Title: Using Circuitscape for Restoration Planning

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Summary: Circuitscape is adept at finding least cost pathways between protected areas and thus areas that need to be conserved to maintain current connectivity. In this lab, Circuitscape was used to compare landscape connectivity before and after restoration and explore sensitivity to changes in landscape resistance conditions. We found that adding restored areas to the model can potentially improve connectivity conditions. Modeling of post-restoration scenarios can further help planners understand and manage better the impact of restoration projects and lower uncertainty of restoration due to model sensitivity.

Problem: Restoration planning is more complex than conservation planning, due to the emphasis on desired future conditions and social concerns associated with conservation. However, there is uncertainty when using models, such as Circuitscape, for restoration action planning.

Approach: Circuitscape is a model that predicts the probability of an individual finding the least cost pathway between protected areas. It applies the electric circuit theory and the random walker theory to find connectivity quality and barriers that inhibit it. In this lab, we ran another Circuitscape model for the two core areas in the Columbia Delta ecoregion with the inclusion of a 1 km^2 restored strip of agricultural land and the resulting resistance layer. The Linkage Mapper, Pinchpoint Mapper, and Barrier Mappers were used to find the least-cost pathways, corridors, pinch points, and barriers. We then compared the results to the previous week's lab.

Results: The least cost pathway shortens and goes the shortest distance between the two core areas after restoration (Figure 1b). This is different from the previous analysis where the least cost pathway went along the lake to connect the two areas (Figure 1a). The least cost corridors, with the 200,000 m cutoff distance, also reflect this change in response to restoration (Figure 2). Connectivity barriers have also increased in amount, with a new patch of high barrier impact near Area II for the new pathway along with the high barrier patch from the old corridor (Figure 1b).

Conclusions: The results from the recent Circuitscape analysis showed significant impacts on connectivity between protected areas after restoration, showing its potential for restoration planning. However, the relative value of restoring different areas for connectivity can vary depending on the restoration goals. Circuitscape is also sensitive to landscape resistance changes, so restoring different areas within the ecosystem Improving connectivity does not guarantee that the ecosystem can be restored to its historic conditions, since alternate stable states are possible. Nevertheless, using Circuitscape can help conservation planners learn from past and present connectivity conditions, address the needs of the whole ecosystem, and plan for the long term.

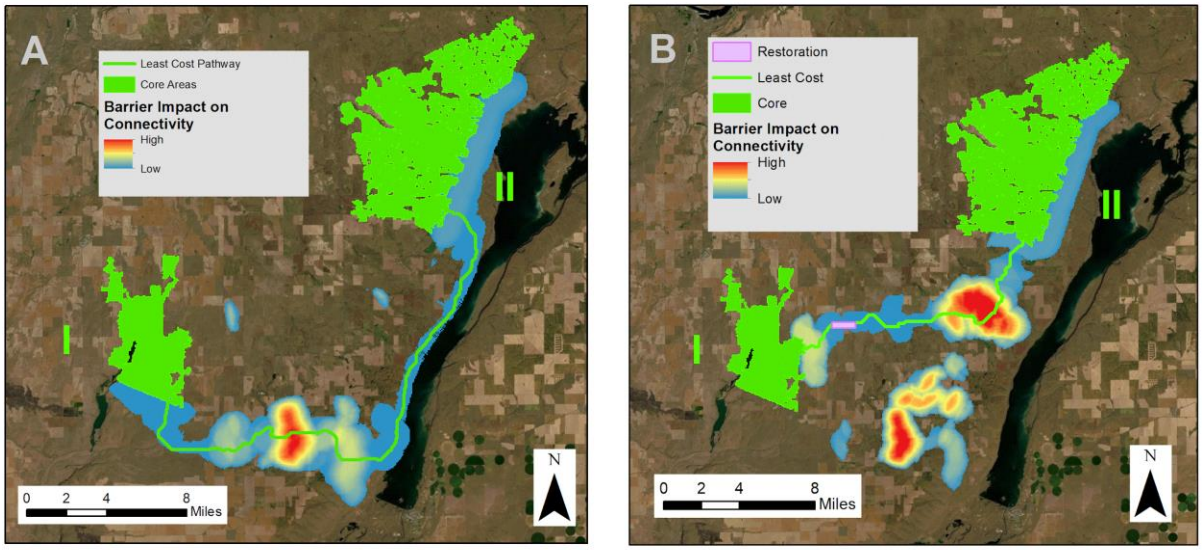

Figure 1. A comparison of least cost pathways and connectivity barriers before and after restoration. (A) The least cost pathway (the green line) spans a long distance and connects to the outside edges of the core areas (shown in green), with barriers concentrated in one part of the pathway (shown in red) prior to restoration. (B) The least cost pathway goes through a shorter, more straightforward distance after restoration, although a bigger concentration of high barrier impact is shown near area II.

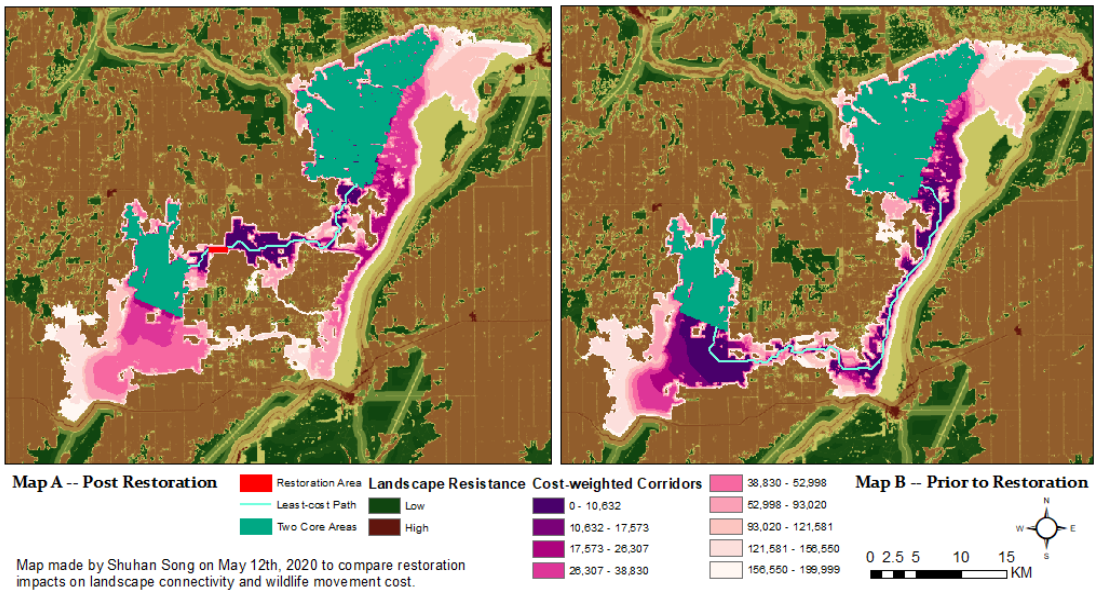

Figure 2. Comparison of corridor cost pre- and post-restoration. Map A and Map B give very different cost-weighted corridors and least-cost path (LCP) due to a 1km^2 restoration area implemented shown in Map A. Corridor around LCP in Map A were cut out of the 20 km threshold in Map B, while the corridor values around LCP in Map B were much higher than values in the same location in Map A. This difference suggested Circuitscape sensitivity.