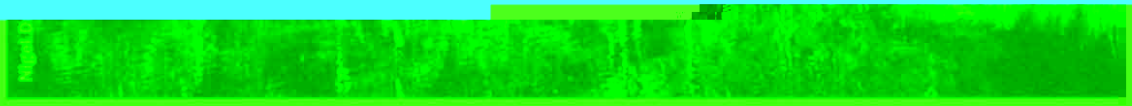
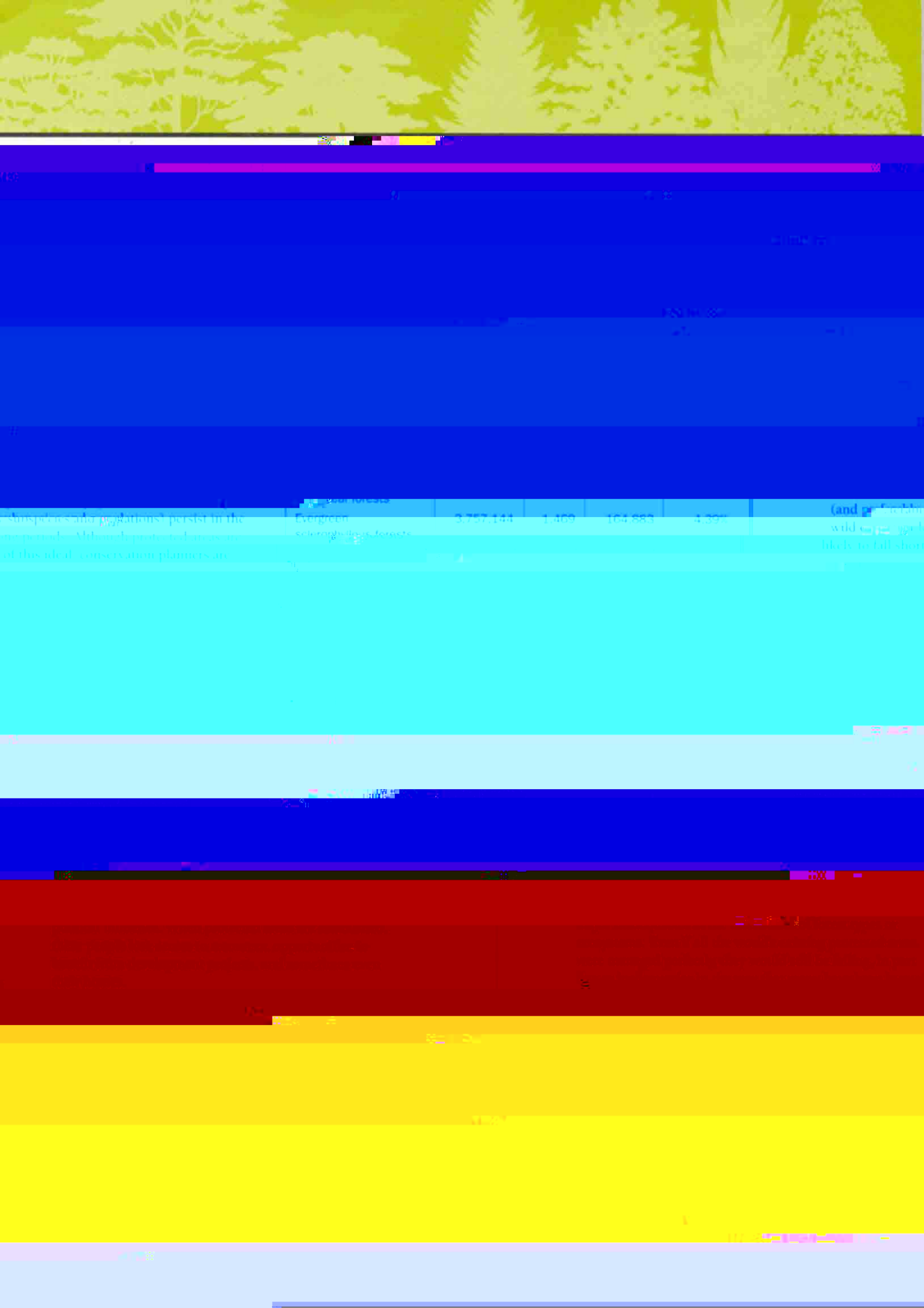
By Nigel Dudley and



Protected areas need to be carefully designed if they are to be effective



Badly sited protected areas can miss most of the biodiversity

When Hawaii's system of nature reserves was established, a prime motivation was to protect the rare and endemic birds that live on the island. But research has shown that many of the most threatened birds actually live outside the protected areas. This is far from unusual. In Sichuan province, China, over half the highly endangered giant pandas still live outside panda reserves. In the USA, many endangered species are 'missed' by the protected area system. There is an all-too-common mismatch between areas with biodiversity that needs protection and areas set aside to protect biodiversity.

Over half the world's

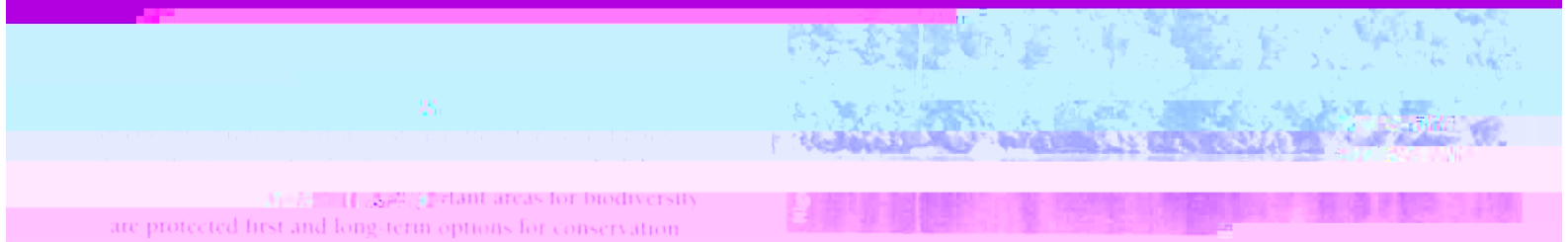
is adequate

Small reserves are likely to be of only limited value if they

is suitable habitat

or urban areas, isolating all but the most adaptable species. Furthermore, research suggests that most of the world's protected areas are small! Analysis by the World Conservation Monitoring Centre in 1997 found that 17,892 (50 per cent)

of the last fragments of temperate



elant areas for biodiversity are protected first and long-term options for conservation

alteration of forests.

The way in which protected areas is also critical to their success

Protected areas that are made up of fragmented habitat, or those without a large 'core' area that is remote from disturbance, or protected areas that contain barriers such as roads, have a higher risk of losing their values.

Protected areas with large and remote 'core areas' are much more secure from human interference from poaching, land invasion and edge effects such as pollution[5]. In Serengeti National Park and World Heritage Site in Tanzania, it is estimated that poachers take 200,000 animals every year, with by far the largest effects occurring at the edges of the 14,763 km² protected area, where teams of porters carry meat out by hand in a large and well-organised operation[6]. Animals living further inside the [illegible] are more secure. Long-term studies in national parks in East Africa have suffered disproportionate losses to poaching.

Some insect and mammal species will evidently have [illegible] leads to their extinction in a protected area or reduced population. In Victoria, Australia, a study through [illegible]

The Kinabatangan River in Sabah, Malaysia provides a biological corridor through [illegible] of oil palm. But a road crossing the river isolates populations of elephants and orang-utan from the forested mountains further inland.

Protected areas that lack a key habitat may be unable to protect all their biodiversity

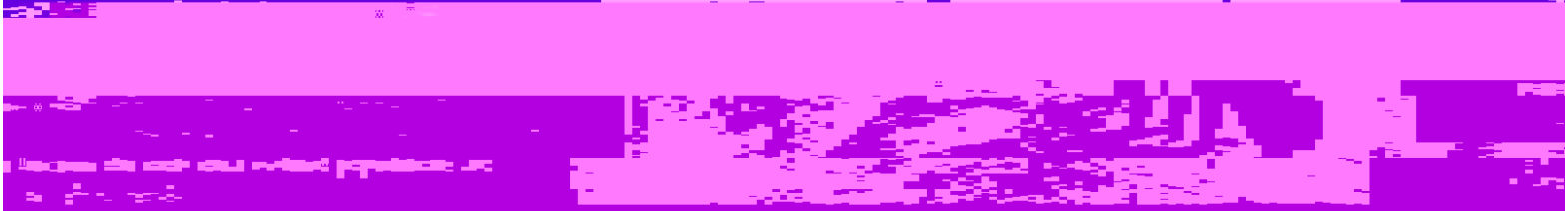
Another design problem is that protected areas can sometimes be established without a particular habitat important for one or more of the species that they contain. This is particularly likely in the case of migratory species, where liaison between protected area agencies in a number of different countries is sometimes needed. It can also occur when key resources in the same region remain unprotected, such as seasonal food sources or breeding habitats for birds, bats or fish.

[illegible] many protected areas have been established [illegible] to adjacent [illegible] Many alpine [illegible] species to and from [illegible] upwards or downwards as climate changes, [illegible]

[illegible] ecologically as the 'funnel effect' helped to add [illegible] this an. In this and other regions, many species are [illegible] to core habitat distant from forest edges. It follows [illegible] cted areas with more irregular [illegible]

[illegible] an important reserve on the Wadden Sea in Denmark. The sea and its associated system of mudflats and salt marshes provide habitat for 6.9 million migratory birds and nursery [illegible]

[illegible] known [illegible] frustra [illegible] restric [illegible] that pro [illegible]



...that lines of work and thinking that have tended to remain separate

- Stage 6: Implementing conservation action on the ground.