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# Tree growth in coastal and inland environments of Newfoundland: Wind, salt spray and climate change.

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Wind is a major physical factor influencing trees in coastal environments. In addition to directly imposing physiological stress and mechanical disturbance, high winds also indirectly influence coastal trees through salt spray and winter icing. Atlantic hurricanes often give rise to extratropical storms which have significant negative impacts on coastal regions of the north-eastern United States and eastern Canada. Literature reports indicate that high winds associated with these storms can result in salt damage to trees >70 km from the coast. Predictions are that global climate change will result in an increased frequency and intensity of such storms which would lead to greater wind and salt damage to trees. In Newfoundland, coastal environments are dominated by two boreal conifers, *Abies balsamea* and *Picea glauca* which often exhibit a krummholz growth form in response to high winds and salt spray. Comparative studies of the two species were conducted along relatively short (0 to 3 km) and long (0 to 210 km) coast-to inland transects representing wind and salt spray gradients. Salt deposition to tree canopies was measured by analyzing the concentration of cations extracted by rinsing needles collected along coast-to-inland transects. The chemistry of bulk and throughfall precipitation was also compared along transects. Both methods indicated high sodium inputs to tree canopies at coastal sites, especially during a post-hurricane storm. Coastal forests were characterized by low diversity of tree species and relatively high tree mortality. Along short transects, fir and spruce trees differed in growth form and needle structure. Tree ring patterns showed high a proportion of eccentric growth in coastal trees and lower ring increments than those of inland trees. Structural differences were observed between needles on the seaward and leeward sides of the same tree. Compared to those of inland populations, the needles of coastal trees exhibited high accumulations of various chemical compounds associated with salinity tolerance; namely, free amino acids, proline and glycinebetaine. The forest industry is critical to the economy of Newfoundland. Few areas on the island are greater than 100 km from the ocean. While stunted trees in coastal environments are not merchantable, a significant portion of trees harvested in western Newfoundland come from within the potential zone of influence of high winds carrying marine aerosols. Increased wind and salt damage accompanying global climate change would affect the structure and function of trees and forests in this zone of influence and could result in significant economic losses.