

Climate influences competition between two tree species in Glacier National Park

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Glacier National Park has seen many recent wildfires, and during the last 23 years, over 27% of its forests have burned at least once (Figure 1). Meanwhile, climate has started to change

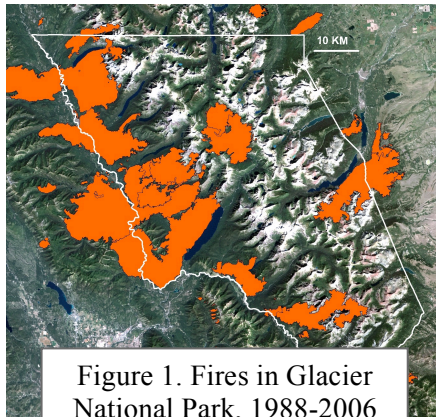


Figure 1. Fires in Glacier National Park, 1988-2006

in the region. This means that a lot of Glacier's forests are regenerating in climate conditions that are different from those after their last major fire. It is important to know how climate can influence patterns of tree regeneration, driving the species composition of future forests.

Western larch and lodgepole pine are common tree species on the west side of Glacier. Both of these species have evolved traits that allow them to regenerate after fire (Figure 2). Western larch has thick bark that allows trees to survive fire and tiny seeds that can be carried by wind.

Lodgepole pine has cones that release their seeds when they are heated by fire, providing a seed source when trees are killed. Within a year after a fire, seedlings of both species are usually abundant. However, successful seedling establishment does not guarantee a place in the future forest. Both species are extremely shade intolerant, so seedlings that grow slowly will eventually die if taller trees block incoming light. Seedling growth rates determine whether a tree survives to maturity, influencing the composition of the future forest.

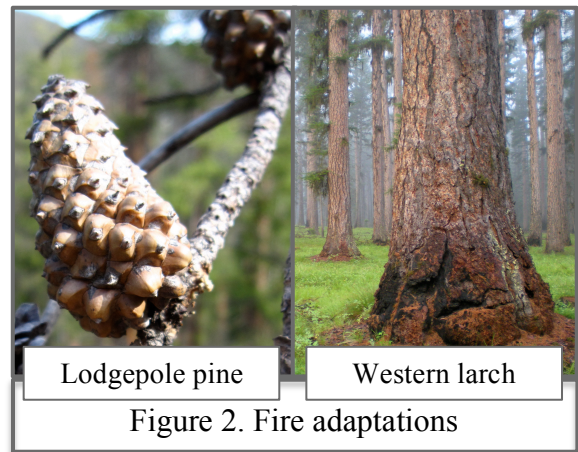


Figure 2. Fire adaptations

We used growth measurements to model the conditions promoting canopy recruitment. We found that lodgepole pine seedlings prefer high elevations and dry years, while western larch seedlings prefer low elevations and warm, wet growing seasons following cool years (Table 1).

Within historic climate, the differences between these species' resource needs have likely allowed for their coexistence because each species can outcompete the other under periods of relative advantage.

Variable	Western larch	Lodgepole pine	Projected climate change
Winter precipitation	+	+	+
Summer precipitation	+	-- Next year: +	--
Summer temperature	+	+	+
	Next year: --		

However, climate projections for Glacier, including increased year-round temperature and a shift from summer to winter precipitation, could favor lodgepole pine over western larch at mixed sites. Even minor changes in climate that increase fire frequency and favor lodgepole pine could lead to a regional decline of western larch.