Ecological infrastructure
Case study 2

Management of invasive alien plants in catchments along riverbanks and in wetlands, along with the restoration of vegetation, will stabilise soils, restore river flow, and replenish grasslands for grazing.

Water thieves

TWO STREAMS, KWAZULU-NATAL

Dense growth of invasive alien plants dry out water catchments, drops the water levels in rivers and increases fire risk. River banks and surrounding grasslands become erosion-prone, meaning the water that does make it into the river is sediment-laden and of poor quality.
Fourty-four, that’s the critical double-digit number that’s come out of a small but significant study site at Two Streams in the misty grasslands of the KwaZulu-Natal Midlands, 70 km northeast of the provincial capital, Pietermaritzburg. This study has confirmed what scientists have long suspected about many of the alien trees growing rampant in parts of the country.

Black wattle is one of numerous woody tree species introduced into South Africa over the past three and a half centuries to beautify gardens, bind sand dunes, and for their tannins which are used to cure leather. Mostly from Australia, the United States and Europe, some alien species have found environmental conditions here ideal with no natural diseases or pests to keep their numbers in check. They have spread into the wild veld, first becoming pesky weeds and then full-blown invaders.
Scientists have long suspected that dense thickets of these plants are much thirstier than their indigenous counterparts. To understand precisely how much water they use, researchers from the University of KwaZulu-Natal and the Council for Scientific and Industrial Research (CSIR) set up a thorough, long-term monitoring process.

First, researchers cordoned off a section of a riverbank and adjacent grassland that had a mature stand of cultivated black wattle growing in it. For 13 years researchers tracked scientific sensors which they had sunk into the soil, hammered into the bark of trees, and suspended high in the overhead tree canopy.
Scientists measured how much water was coming into the site from rainfall and mist. They then measured how much water was going out of the site: trickling down into the soil, into the groundwater, up in the sap of the trees, lost through transpiration (being ‘breathed’ into the surrounding air by the trees), and lastly into the nearby stream. They then cut the trees down and kept taking measurements. Later, black wattle seedlings were replanted and the measurements were taken as the trees grew and matured.

After 13 years, the data were clear: dense thickets of mature black wattles drew 44% more water out of the catchment than grasslands, depriving the stream of that volume of water. This is significantly more water than the indigenous grass or river-edge bush would use, and far too high a number in our water-scarce country.
Other experiments from around the country show that heavily invaded patches of black wattle, gum or pine trees use even more water than this, further impacting stream flow and water quality. In areas where these stands of invasive species have been cleared from the water catchments, streams and rivers have begun to flow again after being dry for years, thus reinvigorating the defunct ecosystem services.

A botanical ‘slum’

The environmental decay that comes with this sort of invasion is like a form of pollution. But unlike an oil spill or litter dumped in the veld, this form of pollution self-replicates.

Once these invasive species have gained enough momentum, they keep on spreading. Black wattle seeds, for instance, can remain viable in the soil for up to half a century.
Why do they use so much more water than indigenous species? Most of these alien trees grow much taller than indigenous bush and have extensive root systems. They grow deep into the underground water supply. Because they have wider canopies, with more leaves than many local species, they’re transpiration-factories, sucking water out of the soil and breathing it out into the surrounding air. This means that there is less moisture in the soil to maintain the health and wellbeing of indigenous species.

Their impact isn’t just on the volume of water they absorb. They also change the soil in which they grow, which has a profound impact on the quality of the water that eventually makes it into nearby streams.

Firstly, many of these species change the chemical make-up of the soil. Black wattles, for instance, load the soil with nitrogen, impacting threatened grassland species that thrive on low nitrogen soils and modifying the environment for other invaders. Gum trees poison the soil for other plants. The result is that indigenous plants die out around these trees.
Similarly these invaders change the fire regime which can be catastrophic, even for fire-adapted vegetation types like fynbos and grasslands. The trees grow big, with heavy wooden stems and branches, and therefore carry a higher fuel load. When fire burns through a forest of black wattles, instead of moving through hot and fast, as it would in indigenous vegetation, the fire will burn much longer. This bakes the soil and kills indigenous seeds.

When it rains, instead of the water being slowed down by grass and shrubs, and percolating down into the soil to recharge the groundwater and trickle through to nearby rivers, the water rushes across the surface of the ground, shearing off layer upon layer of top soil. Rivers become clogged with this sediment.

Other invaders might be toxic or unpalatable to grazing animals and often out-compete fodder plants – thus reducing the food source available for livestock. Research estimates that if invaders are allowed to spread, they could reduce the country’s carrying capacity for large grazing animals by more than two-thirds.
The big offenders

The ‘big guns’ in the arsenal of invaders are the Australian wattles (Acacia spp.), gum trees (Eucalyptus spp.), pines, poplars, weeping willows and mesquite. By 2010, these plants had spread over 16% of South Africa’s land area – some 20 million hectares – which is dramatically greater than their estimated footprint from 15 years earlier.

According to the National Biodiversity Assessment 2011, scientists calculate that the profuse mass of invasive plants uses about 7% of the country’s total annual runoff (equivalent to 18 large dams), water which should end up in our rivers and dams. If left unchecked, they will continue to spread, eventually using up nearly 60% of our yearly runoff.

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Researchers estimate that South Africa now loses the equivalent of R6.5 billion worth of ecosystem services annually due to the dramatic expansion of these invaders.

The message is clear: if we want to conserve South Africa’s already scarce water reserves, invasive alien trees need to be cleared from catchments. This is not a once-off effort, but needs to be maintained for decades.

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An invasive alien species is:

- a species that has been introduced into an area outside of its natural range, by intentional or unintentional human action;
- once established in the new habitat, it spreads, threatening ecosystems, habitats or species, and may cause economic harm and damage to human livelihoods.

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