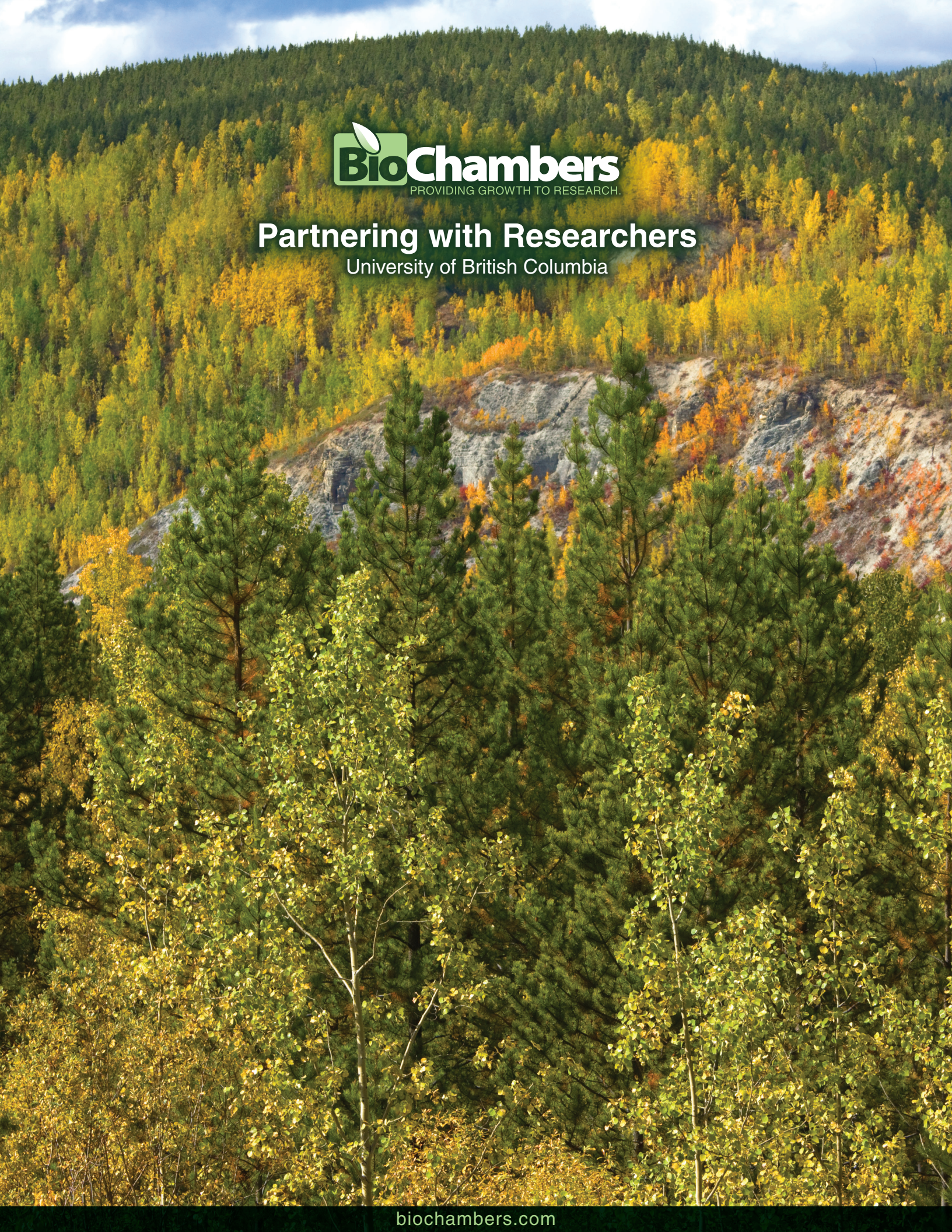
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What makes up the forest and the trees, and how do they persist?

Temperate forests at higher latitudes are warming disproportionally more from climate change than forests at lower latitudes. Greater warming is resulting in both stressful challenges and opportunities for extending the growing season. In the spring, temperature is an important controller of leaf out and early season growth. However, temperature more often limits spring growth compared to the fall due to the seasonal lag of temperature relative to daylength and light availability. In the fall, warmer temperatures are offset by rapidly declining daylengths past the equinox, with less and less light available for photosynthesis and growth. Warmer winter and spring temperatures may decrease the time plants experience chilling, delaying this requirement to break dormancy in many deciduous trees. Research has raised concerns that potential declines in chilling could underlie a slow-down in plant's advancing leaf out with warming, but the complexity of how plants accumulate warm temperatures in the spring could also explain this.[1] Or, if winter chilling is sufficient with early spring warmth, a late spring freeze during budburst can delay leaf out.[2] For species that can extend their growing season, how they invest additional resources is a critical question, whether into storage, reproduction, or increased vegetative growth. Scaling this up, how the growth and community assemblages of temperate forests are changing are questions the Temporal Ecology Lab (Wolkovich group) at the University of British Columbia are trying to answer.[3]

The reality of spring and fall warming on tree growth is more complex and nuanced than it may appear. Deciduous trees take time to leaf out, green up, and become fully photosynthetically active. How quickly this occurs depends in part on nutrient availability for the developing leaves, which is a combination of nutrients that are stored in the plant, and nutrients that are taken up by the roots in the spring. Masters student Christophe Rouleau-Desrochers is conducting a full factorial design of spring and fall warming with two levels each (control/warmed) resulting in four treatments plus an additional two treatments to test fall nutrient effects. The aim here is to understand the relative contributions of perennially stored nutrients compared to spring nutrient uptake via roots on early leaf development and spring growth.

Masting, a synchronized and variable seed production strategy plays an important role in many ecosystem-level functions. For trees, the decision of how much and when to invest vegetatively or in reproduction is not only determined by the conditions of a given year but spans the conditions of past years.[3] Xiaomao Wang, a PhD student in the Temporal Ecology Lab, is analyzing historical data of tree growth and mast events to understand if and how climate change is affecting trees' growth and regeneration dynamics in Mount Rainier.

A changing climate could mean opportunities for those species and populations with broader environmental tolerance, but more often presents challenges.[4,5] With the help of their BioChambers, the Temporal Ecology Lab is doing the hard work of parsing out the important factors to predict forest growth and community changes into the future, ultimately to help direct management and restoration strategies toward ecosystem resilience into the future.

References

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