Challenges to long distance transport in trees under 'new climate normal' conditions

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Climate models predict increases in frequency and intensity of extreme environmental conditions, like changes to minimum and maximum temperatures, duration of drought periods, intensity of rainfall/snowfall events, and wind strength. Such local extremes, rather than average climatic conditions, determine woody plant survival, as trees cope with such events over long lifespans. While stem provides trees with structural strength and is considered the most robust part of the tree's structure, it is also the most physiologically fragile part, as tree survival depends on its ability to sustain water supply to the tree crown and carbohydrates to roots under variable environmental conditions. Many structural, functional and biological tree properties evolved to protect stem from loss of transport function. How 'the new climate normal' conditions will affect these evolved strategies is yet to be seen. Our understanding of stem transport physiology and current conceptual models describing embolism formation and plant recovery from water stress, however, can provide insight into near future challenges that woody plants will face. In addition, knowledge on species-specific properties of stem function may help guide engineering effort to mitigate climate change impacts on woody plants' transport physiology in agricultural settings.