NEIGHBORHOOD FUNCTIONS ALTER UNBALANCED FACILITATION IN AN ALPINE TREELINE SIMULATION

Problem: Treelines
- Range limits
- Fundamental niche?
- Stress-gradient hypothesis?
- Climate effects questionable?
- 1o impact: biodiversity?

Why do treelines respond to climate change – or not? What can we learn about ecological relations? Malanson et al. 2011, AAAR

Alpine Treelines
- Pioneer
- Keystone
- Foundation
- Unbalanced facilitation?
- Spatially explicit feedbacks

Pinus albicaulis
Resler & Tomback 2008 AAAR; Tomback et al. 2014, AAAR

Facilitation & SGH
Spatial effects of neighbors
- Stress gradient correlated facilitation (SGCF) boosts edges and mean facilitation
- SGCF increases populations in the area of higher stress
- SGCF increases the beneficiary species relative to even facilitation
- Unimodal functions of facilitation for neighbor density magnify all above effects: important in ecotones with patchy patterns
Malanson & Resler 2014, JTB

Facilitation vs Competition
Latest results: for 3 species on a hierarchical competition niche gradient:
- facilitation decreases coexistence, sharpens boundaries
- competition has strong transient effects with climate change and leads to long term coexistence
- effects are shifted spatially in the stress gradient case

Extensions of an Agent-Based Model
Smith-McKenna et al. 2014, EM&S

Environmental gradient
Establishment seeds, seedlings
Growth branches
Mortality age class
Pathogen blister rust
Climate change amelioration

Newer question: how do neighbors create stress-gradient interaction intensity?

Newer model: Delete pathogen, climate change Focus on neighbor relations (linear, logarithmic, unimodal) in stress-gradient hypothesis

Newest question: how do contrasting neighbor interactions affect coexistence with climate change?

Newest model (w/climate change): 3 types of interaction:
- negative, competitive
- positive, facilitative
- stress-gradient switch

Funding: