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# Growing Degree Day Trends on the Semiarid Prairie of Southwestern Saskatchewan

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**Key Words:** Growing degree days, southwestern Saskatchewan

## Introduction

- Generally, the Canadian Prairie has become warmer over the past 4-5 decades.
- Some regions of the prairies have warmed faster than others.
- Since 1950, some of the highest temperature increases of any region in Canada have occurred in southern Saskatchewan.
- The climate of southwestern Saskatchewan has warmed over the past 50 years (Fig. 1). Seasonally, January through April (JFMA) has experienced the largest warming trend, whereas September through December (SOND) has not warmed.

## Objective

- To investigate trends in growing degree days within southwestern Saskatchewan.

## Methods

- Daily maximum ( $T_{mx}$ ) and minimum ( $T_{mn}$ ) air temperatures were recorded at Aneroid, Gravelbourg, Maple Creek, Shaunavon and Swift Current in southwestern Saskatchewan from 1950 to 1997, representing a region of approximately 15000 km<sup>2</sup> (Fig. 2).
- All weather recording sites were manned by volunteers (except Swift Current) using equipment maintained and calibrated by Environment Canada.
- Average monthly and average seasonal - AMJ (April, May, June) and MJJ (May, June, July) - growing degree days greater than 0°C (GDD>0) for the region were determined from the daily temperatures averaged across locations.
- $GDD = (T_{mx} + T_{mn}) / 2$  were calculated on a daily basis. For a given year, monthly and seasonal GDD were calculated by summing daily GDD>0 over that month or season.

## Results

- Similar to trends in temperatures, monthly total GDD>0 have steadily increased for the late winter-early spring months of March and April, as well as for the early summer month of June (Table 1).
- Growing degree days above 0°C for the forage growing season (April, May, June - AMJ) have increased linearly between 1950 and 1997 (Fig. 3).
- Growing degree days above 0°C for the spring wheat growing season (May, June, July - MJJ) responded curvilinearly between 1950 and 1997 (Fig. 4). GDD>0 for spring wheat has been slightly decreasing since the late 1970's.

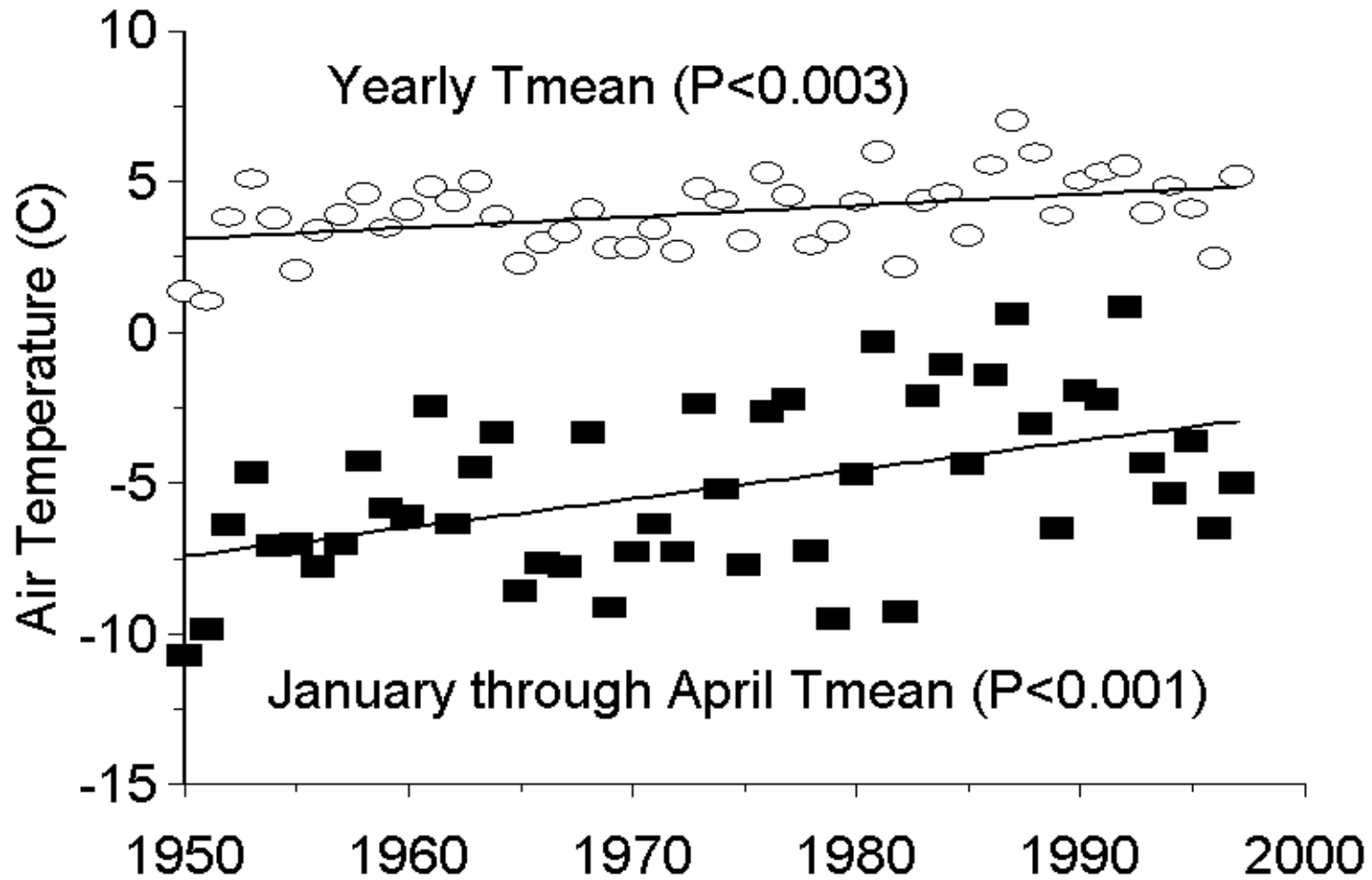
## Conclusions

- The trends in growing degree days have followed closely the trends in temperature. During late winter-early spring, temperatures and therefore, GDD have steadily increased since the 1950's. Whereas for the mid to late summer months, temperatures and therefore, GDD have either generally not changed or have at first increased slightly and then decreased slightly since the 1950's.
- Generally, total GDD's during the growing season for perennial forages have increased, whereas total GDD's for the growing season of annuals such as spring wheat have remained relatively unchanged since the 1950's.

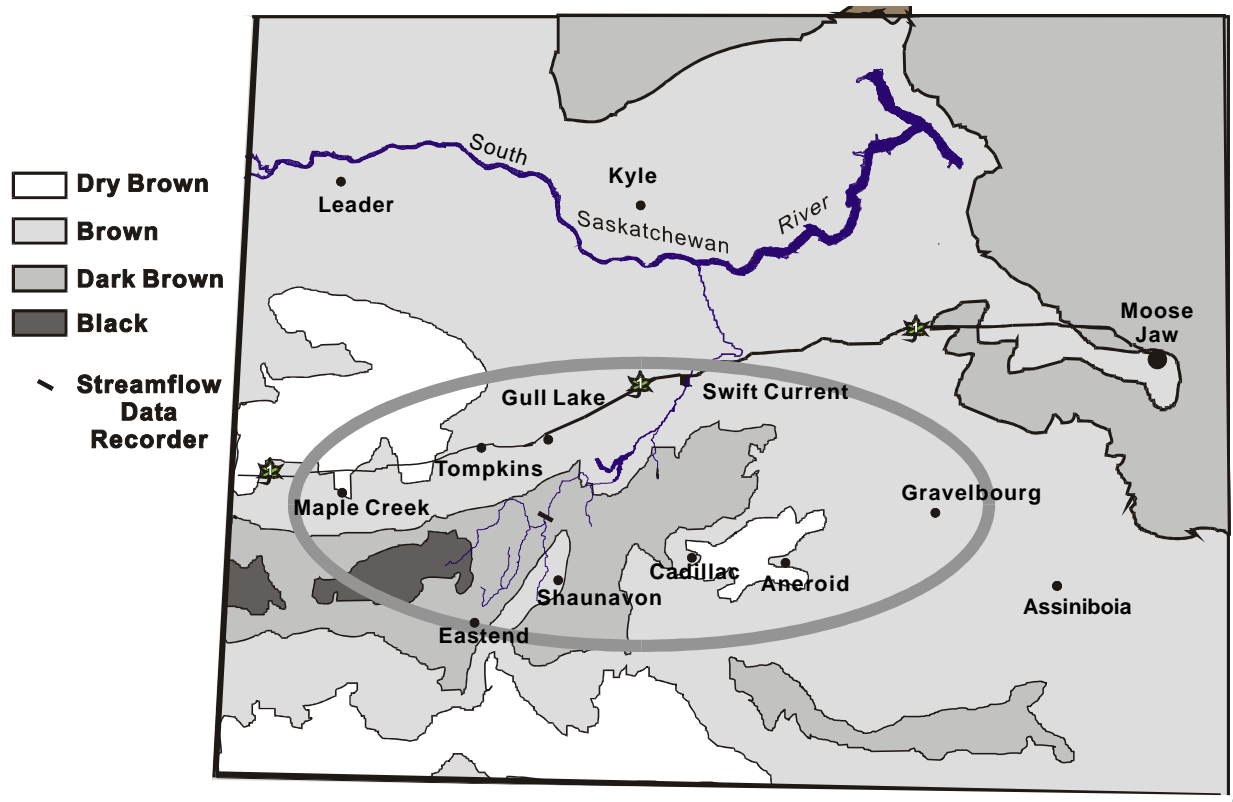
**Table 1.** For a given month, regression equation describing the relationship of growing degree days  $> 0^{\circ}\text{C}$  ( $\text{GDD}>0$ ) with years from 1950 to 1997. Temperatures were averaged across several locations within the study area south of Swift Current.

Month	Equation for $\text{GDD}>0$	P<	$(R_{\text{adj}})^2$
March	$\text{GDD}=-2121.8+1.097*\text{Year}$	0.0006	0.21
April	$\text{GDD}=-2743.8+1.470*\text{Year}$	0.012	0.11
May	$\text{GDD}=-867.8+0.615*\text{Year}$	0.24	
June*	$\text{GDD}=-1771+1.135*\text{Year}$	0.0053	0.14
July	$\text{GDD}=828.4-0.126*\text{Year}$	0.77	
August	$\text{GDD}=-475.0+0.523*\text{Year}$	0.39	
September	$\text{GDD}=-512.2+0.443*\text{Year}$	0.51	

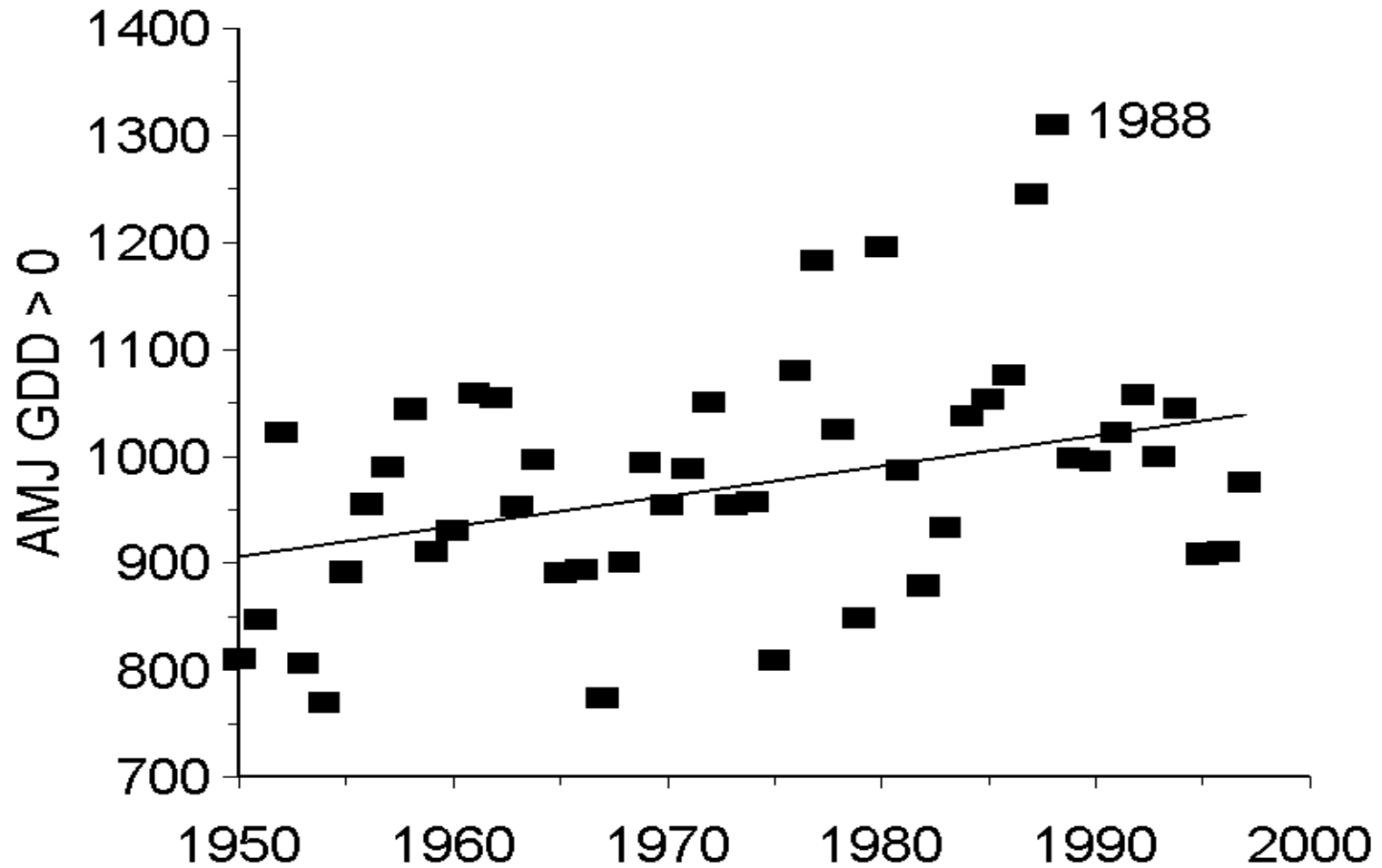
\* 1961 and 1988 were outliers and not included in analysis.



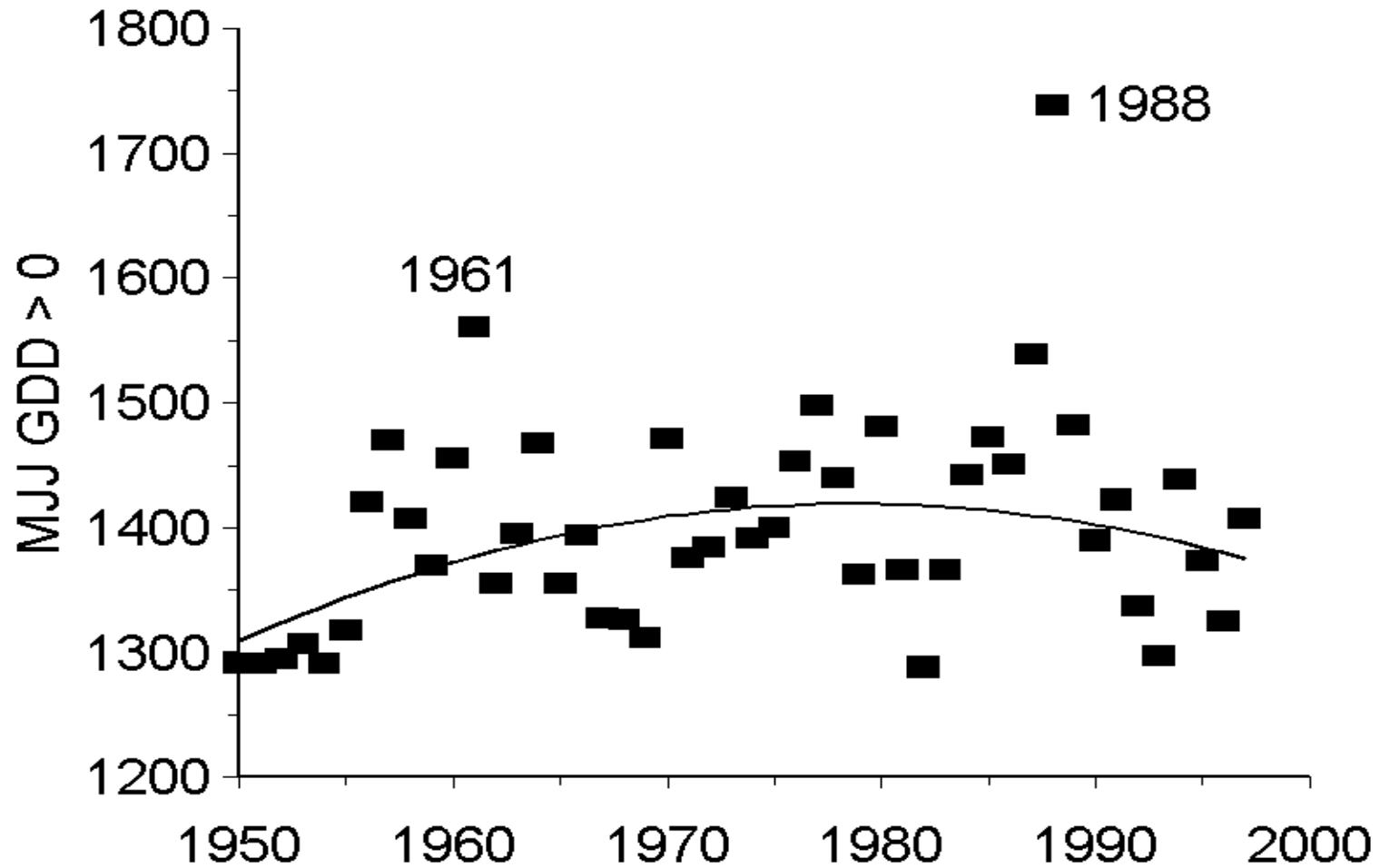
**Figure 1:** The relationships of the annual average and average seasonal (JFMA) air temperature with year from 1950 to 1997. Temperatures were averaged across several locations within an approximately 15000 km<sup>2</sup> region south of Swift Current, SK.



**Figure 2:** Location of the weather recording sites in southwestern Saskatchewan. Circled is the approximate area over which the temperature measurements chosen to detect trends in growing degree days  $> 0^{\circ}\text{C}$  apply.



**Figure 3:** The relationship of growing degree days above 0°C for the growing season corresponding to the first-cut forage production (April, May, June - AMJ) with year from 1950 to 1997 for the 15000 km<sup>2</sup> region south of Swift Current, SK. The year 1988 was excluded from the analysis.



**Figure 4:** The relationship of growing degree days above 0°C for the growing season corresponding to the spring wheat production (May, June, July - MJJ) with year from 1950 to 1997 for the 15000 km<sup>2</sup> region south of Swift Current, SK. The years 1961 and 1988 were excluded from the analysis.