# Electronic Supplemental Material (ESM) 5 for “Evaluating Alternative Metacommunity Hypotheses for Diatoms in the McMurdo Dry Valleys Using Simulations and Remote Sensing Data”

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# Description of simulation initial conditions derived from empirical observations

The 500 pixels selected from the NDVI source image to represent the spatial distribution of patches of high-density cyanobacterial mats, which served as patches for diatom assemblages in the metacommunity simulations, had observed NDVI values between 0.218 and 0.675, with the strongest NDVI signals occurring in the catchment of Canada Stream (Table 2, Fig 1). Of these top 500 NDVI pixels, 65 were located in the catchments of SG1, seven were located in the catchments of SG2, and 428 were located in the catchments of SG3.

The initial contrived metacommunity used as a common starting point for all 10000 simulations had a mean local (i.e., patch-scale) diversity (*Dα*) of 10.6 species equivalents, a total metacommunity diversity (*Dγ*) of 22.0 species equivalents, and among-patch turnover in community composition (*Dβ*) was 2.07. Community composition in the source data from the MCM LTER varied both by mat type and across stream groups (Fig 2), which has been described in detail elsewhere (Esposito et al., 2006; Stanish et al., 2011, 2012). The variation in the source data was preserved in the initial contrived metacommunity (ESM2) because of the stratified random sampling with replacement that was used to select records from the MCM LTER database to construct the contrived metacommunity.

The distribution of mat types in the simulation map (Fig 3A) reflects the proportion of records from orange and black mats in the MCM LTER record for each stream group. In the simulated landscape, patches in SG1 have a nearly even proportion of orange and black mats, whereas orange mats are 2.6 and 1.6 times more common than black mats in SG2 and SG3, respectively. Reported chlorophyll-a standing biomass measurements were generally greater in records from black mats than orange mats, and the greatest values were reported in records from SG1, which largely represented mats in and near Canada Stream (Table 3).

Chlorophyll-a standing biomass and the presence of black mats were both negatively correlated with the PCA axis used to define the environmental gradient (*E*) in the simulated landscape (Fig 3C). The presence and relative abundances of diatom taxa were mapped onto this gradient in the contrived dataset using an OMI analysis (Dolédec et al., 2000), producing a set of empirically derived niche preferences (*µ*) and niche breadths (*σ*) for each taxon (Fig 3C-i). The same habitat preference (values of *µ*) were used for the same taxa in all 10000 simulations. Many taxa had broad niche breadths (i.e., large values for *σ*), indicating these taxa occurred in similar abundances across the gradient *E*. However, a few taxa had relatively narrow niche breadths, which indicated either positive (*µ* > 0) or negative (*µ* < 0) associations with the environmental gradient, *E*. SSS type metacommunity dynamics occurred in simulations in which the species pool was assigned the empirically derived values of *σ* (Fig 3C-i), whereas, MSS dynamics occurred in simulations which used species niche breadths that were multiplied by a *Cniche* of 4 (Fig 3C-ii, see eq. 3), and NM dynamics occurred when niche breadths were all multiplied by a *Cniche* of 20 (Fig 3C-iii).