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The role of road infrastructure in driving land cover patterns in South Africa

Major planned road infrastructure developments are likely to bring significant changes to natural ecosystems in SSA, most often via land use and landcover change. This is because they provide access to markets, economic opportunities and previously hard to access habitats, all of which incentivize landscape transformation processes. We use South Africa as a case study to identify land cover patterns associated with mobility and access roads, and important socio-economic and biophysical modifiers of these patterns.

We processed the 2020 South African national land cover dataset (20m-by-20m), to generate a new 6km-by-6km dataset with app. 30000 cells, each containing information on the proportion of natural and non-natural cover within it. Road-related predictor variables, along with other biophysical, demographic, socio-economic variables, were generated and aggregated to this common resolution for further analysis. We used Gradient Boosted Regression Tree (GBM) machine learning models to identify the main variables that explain land cover patterns in SA. We also fitted gradient boost regression tree models to nine individual biomes in the country: Grassland, Savanna, Fynbos, Nama-karoo, Succulent-karoo, Indian Ocean Coastal Belt, Desert, Albany Thicket and Forest. Those features with greatest explanatory power were used in further analysis (partial-dependence plots) to understand the interactions between important drivers.

From our preliminary analyses, using the national scale model, some of the most important predictors of natural cover were (in order of importance), rainfall, topographic complexity, GDP, population density and road density (both mobility and access road types). Most of these were also important predictors of natural cover in different biomes, but their relative importance varied. Furthermore, in some biomes (such as Fynbos) other variables, like distance to a protected area, were more important for explaining patterns.

*Further work will be done to identify the drivers of non-natural land uses as well as the main land use transitions observed between 1990 and 2020.