Stability of alpine treeline in Glacier National Park, Montana, U.S.A.

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with 3 photos, 3 figures and 1 table

Abstract. Repeat photography was used to assess the stability of alpine treeline in Glacier National Park, Montana, U.S.A. Photographs from 15 sites revealed positionally stable treeline, although growth of individual trees is noted. Treelines controlled by snow avalanches have also remained stable in most locations, suggesting an absence of change in avalanche magnitude and frequency. Tetraterm (June–September) temperature values from the town of West Glacier reveal an upward trend since 1985 that may be associated with seedling establishment noted at two topographically favorable sites not included in the repeat photography program.

Introduction

One of the most important points to consider in assessing the potential impacts of atmospheric change (whether that be CO₂, temperature, precipitation amounts and/or seasonality patterns, or just cloudiness) is the rate and manner by which natural systems can respond (Henderson & Rosenbaum 1992, Ringelberg et al. 1992). Peter & Darling (1985) and Hanson et al. (1989) illustrated that organisms isolated at the tops of mountains could be squeezed out of existence by an advance of organisms from lower elevations caused by global warming. For mountains of the northwestern U.S.A., a critical component of this assessment must be projections of the rate at which alpine tundra can establish on higher sites now without soil. Hanson et al. (1989) noted that higher elevations above current alpine tundra do not have sufficient soil to support the potential upward displacement of tundra, and a subalpine forest advance may therefore be more rapid than the potential colonization of new tundra sites. Alpine tundra is, therefore, potentially threatened by global warming. The sensitivity of treeline to climatic change is of central interest because its upward advance is the threat.

Malanson (1993) noted that the central aspect of ecological response to climate change is spatial, i.e., species and landscape units shift their ranges (also see Solon 1993 for a discussion of vegetation landscape responses to anthropogenically induced change). Data from the Holocene indicate that there was inertia, or time lags in such responses (Davis 1989), potentially including treeline (Davis & Botkin 1985). Given that projected future rates of change are much greater than those recorded for the Holocene, disequi-