

# The forgotten ecosystem

Everyone knows about the Amazon rainforest, but Brazil's tropical savannah is arguably under greater threat. **Emma Marris** visits a testing ground for future conservation strategies.

**O**n the savannah of central Brazil, it is dry and hot, but far from lifeless. Iridescent blue butterflies the size of handkerchiefs fly by. Leafcutter ants march in line across the dusty red soil, holding snippets of foliage like sails. The silica-filled leaves of shoulder-high shrubs clatter like snare drums in the breeze.

Yet just over the next rise lies another landscape: the unvarying green of a soya field. In a dramatic change in land use, this vast inland region of savannah and dry woodland, known as the Cerrado, is rapidly being replaced with crops and pasture. Over the past 35 years, more than half of the Cerrado's original expanse of two million square kilometres has been taken for agriculture. It is now among the world's top regions for the production of beef and soya.

Agriculture is one of the largest and most dynamic parts of Brazil's economy, and those working to save the Cerrado are unlikely to be able to slow or stop the sector's expansion. Just 2.2% of the Cerrado is protected, and it is losing ground faster than the Amazon rainforest to the north. At the current rate of loss, the ecosystem could be gone by 2030, according to estimates by Conservation International in Washington DC (see map, opposite).

Like the Amazon basin, the Cerrado is a great source of biodiversity. Its 137 threatened species include the maned wolf (*Chrysocyon brachyurus*), a striking, long-legged beast that resembles a fox on stilts. And the sparse, scrubby vegetation features more than 4,000 species that grow only here.

Yet the Cerrado has little of the global recog-

inition or celebrity advocacy that has helped advance the cause of conservation in the Amazon. If some of the savannah is to be saved, conservationists have realized, they will have to stress its importance to Brazil's economic well-being. This may also mean working hand-in-hand with those who are developing the Cerrado for agriculture — risking accusations of 'greenwash' from purists in the environmental movement. Given that similar pressures face other neglected ecosystems, the Cerrado could become an important barometer of the prospects for conservation worldwide.

## In from the cold

The Cerrado might still have been an overlooked ecosystem had it not been for a project to document the workings of the world's tropical savannahs, set up in the mid-1980s by the United Nations Educational, Scientific and Cultural Organization. Under that project, a group of students at the University of Brasilia were given their start in ecology. "Seven of us went abroad to get our PhDs, and we formed a little revolution," says Carlos Klink, who is now a professor at the university. Today, they are in the vanguard of efforts to characterize and preserve what remains of the Cerrado.

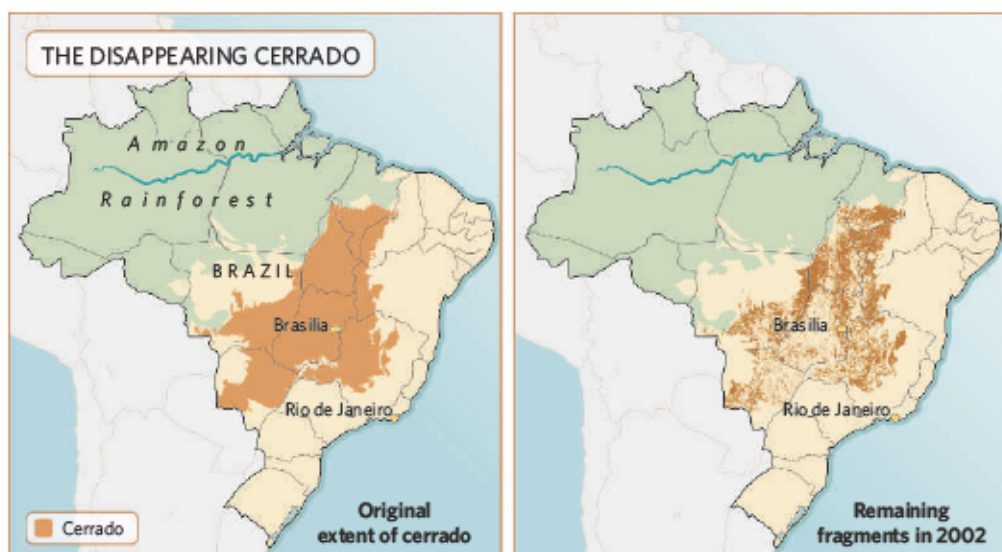
At his field site, 35 kilometres south of Brasilia, Klink shows off the pits he has dug to study the Cerrado's underground life. Below the surface, huge root systems stretch to suck up water and nutrients from the poor soil. Klink points to fields that he has burned off after various intervals to see how the natural fire cycle affects the pattern of vegetation.

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The push to grow soya beans (above) is destroying the habitat of endangered species such as the maned wolf (top).

"This is a pequi," he says, grasping a skinny tree with wilted-looking leaves. Its fruits have a yellow pulp and taste divine. "It's pollinated by bats," he adds. The pequi tree (*Caryocar brasiliense*), at three metres, is the tallest thing in this bit of the Cerrado — an untidy patchwork of tall floppy grasses, greyish bromeliads and nondescript scrubs with puckered leaves.



It's certainly not the archetype of scenic beauty. "Even scientists in Brazil tend to think that this is a secondary kind of ecosystem," says Klink. "That's a pity. I find it a lovely place."

It is also a fragile ecosystem, which can be severely damaged by fires that start on neighbouring pasture. The savannah depends on natural fires, started by lightning, to clear out dead grasses and pop open seed-pods. "But you must have the right amount of fire," says Roberto Cavalcanti, another University of Brasilia ecologist, who is currently working with Conservation International in Washington DC. Alas, the oily molasses grass (*Melinis minutiflora*), which was once widely planted for pasture and has since invaded the fringes of the wild Cerrado, can cause fires to rage so hotly that they burn through the tough fire-adapted bark of native woody plants.

Fires are also set deliberately to clear land for pasture. But the soil is so poor that, without extensive use of fertilizer, the imported grasses tend to fail after two or three years of busy grazing, leaving just dust, rock and carbuncular termite mounds several feet high.

### Price of progress

For hundreds of years, the Cerrado's inaccessibility and poor soil saved it from large-scale exploitation. But as Brazil embraced the Green Revolution in the 1970s, new soya varieties and fertilizers made the region a viable agricultural prospect. By then, the gleaming new administrative capital of Brasilia had been built in the midst of the area, bringing with it roads and people, eager for fresh economic opportunities.

For a while, clearing of savannah was encouraged by the government, because it eased development pressure on the Amazon. Today, there is official recognition of the need for conservation in the Cerrado. But still the odds remain stacked in favour of the rainforest. Brazil's Forest Code requires owners of Amazon land to set aside 80% as a reserve. In the Cerrado, the requirement is just 20%, and enforcement is poor.

Ruth DeFries, a geographer at the University

of Maryland in College Park, can testify to the problems. She is keeping track of changes in land use in Brazil using data from the Terra and Aqua satellites. But it is not easy because the Cerrado and pasture look very similar from low orbit. So she travels periodically to the region of Mato Grosso, where the Cerrado meets the rainforest, to verify her satellite observations. In Mato Grosso alone, she has seen some one million hectares of Cerrado and forest cleared for cropland between 2001 and 2004. "I have seen an awful lot of clearing," she says.

Slowing this destruction will mean working with the government and agricultural interests, say ecologists. And the window of opportunity may be small. "These are the crucial five years," says Cavalcanti. "Remember, conservation is cheaper than restoration."

John Buchanan, director of agriculture and fisheries at Conservation International's Center for Environmental Leadership in Business in Washington DC, is grasping the opportunity in partnership with Bunge, the largest producer of soya beans in Brazil, headquartered in White Plains, New York. In a pilot project, Buchanan has worked with Bunge employees

and local farmers to set up the legally required reserves so that a contiguous corridor of Cerrado snakes across the landscape. "We really have no choice but to work with agribusiness," says Buchanan. "It's not an either/or situation."

### Trading places

In July, when the Society for Conservation Biology held its annual meeting in Brasilia, such projects came under scrutiny in a session on assessing trade-offs between human and ecological needs. Some representatives from the state-run Brazilian Agricultural Research Corporation, known as EMBRAPA, attended warily, worried that their role in bringing about the large-scale development of the Cerrado would see them cast as villains.

Geraldo Martha Júnior, an agronomist at EMBRAPA based in Brasilia, gave one of the most provocative presentations, arguing that the best way to avoid unnecessary encroachment into the Cerrado is to ensure that introduced pasture grasses are adequately fertilized. He also considered the option of pasturing cattle on natural vegetation. But his presentation showed that it wasn't economically viable: the cows just wouldn't get fat enough to turn a profit.

By the end of the session, the EMBRAPA scientists seemed less cautious — and by and large, their presentations were received graciously by the assembled conservation biologists. In part, that reflects a sense of relief that research into protecting the Cerrado is now under way. Until recently, Brazil's savannah was a minority scientific interest, and there was no organized effort to save it from the plough.

The welcome extended to Martha Júnior and his colleagues is also indicative of a growing realization among conservationists that their strategies must accommodate economic development (see *Nature* 437, 614–616; 2005). To this end, ecologists working in the Cerrado are now stressing the 'ecosystem services' it provides — many of which have a tangible economic value. Some are investigating the role of the native landscape as a carbon sink, as a centre of genetic diversity for the crop cassava, or as a protector of Brazil's soil and water.

Klink is working to map the region in terms of carbon storage and movement. Native pasture, with its huge root systems, stores more carbon than pasture and crops. He and his team have also quantified the amount of water held in different ecosystems. They found that in planted pasture, evaporation equalled rainfall, whereas in the Cerrado it was about 20% less, keeping more water available in the ground.

João Campari, director of the central savannah programme at the Nature Conservancy in Brazil, has taken this approach a step further and proposed a Cerrado Grassland Exchange — a financial instrument that would attach monetary, tradable value to the areas that are protected by Brazil's Forest Code.

DeFries is saddened by the thought of more savannah being cleared for the inevitable expansion of agriculture. But pragmatism has to be the order of the day, she says. "Agricultural production and the revenue that it provides is important for the development of Brazil. I don't think it's effective to take the viewpoint that the entire Cerrado be conserved," says DeFries. "That's not realistic or desirable."

Emma Marris is a correspondent for *Nature* in Washington DC.

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