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Food and Rural Affairs



# Extreme weather impacts on eastern Ontario crops: historical trends and future scenarios

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# Extreme weather and agriculture



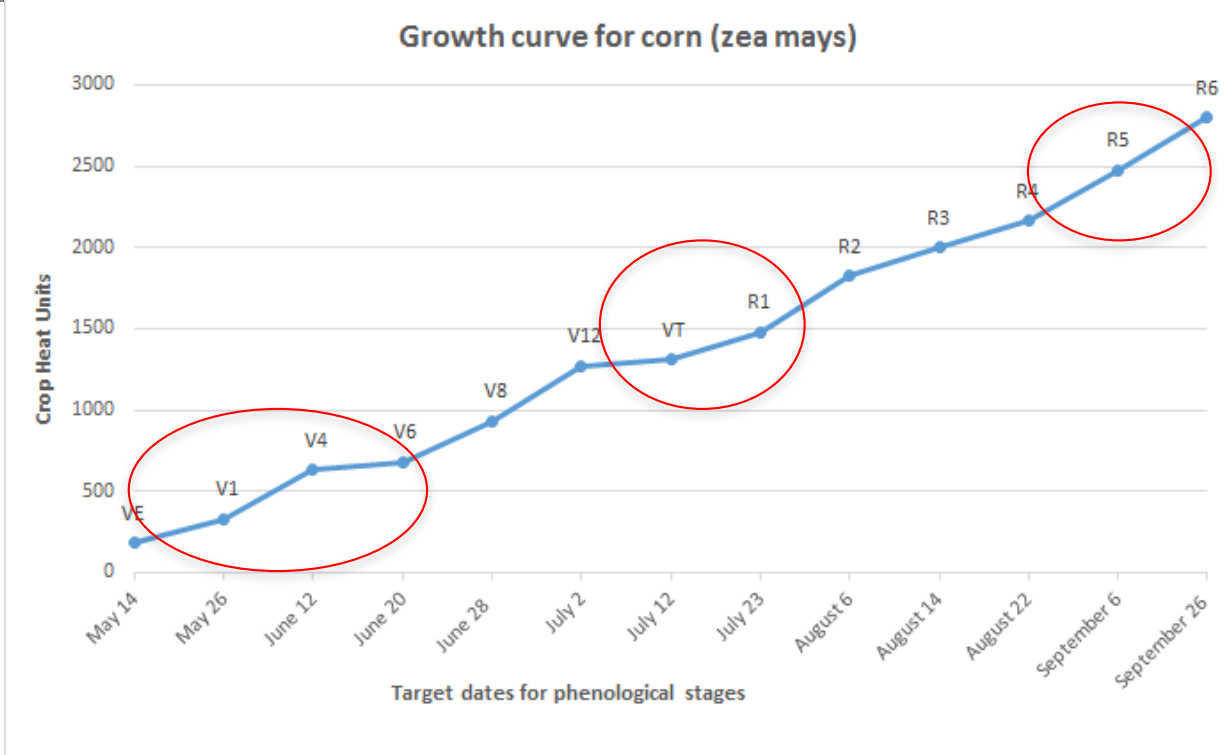
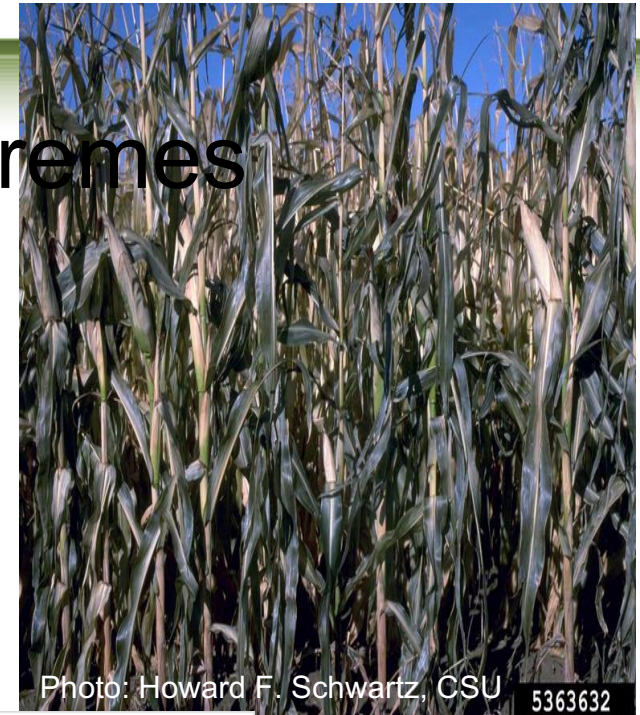
Photo: Tim Smith, The Canadian Press



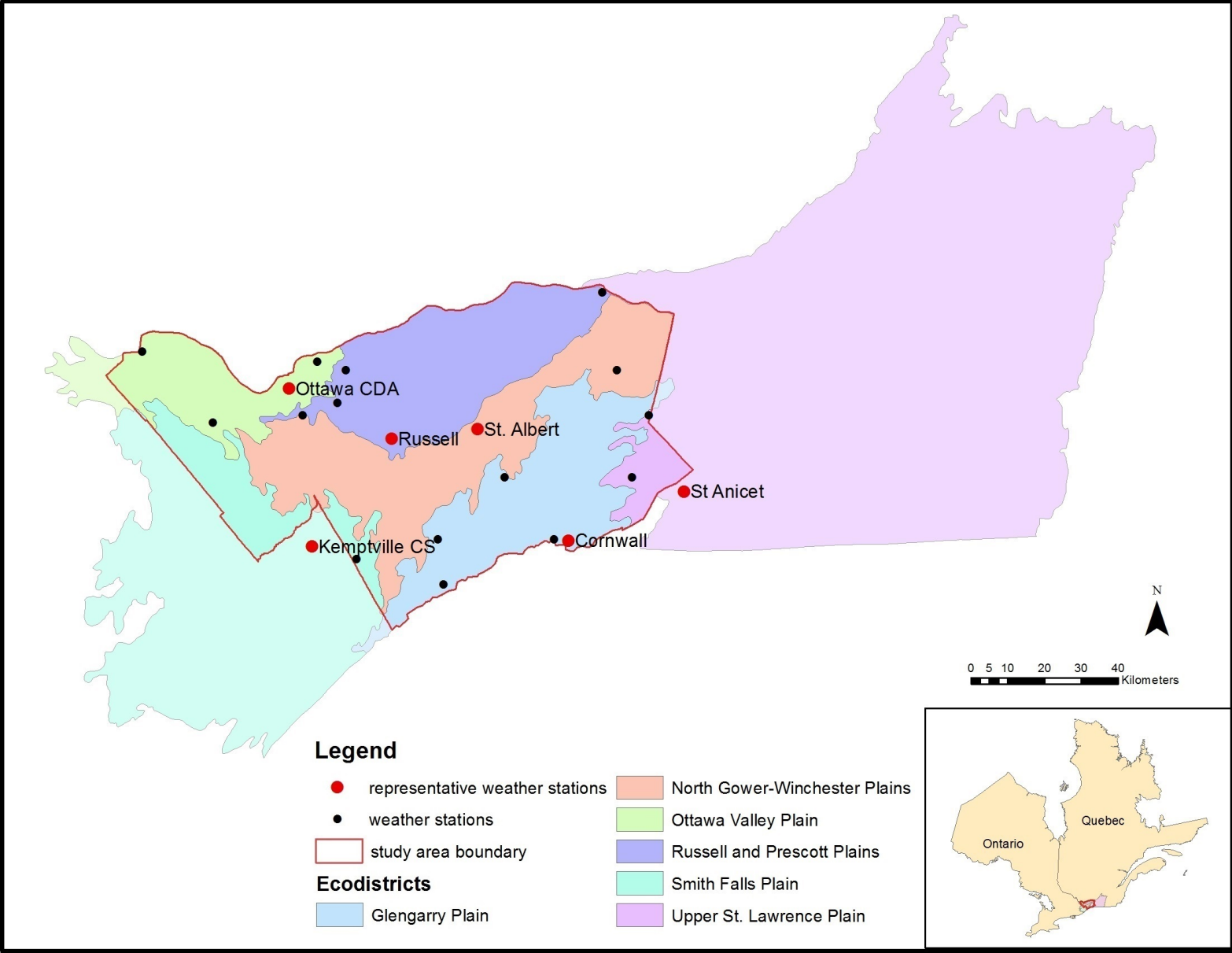
Photo: Bob Nichols, USDA



# Crop-specific weather extremes

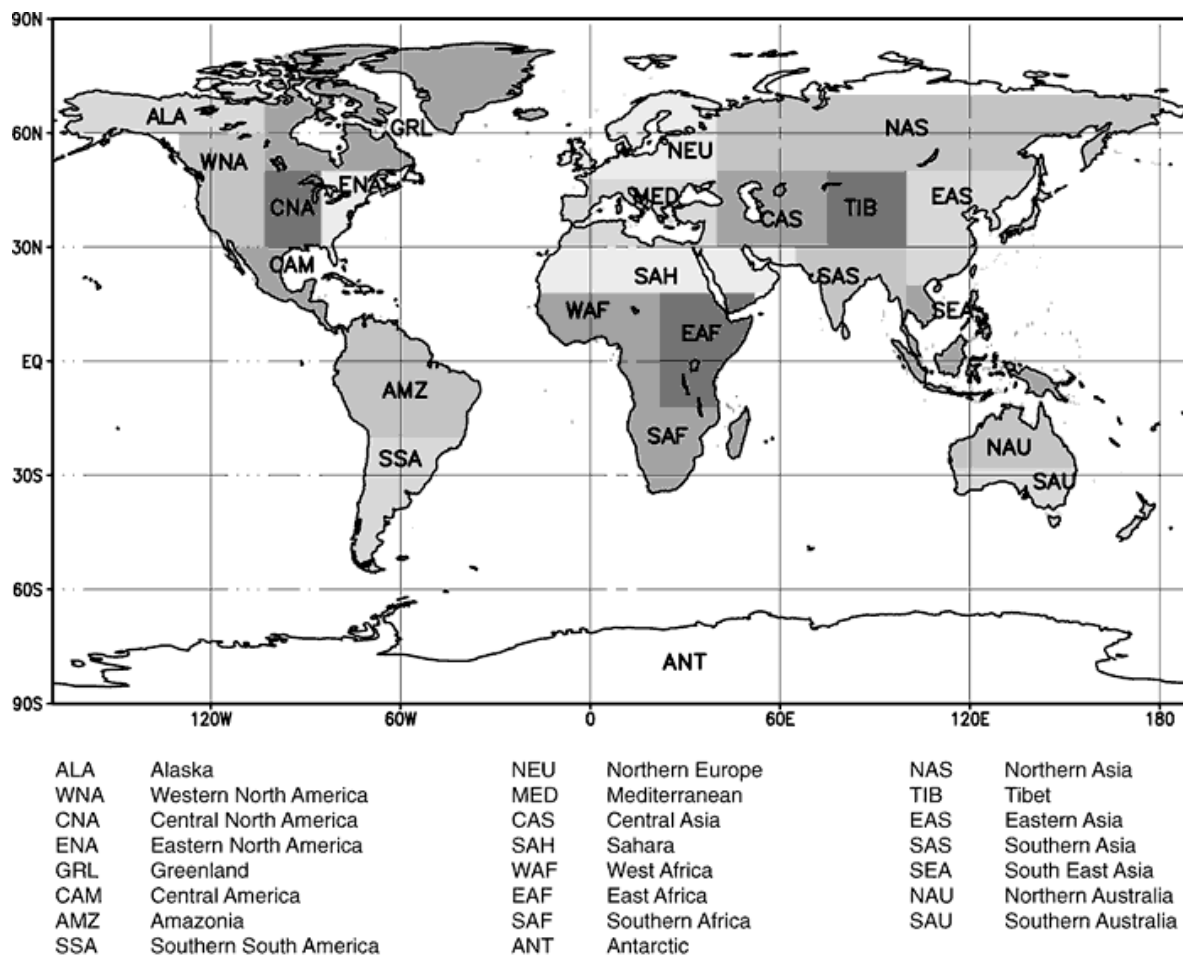


# Study area



# Climate data

- Quality controlled gap filled data for daily min and max temperature and daily precipitation from 1961 to 2010. (Sources: EC, Schroeter and Associates)
- High resolution downscaled daily temperature and precipitation data for an ensemble of 12 models used in CMIP5 under RCP 8.5 from 2011 to 2035. (Source: Pacific Climate Impacts Consortium)



Source: Giorgi and Fransisco, 2000

# 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

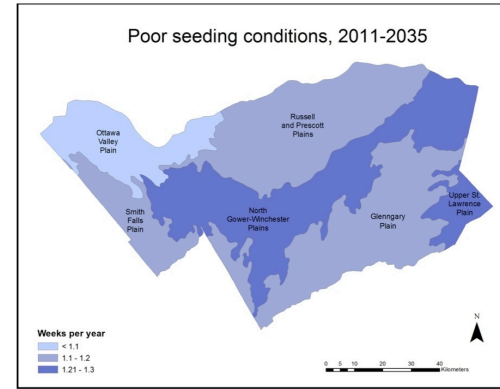
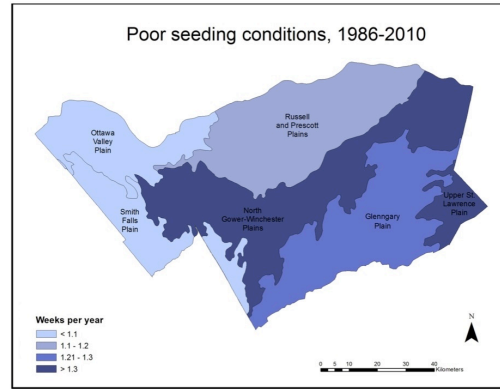
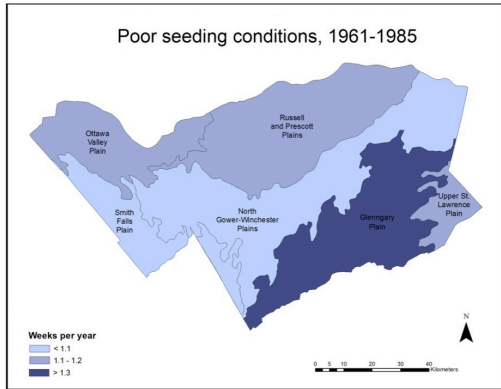
Index name	Definition	Units
<b>Corn:</b>		
Poor seeding conditions	Weekly precipitation 30% greater than weekly mean precipitation (between April 23 and May 20)	weeks/year
Early flooding	Weekly precipitation 30% greater than weekly mean precipitation with 1 to 780 accumulated CHUs	weeks/year
Pollination 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

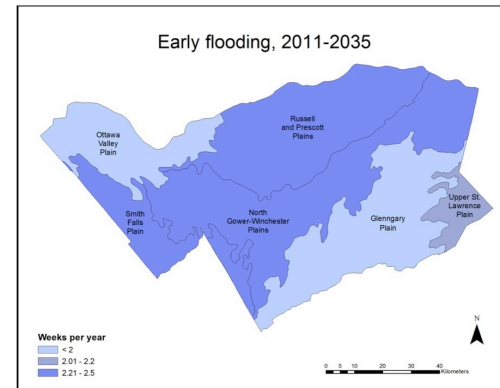
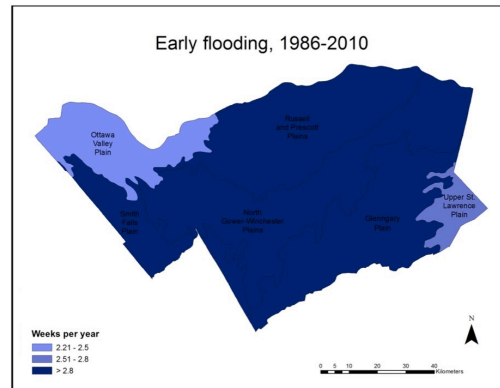
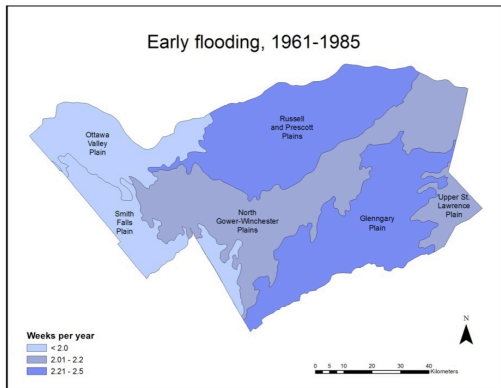
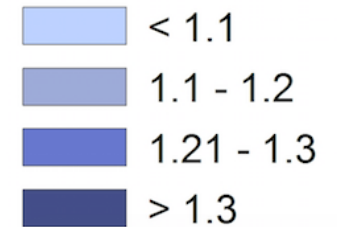
Index name	Definition	Units
<b>Soybeans:</b>		
<b>Poor seeding conditions</b>	<b>Weekly precipitation 30% greater than weekly mean precipitation (weeks between May 7 and June 10)</b>	<b>weeks/year</b>
Spring killing frost	Tmin <0°C 26 to 50 days after seeding	days/year
Early flooding	Precipitation 30% 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>



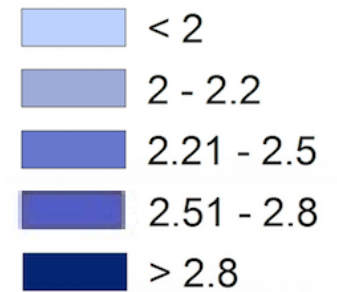
# Results (Corn)



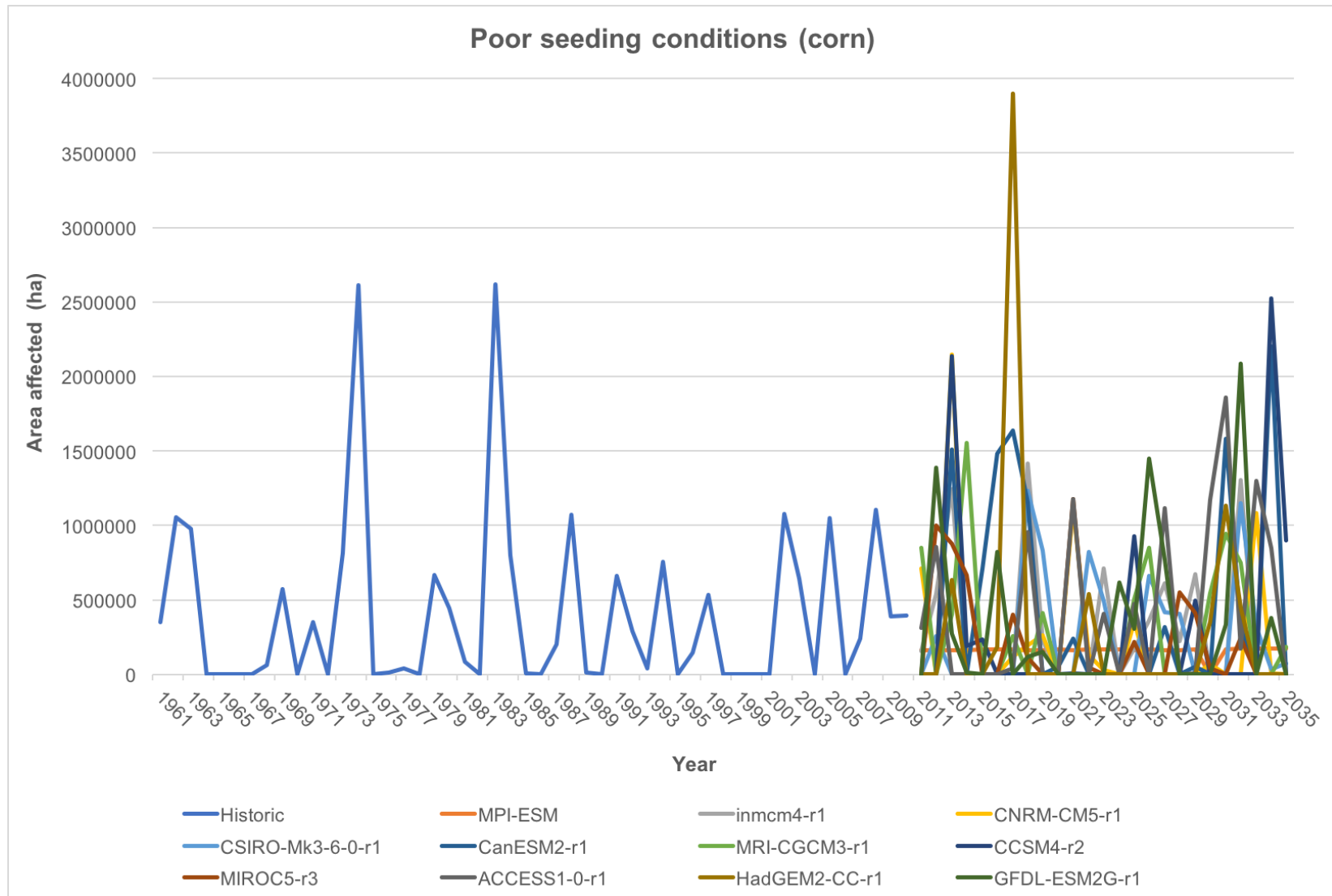
## Weeks per year



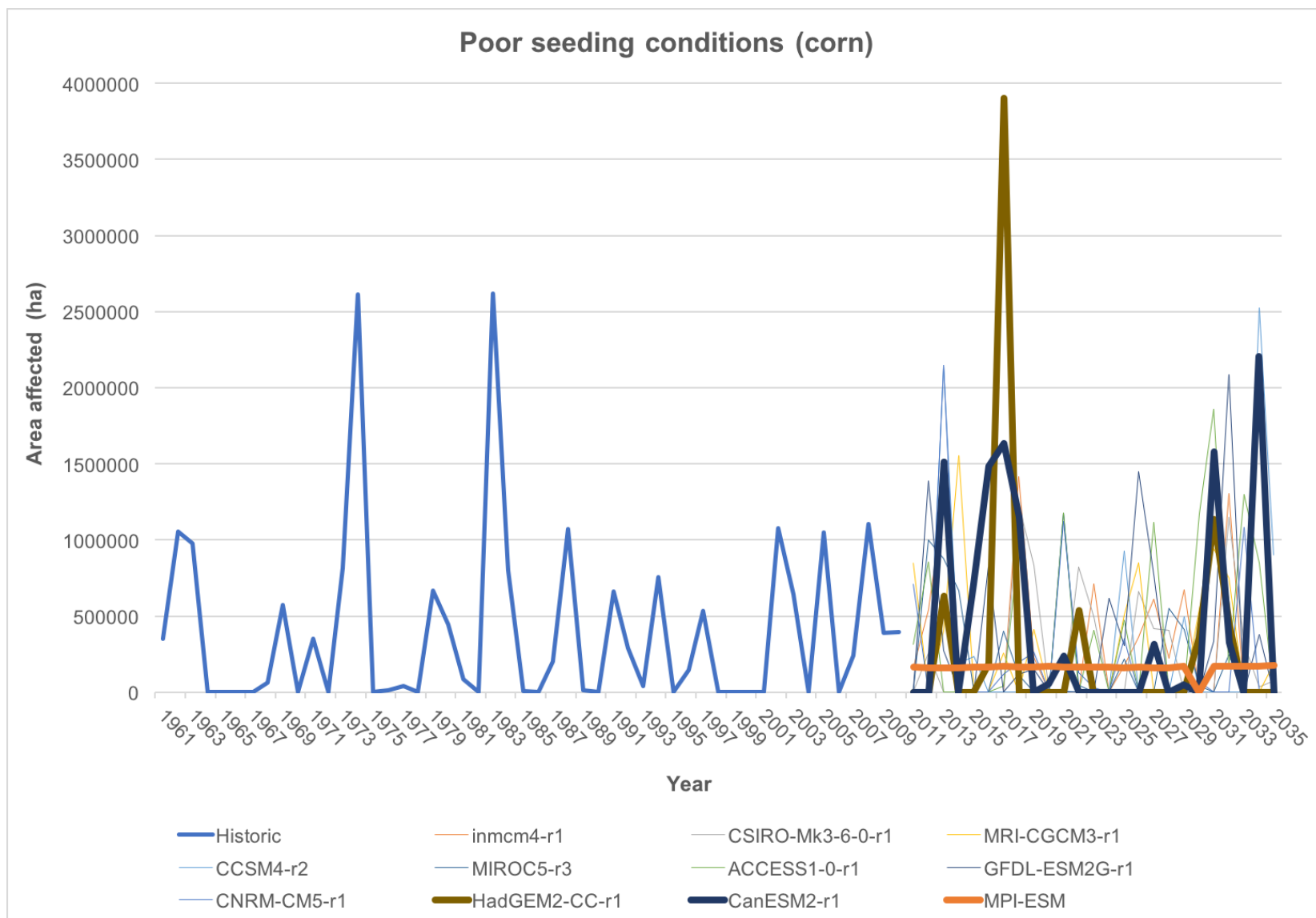
## Weeks per year



# Results (Corn)

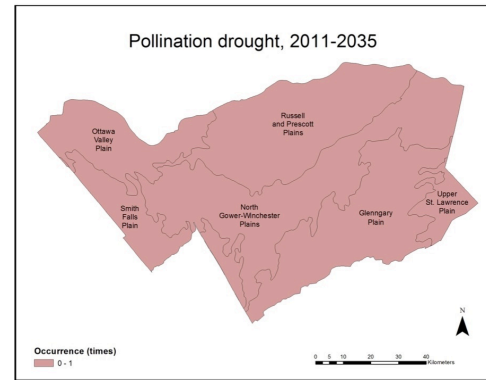
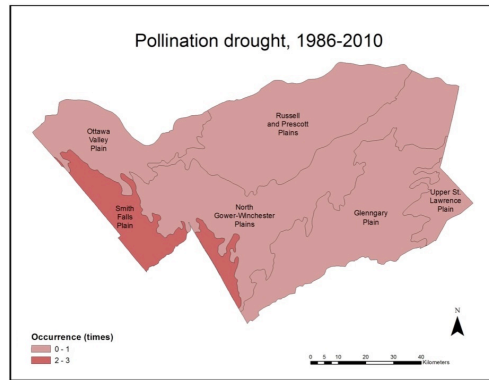
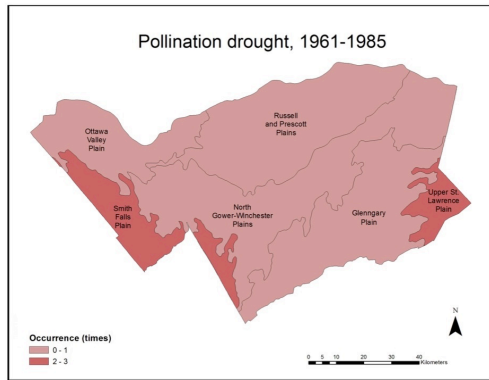


# Results (Corn)

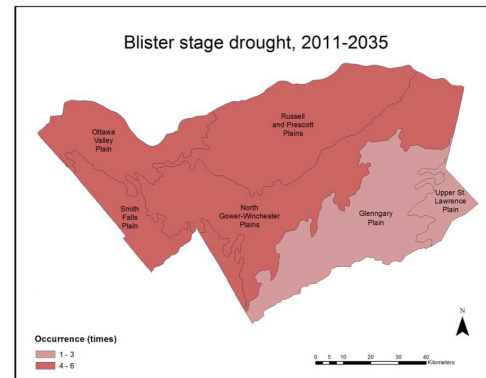
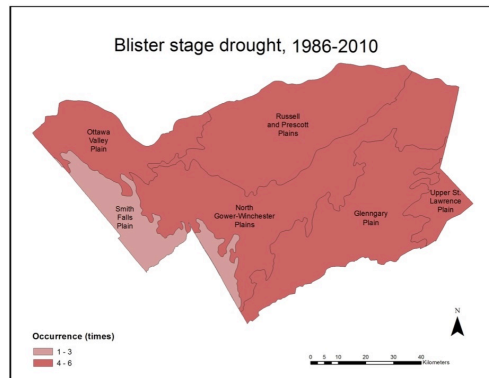
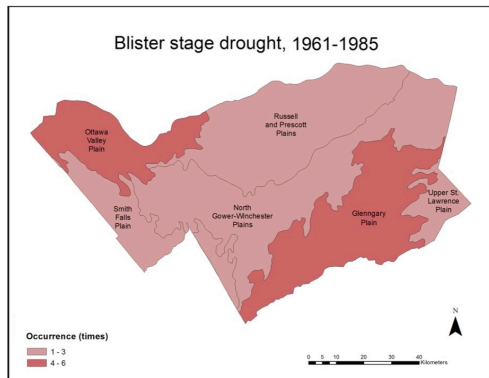
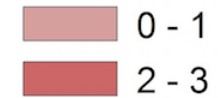




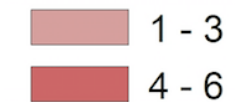
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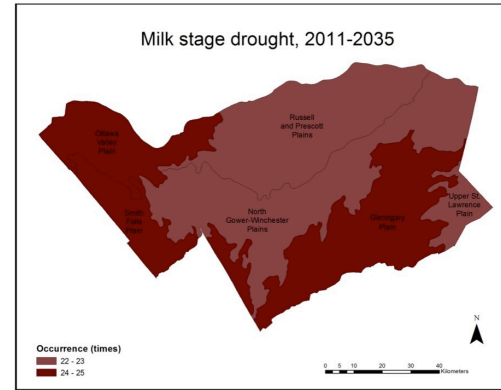
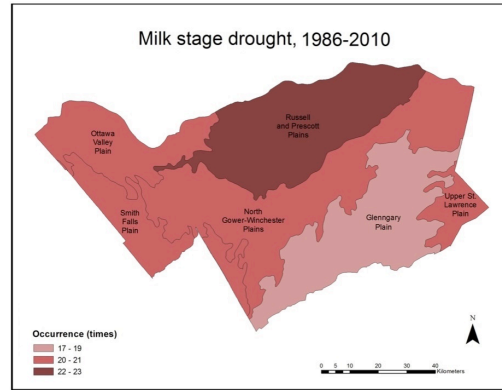
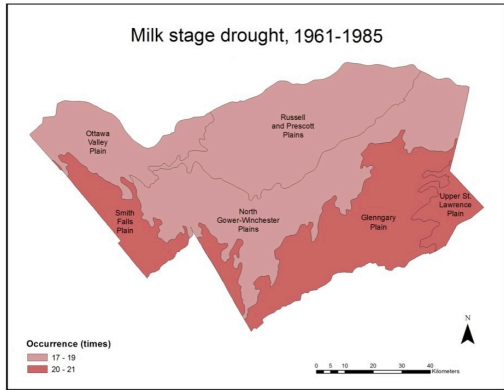
## Occurrence (times)



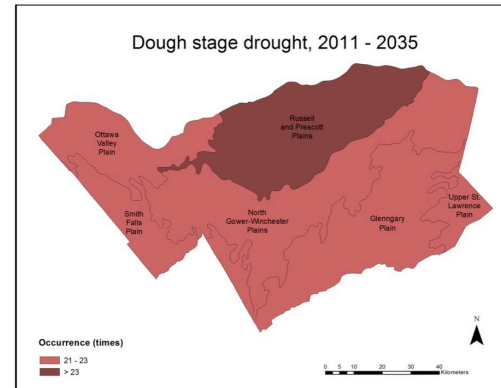
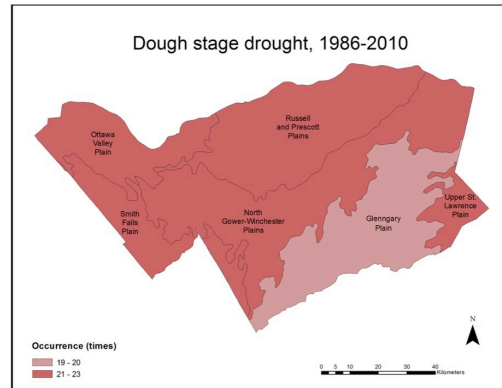
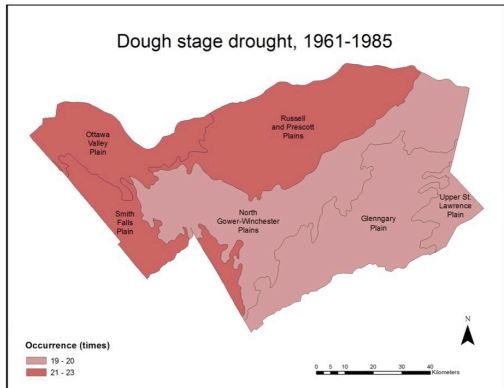
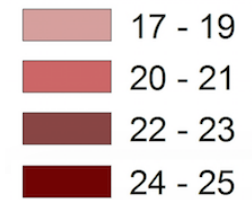
## Occurrence (times)



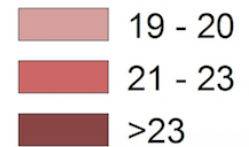
# Results (Corn)



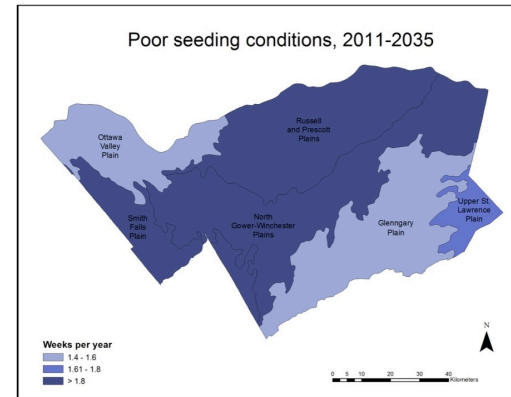
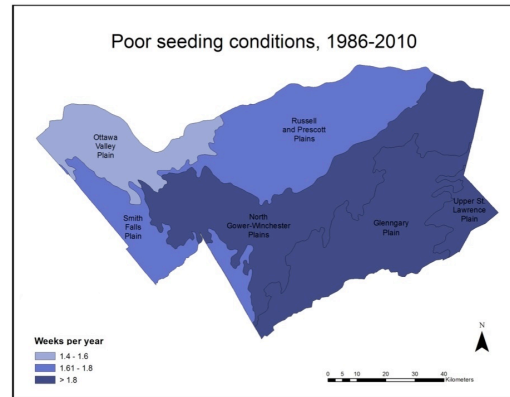
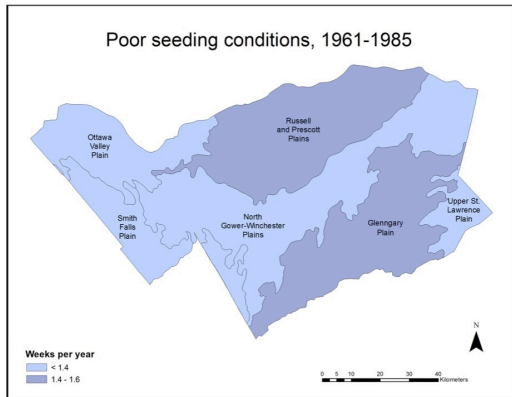
## Occurrence (times)



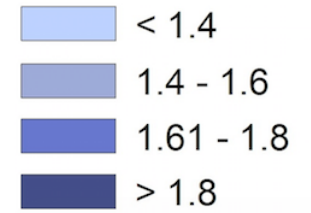
## Occurrence (times)



# Results (Soybeans)

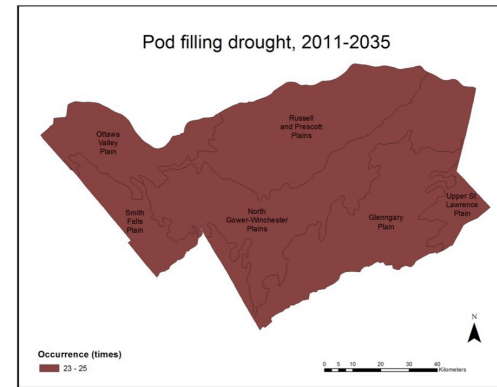
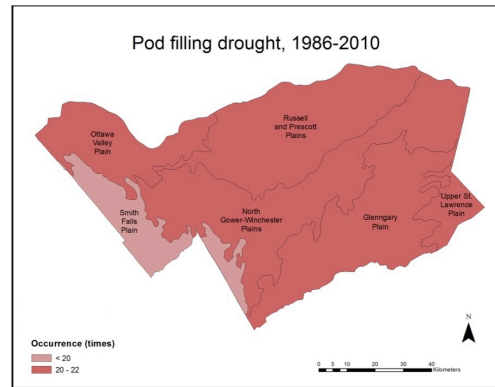
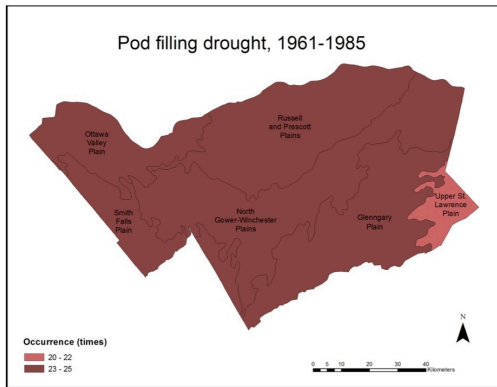


## Weeks per year

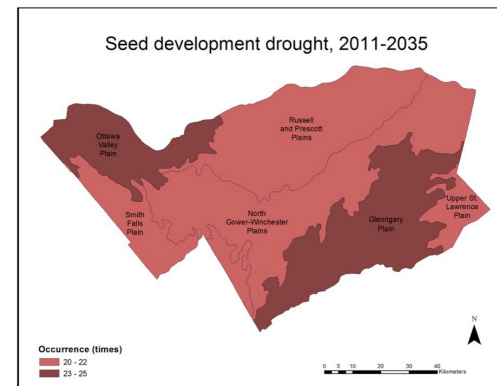
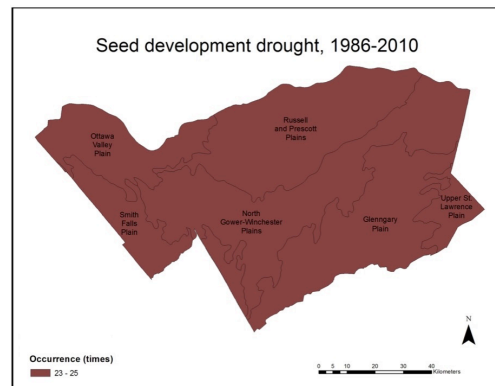
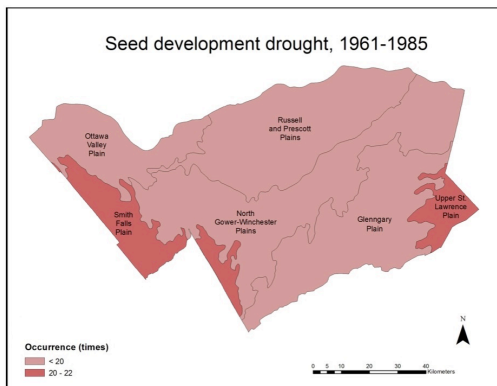
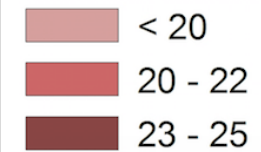




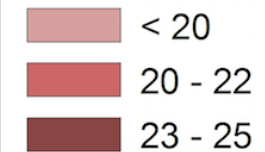
# Results (Soybeans)



**Occurrence (times)**



**Occurrence (times)**



# Thank you!



Photo: TYWKIDDBJ, Blogspot