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Boosting propagule transport models with individual-specific data from mobile apps

Human traffic is an important vector for various invasive species and infectious diseases. Hence, modelling the dynamics of these species and diseases requires accurate estimates of human traffic flows. Such estimates are often computed using traffic models fitted to on-site or mail-out survey data. Recently, data collected via mobile apps have become a promising alternative, potentially allowing for more intricate traffic models incorporating numerous covariates and accounting for vectors' individual preferences. However, as potential vectors may not record all their trips, data voluntarily recorded via apps come with an additional level of uncertainty. We show how the benefits of app-based data can be exploited despite this drawback by accounting for repeating behaviour of vectors. We demonstrate our approach by considering a case study estimating angler traffic in Alberta, where anglers facilitate the spread of a parasite-induced fish disease. Our results do not only provide valuable insights into the traffic patterns of anglers in Alberta but also indicate that anglers' local preferences and their tendency to revisit previous destinations significantly affect traffic volumes between waterbodies. Ignoring these individual characteristics could lead to significant overestimates of vector traffic and propagule dispersal.

This work is joint with Pouria Ramazi, Sean Simmons, Mark Poesch, and Mark Lewis.