



Canadian Foundation for Climate
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2007 DRI Progress Report

Project Title: The Climatological Nature of the 1999-2005 Drought in the Canadian Prairies

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1.0 Progress (beginning January 2007 to end December 2007)

1.1 Describe progress towards meeting the project objectives for those theme areas where you have received funding for 2006-2007. How are the original milestones being met (be specific)? List the key objectives and results achieved to date as well as any relevant application(s) of the results.

1.1.1 Objectives

The overall objective of the Drought Network Initiative (DRI) is *to better understand the physical characteristics of and processes influencing Canadian Prairie droughts, and to contribute to their better prediction, through a focus on the recent severe drought that began in 1999.*

To address this overall objective, the Network is focussed on complementary and cross-cutting research objectives that correspond to the following themes:

1. Theme 1: Quantify the physical features of this recent drought: a) spatial and temporal features,

The main objective of our study is to quantify the extent and severity of the 1999-2005 Canadian Prairie drought at a variety of spatial and temporal scales. We have formalized our research plan and developed a full list of data requirements. Relevant datasets include: temperature and precipitation (monthly, daily, gridded); soil moisture; monthly Standardized Precipitation Index (SPI) and Palmer Drought Severity Index (PDSI); and various agricultural and hydrological impacts. Other drought indices may include evapotranspiration and the Climate Moisture Index (CMI).

The research plan overview includes: calculating and comparing the various indices; determining those that best reflect the drought in terms of documented agricultural and hydrological impacts; indicating improvements needed in drought indices; developing methods to analyze the migration of the drought to assess how it evolved, where it persisted, and how it terminated.

Progress towards these objectives include:

- Hiring of a full time research assistant
- Acquisition of several gridded datasets of temperature and precipitation for Canada (CANGRID) and North America (Climate Research Unit (CRU) TS 2.1). Recently a

North American ANUSPLIN dataset (McKenney et al. 2006) was identified and work towards acquiring the data continues. The CRU and ANUSPLIN datasets are of particular interest because the data extend into the United States. As a result, the 1999-2005 drought can be examined over the prairie regions of Canada and the United States.

- In depth evaluation of the CRU TS 2.1 dataset (Mitchell and Jones, 2005) to determine how these gridded temperature and precipitation values correspond with recorded station values.
- First stages of calculating drought indices (PDSI and SPI) and comparing these results to previous work over the prairies during the 1999-2005 drought (PFRA Drought Watch among others).
- Research into the background and data requirements of additional drought indices, including the Climate Moisture Index (CMI), evapotranspiration and soil moisture, will continue

b)flows of atmospheric and terrestrial water and energy into and through the region, and their storage and redistribution within the region.

Not Applicable

2. Theme 2: Improve the understanding of the processes and feedbacks governing the formation, evolution, cessation and structure of the drought.

Not Applicable

3. Theme 3: Assess and reduce uncertainties in the prediction of drought and its structure.

Not Applicable

1.2. What contributions have you made, if any, to the unfunded themes of DRI through support in kind.

Theme 4: Compare the similarities and differences of the recent drought to previous droughts over this region and those in other regions, in the context of climate variability and change.

Through in-kind research funds from Environment Canada, an analysis was carried out that compared the 2001/2002 Canadian Prairie drought to those that occurred during the instrumental period of record. Results were published in a journal manuscript:

Bonsal, B.R. and M. Regier. 2007. Historical comparison of the 2001/2002 drought in the Canadian Prairies. *Climate Research*, 33: 229-242.

Theme 5: Apply our progress to address critical issues of importance to society.

Through in-kind research from Saskatchewan Research Council (SRC) and Environment Canada (EC) several Theme 5 related publications and reports have resulted. They include:

Journal Articles

*Marchildon, G.P., Kulshreshtha, S., Wheaton, E., Sauchyn, D. 2007. Drought and institutional adaptation in the Great Plains of Alberta and Saskatchewan, 1914 – 1939. *Nat Hazards*. DOI 10.1007/s11069-007-9175-5

*Wheaton, E., S. Kulshreshtha, V. Wittrock, G. Koshida. 2007 Accepted. Dry times: lessons from the Canadian drought of 2001 and 2002. *The Canadian Geographer*.

*Wheaton, E.E. 2007. Focus Study 3.1 Drought. In: Thraves, B.D., M.L. Lewry, J.E. Dale, and H. Schlichtmann (eds), *Saskatchewan: Geographic Perspectives*. University of Regina, Regina.

*Wheaton, E.E. 2007. Focus Study 3.2 Dust Storms. In: Thraves, B.D., M.L. Lewry, J.E. Dale, and H. Schlichtmann (eds), *Saskatchewan: Geographic Perspectives*. University of Regina, Regina.

Research Reports

*Wheaton, E., G. Koshida, B. Bonsal, T. Johnston, W. Richards, V. Wittrock. 2007 May. *Agricultural Adaptation to Drought (ADA) in Canada: The Case of 2001 to 2002. Synthesis Report*. Prepared for Government of Canada's Climate Change Impacts and Adaptation Program. Saskatchewan Research Council (SRC) Publication No. 11927-1E07. 35 pp.

Wittrock V., and Wheaton, E. 2007 May. *Towards Understanding the Adaptation Process for Drought in the Canadian Prairie Provinces: The Case of the 2001 to 2002 Drought and Agriculture*. Prepared for Government of Canada's Climate Change Impacts and Adaptation Program. Saskatchewan Research Council (SRC) Publication No. 11927-2E07, 154 pp.

Presentations/ Conference Proceedings

Wheaton, E., C. Beaulieu, M. Johnston, J. Thorpe, and V. Wittrock. 2007 November. *Risks and Opportunities of a Warming Climate: Views from the Prairies*. Invited Presentation to Environment Integrated Systems – Putting Policy into Action, November 22, 2007, Regina, SK. Saskatchewan Research Council (SRC) Publication No. 11225-20D07.

Wheaton, E., G. Koshida, V. Wittrock. 2007 September. *What does Current Agricultural Adaptation to Drought mean for Future Vulnerability?* In: Heinonen, M. Proceedings, Third International Conference on Climate and Water, Marina Congress Center, Helsinki Finland, 3 to 6 September 2007. Finnish Environment Institute, Helsinki. Saskatchewan Research Council (SRC) Publication No. 11927-10A07.

Wheaton, E., G. Koshida, and V. Wittrock. 2007 July. *What Does Current Adaptive Capacity Mean for Future Drought Management?* Abstract in Proceedings, Canadian Water Resource Association 60th Annual National Conference, July 25-28, 2007.

Koshida, G. E. Wheaton, E. Stratton and V. Wittrock. 2007 June. *Using Decision Support Tools to Enhance Sustainable Agricultural Water Use in the Prairie Provinces*. Abstract in CWRA June 2007 Annual National Conference.

Sauchyn, D., M. Fiebig, E. Wheaton, J. Barichivich, S. Lapp and V. Wittrock. 2007 June. *Variability in the Hydroclimate of the Elqui and South Saskatchewan River Basins*. Abstract in CWRA June 2007 60th Annual National Conference Proceedings.

Wheaton, E., G. Koshida, V. Wittrock. 2007 June. *Current Agricultural Adaptation to Drought: Implications for Future Water and Resource Management Capacity Building*. Abstract in CWRA June 2007 60th Annual National Conference Proceedings.

Wittrock, V., E. Wheaton and S. Kulshreshtha. 2007 June. *Assessing the Vulnerability of Prairie Communities' Water Supply*. Abstract in Proceedings CWRA June 2007 60th Annual National Conference Proceedings.

Wittrock, V., S. Kulshreshtha and E. Wheaton. 2007 June. *How Vulnerable are Prairie Communities' Water Supply?* Presentation to CWRA 60th Annual National Conference of the Canadian Water Resources Association, Saskatoon, Saskatchewan, June 26 to 28, 2007. Saskatchewan Research Council (SRC) Publication No. 11899-4D07.

Lawford, R., I. Hanuta, H. Hill, A. Warkentin, E. Wheaton, R. Stewart, and B. Girling. 2007 May. *A Review of Some Requirements for Drought Information on the Canadian Prairies*. CMOS/CGU Congress, May 2007, St. John's Newfoundland. SRC Publication No. 11602-3D07. 20 pp.

Wittrock, V., M. Khakpour, S. Kulshreshthra and E. Wheaton. 2007 April. *Impacts and Adaptation Strategies: A Case Study of Outlook, Taber and Hanna and the 2001 and 2002 Drought Progress Report*. Invited presentation to the *Institutional Adaptation to Climate Change Annual Meeting*, April 23-27, 2007, La Serena, Chile. Saskatchewan Research Council (SRC) Publication No. 11899-2D07.

Wittrock, V. and E. Wheaton. 2007 February. *Impacts and Adaptations: The Case of the 2001-2002 Drought*. Invited presentation to the *Water Management Workshop in Alberta's Special Area #2*. February, 26, 2007, Hanna, AB. Saskatchewan Research Council (SRC) Publication No. 11899-1D07, 24 pp.

1.3 Describe your plans for research during the coming year and the following year and outline how the expected results will support the deliverables and goals of DRI.

Future work will:

- Use drought indices to examine the spatial, temporal patterns, and intensity of the 1999-2005 drought.
- Compare different methodologies to calculate the drought indices
- Relate drought patterns to agricultural and hydrological impacts
- Develop methods to document the dynamics of drought migrations

This research supports Theme 1 in that it aids in the description and quantification of the physical features of the drought across the Canadian Prairies between 1999 and 2005. In addition, this research will make a contribution to the understanding of the wide range of impacts associated with the drought and how these impacts relate to the intensity, timing and duration of the drought.

2.0 Impact

2.1 What short and medium term objectives have been achieved, or are anticipated;

Relevant datasets have been identified. These include monthly gridded datasets of temperature and precipitation (CRU TS 2.1, CANGRID, ANUSPLIN) to be used in the calculation of several drought indices over the prairies for the 1999-2005 period. Our first objective is to determine how well these datasets represent observed station values. At present, this work continues.

Our hope is that a global dataset like the CRU data and/or ANUPLIN could be used to calculate drought indices beyond the study area (e.g. into the United States). The objective is to examine how conditions in the United States may have influenced the extent, severity and migration patterns of the drought on the Canadian prairies.

Other objectives include obtaining soil moisture and evaporation datasets to aid in the calculation of additional drought indices to assess the 1999-2005 drought. Once a full set of drought indices have been calculated our next goal will be to relate these indices with observed drought impacts including but not limited to crop yields, pasture growth, water levels (dugouts) and aerosols (dust storms). These comparisons will provide an indication of the usefulness/applicability of drought indices.

3.0 Dissemination

3.1 Provide information on dissemination of the research results (publications, including journal names and whether refereed), conference contributions, seminars, workshops or videos, websites or other methods of transferring the results.

Wheaton, E. 2007 January. *Theme 5 Update: Droughts-Addressing Critical Issues Important to Society*. Invited presentation to the *Canada DRI Workshop*, Winnipeg, MB. Saskatchewan Research Council (SRC) Publication No. 11602-2D07, 4 pp.

Wheaton, E. and B. Bonsal. 2007 January. *Exploring the Surface Characteristics of the 1999-2005 Drought in the Canadian Prairies*. Invited presentation to the *Canada DRI Workshop*, Winnipeg, MB. Saskatchewan Research Council (SRC) Publication No. 11602-1D07, 17 pp.