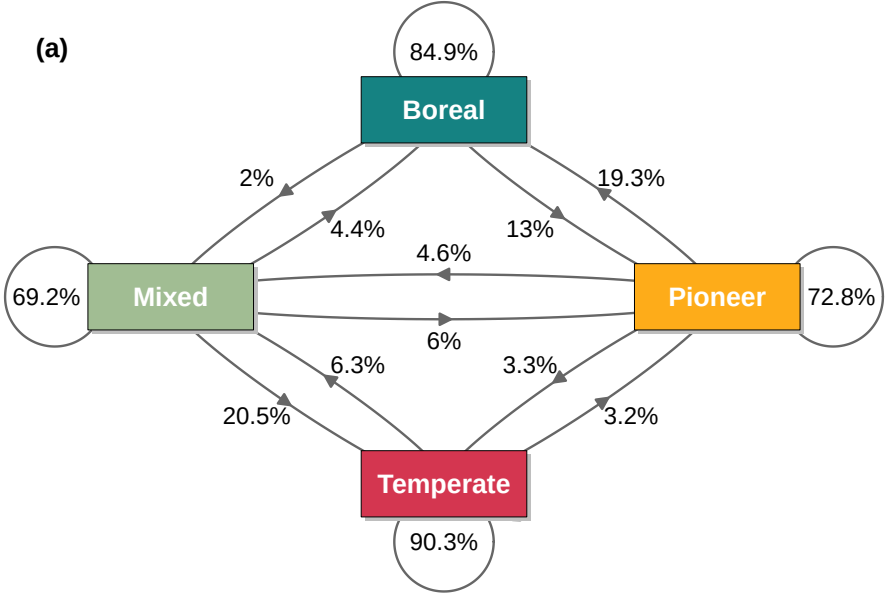
(a)



(b)

$$\mathbf{Q} = \begin{vmatrix} -\sum_{S \neq B} q_{BS} & q_{BM} & q_{BP} & 0 \\ q_{MB} & -\sum_{S \neq M} q_{MS} & q_{MP} & q_{MT} \\ q_{PB} & q_{PM} & -\sum_{S \neq P} q_{PS} & q_{PT} \\ 0 & q_{TM} & q_{TP} & -\sum_{S \neq T} q_{TS} \end{vmatrix}$$

(c)

$$q_{rs} = q_{rs.0} \times \exp(\beta_{rs.1} \times \text{climate} + \beta_{rs.2} \times \text{soil} + \beta_{rs.3} \times \text{disturbances})$$

for $r \neq s$ and $s \neq$ Pioneer

$$q_{rs} = q_{rs.0} \times \exp(\beta_{rs.3} \times \text{disturbances})$$

for $s =$ Pioneer