Management of biodiversity in reserved areas by the people who live in them has a mixed literature, with many writers maintaining that it does not work. A recent paper by anthropologist Anthony Stocks of Idaho State University and two colleagues from the University of Arizona uses remote sensing innovatively to illuminate the record of a biosphere reserve in northern Nicaragua. The reserve was created in 1991 after a decade in which the 8000 km2 area had been almost completely depopulated during the Sandinista/Contra war (it became a UNESCO-recognized reserve in 1997).

Two indigenous groups, the Miskitu and the Mayangna, have ancestral claim to this land and were allowed back in 1991. At this time the southern part was being aggressively occupied by ex-soldiers and other mestizo settlers from western Nicaragua. Because the area is without roads both indigenes and settlers farmed mainly for their own subsistence, although the settlers also aimed to convert the forest to pasture which they could later sell – 'the frontier equivalent of having a job' (p. 1498). Unlike the settlers, who scattered on individual farms, the indigenous people live in nucleated villages farming land within a 2-hour-walk radius for a year or two and then leaving it fallow.

No individual has full legal title to land in the reserve, but the indigenous groups established a mapped claim to six multi-community territories with external help, notably from Anthony Stocks (Human Organization 62, 4, 2003: 344-356). Through negotiated demarcation a boundary was drawn between colonists and the community territories, and has remained secure since the late 1990s. Settlers ceased to enter the reserve as land outside the claim became scarce. Since 1995, the boundary zone has been patrolled by volunteer indigenous forest rangers even when there was no external financial aid. Their sense of ownership has been a key motivator. Since 1999 they have operated under the aegis of the ministry responsible for the reserve whose own officer rarely visits the area. In 2005, government reluctance to recognize indigenous land rights was finally overcome to the extent that the territories were recognized as community titles, although they are still not inscribed in the !
national land registry.

Miskito and Mayangna have thus successfully defended their

homelands but they have also better defended its biodiversity. The authors analyze this through a meticulous geostatistical exercise using the high resolution of modern remote sensing. They use the simple 'normalized burn ratio' (NBR) which quantifies the ratio between the near-infrared and middle-infrared bands on Landsat TM imagery. Because it sharply distinguishes forest land that has been disturbed sufficiently to show up on imagery, this measure has wide potential use in studies of conservation and its successes and failures, and not only in regions prone to wildfire in which it has mainly been used. Mapped forest disturbance for 1987 (when the area was largely uninhabited) , 1995/6 and 2001/2 demonstrates a clear and growing contrast between the indigenous and settler portions of the reserve, and in the intermediate buffer zone between the two. Normalized burn ratios were much higher (i.e. less disturbed) on the!
indigenous side with the contrast growing much sharper over the years.

Per capita deforestation is also much less on the indigenous land. Indigenous farms, together with their fallow areas, occupy on average under 15 ha, compared with 50 ha for the more completely cleared settler farms. The disturbance also has a completely different spatial pattern: the settler area being a patchwork of cleared and uncleared plots, whereas much of the indigenous land is occupied by large blocks of uncleared forest. Miskitu cash-crop farming takes place mainly in the river beds during the dry season. The produce (beans) is shipped down river in the wet season. This activity does not show up on the imagery. Mayangna rely on gold panning and the sale of pigs. Neither indigenous group gets the major proportion of its protein from hunting. Although in a few Mayangna communities hunting may account for 48 per cent of the biomass consumed, no species seems to be under threat and, indeed, a number of species once thought to be extinct north of Panama have been sight!
ed in recent years.

The success of the Miskitu and Mayangna in conserving biodiversity is clearly a part of their long-standing drive to preserve their territorial base and manage their own affairs. With a significantly higher level of literacy than the colonists, they are well aware of the political value of conservation in this struggle. Government authorities have been unable to prevent a significant part of this reserve – and others – from being taken over by colonists. The ability of the indigenous people to retain their area, without

violence, and to conserve biodiversity within it, ought to offer a model, although it is one with little appeal to most of the governments of central America.

To communicate with the authors and/or to request a single electronic copy of the paper, write to astocks@isu. edu

A. Stocks, B. McMahon and P. Taber 2007 Indigenous, colonist and government impacts on Nicaragua's Bosawas reserve. Conservation Biology 21(6): 1495-1505.