Stellenbosch University ecological network research (Mondi Ecological Network Programme (MENP)

Ecological networks (ENs) reduce the isolation of populations or even individuals, allowing better gene flow and reducing founder effects (loss of genetic variation that occurs when a new population is established by a very small number of individuals). ENs also allow species to recolonize areas after localized extinctions. This reduction of isolation and fragmentation helps to prevent ecological relaxation (the loss of ecological systems and interactions) and so prevents biodiversity loss.

The design of ENs is a major determinate of their effectiveness. For example, even though stepping-stone patches within ENs are useful for some of the larger animals using the ENs (particularly large mammals and birds), continuous corridors of good quality habitat in ENs are preferable, as they allow smaller, less mobile, animals, such as insects and spiders, to use the linkages. In fact, at Stellenbosch University, we have shown that these small animals use these corridors as habitats in their own right, giving the corridors themselves their own inherit biological value.

What is an ecological network?

Ecological networks (ENs) are composed of remnant set-aside natural land for mitigating any negative effects of intensive land-use such as plantation forestry. ENs consist of large scale interconnecting linkages (corridors or stepping-stone patches) and nodes (mini or true nature reserves) that together play an important role in ensuring connectivity across the landscape. This ensures organisms disperse on evolutionary as well as on ecological time scales. ENs feature design and management strategies that link important areas together and so reduce the effects of fragmentation, and also create extra space for organisms to survive in these ENs as if they were protected areas.

Ecological network research at Stellenbosch University

Research at the Department of Conservation Ecology and Entomology, Stellenbosch University, is finding ways to mitigate biodiversity loss due to agriculture and forestry. The Mondi sponsored Mondi Ecological Network Programme within the department maintains a core research team dedicated to Ecological Networks for agriculture and forestry plantations. Research on the implementation, design, management and effectiveness of ENs within the South African plantation forestry context is a central theme of this research. South African forestry has had a significant impact on biodiversity and although further expansion has been curtailed by the state, plantations are a threat to the remarkable biodiversity of the eastern half of the country, emphasized by it being in the Maputaland-Pondoland-Albany global biodiversity hotspot. ENs were established on the “new generation plantations” of Mondi to help prevent biodiversity loss and mitigate water use, providing us with an ideal study area to test the effectiveness of ENs and to help determine a framework for their best design and management. This is now becoming a model for similar approaches in other agricultural systems, locally and internationally.

What makes ecological networks work?

ENs function at the landscape scale. So, to be effective, they need to incorporate as many landscape features as possible. Stellenbosch research has shown that the inclusion of as many habitat types as well as landscape features as possible is fundamental to good EN design. For example, our research

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shows that grassland ENs with indigenous forests embedded within them have higher biological value, not only because there are more species in the forests themselves, but there are also more species in the associated grasslands. This is due to grassland-indigenous forest interface, so essential for some species, improving the biodiversity of the grassland.

Stellenbosch University has also researched the edge effect between the transformed plantation blocks and the corridors of the ENs. We have established that there is a 32 m edge zone around each plantation block. The consequence of this is that corridors of less than 64 m would be mainly edge and would make poor linkages for many species. This means that we recommend that corridors should be at least 250 m wide to allow for a great deal of interior space for more sensitive species. Along with design, management considerations are vital for ensuring that the ENs function optimally. Such management includes using correct fire regimes and controlling invasive alien plants, to make sure that there is high quality habitat. Using grasshoppers as sensitive indicators, management of the ENs was found to be 3-5 times more important than EN design. This means that all the expense and time put into designing and setting up ENs can be undone if ENs are not managed correctly.

At Stellenbosch University, we have looked at a wide range of different organisms from the habitat base of plants, through to large mammals and birds. Much of our research has been based on arthropods, as they are small, hyperdiverse, habitat sensitive, resource dependent, ecologically important and can be sampled in large numbers. Although there is much variation among these groups, they all benefit from ENs, provided that the ENs are well designed (corridors wide enough and all landscape feature are considered) and good quality habitat is maintained.

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Ecological network with an unburned corridor in the foreground, a burned corridor in the middle and a reserve in the background.

Ecological networks need to conserve ecological processes and servicies such as hydrology.

Indigenous forest in the foreground, and a production landscape in the background.