OPINION

Road will ruin Serengeti

Tanzania's iconic national park must not be divided by a highway, say **Andrew Dobson**, **Markus Borner**, **Tony Sinclair** and 24 others. A route farther south would bring greater benefits to development and the environment.

Plans for building a two-lane road through 50 kilometres of the Serengeti National Park in Tanzania must be halted. The road will cause an environmental disaster by curtailing the migration of wildebeest. Evidence from other ecosystems demonstrates that migratory species are likely to decline precipitously, causing the Serengeti ecosystem to collapse, and even flip from being a carbon sink into a major source of atmospheric carbon dioxide.

A road linking Tanzania's coast to Lake Victoria and Uganda, Rwanda, Burundi and the Democratic Republic of the Congo has been under discussion for the past 20 years. Pressure to start digging is mounting in the run-up to Tanzania's election next month, in part because of increasing foreign economic interest in the mineral wealth of Central Africa.

There is an alternative to driving the road through the World Heritage Sites of the Serengeti National Park, where humans took their first recorded steps[1] and which harbour one of the last great animal migrations[2]. Building a road to the south of the Ngorongoro Conservation Area would minimize environmental and economic damage and maximize benefits to human development and infrastructure.

Domino effect

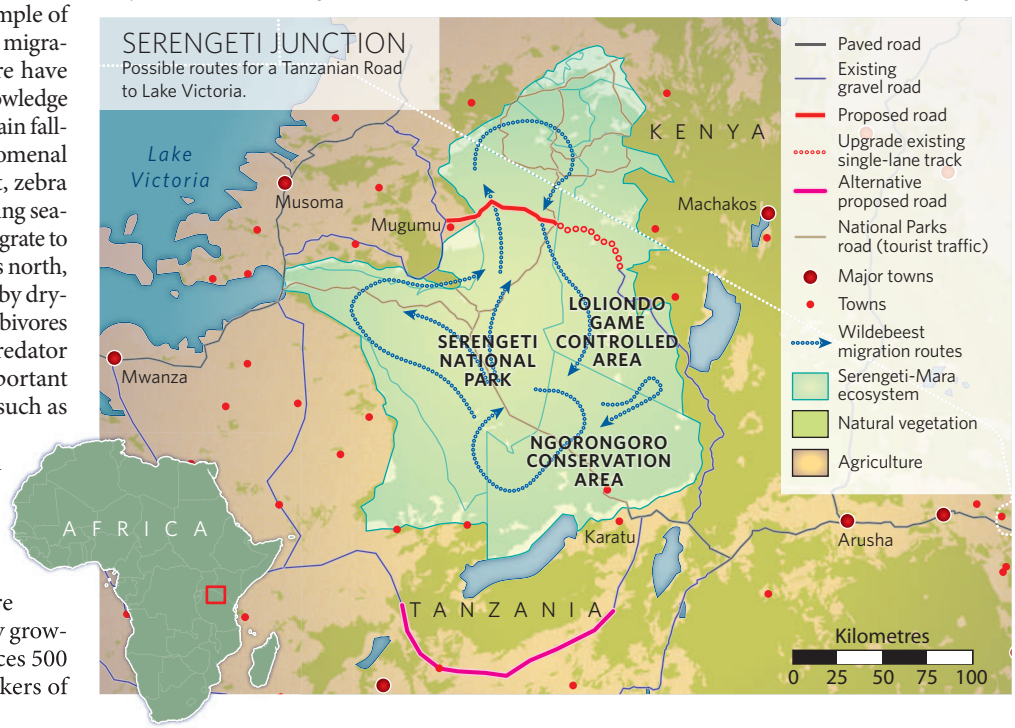
The Serengeti is a rare and iconic example of an ecosystem driven by a large mammal migration[3]. Classic, long-term studies there have made fundamental contributions to knowledge of how natural ecosystems function[4,5]. Rain falling on rich volcanic soils creates phenomenal nutrient-rich plant life that wildebeest, zebra and gazelle consume during their breeding seasons. When the rains end, these herds migrate to southern Kenya, hundreds of kilometres north, to access water and pastures nourished by dry-season rainfall. The nearly 2 million herbivores are an essential resource for a large predator community that includes globally important populations of threatened carnivores such as lions, cheetahs and wild dogs.

Wildebeest — 1.3 million of them — are the keystone species in the Serengeti ecosystem. They determine the abundance and diversity of all other species. Each year about 500,000 calves are born in February, on plains where they consume about 50% of the rapidly growing grasses. Each day the herd produces 500 truckloads of dung and 125 road tankers of urine, recycling vast quantities of nutrients throughout the system. Their grass consumption removes fuel that would otherwise cause fires to destroy trees. They also maintain grasslands by trampling and thrashing seedlings and saplings. Disrupting their annual migration cycle would dramatically alter this ecosystem.

Each year, about 1.5 million wildebeest and zebras cross the path of the proposed road as they head north, and then again on their return south. In drier years, or those with erratic rainfall, they cross many times, responding to local rainfall. This would be a significant hazard for traffic, and would probably result in human and animal casualties. The proposed road (see graphic) would also bisect newly re-established wild dog and rhinoceros populations, reducing the probability of the emergence of spatially distinct, interbreeding populations of these endangered species.

Once the public road is built, the area within 50 metres on either side would no longer be under the jurisdiction of the national parks (as in Mikumi National Park in eastern Tanzania). Traffic could travel at night and at speed — restrictions and calming methods are difficult to implement in rural Tanzania[6]. Increasingly hazardous road-traffic collisions would probably necessitate fencing, as happened in Banff National Park in Canada[7,8]. Fences, roads and habitat fragmentation have caused the recent collapse of at least 6 of the last 24 terrestrial migratory species left in the world[2]. Although speed bumps in Mikumi and overpasses in Banff have reduced the number of wildlife collisions, these have cost several million dollars and speed bumps scarcely slow traffic or prevent collisions. In Banff, overpasses carry populations of several hundred elk and deer and increasingly rare carnivores. No overpass could be wide enough, or long enough, for 1.5 million wildebeest and zebras. In all other areas where fences and roads have hampered large-mammal migrations, notably Banff, Etosha National Park in Namibia and Kgalagadi Transfrontier Park in Botswana, the ecosystem has collapsed to a less diverse and less productive state[9,10].

Simulations[11] suggest that if wildebeest access to the Mara river in Kenya is blocked, the population will fall to less than 300,000. This would lead to more grass fires, which would further diminish the quality of grazing by volatizing minerals, and the ecosystem could flip into being a source of atmospheric CO_2. The trees and soil there are a significant carbon sink. The system would return to the impoverished state that developed when wildebeest numbers plummeted during the



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rinderpest pandemic in the last decade of the nineteenth century[12]. There would be far fewer game, fewer predators and more than 80% of the park would burn every year.

The public road would carry goods and supplies, including seeds of potentially invasive and non-native species, chemical pesticides, herbicides and livestock pathogens transmissible to wildlife. It would also disrupt local patterns of water drainage, increasing erosion and changing local vegetation. The road would become a source of chemical pollutants, particularly lead and other heavy metals; these would accumulate in the dry season and then flow into streams and rivers at high concentrations during the rains[13,14]. Roads also allow easy access for poachers, and create a ribbon of communities on either side, increasing human–animal conflict.

Construction of the road by the Tanzanian government is planned for 2012; marker flags have already been placed in some sections of the park. An evaluation, 15 years ago, of a route between the coast and Musoma considered a route through Ngorongoro and the Serengeti — it was discarded because of their environmental sensitivity. At the time, the Tanzania National Parks authority was not supportive of the road through the park. After the last election (2005), promises by President Jakaya Kikwete for a road linking Lake Victoria to the coast led to two more evaluations: both concluded that a road would ruin the Serengeti's status as a major tourist destination and as a World Heritage Site.

A better way

There is a clear alternative to the Serengeti route. A road going around the southern end of the park, and never crossing park boundaries (see graphic), would also connect Lake Victoria to Arusha and then to the coastal ports. It would provide valuable access to agricultural markets for around 2.3 million people as opposed to 431,000 on the northern route. The southern road could use an existing gravel road network and would require an additional 155 kilometres of new road, as opposed to 120 kilometres. The total southern road from the coast would be about 50 kilometres longer than the northern route, but could cost less, in not having to climb the 500-metre cliff face of the Rift Valley. Above all, it would allow crucial development in rural Tanzania to proceed with minimal damage to tourism, which contributed US$824 million to the nation in 2005 — 23% of the total foreign revenue and 6.3% of all Tanzanian jobs.

Tanzania is a developing country, with an average gross national income of $350 per year; more than 95% of its people live on less than $2 per day. These people need improved infrastructure to facilitate development, distribute goods and reach agricultural markets. However, wildlife tourism is a cornerstone of Tanzania's economy, and the Serengeti, along with Mount Kilimanjaro, is central to the success of this industry. Moreover, ecotourism is supported by pastoralist land use in conservation areas, such as Loliondo and Ngorongoro (see graphic), that surround the park. Livestock production accounts for well over half of all household income across these buffer-zone districts[15] and drives regional, national and international livestock trade. The proposed road would severely affect these economic and ecological synergies.

In sum, the proposed road could lead to the collapse of the largest remaining migratory system on Earth — a system that drives Tanzania's tourism trade and supports thousands of people. Such a collapse would be exceedingly regrettable for a country that has consistently been a world leader in conservation. We therefore urge the government of Tanzania and all stakeholders to consider carefully the full ecological and economic benefits of building the route to the south. This road would open up transport to the interior, but explicitly acknowledge and conserve the global benefits of preserving the Serengeti National Park, one of the world's natural wonders and one of Africa's last surviving pristine ecosystems. ■

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