At the meta-ecosystem level, resource flows … mean α-diversity, … β- diversity, … diversity, and decreased total biomass in meta-ecosystems with asymmetric patch sizes (SLLS; Fig. 2 purple solid versus dashed lines) but not in meta-ecosystems with identical (symmetric) patch sizes (MMMM; Fig. 2 green solid versus dashed lines). SLLS had a higher mean α-diversity (p = 0.019), lower β-diversity (p = 0.012), and lower total biomass (p = 0.003) compared to SL unconnected meta-ecosystems (purple lines in Fig. 2a, 2b, 2d respectively). MMMM had the same mean α- and β-diversity (green lines in Fig. 2a and 2b, respectively, p > 0.1), as well as total biomass (green lines in Fig. 2d, p > 0.1), compared to MM pairs. Resource flows did not influence γ-diversity in either asymmetric or symmetric meta-ecosystems, as SLLS had the same γ-diversity as SL pairs (purple lines in Fig. 2c, p > 0.1) and MMMM had the same γ-diversity as MM pairs (green lines in Fig. 2c, p > 0.1).

At the local level, small ecosystems that were connected to large ecosystems had higher diversity (Shannon Index) (solid vs dashed brown lines in Fig. 3a, p = 0.002) and biomass (solid vs dashed brown lines in Fig. 3b, p = 0.019, connection interacted with time) than when unconnected (SL vs S). This effect on biodiversity can be broken down into two components. First, the size of the connected ecosystem, as being connected to large ecosystems led to greater biodiversity (solid vs dotted brown lines in Fig. 3a, p = 0.013) Second, the presence or absence of the connection, as small ecosystems when connected to other small ecosystems were more diverse (dotted vs dashed brown lines in Fig. 3a, p = 0.012) than when unconnected (SS vs S). We observed a similar but weak (marginally not significant) trend for biomass, as being connected to large led to greater biomass (solid vs dotted brown lines in Fig. 3b, p = 0.06) than when connected to small ecosystems (SL vs SS), as well as being connected to other small ecosystems (dotted vs dashed brown lines in Fig. 3b p = 0.071) instead of being unconnected (SL vs SS).

Also at the local level, large ecosystems that were connected to small ecosystems were similar in their biodiversity (solid vs dashed blue lines in Fig. 3a, p > 0.1) but had lower biomass (solid vs dashed blue lines in Fig. 3b, p = 0.001) than when unconnected (LS vs L). For large ecosystems, the connection with small ecosystems decreased their biomass (solid vs dotted blue lines in Fig. 3b, p = 0.036) (LS vs LL). This effect was mediated by the size of the connected ecosystem, as when large ecosystems were connected to other large ecosystems, the effect was not observed (dotted vs dashed blue lines in Fig. 3b, p > 0.01) (LL vs L).

We observe a weak, yet marginally non-significant, trend of resource flows slightly increasing biodiversity (Fig. S8, p = 0.081) and biomass (Fig. S8, p = 0.062) in medium ecosystems compared to if they were unconnected (MM vs M).