CENTER for LARGE LANDSCAPE CONSERVATION

A.P.E. Project

(Assess. Protect. Evaluate.)

Estimating the Road Effect Zone for Apes

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Introduction

As roads increasingly bisect forest habitats across the tropics, it is important to understand the effects of road development and subsequent increased human impacts on the forests where species of concern occur. Developers need to have excellent policy guidance for planning new roads to avoid areas of high biodiversity and conservation concern, and to mitigate the damage existing roads inflict on landscapes and species, far beyond the tarmac and verges of their physical boundaries.

Figure 1. Location of Western chimpanzee range

Animals undergo behavioral changes and increased stress when their territories are impacted by roads and fragmented by forest loss. In colobus monkeys in Uganda, increased human access to forests increased stress levels which were measured by increased fecal cortisol levels. Gut parasites were also measured and over 15 years as forest patch sizes rapidly declined, parasites and stress hormones increased. Monkeys living in small forest fragments also shared bacteria with nearby humans and livestock at higher rates than those living in protected areas or larger forest patches.[1]

Road Effect Zones

The effects of roads and disturbance on species is an emerging science, and the zone of ecological influence has been estimated by quantifying the reduction in density of a particular species as well as the spatial extent of ecological effects that extend beyond the physical borders of the road and called the road-effect zone or REZ.[2-4] These REZ's are meant to be used to inform developers to design better wildlife-friendly infrastructure and to avoid placing infrastructure in critical habitats. They are also meant to be used to inform and demand the use of the mitigation hierarchy to reduce or minimize impacts on species where noise, light, contamination and human presence affect species behavior and survival over time.

The extent and severity of many of the ecological impacts of linear infrastructure are influenced by many factors including the width of the road, power line, rail or canal, density of the network, the type, volume and speed of vehicles, type of road surface, maintenance of verge or lands under lines, and other design features.[5] These impacts extend well beyond the footprint, in some cases thousands of meters from the footprint of the road.[6] This concept has been applied to railways and could similarly be applied to canals and power lines.[7]

REZ's are species specific and vary widely in area, from the requirements of small animals like invertebrates, birds, amphibians and small reptiles, to large, wide-ranging mammals including African forest elephants, impala, and frogs which all exhibited lower densities and activity levels near roads.[8-10] There is only one

published REZ for non-human primates, whose REZ areas are necessary to understand because the vast majority of ape populations are at risk due to linear infrastructure development.[11]

Estimating REZ for Chimpanzee

Andrasi et al. (2021) developed a REZ for western chimpanzees, whose population has declined by 80% since the early 2000's and are critically endangered based upon ecological threshold analyses to develop a REZ that can be used to base other primate conservation REZ calculations.[12] They used road data from public data bases, organizations and hand digitization from satellite imagery and delineated major and minor roads into two different categories of major (paved and wide) and minor (more narrow, un-paved) roads. They used IUCN's accepted western density chimpanzee distribution.

Chimpanzee REZ was defined as the areas and distance where chimpanzee densities decreased in proximity to roads. 14.5% of chimpanzee range is within 1 km of a major road across their range. The average density of chimpanzees peaked at 17 km from the closest major road (0.1 individuals per km2) and the REZ of major roads for the western chimpanzee is estimated to be between 15.8 and 18.6 km. For minor roads 41.7% of their range is located within 1 km of a road. Average chimpanzee density values peaked at 5 km from the closest minor road (0.1 individuals per km2). The REZ of minor roads for the western chimpanzee is estimated to be between 4.9 and 5.8 km.

Andrasi et al state: We argue that in cases where the REZs overlap protected areas, it is imperative that their legal status is maintained through better funding from developers to support the enforcement of existing laws, which can help reduce human pressures inside park boundaries. For instance, Liberia's oldest protected area, the Sapo National Park, experienced high levels of human encroachment partly mediated by the surrounding major roads. However, in 2018, after Community Watch Teams and the Forest Development Authority ramped up efforts to enforce the protection of the park, illegal mining activities within its borders ceased.

Conclusion

All great apes are impacted by roads, and for western chimpanzees, Andrasi et. al determined that only 4.3% of their range is NOT impacted by roads. More analyses are needed to understand REZ's for primates in general and all great apes specifically. This also highlights the need of cooperation and policy development at all levels to prevent road building through any ape range. Excellent mitigation strategies and continual monitoring are needed across ape ranges where roads exist. In the face of continued pressures to develop natural resources in chimpanzee range, this will require all stakeholders to work towards reducing any and all impacts of roads to ensure conservation of chimpanzees and other great apes.

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