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Controls and Rates of Change of Shrub Cover in the Arctic: How do Arctic Dynamic Vegetation Models Differ in Their Results for Future Scenarios?

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Contemporary observations in the Arctic show increased shrub growth and colonization with regional warming and both observations and models suggest that as global climate warms, shrubs will become more widespread pan-Arctic. Compared to low-statured tundra vegetation, shrubs – particularly tall shrubs such as alder, birch and willow – have strong effects on climate through both biophysical and biogeochemical processes, including differences in albedo, carbon storage, energy and water fluxes, N fixation and N cycling. Future climate feedbacks depend on how quickly vegetation patterns change in response to regional warming. Predicting such changes is difficult, however, because they are not simply a function of shifts in the climate envelope of suitable temperature and moisture; expansion is influenced by interacting factors, including dispersal, recruitment, soil temperature, hydrology, biogeochemical cycling, edaphic characteristics, disturbance, and herbivory. We are synthesizing literature on known controls and rates of change in shrub cover, including a comparison of how arctic dynamic vegetation models (DVMs) incorporate shrub dynamics and how their results for future scenarios differ. We present a summary of our synthesis to date and a table that compares and contrasts arctic DVMs and their treatment of shrub dynamics.