

## Impact of road widening on wildlife in Namdapha National Park, Arunachal Pradesh, India: a conservation issue

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Human activities have modified and altered the natural habitats in numerous ways. The most remarkable changes involve widespread degradation of entire areas, such as a shift from forest to agricultural use. However, a more pervasive influence is the construction of linear open areas like tracks, paths, and roads through previously continuous habitat (Forman, 2000). Roads act as a part of development and this part, connectivity being a priority, large areas of pristine habitats have been sacrificed resulting in several direct and indirect negative impacts on ecosystems (Goosem, 2007). Also, roads act as large threat to some wildlife populations (Forman, *et al.*, 2003) acting as complete or partial barriers for their movement (Brody and Pelton, 1989; Burnett, 1992; Mader, 1984; Oxley, *et al.*, 1974; Rondinini and Doncaster, 2002; Shine, *et al.*, 2004; Van Gelder, 1973). Such barriers lead to fragmentation of habitats and reduce population persistence by reducing recolonization of empty habitats by limiting immigration. Namdapha National Park (NNP) (27° 23' 30"– 27° 39'40" N, 96° 15' 2"– 96° 58' 33" E) comprising of 1985 sq. km area is situated in the eastern Himalayan region of Arunachal Pradesh. It harbours some of the northernmost lowland tropical rainforests in the world (Proctor, 1998) and extensive dipterocarp forests (Arunachalam, *et al.*, 2004) and accentuated as a high priority habitats for large carnivore conservation such as tiger (Wikramanayake *et al.*, 1998). The habitat heterogeneity of the park is due to vast differences in altitude (elevation ranges from 200 m to 4,571 m above sea level) and various habitat types ranging from subtropical broad-leaved forests, subtropical pine forests, temperate broad-leaved forests, alpine meadows to perennial snow capped peaks (Datta, *et al.*, 2008). The primary forest cover dominates the park area. However, extensive bamboo and secondary forests are also evident. The diverse Mammalian assemblage of the region could be due to its geographical positioning within the Himalaya and the Indo-Burma global biodiversity hot-spots (Murali Krishna, *et al.*, 2012) and also, being hemmed in at the junction of the Palaearctic and Malayan bio-geographic realms (Datta, *et al.*, 2008). NNP harbours 96 species of mammals, 453 birds, 25 amphibian, 50 reptiles, 76 fishes, 140 butterflies and moths and numerous invertebrates (Ghosh, 1987) including many least known, endemic, threatened, endangered and critically endangered floral and faunal species (Saha, 1981; Adhikari, *et al.*, 2003; Datta and Goyal, 2008; Datta, *et al.*, 2008a; Srinivasan, 2010;

Murali Krishna, *et al.*, 2012). A 157 km road (from Miao on the west to Vijoyanagar on the east) that passes through the park was built in 1972 (Datta, *et al.*, 2008b). Earlier road was motorable for 16 km within the park but in 2010-2011, Govt. of Arunachal Pradesh has given an order to widen the entire road in motorable condition up to Vijoyanagar to connect around 6000 population of *Lisus* and *Nepalis* living in Vijoyanagar area near Myanmar border.

In Oct-Nov 2011, we conducted surveys on Hoolock gibbons in Namdapha National Park during which, we observed the road widening works (ranging between 5-20 feet) progressing between Miao and Vijoyanagar (c157km) through Namdapha National Park. For this purpose JCB's and bulldozers were used to widen the road. Several mature large and wolf trees along the pre existing road were uprooted along with huge amounts of soil being pushed downhill. The direct evidences that we came across during the survey were the loss or reduction in the number of canopy bridges (cb). The number of cb in undisturbed areas were estimated to be 10 cb/500m and 3-4 cb/500m in areas where the road widening process is in progress during the study around Deban area of the National Park (Figure 1). The decrease in the canopy bridges hampers the movement of the arboreal animals from being dispersed from one portion of the forest to the other. This could result in the changing behavioural patterns of the species. The ability of a species to persist at sites after disturbance depends on its ability to modify its behaviour, ranging and dietary patterns to accommodate changes in forest structure and composition and also, key factors in determining survival of a species in its habitat are diet, degree of arboreality and nesting requirements (Datta and Goyal, 2008). Changes in these factors would ultimately lead to suppression of breeding of the species (Joshua and Johnsingh, 1994). Arboreal mammals such as hoolock gibbons are the worst among those which could get affected due to fragmentation and such disturbances have an impact on the primate species populations (Srivastava, *et al.*, 2001). Due to road widening, population of arboreal animals such as gibbons may be fragmented into small sub-populations. The fragmented subpopulations suffer due to inbreeding depression, loss of genetic variability and finally to local population extinction (MacArthur and Wilson, 1967; Caughely, 1994). However, till date very few studies relate genetic changes in population of which few are - e.g. the common frog *Rana temporaria* (Reh and Seitz, 1990),



**Figure 1.** Showing the progressing road widening works in Maio-Vijoyanagar Road, Namdapha National Park.

key deer *Odocoileus virginianus clavium* (Calvo and Silvy, 1996), possibly the grizzly and mountain lion in Alberta (Gibeau and Heuer, 1996). All these studies caution us about the upcoming problems.

The scrubby vegetation along the hilly slopes is lost due to clearings leading to landslides. Huge amounts of soil removed as a result of uprooting of trees being pushed down hills covered the burrows of many fossorial mammals affecting their habitat and to move in search of new habitats. The road widening provides scope for the vehicles to move fast which possibly could affect reptiles, amphibians and mammals.

Road mortality is one factor which is potentially important in declining populations of amphibians and reptiles' worldwide (Fahrig, 1995) such studies are given very less importance. Several studies have quantified road kills of many different taxa, e.g. toads (Van Gelder, 1973; Cooke, 1995), birds, mammals, amphibians, and reptiles (Hansen, 1982; Fuellhaas, *et al.*, 1989), butterflies (Munguira and Thomas, 1992), snakes (Rosen and Lowe, 1994), mammals, birds and reptiles (Drews, 1995), deer and other ungulates (Groot Bruinderink and Hazebroek, 1996; Romin and Bissonette, 1996).

We also observed Sambars and barking deers on the pre-existing forest roads feeding on the fallen fruits during the nights and basking at day time (Figure 2). As a



**Figure 2.** A Barking deer feeding on fallen fruits roadside



**Figure 3.** The canopy gap due to road widening

result of the road widening, many local people reported that there is a decreasing trend in sambar sightings on the road side. The road widening and extension may also lead to easy access for hunting and illegal poaching, trampling and damage to natural ecosystem in terms of forest product collection. Also, we observed a canopy gap of approximately 50-75m in areas where the road widening works are in progress which might affect the faunal diversity (Figure 3).

Necessary actions such as destruction of canopy bridges, removal of scrubby vegetation on the hilly slopes are to be decreased so that ecosystem's health can be ensured from getting degraded by such developmental activities. Activities such as construction of roads are also important part of management of protected areas as well as from the developmental perspective of local communities inhabiting the fringes of PAs. Roads help in patrolling and monitoring of the PAs, thus, serving in curbing the illegal activities. However, at the same time, developmental activities should not hamper the interest and requirements of wildlife in general.

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