeding	annual occurrence (Yes or No)
<b>Pod filling drought</b>	<b>Precipitation &lt;10mm 81 to 95 days after seeding</b>	<b>annual occurrence (Yes or No)</b>
Early killing frost	Tmin <-1°C between 90 and 100 days after seeding	days/year
Extreme heat	Mean Tmax >33°C 95-120 days after seeding	days/year
Fall killing frost	Tmin <-1°C 101 to 110 days after seeding;	days/year
<b>Seed development drought</b>	<b>P&lt;5mm 96-115 days after seeding</b>	<b>annual occurrence (Yes or No)</b>



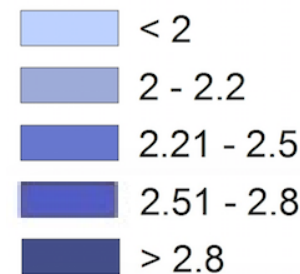
# Results (Corn)



## Weeks per year

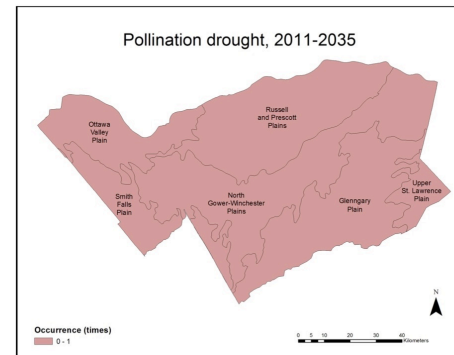
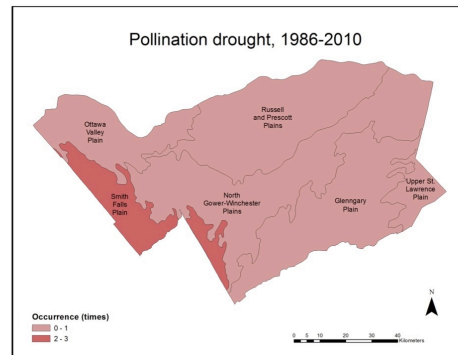
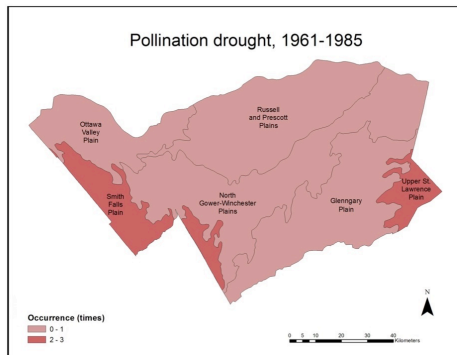


## Weeks per year

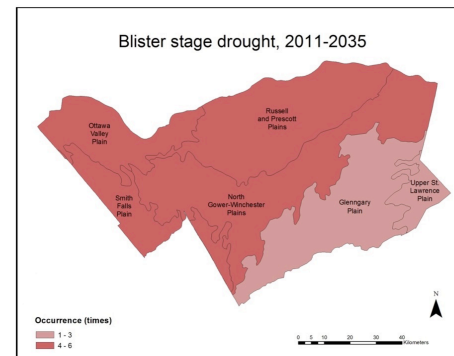
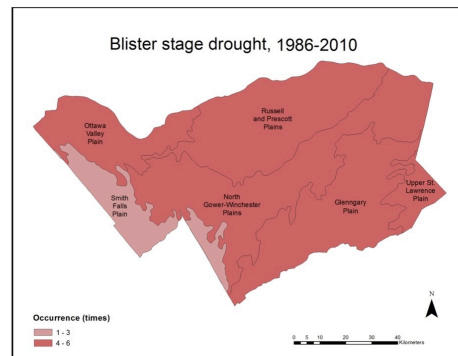
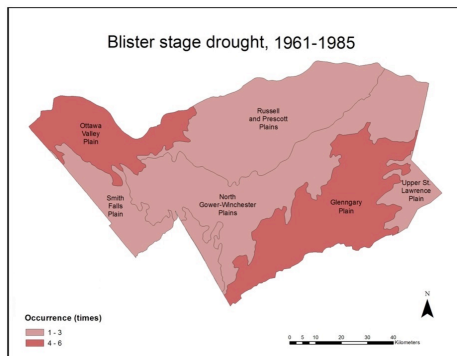
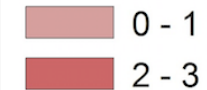




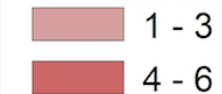
# Results (Corn)



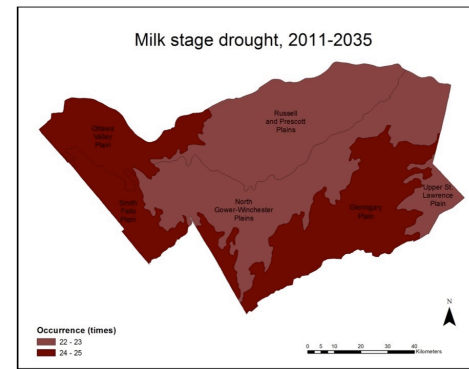
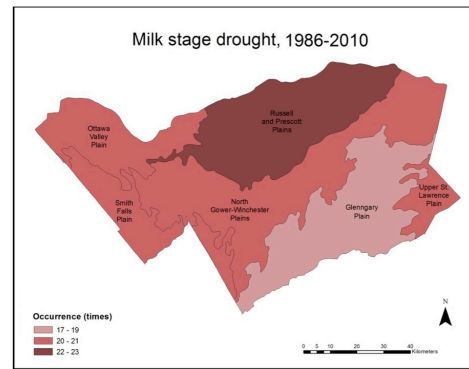
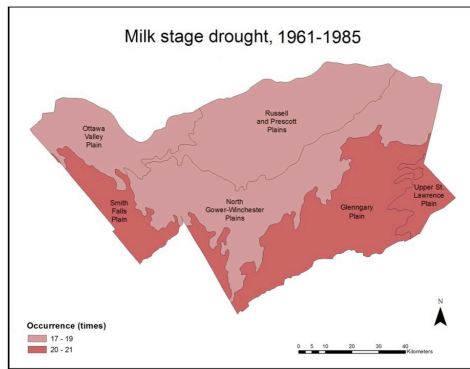
Occurrence (times)



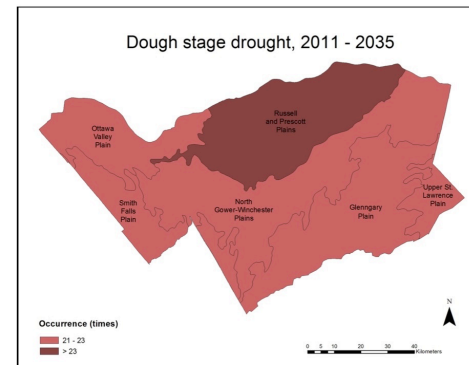
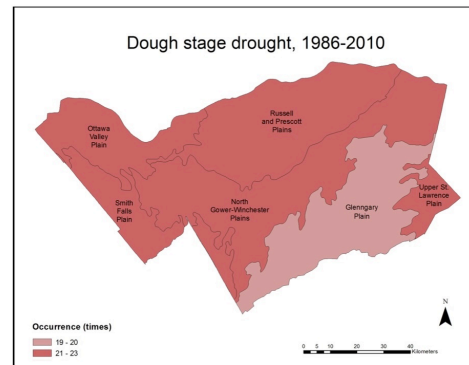
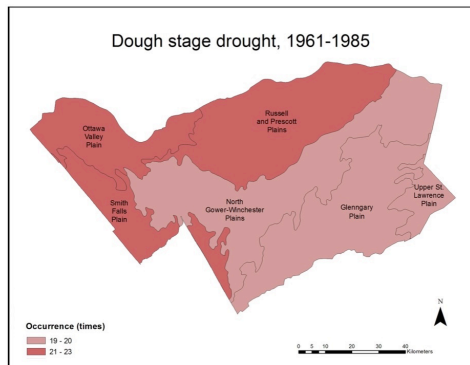
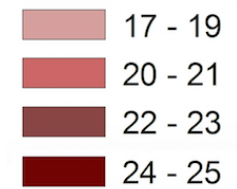
Occurrence (times)



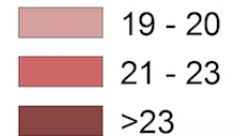
# Results (Corn)



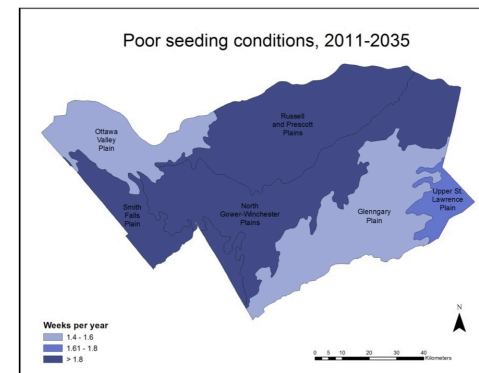
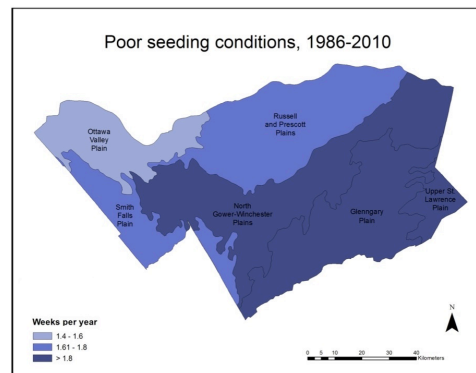
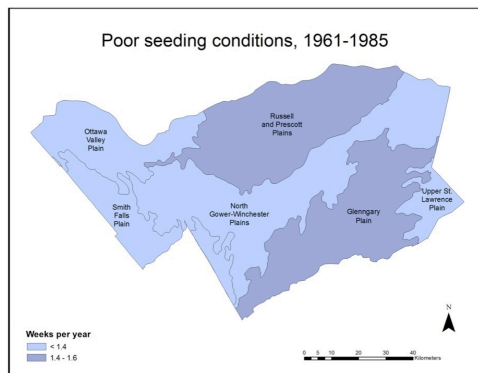
## Occurrence (times)



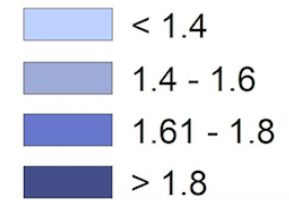
## Occurrence (times)



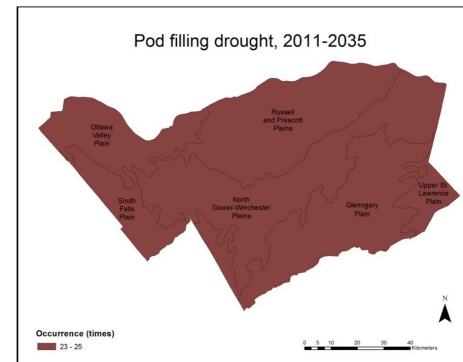
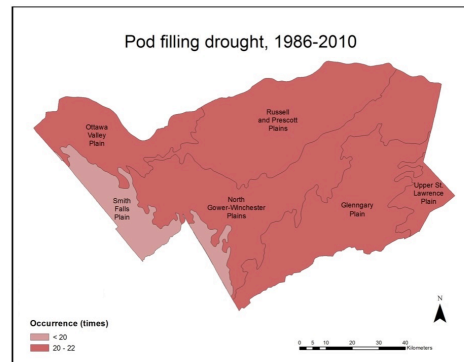
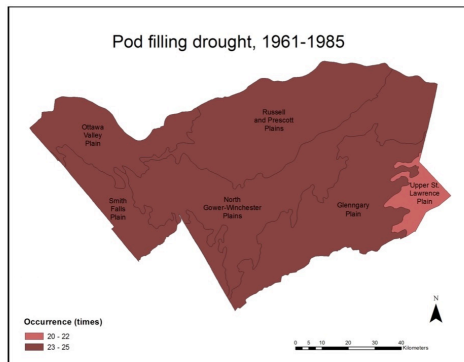
# Results (Soybeans)



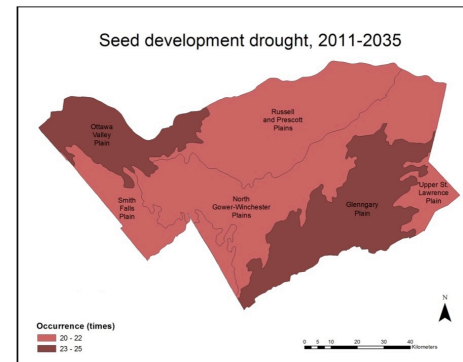
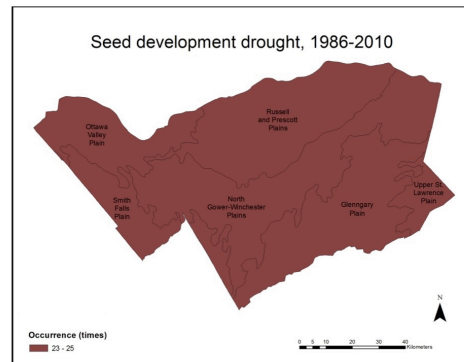
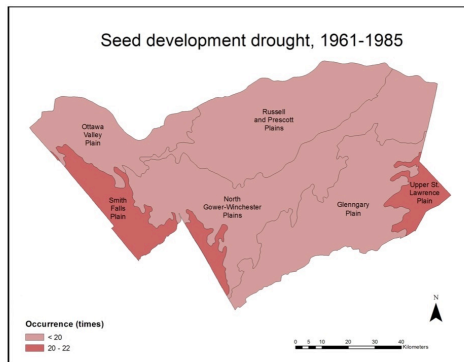
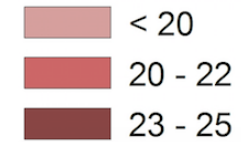
## Weeks per year



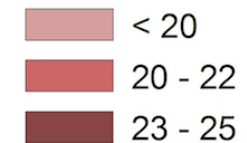
# Results (Soybeans)



## Occurrence (times)



## Occurrence (times)





# Thank you!



Photo: TYWKIDDBI, Blogspot

## Questions for discussion

- Which of the crop-specific extremes are most likely to affect your farm?
- Are there extreme events of concern to you that have not been captured?
- What would adaptation to the impacts we identified look like?
- What are the challenges of adapting to the impacts?
- How do we plan for the future given the facts that we know?