

## GEOMORPHOLOGY

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Research Geomorphologist  
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Marten is a Research Geomorphologist in the Northern Interior Forest Region, as well as an adjunct professor at UNBC. Marten is involved in numerous interdisciplinary and collaborative research projects that include the disciplines of geomorphology, natural hazards, ecology, and climate change.



### Permafrost Distribution and Landslides

NIFR scientists Marten Geertsema and Vanessa Egginton have initiated the first research in BC to establish permanent monitoring installations for linking permafrost and weather data in remote locations, particularly on high-elevation mountain slopes. These weather stations and rock temperature loggers are installed at permafrost sites in the Fort Nelson, Peace and Skeena Stikine Districts. The data collected will be used to establish baseline information on the status of permafrost at points across northern BC. Understanding the changes in permafrost is important to northern resource users and managers since transportation and utility corridors may be vulnerable to mountain landslides triggered by receding permafrost. This ongoing work is in collaboration with the University of Ottawa and the University of Zurich.

### Landslide Ecology – Natural Disturbance Agents

Marten is studying the ecological role of landslides as natural disturbance agents. In some areas, the most productive forests are those found on old landslide tracks. This research examines the natural reforestation processes on landslides and may lead to identification of sites where landslide paths do not need rehabilitating. Collaborators included Jim Pojar and Ken Simonar.

### Economic Geology

Marten is involved in an ongoing mapping project spearheaded by Brent Ward (SFU) and funded by Geoscience BC. The focus of the work was to map mineral potential in the Prince George area. The work is being done to promote economic diversification in MPB-impacted areas. A preliminary report has been published (Ward et al. 2009).

### Historic Landslides, Prediction and Climate Change

Marten is investigating the historic and prehistoric rates of landslides in northern BC to enable predictions of future landslide rates. This research is being conducted in collaboration with Jim Schwab, Matt Sakals and Vanessa Egginton.

Marten continues to examine the linkages between climate change and historic and prehistoric landslide occurrences. A BC landslide database assembled by FSP researchers shows that these events have become more frequent during the last 30 years. An analysis of the impacts on pipelines, roads and railways in northwest BC and the influence of climate change was published in 2007.

## Natural Hazard Processes

Marten has been busy writing about a diverse array of landslide processes. He is co-authoring a chapter on hillslope processes in a forthcoming compendium of hydrology and geomorphology in BC. He has written two papers for a landslide conference in Strassbourg, France. He has also written on the travel angles of large landslides –which have implications for the development of risk management zones. Marten is also collaborating with Jim Schwab and Matt Sakals on a handful of specific landslide case histories in the region.

In addition to landslide hazards, Marten has been involved with the study of natural dams, floods, and tsunamis. He recently presented a paper, prepared in collaboration with Centre for Natural Hazards Research titled *Natural dams, temporary lakes, and outburst floods in western Canada* at the First World Landslide Forum in Tokyo. He is also co-author on a submitted paper on landslide-generated tsunamis.

## Past Climate Regimes

Marten in his role as adjunct professor at UNBC, is involved with several paleoenvironmental studies where the objective is to reconstruct past climatic regimes. He has investigated a rare erosional site in the Bowron watershed that exposes surfaces predating the last ice age. Exposed rock and rubble reveal the landscape's history going back 30,000 years. The spot is rich in fossils of insects and trees which researchers analyzed to infer prehistoric climates. This work involved collaboration with Brent Ward (SFU).

Marten is currently working with John Clague (SFU) to reconstruct past glacier activity and associated hazards.

Marten has also been studying prehistoric fire regimes of the Peace River area as revealed by soil and charcoal buried in alluvial fans. The research was done in collaboration with BC Provincial Museum, SFU, and University of Arizona, and with funding from Canfor and the US National Science Foundation. One discovery from this work, of taiga vole fossils, was reported in Hebda et al (2008).

## International Projects

In collaboration with SFU and researchers from Italy, Marten is comparing landslide rates in western North America with those in the Alps, where more intensive research has correlated landslide and climate trends.

Marten has coauthored (with US colleagues) a chapter on the *Environmental Impact of Landslides* for the First World Landslide Forum in Tokyo in the 2009 book *Landslides — Disaster Risk Reduction* edited by K. Sassa and P. Canuti. Marten was also the chair of the session on the Environmental Impact of Landslides.

Marten has been approached by Elsevier Science to author a chapter titled *Landslides* for an encyclopedia (The Encyclopedia of Environmental Health). The chapter was written in collaboration with a colleague from the US Geological Survey.

## Consultation

Marten's work also includes the following consultation activities:

Advising Energy & Mines and Petroleum Resources and the Oil and Gas industry on safe operating limits for steep and unstable slopes.

Providing ongoing consultations to BC Parks regarding slope instability following prescribed burns in Mt. Robson Park. Of particular concern were slides occurring above Highway 16 and CN rail tracks.

Conducting periodic investigations of landslides associated with timber harvesting for Compliance and Enforcement.

## Recent Publications

### Submitted

Clague, J.J., Koch, J., **Geertsema, M.** Submitted. Expansion of outlet glaciers of the Juneau Icefield before and during the Little Ice Age.

Blais-Stevens, A., Clague, J.J., **Geertsema, M.**, Schwab JW. Submitted. An overview of destructive landslide-generated tsunamis affecting North America. *Natural Hazards*.

**Geertsema, M.**, Cavers, D., Egginton, V.N. Submitted. Recent large flow-like landslides in the sporadic permafrost zone, northeastern British Columbia. *Canadian Journal of Earth Sciences*.

**Geertsema, M.**, Highland, L.M. Submitted. Landslides. In Encyclopedia of Environmental Health. Elsevier Science.

**Geertsema, M.**, Schwab, J.W., Jordan, P., Millard, T., Rollerson, T. Submitted. Chapter 9. Hillslope Processes. In Watershed Management: Compendium of forest hydrology and geomorphology in British Columbia.

### 2009

**Geertsema, M.**, Cruden, D.M., 2009. Rock movements in northeastern British Columbia. In Landslide Processes from Modeling to Geomorphic Mapping, Strasbourg France.

Beguiria, S., van Hees, M., **Geertsema, M.**, 2009. Comparison of three runout models on the Turnoff Creek rock avalanche, British Columbia. In Landslide Processes from Modeling to Geomorphic Mapping, Strasbourg France.

**Geertsema, M.**, Highland, L.M., Vauegois, L. 2009. Environmental impact of landslides. In K. Sassa, P. Canuti (eds.), Landslides – Disaster Risk Reduction, Springer-Verlag Berlin Heidelberg. 2009, pp. 585-604.

**Geertsema, M.**, Schwab, J.W., Blais-Stevens, A., Sakals, M.E. 2009. Landslides and linear infrastructure in west-central British Columbia. *Natural Hazards*. 48:59-72.

Ward, B., Maynard, D., **Geertsema, M.**, Rabb, T. 2009. Ice-flow history, drift thickness, and drift prospecting for a portion of the QUEST Project Area, central British Columbia (NTS 093 G,H(west half), J). In Geoscience BC Summary of Activities 2008, Geoscience BC Report 2009-1, p. 25-32.

### 2008

**Geertsema, M.**, Clague J.J. 2008. Natural dams, temporary lakes, and outburst floods in western Canada. In Proceedings of the First World Landslide Forum, Tokyo Japan November 2008, pp. 211-214.

**Geertsema, M.**, Cruden, D.M. 2008. Travels in the Canadian Cordillera. 4th Canadian Conference on Geohazards. Quebec PQ.

**Geertsema, M.**, Schwab, J.W., Blais-Stevens, A. 2008. Landslides and linear infrastructure in west-central British Columbia. 4th Canadian Conference on Geohazards. Quebec PQ.

Hebda, R.J., Burns, J.A., **Geertsema, M.**, Jull, A.J.T. 2008. AMS-dated late Pleistocene Taiga Vole (Rodentia: *Microtus xanthognathus*) from northeast British Columbia, Canada: a cautionary lesson. *Canadian Journal of Earth Sciences*. 45:611-618.

Schwab, J.W., **Geertsema, M.** 2008. Terrain stability hazard mapping on forest lands: an historical perspective. 4th Canadian Conference on Geohazards. Quebec PQ.

## **2007**

Blais-Stevens, A. **Geertsema, M.** Schwab, J.W. Asch, Th. van, Egginton, V.N. 2007. The 2005 Sutherland River rock slide – debris avalanche, central British Columbia. 1st International Landslide Conference Vail, Colorado, USA.

**Geertsema, M.**, Egginton, V.N., Schwab, J.W., Clague, J.J. 2007. Landslides and historic climate in northern British Columbia. Landslides and Climate Change – Challenges and Solutions. *In* R. McInnes, J. Jakeways, H. Fairbank, E. Mathie (Eds). Taylor and Francis, UK, pp. 9-16.

**Geertsema, M.**, Pojar, J.J. 2007. Influence of landslides on biophysical diversity – a perspective from British Columbia. *Geomorphology* 89: 55-69.