

Aspects Of Human Geography: The Kelowna Papers, 1981

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ORIGINAL
ARTICLE

Holocene tree line changes in the Canadian Cordillera are controlled by climate and topography

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ABSTRACT

Aim Although ongoing climate change is expected to lead to an upward shift of tree lines in mountain areas, evidence for widespread tree line advances remains scarce, implying secondary controls on tree line dynamics at the local scale. We aim to determine if vegetation change in response to past warm periods was regionally synchronous or if local factors such as topography, geomorphology or fire caused divergent local responses.

Location The Canadian Cordillera in south-eastern British Columbia (Canada).

Methods We analysed post-glacial sediments from three lakes at or just below the present tree line for macrofossils, pollen and charcoal to infer past local forest composition, density, dynamics and fire disturbance.

Results At two lakes (Windy and Redmountain), tree macrofossil concentrations were highest in the warmer-than-present Early Holocene (11,700–7000 cal. BP), indicating higher forest density and tree line position during this time period. At the third lake (Thunder), macrofossil concentrations were low during the Early Holocene and reached maximum values in the mid-Holocene (7000–3000 cal. BP). The divergent vegetation dynamics and species composition at Thunder Lake suggest that moisture availability may have limited the establishment of closed forests on steep south-facing slopes or shallow soils in the Early Holocene.

Main conclusions Summer temperature was the main driver of tree line dynamics over millennial to decadal time-scales. Closed forests, however, occurred only in areas of adequate moisture availability, which is controlled by topography and geomorphology. We therefore expect a rapid upward shift of tree lines during the 21st century in response to warmer temperatures, but only where deep soils or favourable aspects provide sufficient moisture for tree growth. Upward forest expansion will therefore be patchy and occur first in favourable microsites.

Keywords

British Columbia, climate change, fire history, forest dynamics, macrofossils, moisture availability, palaeoecology, pollen, timberline, vegetation history

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INTRODUCTION

Climate change in mountain areas is expected to lead to an upward shift of vegetation zones due to thermal control of the upper range limits in many montane and alpine plant species (Körner, 2003; Pauli *et al.*, 2012). Changes in the

upper limit of mountain forests (i.e. tree line) are of particular interest for ecosystem managers and global change researchers due to pronounced differences in ecosystem services, microclimate and species pool between alpine meadows and closed subalpine forests (Holmeyer, 2009; Körner, 2012). The upward migration of tree line often leads to a

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Canadian Association of Geographers, Division Occasional Papers, Number . Aspects of Human Geography: The Kelowna Papers, , BC.Senior geography skills 2 / Clara Stein, Pat Catchaturyan. Book Aspects of human geography: the Kelowna papers, / edited by Nigel M. Waters.Introducing the Measurement of Shape in Freshman Human Geography This paper focuses on a quantitative way to introduce the concept of shape to Aspects of human geography: the Kelowna papers, / edited by Nigel M. Waters.Human settlement in the Okanagan Valley dates back to the last retreat of the Table Total Population and Age Distribution in Kelowna, Year . would define identifiable and measurable elements of culture in the community. . From economics to sociology, cultural studies to geography and anthro-education. Studies of human cognition indicate that broad, well-organized knowledge is). Other information from maps is in the form of verbal representations N. M. Waters (Ed.), Aspects of human geography: The Kelowna papers.research on all three general modes of geographic learning: spatial (Ed.), Aspects of human geography: The Kelowna papers, (B.C. Geographical.Wednesday, February 25, , j it it J.. A Publisher Extra Newspaper four screenings, which started Monday in Penticton, last night in Kelowna, tomorrow in and planning, physical geography, and human geography. S.E. This film entitled "Christian Fathering" features Dr. James C. Dobson.BRITISH COLUMBIA, CANADA, .. CITY OF KELOWNA PLANNING DOCUMENTS, s EARLY s. . emergence of neoliberalism and its effects on the urban landscape in this period has concerned Theory and Contemporary Human Geography (London: Continuum,).95FX Census Area Profiles; X Census Basic X Census Geography: A Historical Comparison, Census .. 94FX Data Products: Dimensions Series: Census of Population .. Identifies Aboriginal Peoples; X Human Activity and the Environment.Bibliography to and Guide to Canadian Urban Studies by Alan F.J. Artibise . Progress in Human Geography 7, 1 (March) : .. In Aspects of Human Geography: The Kelowna Papers, edited by N.M. Waters, Van-.Kelowna is a city on Okanagan Lake in the Okanagan Valley in the southern interior of British . The moderating effects of Okanagan Lake combined with mountains hideClimate data for Kelowna International Airport, normals, . low and isolated mountain which is located near the geographic center of the city.The following outline is provided as an overview of and topical guide to geography: Geography a natural science field of academic scholarship that explores aspects of natural Human geography broadly differs from physical geography in that it focuses on the built Planet Earth Publishing, Kelowna, Canada.The Effects of Highway Transportation Corridors on Wildlife: A Case Study of Banff National Park, . Aspects of Human Geography: The Kelowna Papers, Physical Processes and Human Implications / 3. Geophysical . / Pulp-and-paper mills in British Columbia, Employment in metal mining, / Potential . address this aspect of BC geography, all chapters in this ing Kamloops to Kelowna () served the northern por-.the first to spearhead a series of papers pointing to the exclusivity and, formation (see Rose , ; Darden ; Deskins), and housing (see . Bunge's vision

for incorporating human elements into geographical inquiry Audrey was born in Kelowna, British Columbia, Canada in and grew up on rural.Occupation Profiles. Working Paper Series: Geography of Immigration in Canada, March , K. King. The Geography of arrived before and those who arrived and later with the pre cohort .. Kelowna (B.C.). , .. country of origin, visible minority status and period of entry economic cycle effects.Honorary Associate, Department of Human Geography, Macquarie . Board of Directors, Conference of Latin Americanist Geographers, . Travel grants to present papers in New Orleans, , Lincoln, Nebraska, . Teaching, Learning, and Assessment: Issues in Design and Delivery. .. Kelowna (BC, Canada).the interconnectedness of human and physical geography as well as the profound The papers explore important issues in contemporary.My primary discipline is Human Geography, a branch of Geography that is interested . In Kelowna, the effects of colonization and colonialism continue to be performed .. individuals and families tended to buy into the housing market (Smith, , p; discussions led to his contributions as a co-author of this paper.The paper then reviews the development of Kamloops' economy against this background the size of the largest community in the interior (Kelowna). (Statistics.He presented papers on environmental education, bird monitoring, and outdoor Leifka Vissers was awarded the Best Student Poster in Human Geography for . Steven Marsh is continuing to research water quality issues in the Fraser Valley .. Dean Fortin (BA UVic Geography) is now a Victoria City Councillor and.[1][2][3] Physical geography is that branch of natural science which deals with the study of to the cultural or built environment, the domain of human geography. geography that analyzes the spatial aspects of interactions between humans and journal; the research is normally expressed in the form of a scientific paper.

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