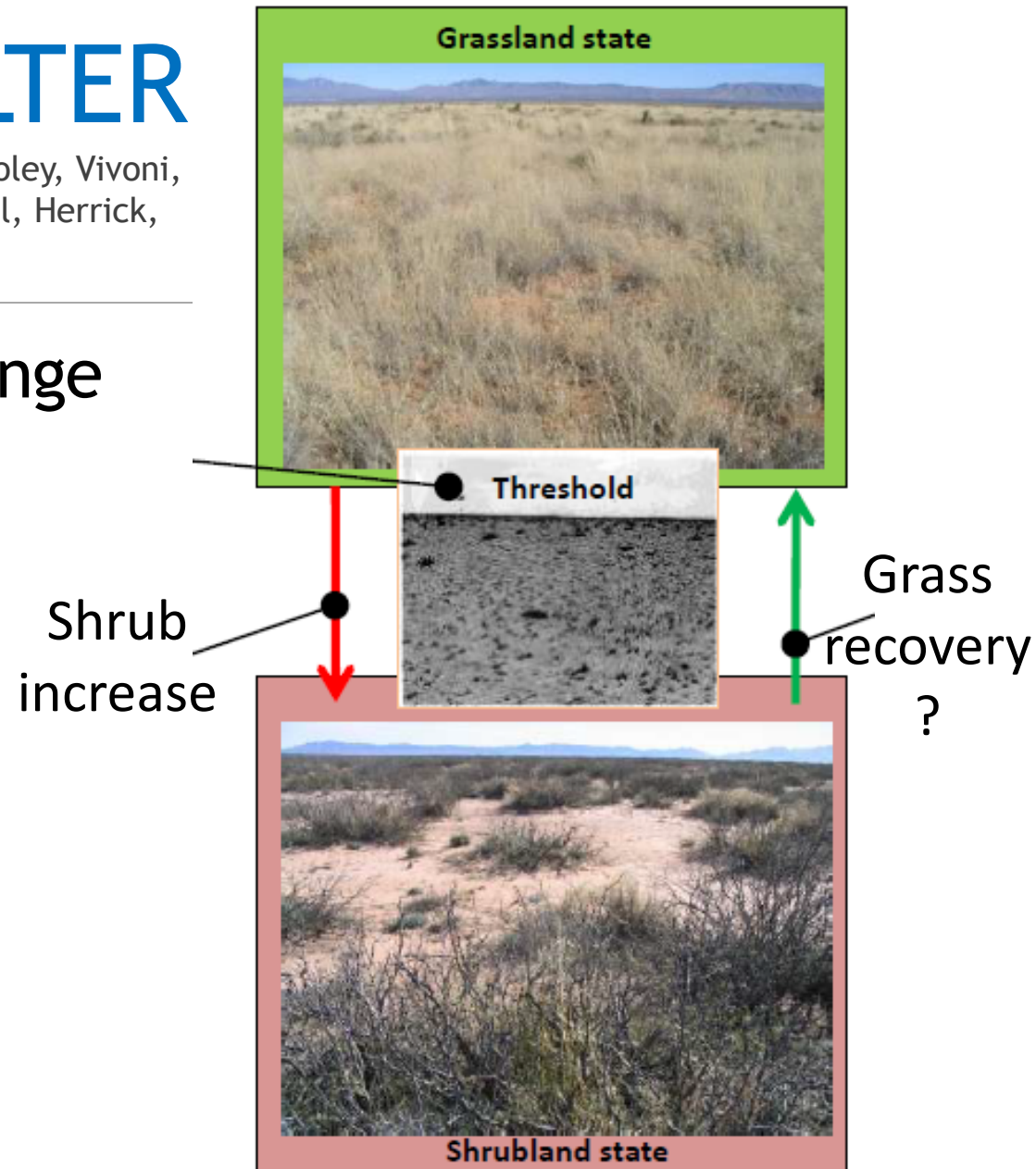


Broad Theme: Resilience, Abrupt State Change and Alternative Stable States

JRN-LTER Example:

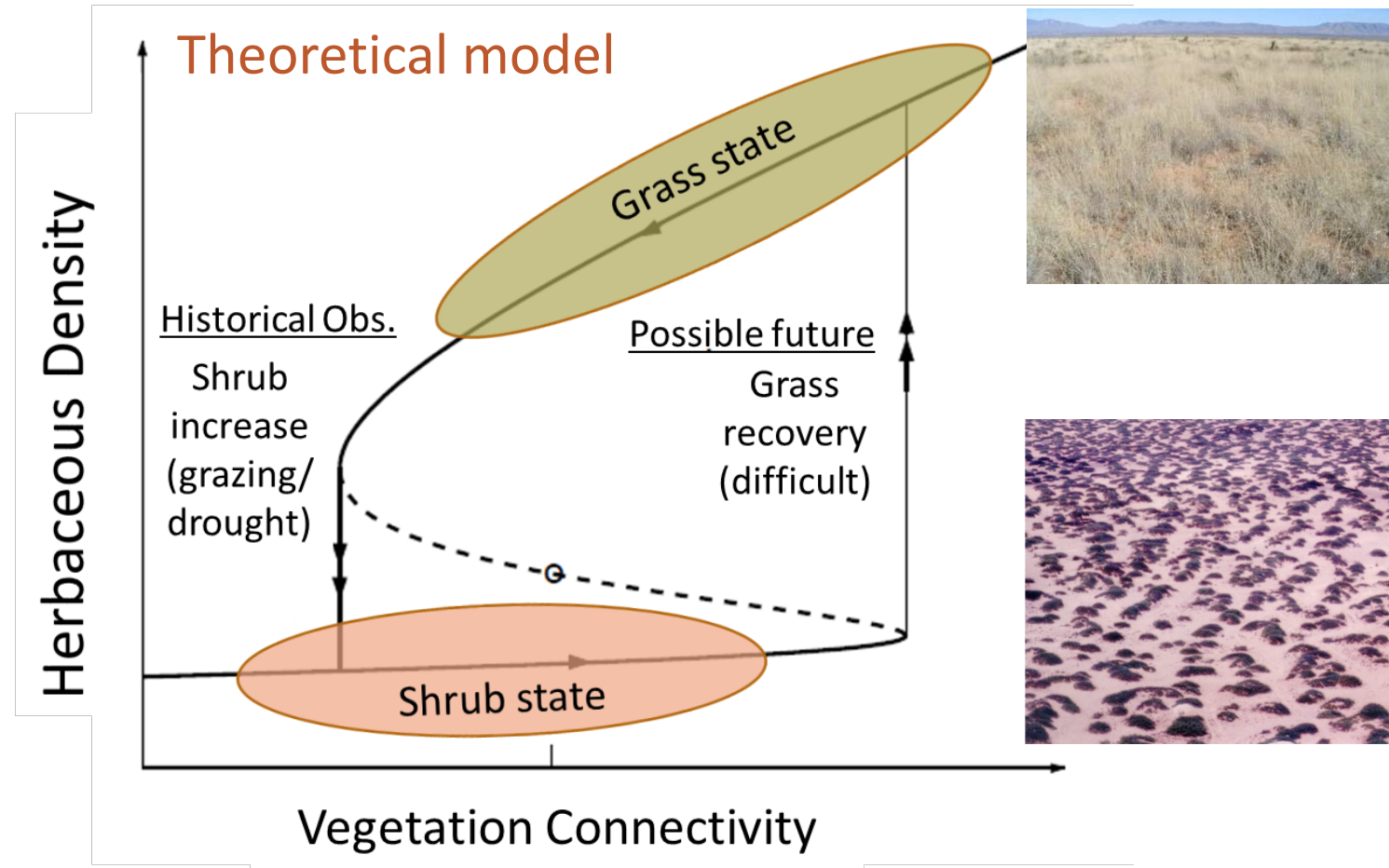
- Shrub encroachment and grass recovery
- Identifying processes / feedbacks for grass loss and grass recovery
- Demographic and density dependent processes
- Operating in time and space



JRN-LTER: State Transitions in Shrub-Grass Systems

JRN-LTER Example:

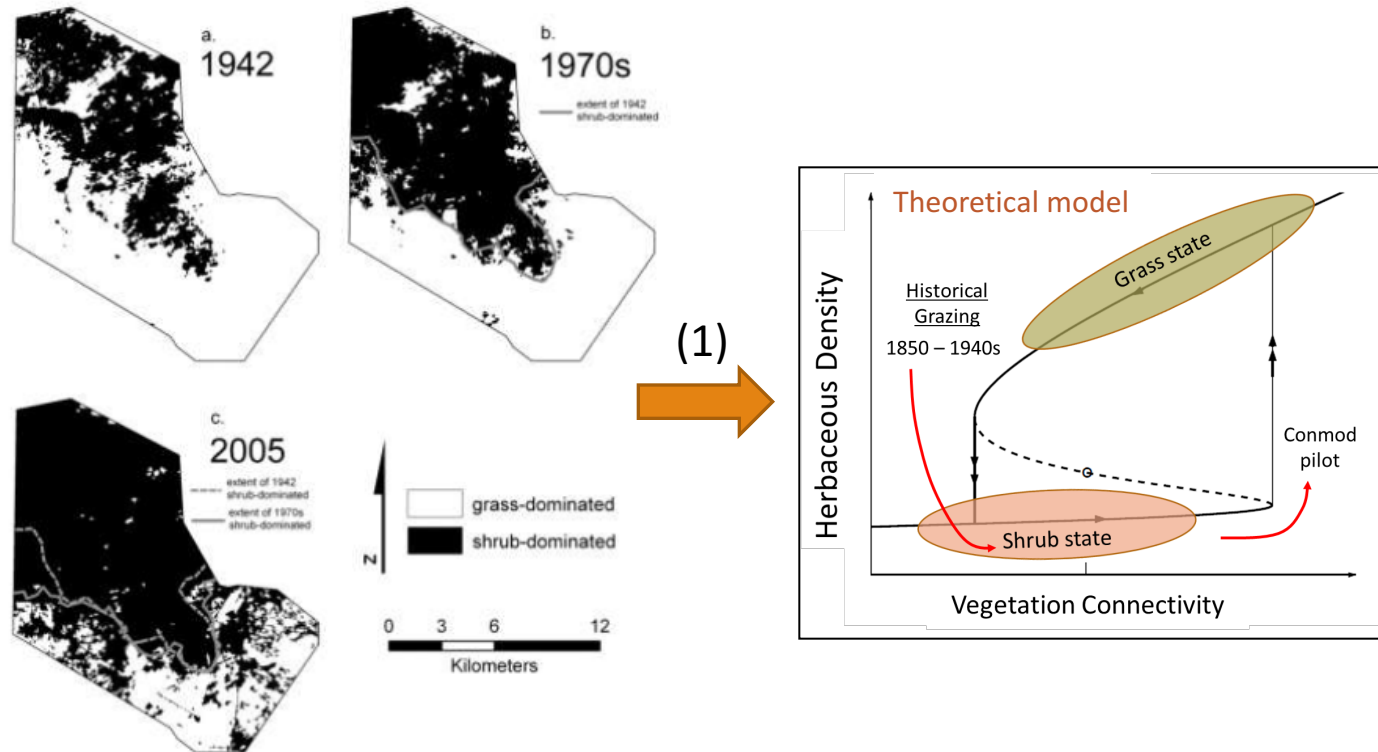
- Shrub encroachment and grass recovery
- Identifying processes / feedbacks for grass loss and grass recovery
- Demographic and density dependent processes
- Operating in time and space



JRN LTER-I to LTER-IV

(1) Shrub Encroachment Studies

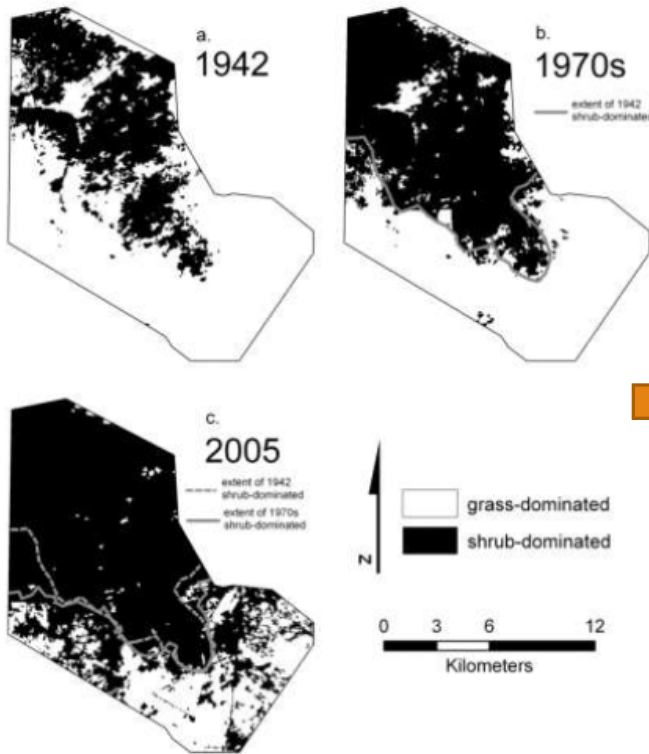
(1980s to 2000s)



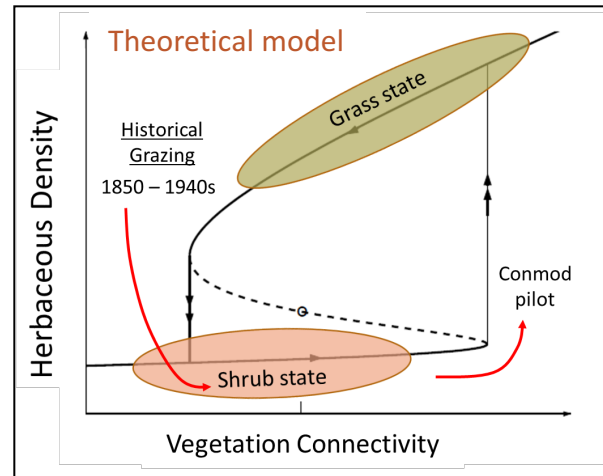
(1) Bare ground, seed transport by cattle, enabled shrub establishment; wind/sediment transport suppresses grass re-establishment and propagates spatially

JRN LTER-I to LTER-IV

(1) Shrub Encroachment Studies (1980s to 2000s)

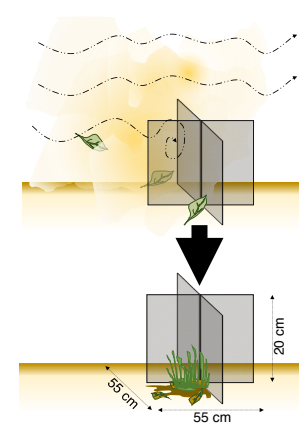


(1) →



JRN LTER-V to LTER-VI

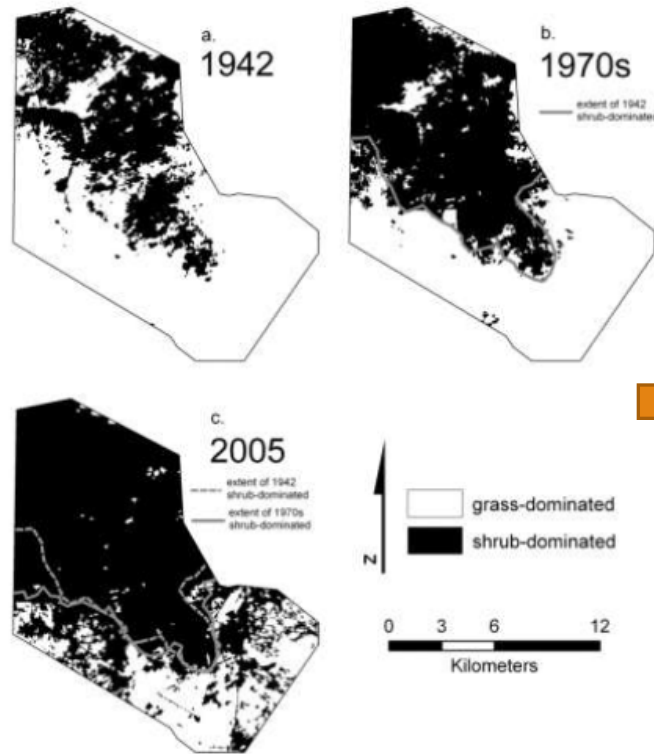
(2) Conmod Pilot Study (2008 to 2016)



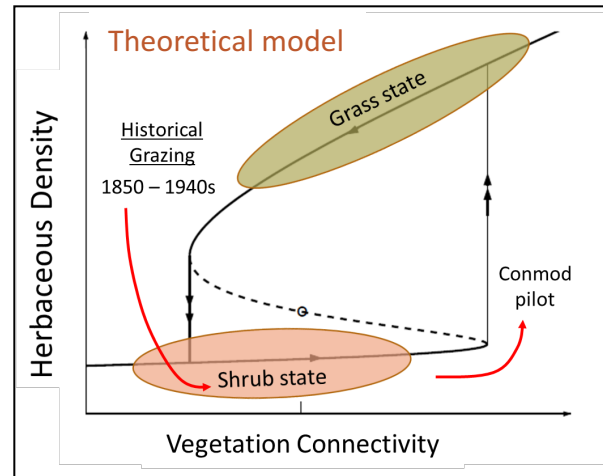
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JRN LTER-I to LTER-IV

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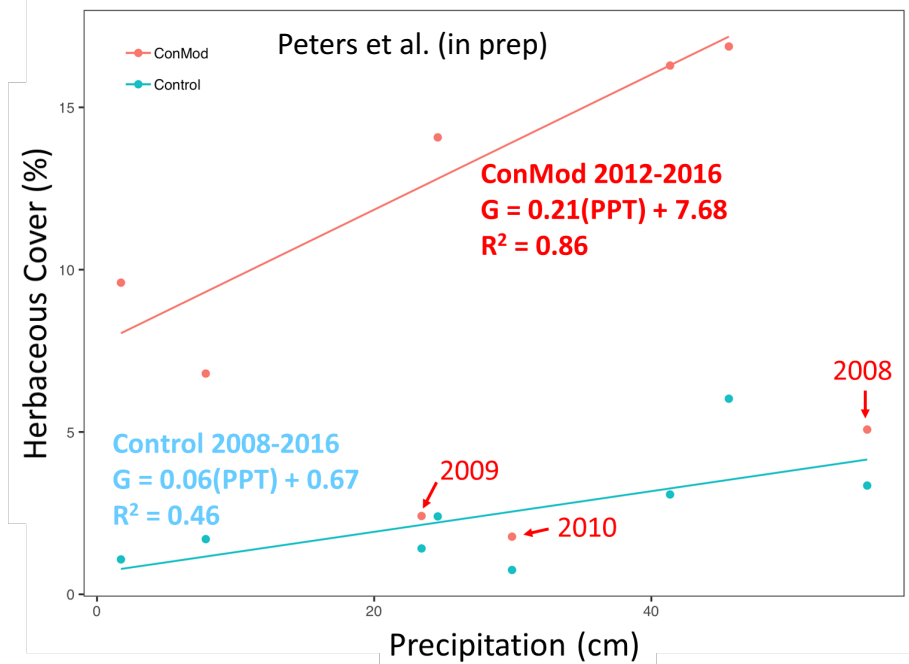
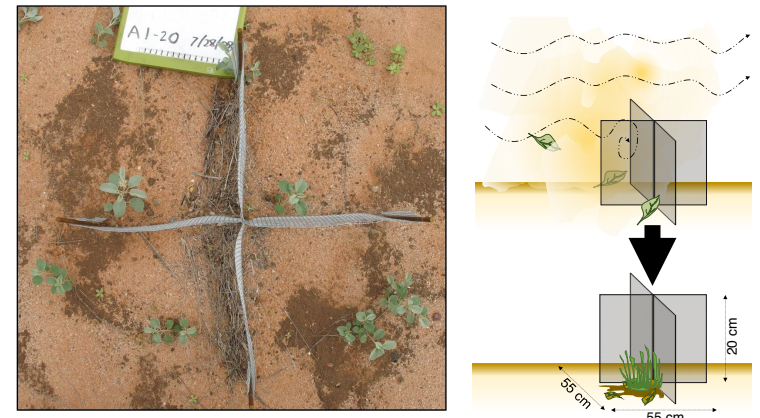


(1)



(2)

JRN LTER-V to LTER-VI (2) Conmod Pilot Study (2008 to 2016)

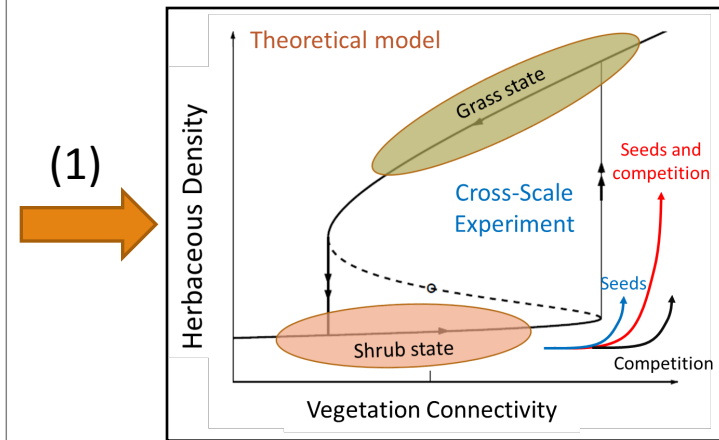
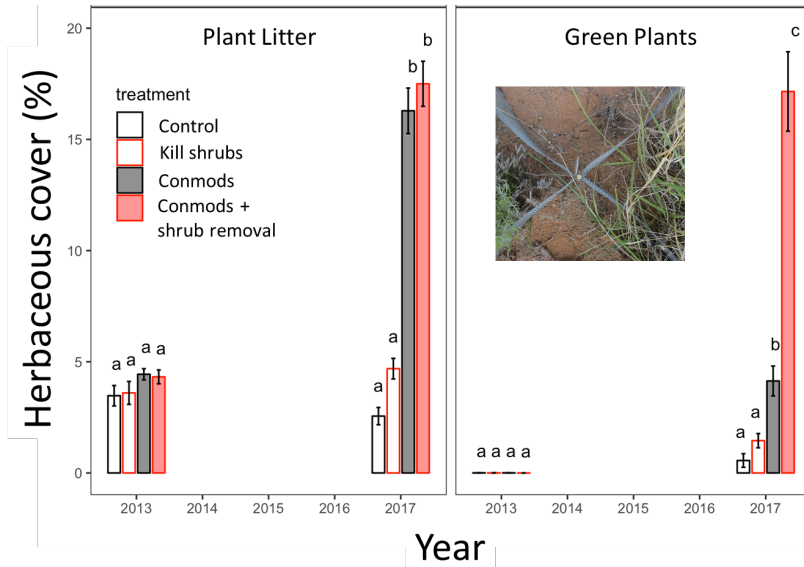


(1) Bare ground, seed transport by cattle, enabled shrub establishment; wind/sediment transport suppresses grass re-establishment and propagates spatially

(2) Connectivity-modifiers (conmods) reduce connectivity and wind erosion: after a short lag (for establishment) they produce a local state change (temporal state change)

JRN LTER-I to LTER-IV Cross-Scale Experiment (2012 to 2024)

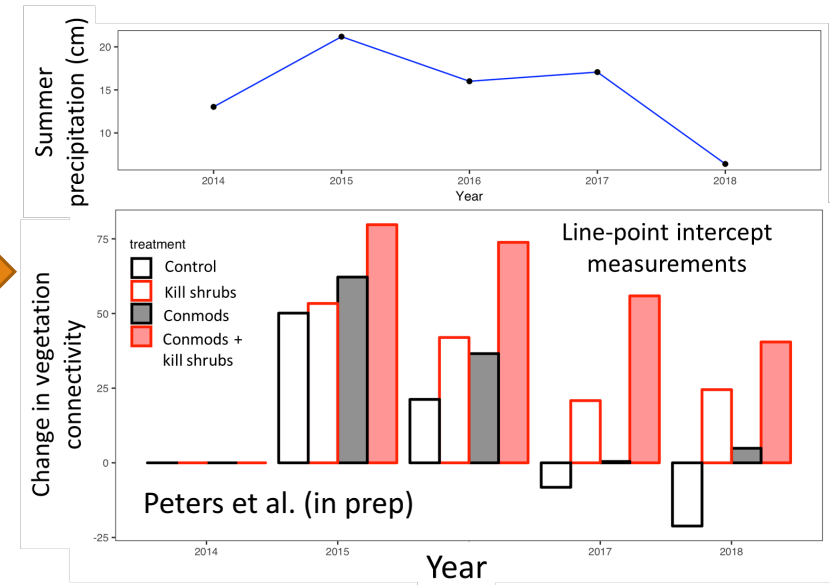
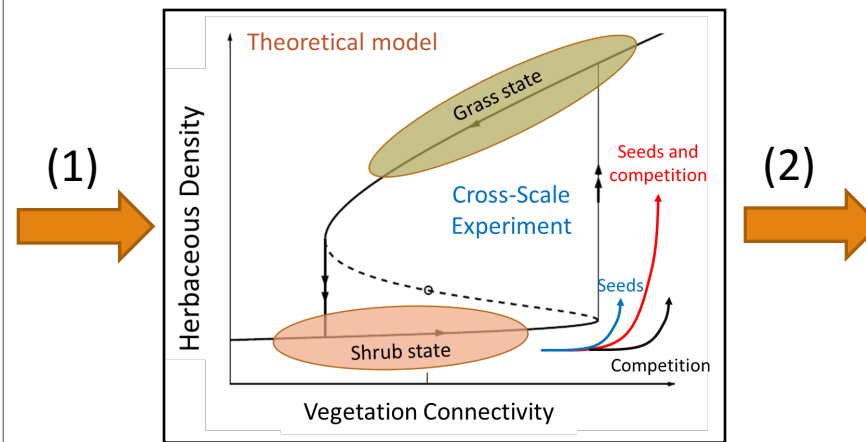
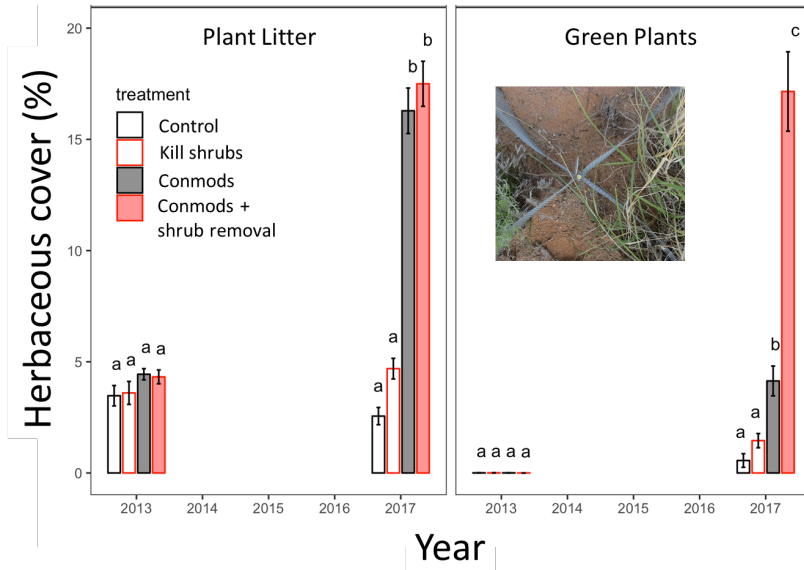
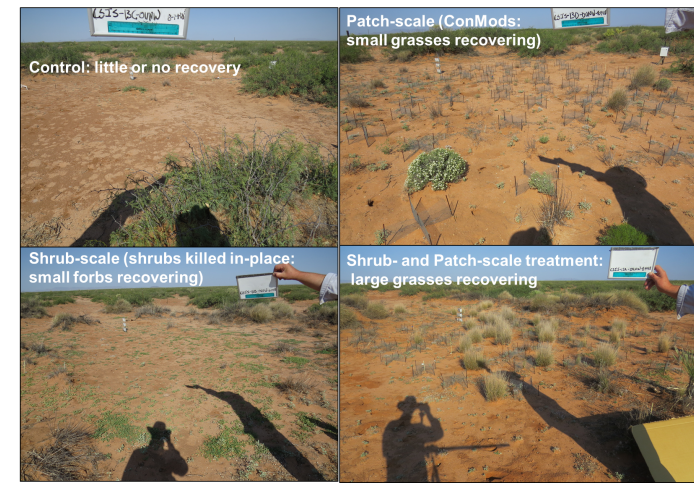
Conmod pilot led onto long-term experiment on the interaction of connectivity and shrub competition on grass recovery



(1) Conmod scale herbaceous increase (i.e. within conmod frames) suggests critical need for seedling establishment and reduced competition from shrubs (neither process is sufficient alone)

JRN LTER-I to LTER-IV Cross-Scale Experiment (2012 to 2024)

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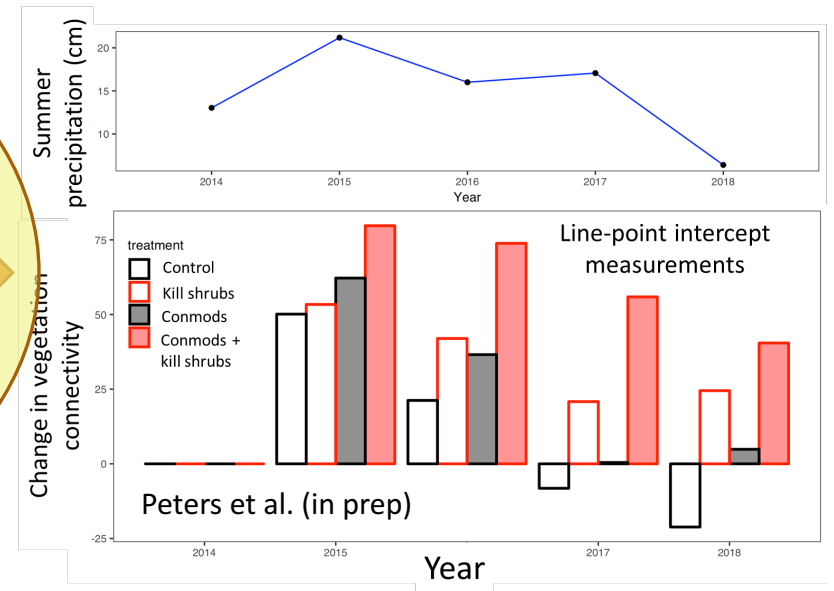
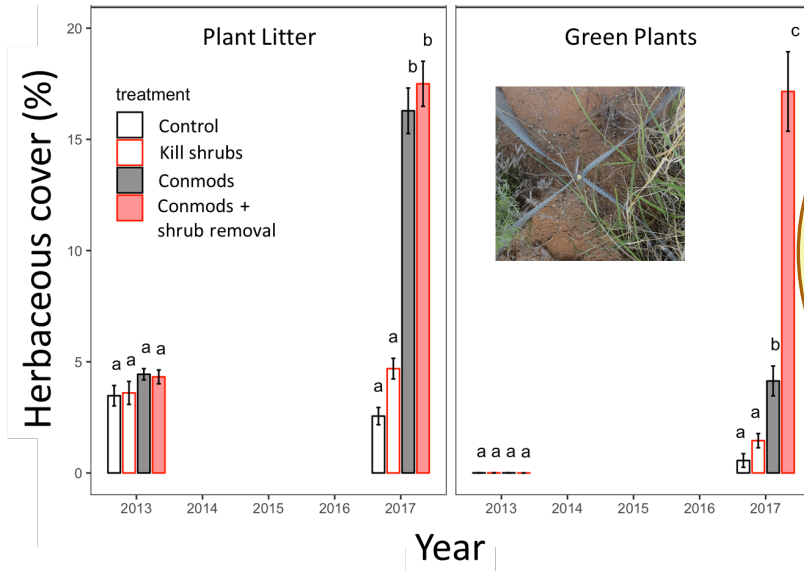
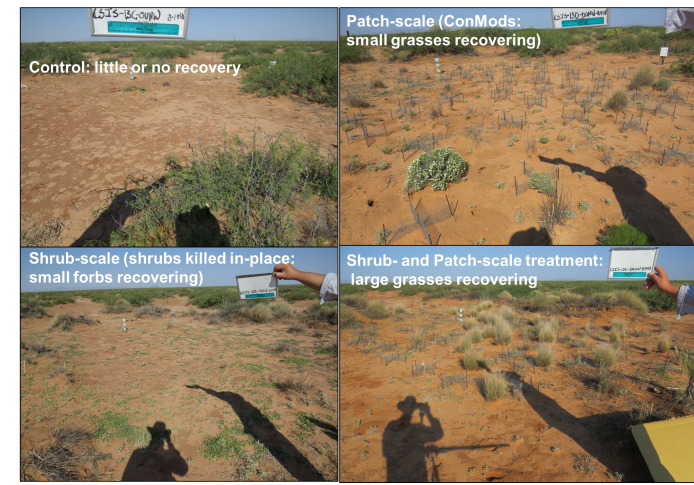


(1) Conmod scale herbaceous increase (i.e. within conmod frames) suggests critical need for seedling establishment and reduced competition from shrubs (neither process is sufficient alone)

(2) Plot-scale measurements show treatment effects are propagating between the conmods (i.e. state change from bare to grassy is propagating in space)

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