Key limitations in the assessment of global roadless areas

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With the support by the National Natural Science Foundation of China and Ministry of Science and Technology of China, the research team led by Dr. Wu Ruidong (**武瑞东**) from Yunnan University reveals several key limitations in the study of global roadless areas mapping and assessment, which was published in *Science* (2017, 355: 1381—1383).

Ibisch *et al*. published a study in *Science* (2016, 354: 1423—1427) that presented a global map of roadless areas, and assessed their ecological values and conservation status within existing protected areas. There is no doubt that Ibisch *et al*.'s data and results will provide valuable guidance for protecting the world's remaining wilderness areas and biodiversity. However, Dr. Wu's team revealed three key limitations that must be further explored to clarify the contributions and constraints of the study.

Ibisch *et al*. oversimplified the impacts of roads by applying a globally uniform 1-km road-effects buffer. Specifically, road impacts can vary greatly with terrain features and different road levels. For instance, in the Three Parallel Rivers Region of China—a global biodiversity hotspot with extremely deep gorges and high mountain ranges, the steep terrain can substantially restrict human influences on natural environment and reduce the spatial extent of road impacts. Moreover, terrain features can affect the spatial configurations of road levels, and different road levels can have different types of impacts. Therefore, instead of using a globally homogenous 1-km buffer, different road-effects buffers should be set according to road levels and terrain conditions.

The ecosystem functionality index that Ibisch *et al*. used to assess the ecological values of roadless areas comprised vegetation density, tree height, carbon storage, vascular plant richness, plant functional richness and slope. These factors were skewed toward valuing forests more highly than other ecosystems. This can be misleading for global conservation strategies. It is well established that all ecosystems (e.g., grasslands and deserts) have distinctive ecological values, and their representative examples must be protected. For instance, Ibisch *et al*. assigned very low ecological values to the deserts in central Asia and Australia because of their sparse vegetation and low biodiversity, while these areas are identified as "Global 200" priority conservation ecoregions. To comprehensively assess the ecological values of roadless areas located in all ecosystems, we suggest that the ecosystem functionality index include different sets of ecological factors and be calculated for different biomes. Moreover, the endemism and rarity of species and habitats should be used to reflect the distinctiveness of roadless areas within different ecosystems.

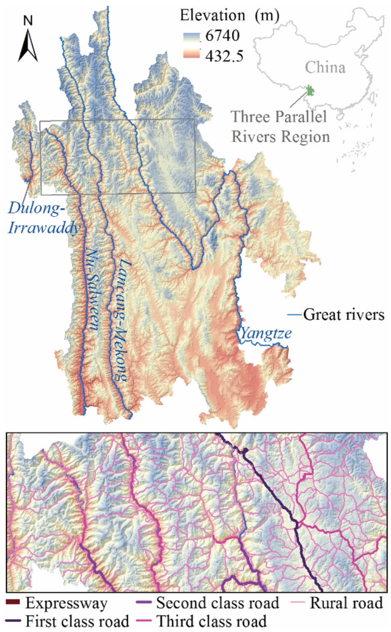

Figure The Three Parallel Rivers Region of China and its road networks.

Ibisch *et al*.'s results regarding the protection coverage of roadless areas may also be biased due to problems in their global protected area data, which are incomplete with regard to the list, spatial data and management categories. For instance, only two of China's protected areas are assigned to the IUCN category IV, with the remainder either being listed under categories V—VI or not categorized at all, and many protected areas are still not included in the global dataset. Therefore, Ibisch *et al*.'s roadless areas in China have almost no protection from strictly protected areas, but they are likely protected by reserves that were not assigned to the proper IUCN categories or not included in the global data set. Finally, considering the difficulties in establishing a global road network data set and the urgency of saving biodiversity, we suggest that future research explore and improve this data at regional and country scales.