# Concept of common potential responses of surface and stomatal conductance to the environments of Far East forests

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We examined the difference in the maximum values and responses to environments of surface conductance ($G_s$) and stomatal conductance ($g_s$), which are ecophysiological regulators of water and heat exchange, at several forest types in three regions of Far East Asia. Based on our findings, we propose a concept that can explain the spatiotemporal variation in the surface and stomatal conductance of Far East forests.

**Methods**

We observed water and heat fluxes at five forests in the Far East (larch and pine forests in Siberia, birch and mixed forests in Hokkaido, Japan, and mixed forest in Aichi, Japan) using the eddy covariance technique. Surface conductance $G_s$ was calculated from observed flux and meteorological data using the Penman-Monteith equation. Stomatal conductance $g_s$ was observed for sun leaves of four genera and seven tree species at nine sites in the Far East using a portable infrared gas analyzer (LI-6400; LI-COR). We applied a Jarvis-type conductance model (Jarvis, 1976) to the obtained $G_s$ and $g_s$ data and compared maximum values and response properties to environmental factors among the sites and species.

**Results and Discussion**

First, the model was applied to $G_s$ data from each site individually (within-site model). We then evaluated the maximum values of $G_s$ and parameters representing the responses to the environment; the response properties differed among regions. However, this result was probably strongly affected by large differences in environmental conditions among them. Second, we applied the model to $G_s$ data from all sites (pooled model). Even though the pooled model used a common parameter set for all the sites, it showed good precision equal to that of the within-site model. This suggests that the within-site model did not necessary represent potential properties and that the potential response properties of $G_s$ may not have differed greatly among the regions. Similar results were also obtained for the $g_s$ of birch, larch, and oak, with only pine showing properties different from those of the other species. Based on these results, our Core Research for Evolutional Science and Technology/Water, Energy, Carbon Cycles in Northern Forests (CREST/WECNoF) project has developed the concept of 'common potential responses to environments' as a means to evaluate $G_s$ and $g_s$ in Far East forests. Using this concept, much smaller $G_s$ and $g_s$ in boreal forests than in temperate forests can be explained by differences in humidity (i.e., severe dryness in boreal forests and humid conditions in temperate forests). Therefore, it is possible that boreal forests exhibit greater $G_s$, $g_s$, and evapotranspiration if environmental conditions are better than the present.