STAYING CONNECTED IN THE FACE OF CLIMATE CHANGE

A modeling, visualization, and design toolkit for climate refugia & wildlife corridors to inform adaptation planning and land management in the Golden Gate Biosphere.

Marina Stern - Master of Landscape Architecture & Environmental Planning, UC Berkeley
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THESIS RESEARCH PLAN

• Abstract & Research Questions
• Theoretical Framework
• Site Description
• Case Study & Precedent Analysis
• Research Methods
• Resources
This research seeks to develop an analysis of landscape connectivity in the Golden Gate Biosphere across multiple target species.
I. RESEARCH QUESTIONS

Considering multiple species in a heterogeneous landscape, where are potential climate corridors located for target species in the Golden Gate Biosphere?

- How do the results of varying connectivity analysis methods compare? Can these methods be used to better inform corridor locations?

- How might refugia and corridor adaptation strategies be visually depicted and modeled to communicate climate risks?

- How can this information be synthesized into a cohesive planning toolkit consisting of climate adaptation strategies and potential application methods?
II. THEORETICAL FRAMEWORK

- Island Biogeography
- Landscape Ecology
- Participatory Ecology & Ecological Urbanism
III. SITE ANALYSIS

URBAN
177,762 acres

GRASSLANDS
346,334 acres

RURAL RESIDENTIAL
85,091 acres

GRAZING
562,103 acres
IV. CASE STUDY & PRECEDENT ANALYSIS

**ARCGIS SPATIAL ANALYST**
- Cost-distance: Identifies path(s) that minimize total travel cost (cost-weighted distance) between source and destination.
- Requires designation of source-destination pairs. Does not account for dispersal distance limitations or affects of path redundancy on connectivity.

**UNICOR**
- Applies modified least-cost path algorithm to all pairs of species' locations, combines to form density map.
- Outputs network of (smoothed) paths, not continuous corridor surface. Often oversimplifies.

**CONNECTIVITY ANALYSIS TOOLKIT (CAT)**
- Network Flow: Optimization problem identifying distribution of movement across landscape that maximizes flow of dispersers between source and destination.
- Computational intensity increases exponentially with number of cells. Requires designation of source-destination pairs. Does not account for dispersal distance limitations.

**CIRCUITSNAPE & OMNISCAPE**
- Circuit Theory: Treats landscape as electrical circuit with probability of movement dependent on resistance, accounts for positive effect of path redundancy on connectivity.
- Computational intensity increases exponentially with number of cells. Requires designation of source-destination pairs. Does not account for dispersal distance limitations.
- Circuitscape with a moving-window algorithm to quantify ecological flow (potential connectivity). The algorithm incorporates all possible pathways between movement sources and destinations and identifies areas of high flow via low-resistance routes.

**LINKAGE MAPPER**
- Cost-distance modeling, circuit theory modeling, graph theory analysis, pinch-point and barrier analysis, climate gradient corridor analysis.
- Does not account for dispersal distance limitations.
- *However, capability to use multiple methods of corridor analysis in combination with one another*
V. RESEARCH METHODS

A. Analysis
   • Suitability analysis for core habitat
   • LinkageMapper for corridor identification

B. Planning
   • Typologies of corridors and barriers

C. Design
   • Downscaled corridor design
A. SPATIAL ANALYSIS
Suitability analysis for core habitat

Opportunities + Constraints = Core Habitat
A. SPATIAL ANALYSIS
LinkageMapper Corridor Analysis

• Core Area – *Suitability of Core Habitat*
• Resistance Raster
• Climate Raster

Potential to use species distribution and climate projection data as “check point” 
(Point Blue and other resources)
B. PLANNING

Typologies of corridors and barriers: Case Studies
KIT OF PARTS

The LA River Master Plan utilizes a kit of parts that includes possible design typologies for sites along the LA River. Each typology is associated with certain Master Plan goals. These parts may be combined in different ways and are intended to support biodiversity of species & habitats along the river.
C. DESIGN

Potential Sample Design Project:
Point Reyes

Site Visits & Photo-Journaling
Plan, Section, Axon & Diagrams, Perspectives
IV. BIBLIOGRAPHY (Some Notable Resources)

Spatial Analysis & Planning

- Achieving climate connectivity in a fragmented landscape *By Jenny L. McGuire et. al.*
- Principles of Wildlife Corridor Design *By Monica Bond*
- Wildlife Connectivity: Fundamentals for conservation action *By The Center for Large Landscape Conservation*
- Rapid conservation assessment for endangered species using habitat connectivity models *By Danica Schaffer-Smith*
IV. BIBLIOGRAPHY  (Some Notable Resources)

Landscape Architecture

- Four Corridors: Design Initiative for RPA’s Fourth Regional Plan By Lewis Nordenson Seavitt
- Patch Analysis By Victoria J. Marshall et.al.
- Infra Eco Logi Urbanism: A Project for the Great Lakes MegaRegion By Geoffrey Thun et.al.
- Resilient City: Landscape Architecture for Climate Change By Elke Mertens
Analysis – Planning - Design