

White Mtns

Mogollon Mtns

Globe

ARIZONA

Tucson

Nonequilibrium Theories of Biogeography

Lordsburg

NEW MEXICO

Nogales

CHIHUAHUA

Magdalena

SONORA

Reading: Brown

Nuevo Casas Grandes

Sierra Madre
Occidental

The Importance of Islands – Islands as Natural Laboratories

Lecture 20 Recap

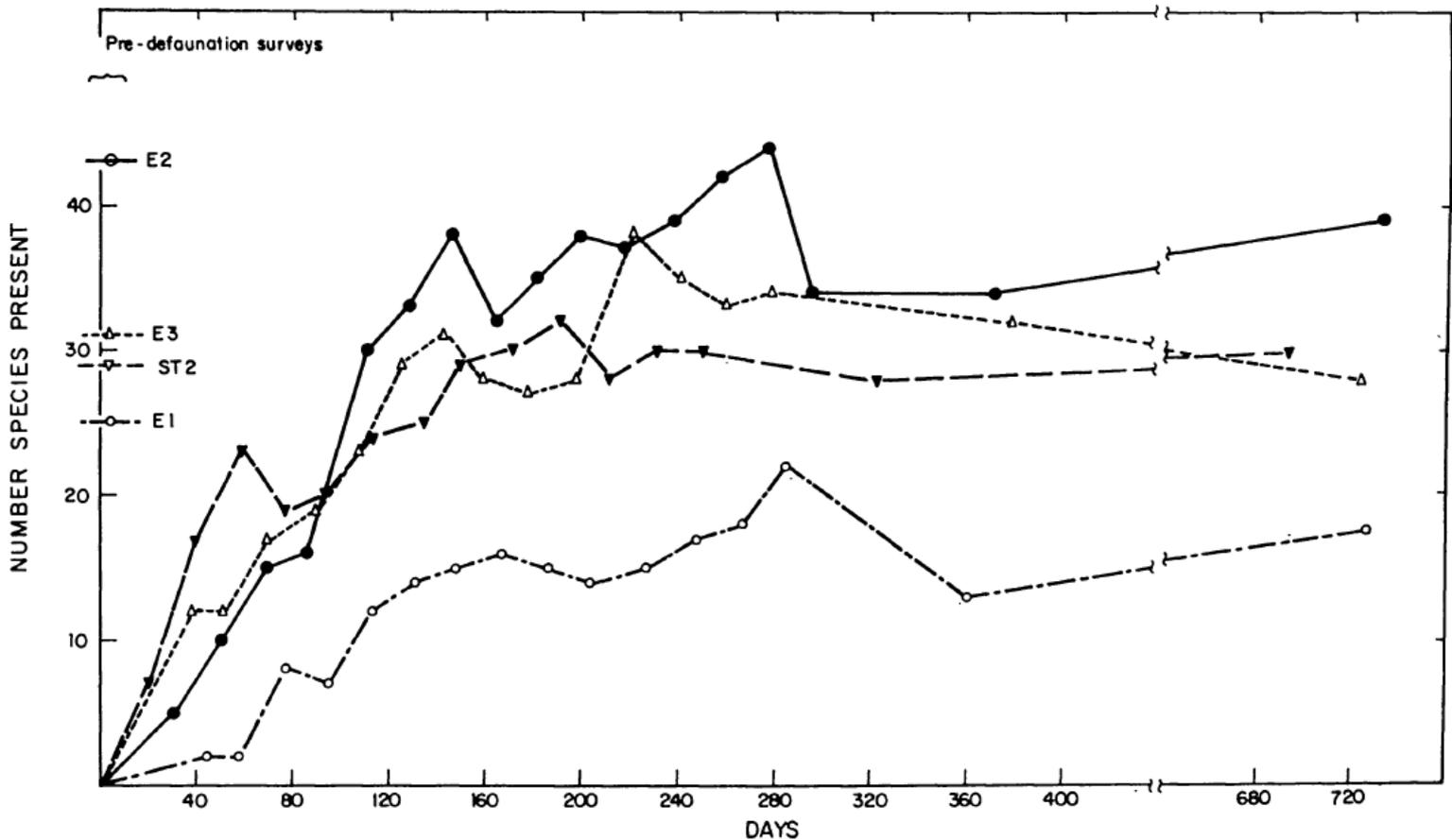


Simberloff &
Wilson



Simberloff &
Wilson

The Importance of Islands – Islands as Natural Laboratories





Simberloff &
Wilson

The Importance of Islands – Islands as Natural Laboratories

- Results demonstrated a return to an equilibrium state and then a balanced turnover due to offsetting colonization and extinction
- Provided strong support for the theory
- Interestingly, most islands showed a slight overshoot of the equilibrium state, then a fall, and then another rise to a new equilibrium point (assortative equilibrium)



Simberloff &
Wilson

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- One of the main issues with the equilibrium theory is that it treats the dominant ecological processes determining species composition on islands as stochastic and equivalent across species
- The theory does not account for any observed regularities in community organization; the role of competition, predation, and evolution in structuring island communities
- The major focus of contemporary studies in biogeography is the search for those processes, in addition to immigration and extinction, that account for overall community organization

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- MacArthur and Wilson implied that nonequilibrium islands could be found in nature, but that the equilibrium model represented the dominant signal
- There have been several prominent nonequilibrium ideas that have taken shape since the 1960's



James Brown

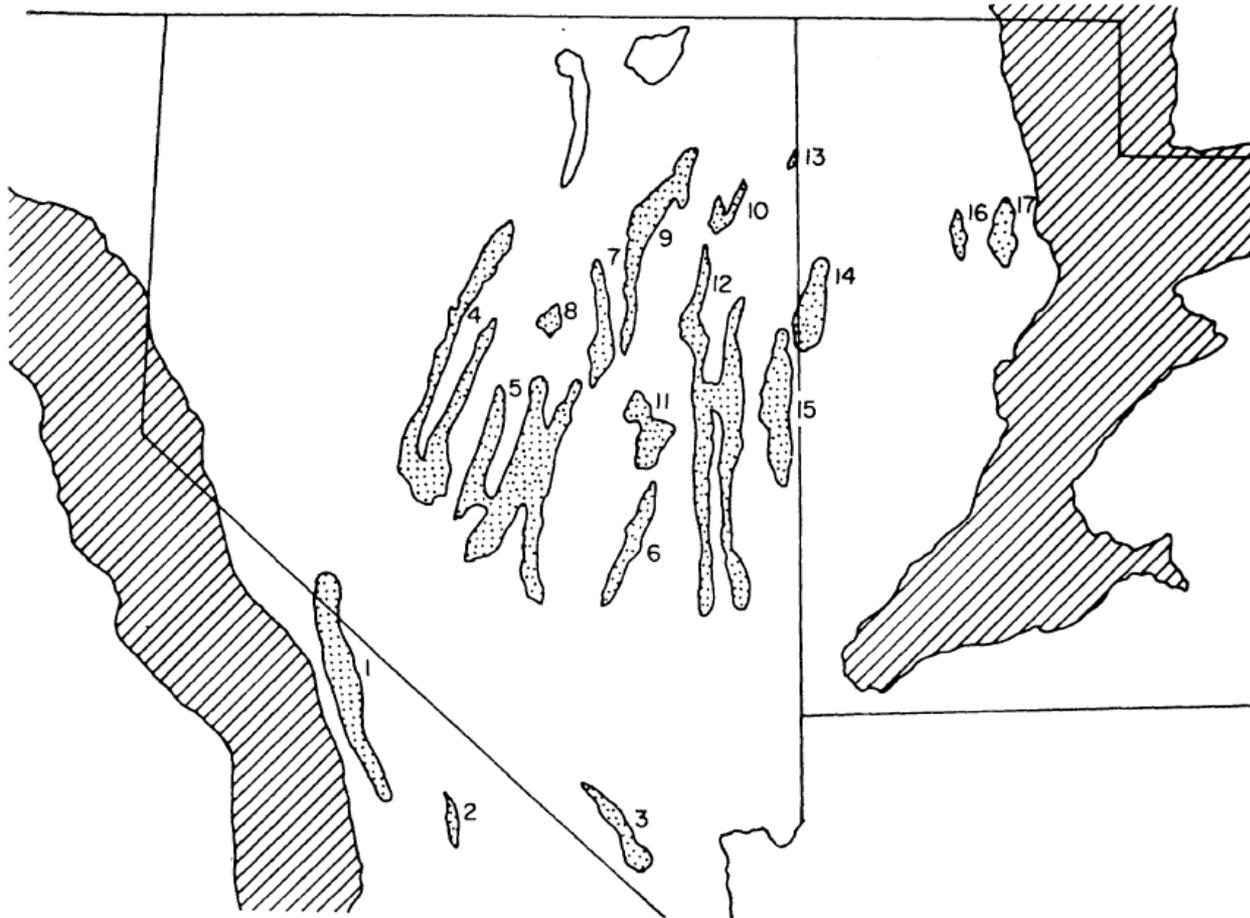
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- *Mammals on Mountaintops: Nonequilibrium Insular Biogeography*
- Studied 17 mountaintop islands across the American west
- These islands represent relicts from the Pleistocene when the desert barriers between these mountaintops were removed
- Varying areas and distance from the Sierra Nevada and Rocky Mountain ‘mainland’



James Brown

The Importance of Islands – Islands as Natural Laboratories





James Brown

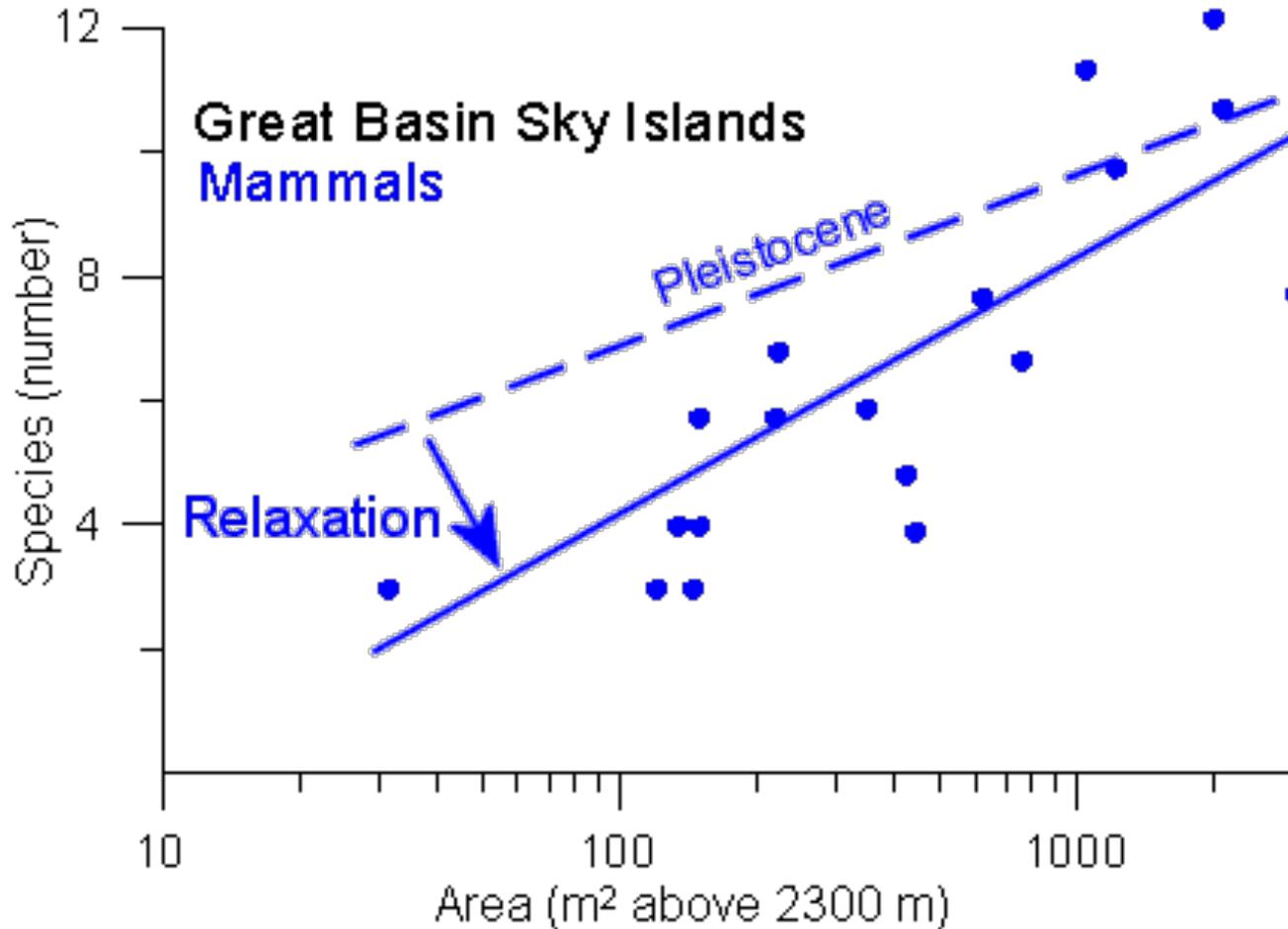
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- Brown found no correlation between species richness and variables likely to affect rates of colonization, like distance from nearest mainland
- Exceptionally low rate of immigration to isolated mountaintops
- Dominant process has been an attrition, or relaxation, of the fauna through extinctions
- Makes predictions as to which taxa (mammals vs. birds) are likely to be found to demonstrate equilibrium patterns



James Brown

The Importance of Islands – Islands as Natural Laboratories





Joseph
Connell

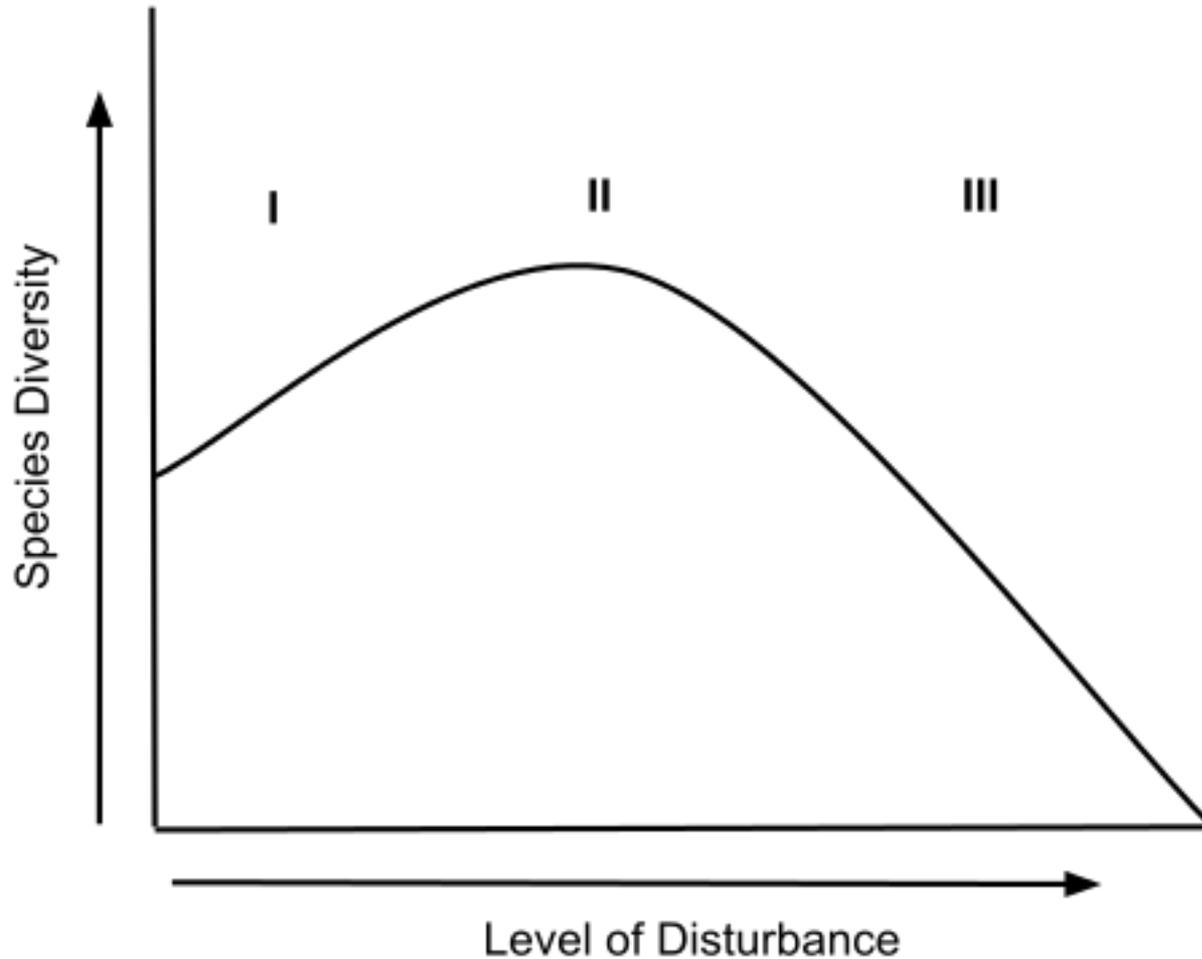
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- Intermediate Disturbance Hypothesis
- Diversity should be maximal in sites of intermediate intensity or frequency of disturbance
- High disturbance would lead to low richness and low disturbance would allow for competition to be the driving factor and result in relatively few species dominating



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Connell

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Main Points

- Nonequilibrium examples of island biogeography exist in nature
- Brown's paper showed relaxation or extinction as a function of island size, but no immigration to provide new colonizers
- Connell showed that intermediate disturbance could lead to maximal species richness, presenting a dynamic nonequilibrium model

Questions on the reading?