CENTER for LARGE LANDSCAPE CONSERVATION

A.P.E. Project

(Assess. Protect. Evaluate.)

Maintaining Connectivity for Arboreal Species Through the Preservation of Natural Canopy Bridges During Pipeline Construction in Peru

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Introduction

Construction of linear infrastructure (LI), such as natural gas pipelines, can disrupt canopy connectivity and negatively impact arboreal species, including primates. There is a variety of existing mitigation solutions to reduce the impact of LI development, such as avoidance of critical habitat or ecological corridors and construction of arboreal crossings to reconnect canopy connectivity post-construction. However, one of the simplest and most effective solutions may be to design development projects which maintain canopy connectivity throughout construction. One such example of this approach is the Kinteroni natural gas pipeline found in the Lower Urubamba region of Peru.[1]

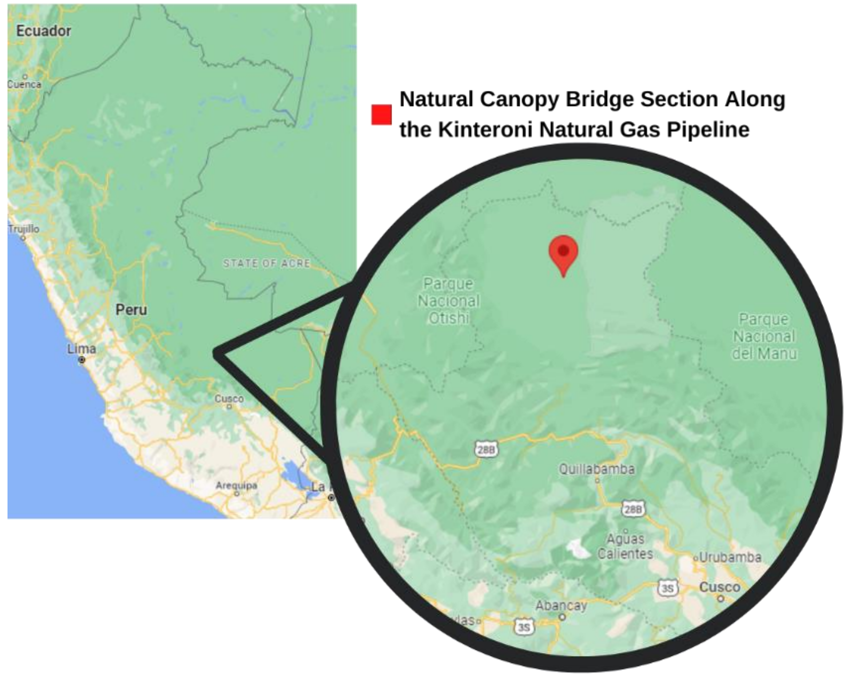

Figure 1. Location of Natural Canopy Bridge Section Along the Kinteroni Natural Gas Pipeline, Peru.

Bridge Selection Criteria

Researchers worked closely with the pipeline project personnel to evaluate the connectivity of the canopy above the proposed right of way (RoW) in a 23 km section to identify potential locations where natural canopy bridges could be maintained. The team outlined strict selection criteria, allowing them to identify 21 possible bridges. Bridge selection criteria included engineering constraints such as:

- Minimum distance between trees on either side of the RoW is 8m;
- Bridges may not be located on inclines, curves, or a narrow ridge;
- Bridges cannot occur where two pipe strings join;
- Bridges cannot be located where temporary construction storage will occur (i.e., topsoil depository, pipe storage, etc.) due to the needed width for the RoW in these areas.

Of the 21 potential bridges maintained during the clearing of the RoW, only 13 remained after construction due to damage or death of trees from construction activity or insufficient canopy connection points after clearance of surrounding trees. In total, there were 25 points of canopy connection among the 13 canopy bridges.

Cost

The researchers described the cost of maintaining these natural canopy connections over the pipeline as almost non-existent due to the pre-project planning. Incorporating these canopy connectivity safeguards early in the project development stream and combining the selection of the potential natural canopy bridges to coincide with field visits to determine the RoW significantly reduces the financial burden on the development corporation. Only one of the 13 bridges required additional time (and therefore, additional cost) from the construction team as the trunks of the selected trees were close in proximity, only 8m apart. This required an extra day of coordinated personnel and specialized machinery to avoid tree damage.

Criteria to Increase Canopy Bridge Use

Based on observations of primate use of the canopy bridge only a week after exposure from construction, researchers on this project suggest that since natural canopy bridges utilize existing substrate and structure (as opposed to an artificial bridge) that the period of habituation is much lower and may result in almost immediate use by arboreal species.[2] Case studies of artificial bridge use vary, but often there is a significant gap in time between installation and the first crossing.[3] This insight suggests that preserving existing natural canopy structures can have immediate mitigation benefits.

Based on the observations from other canopy connectivity projects and their own experience, the researchers suggest that natural canopy bridges are likely to be used more frequently and by a great variety of species if they meet the following four criteria:

1. Natural canopy bridges should connect at multiple points, providing a higher number of canopy crossing options
2. Branches of the trees forming the natural canopy bridge should be in complete contact, reducing the need for animals to jump between gaps
3. Natural canopy bridges should be well connected to the adjacent forest
4. Natural canopy bridges should provide cover from foliage, reducing the potential for exposure to predators

Minimum recommended distances between bridges can vary significantly based on the arboreal species present and understanding of species habitat requirements and territory range. They suggest that LI projects in tropical forests aim to place natural canopy bridges within 300m of each other or closer. They saw no indication that higher bridge density would result in fewer crossings per bridge. Bridge placement and frequency will also depend on the pipeline's characteristics and the route's natural topography. Ultimately, the more canopy connections that can be maintained, the better.

Conclusion

As the use of natural and artificial canopy bridges to mitigate the impacts of linear infrastructure continues to grow, it is essential to emphasize the need for continued production of case studies and dissemination of research. Bridge type and efficacy will always be context specific. Bridge selection will vary greatly depending on target species, infrastructure type, canopy structure, and budget. Any future mitigation projects must provide sufficient post-construction monitoring and ensure insights and knowledge are continually shared broadly so that the mitigation benefits of these structures can be maximized across the globe.

References

1. Gregory, T., Rueda, F. C., Deichmann, J., Kolowski, J., Faura, M. C., Dallmeier, F., & Alonso, A. (2013, June 26). *Methods To Establish Canopy Bridges To Increase Natural Connectivity in Linear Infrastructure Development*. SPE Latin-American and Caribbean Health, Safety, Environment and Social Responsibility Conference. https://doi.org/10.2118/165598-MS

2. Gregory, T., Carrasco-Rueda, F., Alonso, A., Kolowski, J., & Deichmann, J. L. (2017). Natural canopy bridges effectively mitigate tropical forest fragmentation for arboreal mammals. *Scientific Reports*, *7*(1), 3892. https://doi.org/10.1038/s41598-017-04112-x

3. Chan, B. P. L., Lo, Y. F. P., Hong, X.-J., Mak, C. F., & Ma, Z. (2020). First use of artificial canopy bridge by the world's most critically endangered primate the Hainan gibbon Nomascus hainanus. In *SCIENTIFIC REPORTS* (Vol. 10, Issue 1). NATURE RESEARCH. https://doi.org/10.1038/s41598-020-72641-z