
Coupling habitat and human networks: effects of settlement and road configuration on habitat connectivity

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Habitat connectivity is important for species' survival. Therefore, the integrity of habitat networks (i.e. habitat patches connected by potential animal movement) should be maintained. However, this integrity is often threatened by human networks consisting of settlements connected by roads and traffic. This threat is usually two-fold; settlement and habitat patches are mutually exclusive (i.e. where there is settlement, there is no natural habitat and vice versa) and traffic intensity is negatively correlated to habitat connectivity. Spatial habitat and human networks are thus complex interdependent networks, meaning that changes in one network can bring about unexpected changes in the other network. For instance, road closures in the human network can alter traffic flows, which could have both positive and negative effects on overall habitat connectivity. Thus, both settlement and road configuration and their interactions can affect the overall habitat connectivity. To better understand such effects, we have performed simulations with coupled ecological and human networks. For human networks with different settlement and road configurations, we determined the habitat connectivity in habitat networks for several species (tree frog, hedgehog and badger). In general, we found that the effects of settlement and road configuration on habitat connectivity were dependent on the proportion of area covered with settlements and the modelled animal species. Surprisingly, we found that at low densities of settlement the habitat connectivity was higher with dense road networks than with sparse networks. However, at high settlement density we found that sparse road networks were better for the habitat connectivity. With this study we show how simulations with coupled networks can result in valuable information for sustainable landscape and transport planning.