ATELIER
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22–26 JUILLET, 2013

WORKSHOP
"BIODIVERSITY IN A CHANGING WORLD"
JULY 22–26, 2013

Historical contingency in community assembly as a source of beta diversity

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Stochastic and deterministic forces that produce variation in the order and timing of species immigration can cause divergence in species composition among local sites via priority effects, even when sites are identical in environmental conditions and potential colonists. It is now well recognized that such historical contingency in community assembly contributes to the maintenance of beta diversity, the site-to-site variation in species composition. However, factors affecting the degree of historical contingency are not well understood, and this is one of the reasons why patterns of beta diversity in particular and biodiversity in general have been difficult to explain. By integrating studies of community assembly over the past two decades with some new computer simulation results, I will develop a general hypothesis regarding how the degree of historical contingency is determined. For this purpose, I will focus on three spatial factors affecting community assembly : the size of local sites, the distance from the species pool to local sites, and the scale at which environmental conditions vary. In combination, these factors are hypothesized to determine three aspects of community assembly that jointly determine the degree of historical contingency : (i) the rate of species immigration to local sites, (ii) the amount of variation in species immigration history among local sites, and (iii) the extent to which the species pool is external to local community dynamics. Historical contingency is hypothesized to be greater when (i) immigration rate is lower, (ii) immigration history is more variable, and (iii) the species pool that supplies immigrants to local sites exists more independently of local community dynamics. As future research directions, I will suggest that we can refine this hypothesis by considering the evolutionary background of immigrating species and the transient dynamics of assembling communities.

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