

# 3<sup>rd</sup> International Conference on **Earth Science & Climate Change**

July 28-30, 2014 DoubleTree by Hilton Hotel San Francisco Airport, USA

## Past and future extreme climatic events in Canadian prairies: Integrating economics and climate

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The occurrence of dry & wet events causes major adverse impacts in the Canadian Prairies. In the past, dry events, which are typically agricultural and/or hydrological droughts, have been common in the region. At least five major drought episodes have occurred in the Canadian Prairies during the past 120 years. These include multi-year droughts in the 1890s, 1910s, 1930s, late 1950s to early 1960s, 1980s, 1999-2005, 2009-10. The years 2001-2004 resulted in one of the largest area multi-year drought. Almost half of the agricultural prairies were in severe drought or worse during 2001. For the older droughts of the 1900 to 1950 period, the 1930s were the largest multi-year droughts, and 1961 and 1919 were the single-year severe droughts that covered the largest area. According to Bonsal et al. (2011), some of the major droughts have migrated into the Canadian Prairies from the United States Great Plains, including the 1999-2005 drought. This means that it is important to monitor the northern US droughts for expansion or migration into Canada. In the future, the frequency of both droughts and intense precipitation are expected to increase. In fact, the review by Wheaton et al. (2013) found that (i) multi-year droughts (e.g., 5 to 10 years, or so) would occur more than twice as often for the period to 2100; (ii) they would come with more evaporative power and be more intense as they will have much higher temperatures and much longer warm seasons; and (iii) they would cover much more area than even the across-Canada drought of 2001-2002. Droughts of such magnitudes would have devastating impacts on the Prairies, economically, environmentally, and socially, particularly on those industries where weather is a major determining factor to their survival and performance. One such industry is agriculture. It is the contention of this paper that estimation of impacts of the past droughts has been limited in scope, and may have underestimated these impacts. This under-estimation may be a result of several reasons: (i) Past studies have typically measured these impacts for only the drought period. In reality a drought would affect some of the enterprises (such as livestock production) that take several years to completely result in an economic gain to the producers. (ii) Although private costs of the people impacted by droughts are measured, the macro-level changes causing hardships to people and businesses are not measured. (iii) Droughts may impact ecological goods and services which can then affect the society at large. (iv) Loss to human capital through stress, sickness, and loss of employment as well as other changes that lead to lost productivity are typically not included. (v) Fiscal costs to the governments and their resulting impact on other programs have not been estimated. (vi) Economic hardships to smaller communities and people living therein have also not been addressed. We recommend that future investigations attempt to redress these deficiencies in the method of estimation of social, environmental and economic impacts of droughts. Impacts of the recent severe droughts in the US Plains and Canadian Prairies are reminders that current adaptation can be improved.

### Biography

Suren Kulshreshtha is currently a Professor in the Department of Bioresource Policy, Business and Economics at the University of Saskatchewan, Saskatoon over the past 45 years. His main interest has been in various issues related to climate change, including adaptation, drought impacts, and greenhouse gas mitigation. He has been a Visiting Scientist at the International Institute for Applied Systems Analysis, at Laxenburg, Austria, in addition to Visiting Professor at the Virginia Polytechnic Institute and State University, Blacksburg, and at the McGill University (Macdonald Campus) in St. Anne de Bellevue. He has also participated in several overseas projects in Indonesia, Zambia and India through the Canadian International Development Agency, and has been an invited participant at several FAO and United Nations Environmental Program activities.

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