The Impacts of Climate Change on Snow Dependent Mammals

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In the western United States, much of the strongest data demonstrating climate change during the late 20th century are related to changes in snowpack. Snowpack is a particularly sensitive to climate change; shifts from snow to rain occur in many areas with relatively modest temperature increases. Many mammals are specifically snow adapted as evidenced by changes in pelage color and a variety of snow adapted morphologies. The snowshoe hare, for example, has large feet which aid in flotation and turns white in the winter. Both morphology and pelage change are maladaptive in a snow-free environment. Timing of pelage change is particularly critical. Lynx are also morphologically highly adapted to snow, having large feet, long legs, and a light, fragile bone structure. While not as morphologically linked to snow as lynx or snowshoe hares, wolverines obligately den in deep snow. All known reproductive dens, worldwide, occur within areas persistently snow covered through May 15. Further, areas that are snow covered in May contained most (91%) of the year-around telemetry locations in 6 studies in the western U.S. We transformed areas of snowpack associated with wolverine denning and range into climatic parameters by correlating the developed MODIS snow surface with high resolution climate surfaces developed by NOAA. We then used "sharpened" GCM projections developed at Oregon State University. By 2050, in three representative GCMs, virtually all persistent spring snow is gone. Unless wolverine show great plasticity, they will be gone as well. Because snow adapted organisms are adapted to very specific attributes of snow such as the period of snow coverage, snow morphology, or spring snow melt, their responses to small changes in climate can be expected to be both large and rapid.