



WRC CEO, Dhesigen Naidoo



Fluid Thoughts

Saying goodbye to Fidel



In November 2016 Fidel Castro said goodbye to the world at the age of 90.

Tributes piled in from every quarter, and even traditional enemies from the Cold War era, such as the United States, guardedly admitted that Fidel's influence on the shaping of the globe in the 20th century was immense and could not be ignored.

Closer to home, there was a dramatic re-surfacing of a black-white divide in every radio show and social media platform that chose to talk about Fidel. On the one side – the white side – was the familiar eruption of 'rooi gevaar' that I remember so vividly from my childhood years. The stories of communist brutality and oppression that we were being saved from by the benevolent apartheid regime who either failed to assimilate the paradox of their position or that simply thought that the rest of were just ignorant. Why else would we accept their cruel repression if we were anything but.

On the other side came the views of many black South Africans, mostly those with a struggle history, that remembered with a deep fondness the role of Fidel, as he was never Castro, always Fidel, in not only standing up against the dramatic and powerful forces of Imperialism in the sixties, seventies and eighties, that shaped not only this continent, but also the history of this country's tangle with an internal colonialism and the eventual triumph of a non-racial democracy.

We are reminded of the dark days of the Washington-London axis propping up an apartheid government, first to position Mabuto in Zaire and later introduce, arm and support Unita in Angola and Renamo in Mozambique to destabilise the left leaning governments in those two countries. Some have calculated that the Reagan-Thatcher 'constructive engagement' with the Pretoria regime delayed our democracy by more than ten years. And in all that time Fidel led an unrelenting charge for freedom in South Africa, and many other African and Latin American countries.

Perhaps Fidel's parting gift to South Africa is to provide a basis for us to begin a long overdue discussion on our divided experiences of the apartheid years and how this lack of 'toenadering' or converging has led to the divided society that we have today. It is my hope that we can and will use this opportunity.

But, beyond this, we need to take other lessons from Fidel's Cuba and find the right South African formulae that will make them work in our environment. Batista's Cuba was a country of minority elites and an economically disenfranchised majority of very poor people. The parallels with modern day South Africa are uncanny. The game-plan of the soon embargoed Cuban revolution was the development of people through education, an investment in access to people's basic needs, and the development of science. Cuba's Human Development ranking is a tribute to this, despite having a GDP/capita of \$6 051 compared to South Africa's R7 313, it boasts a HDI ranking of 67th compared to South Africa's of 116th. This is in some part due to a Gini co-efficient which ranks Cuba at 44th in the world compared to South Africa's ranking of 118.

The economically embargoed island has been managed through five decades to become one of the most recognised trainers of doctors and engineers in the world. It has over time developed a remarkably enviable track record in many domains, but none more famous than its medical research. This is similar to Nehru and Gandhi's India as they built up a phenomenal human capital capability and technological prowess under its socialist leaning years from independence, and then had the arsenal to take full

advantage of an open economy under Prime Minister Rao in the 1990s to become one of the world's fastest growing economies. This may indeed be the future of Cuba, on a different scale.

We need to take a lesson from Fidel's Cuba and find the right South African formulae that will make them work in our environment.

As South Africa grapples with the throes of the challenge of finding sufficient water security to both see to the current needs of its people in the wake of climate change and extreme weather events, while all the time trying with use innovation, creativity and new knowledge to free up vital water to fuel the engine of badly needed economic growth, we can take another lesson from our Caribbean friend. I think that Cuba's biggest lesson, and Fidel's most important legacy, is that you will never have enough to completely and immediately fulfil all your goals; but, no matter how little you have, you will always have enough to start that journey.



Water Diary

Odour control

February 14-16

The International Water Association (IWA) Symposium on Tastes, Odours, and Algal Toxins in Water: Occurrence and Control, will be held at the University of New South Wales, Australia. Visit: www.iwatando2017.org

Faecal sludge management

February 19-22

The Fourth International Faecal Sludge Management Conference (FSM4) will be held in Chennai, India. FSM4 aims to bring together professionals working in the sector, including utilities, service providers, cities, governments, academics, scientists, consultants, donors and industries to support the global initiative of disseminating sustainable solutions for faecal sludge management. Visit: www.fsm4.susana.org

Water storage and hydropower

March 14-16

The International Conference on Water Storage and Hydropower Africa 2017 will be held in Marrakech, Morocco. The event is supported by the International Committee on Large Dams. Email: africa2017@hydropower-dams.com for more information.

Large rivers

April 18-21

The Third International Conference on the Status and Future of the World's Large Rivers will be held in New Delhi, India. Topics to be covered include hydrology, hydraulics and water quality; sediment transport and river morphology; ecology and restoration; and integrated river management. Visit: <http://worldslargerivers.bku.ac.at>

Water history

June 15-17

The conference of the International Water History Association will be held in Grand Rapids, Michigan, USA. The conference is co-hosted by the Western Michigan University. Visit: www.iwha.net

Hydrology

July 10-14

The 2017 scientific assembly meeting of the International Association of Hydrological Sciences (IAHS) will be held in Port Elizabeth. The theme of the meeting is 'water and development: scientific challenges in addressing societal issues'. This is the first time the IAHS scientific assembly meeting will be held in sub-Saharan Africa. Abstracts can be

submitted until 14 February. Enquiries:

Email Prof Graham Jewitt at Email:

JewittG@ukzn.ac.za or Visit: <http://cwrr.ukzn.ac.za/iahs/call-for-papers/iahs-2017-in-south-africa---invitation>.

Groundwater

October 14-18

The Groundwater Division of the Geological Society of South Africa will be hosting its Biennial Conference at Spier Hotel, outside Stellenbosch with the theme 'Change, challenge, opportunity'. Contact: Deidre Cloete; Email: deidre@iafrica.com; Visit: www.gwd.org.za

Municipal engineers

October 25-27

The Institute of Municipal Engineering of southern Africa (IMESA) will hold its annual conference at Emperors Palace, Gauteng. The theme for this year's event is 'Sustainable engineering. Back to basics for the future'. Visit: <http://www.imesa.org.za/> for more information.



R212-m to support farmers in drought-stricken provinces



The Department of Agriculture, Forestry and Fisheries has allocated R212 million to assist provinces that have been severely affected by the drought.

The money is to be used for animal feed in seven provinces including the Free State, KwaZulu-Natal, Limpopo, Mpumalanga,

North West, Northern Cape and Eastern Cape. These provinces have declared a provincial state of drought disaster, as South Africa battles the worst drought since 1992.

A total of R29 million has been allocated to the Eastern Cape, Free State R31 million, KwaZulu-Natal R23 million, Limpopo R28 million, Mpumalanga R26 million, Northern Cape R25 million, North West R38 million and the Western Cape allocation is R12 million.

“The Western Cape has declared a local state of disaster in three municipalities - Central Karoo, Eden and the West Coast. Gauteng is the only province that has not yet declared a state of drought disaster,” the department said in statement late last year.

During the 2015/16 financial year, the national Department of Agriculture allocated R263 million towards drought relief through reprioritising the Comprehensive Agricultural

Support Programme (CASP). Provincial Departments of Agriculture made R198 million available through their equitable share funding.

“These funds were utilised to assist affected farmers with animal feed and water reticulation for livestock. For the 2016/17 financial year, the department further requested for drought relief assistance from National Treasury through the National Disaster Management Centre,” the department said.

While some parts of the country have experiencing some excessive rain recently, the department noted that the country in its entirety is receiving below average rainfall compared to previous seasons due to the El Niño.

Most rivers are not flowing normally and dam levels are at their lowest in a decade.

Source: SAnews.gov.za

Pour flush/Low flush toilet scoops SAB Foundation Social Innovation Seed Grant Award

On 27 October 2016 the WRC's pour flush/low flush toilet scooped a Social Innovation Seed Grant Award from the South African Breweries (SAB) Foundation.

WRC Research Manager, Dr Sudhir Pillay, received the award on behalf of the organisation. The WRC was one of 23 finalists across the health, disability, education, energy, water and sanitation, and livelihoods and sustainable agriculture sectors.

The pour flush toilet aims to bridge the gap between basic sanitation (VIP toilets) and full-flush sanitation while improving the safety and dignity of recipient communities. The system has a similar look and feel to a full flush toilet but uses significantly less water.

The Ndakana village, in Amathole District Municipality, in the Eastern Cape is the latest community to benefit from the installation of the pour flush toilet, a

project being rolled out by the WRC in collaboration with the Department of Science & Technology and the Bill and Melinda Gates Foundation.

The low flush toilet addressed the aspirations of many South Africans for flush toilet, while overcoming the logistical challenges involved with standard sewerage and working within the limits of the country's water resources.

'Soil crusting' Significant challenge for SA – ARC

The Agricultural Research Council (ARC) celebrated World Soil Day on 5 December. On this day the importance of soil as a critical component of the natural system and as a vital contributor to human well-being is celebrated.

The ARC focused its event – which featured celebrated soil scientist Prof Giel Laker – on soil crusting. Soil crusting, that is surface sealing of soil, is a widespread and very serious problem throughout South Africa. This is due to the fact that large parts of the country are covered by soils that are inherently susceptible to crust formation.

It is particularly severe where the surface of vulnerable soils is left bare due to injudicious farming practices. It is found under all kinds of farming. In extensive rangelands, under both livestock farming and game parks or reserves, it is caused by

overgrazing.

Under dryland cropping, the worst situations occur where non-arable soils are cultivated and then abandoned. Soil crusting is also a serious problem under overhead sprinkler irrigation. This phenomenon in addition affects high value crops, such as fruit orchards, where the soil surface under the canopy in the row is kept bare by use of herbicides.

Soil crusting has several serious consequences. It causes poor water infiltration into soils and thus excessive runoff. The increased runoff leads to increased soil erosion and also to floods, even under normal rainfall conditions. Due to the poor water infiltration, little water enters the soil and causes drought conditions to prevail even under adequate rain.

Poor water infiltration under irrigation leads to poor irrigation water use efficiency. A dense crust also leads to poor soil aeration, and thus poor germination, and causes a high mechanical resistance against seedling emergence. This leads to a poor crop stand, especially of small-seeded crops such as wheat.

Much research has been done in South Africa on the mitigation by soil crusting and amelioration of crusted soils. In rangelands, a dense grass cover should be maintained by avoiding overgrazing, especially of vulnerable areas. This is a large and a difficult challenge in game parks. Cultivation of mulch is essential. In irrigated areas under high value crops, application of organic soil conditioners or mulching are both very effective.

Source: ARC

National water RDI Roadmap hits the highway with national workshops



In order to overcome the challenge of water-related innovation and associated skills needs in the South African water sector, the Water Research, Development and Innovation (RDI) Roadmap was conceptualised and co-created by the Department of Science and Technology

and the Water Research Commission (WRC).

The Roadmap provides a structured framework to focus the contribution of national policy, strategy and planning in water resources management in

South Africa. It lays out seven innovation investment clusters which over a ten-year period intend to facilitate a more competitive and effective innovation position for the South African water sector and ultimately help to secure water for future needs.

Late last year the WRC rolled out a national roadshow, holding workshops in four centres, Cape Town, East London, Bloemfontein and Durban, in an effort to introduce a finalised plan to all interested stakeholders and allow them to engage with the instruments that have been put in place to support the implementation of the Roadmap.

Commented Dr Valerie Naidoo, WRC Executive Manager responsible for Business Development: "In all the planned roadshows, the morning sessions served as a short introductory overview of the roadmap, while in the afternoon stakeholders had the opportunity to engage with the Roadmap team on a one-on-one basis."



Global

Year 2016 set to be named 'hottest' year yet



It is very likely that 2016 will be the hottest year on record, with global temperatures even higher than the record-breaking temperatures in 2015.

Preliminary data (released in November) showed that 2016's global temperatures

are approximately 1.6°C above pre-industrial levels, according to an assessment by the World Meteorological Association (WMO).

Global temperatures for January to September have been about 0.88°C above the average (14°C) for the 1961-1990 reference period, which is used by WMO as a baseline. Temperatures spiked in the early months of the year because of the powerful El Niño event of 2015-16. Preliminary data for October indicated that they are at a sufficiently high level for 2016 to remain on track for the title of 'hottest year on record'. This would mean that 16 of the 17 hottest years on record have been this century (1998 was the other one).

Long-term climate change indicators are also record breaking. Concentrations of major greenhouse gases in the atmosphere continue to increase to new records. Arctic sea ice remained at very low levels, especially during early

2016 and the October re-freezing period and there was significant and very early melting of the Greenland ice sheet.

Ocean heat was boosted by the El Niño event, contributing to coral reef bleaching, and above-average sea-level rise.

The deadliest event in 2016 was Hurricane Matthew, which was Haiti's worst humanitarian emergency since the 2010 earthquake. Throughout the year, extreme weather led to considerable socio-economic losses in all regions of the world.

"Another year. Another record. The high temperatures we saw in 2015 are set to be beaten in 2016," said WMO Secretary-General Petteri Taalas. "The extra heat from the powerful El Niño event has disappeared. The heat from global warming will continue."

Source: WMO

Global report places spotlight on water quality

The quality of surface water has noticeably improved in recent decades in many parts of the developed world, but is being challenged as economic growth, intensification of land use often combined with demographic or climate change lead to widespread and severe degradation.

The need to reverse this development is reflected in the 2030 Agenda for Sustainable Development, both as a dedicated goal on water and as an integral element of the objectives in other sectors.

The report, *A Snapshot of the World's Water*

Quality – Towards a global assessment summarises, key findings of the pre-study for a World Water Quality Assessment. This includes the fact that water pollution has worsened since the 1990s in many rivers in Latin America, Africa and Asia; the majority of rivers are still in good condition, and there are great opportunities for short-cutting further pollution and restoring the rivers that are polluted; monitoring and assessment are essential for understanding the intensity and scope of the global water quality challenge, yet data coverage is inadequate.

The methodology developed offers a baseline to measure progress, a framework for global assessment and a pathway towards sustainable solutions that will deliver on that agenda. With the support from UN Water and the many contributing authors, this report will help bridge the gap between water quality, the inclusive green economy and the interlinked issues of sustainable development.

To download the report, Visit: www.wwqa-documentation.info

Researchers produce world map of farming households

Smallholder and family farms are crucial to feeding the planet, and successful policies aimed at alleviating poverty, boosting food security and protecting biodiversity and natural resources depend on the inclusion and participation of small farmers.

However, despite the recent spotlight on small farms and increasing consensus on their importance, detailed information on location and size of smallholder farms is virtually absent. Small farms exist in some of the planet's most diverse landscapes and are home to many of the planet's most vulnerable people, and yet we have very little information about them.

A recently published study by researchers at the University of Minnesota Institute on the Environment attempted to fill this crucial knowledge gap using household

census data made available by the Minnesota Population Centre to identify and map smallholder farms in developing countries. The study was published in the journal, *Environmental Research Letters*.

"This map is a first step toward a better understanding of where and how smallholder farming can be sustainable for both landscapes and livelihoods," said Leah Samberg, lead author of the study. Information about the number, location and distribution of small farms can be used to guide investments and target policies for agricultural development, food security and sustainable land use, adds study co-author, Paul West.

In addition to producing the map, the study identified more than 900 places in 83 countries in Asia, sub-Saharan Africa and Latin America where there are fewer

than 5 ha of agricultural land per farming household. These places are likely to be home to a high concentration of small farms and are farmed by more than 380 million households. These smallholder systems produce more than half of the planet's food calories.

"This study is only a first effort at utilising these rich and complex data sets," noted Samberg. "We envision numerous future applications of this farm size product in combination with other variables related to food security, natural resource use and human well-being that will further increase our understanding of the dynamics of small farms and the livelihoods of those who depend on them."

Source: University of Minnesota

Mainstreaming 'nature' can help conserve ecosystems

Time is running out to stop the global decline in biodiversity and protect ecosystems that are essential for the livelihoods and well-being of billions of people, the United Nations Convention on Biological Diversity warned before the 13th meeting of the Conference of the Parties to Convention on Biological Diversity (CBD), known as 'COP13'.

Protecting biodiversity is crucial for human well-being and economic development. For example, global benefits from coral reefs including tourism, fisheries and coastal protection are estimated at some US\$30 billion per year, insect pollination of over 40 commercial crops in the United States alone at US\$30 billion per year, and the international trade of medicinal plants is estimated to be worth around US\$60 billion per year.

Biodiversity loss caused by agriculture, infrastructure expansion and climate change will greatly affect these sectors. For instance, it is estimated that 40% of land currently used for extensive agriculture will be lost by 2050. However, global agricultural production will need to increase by 50% to feed the world

population by 2030, making sustainable agriculture a pressing issue.

"If we are going to save biodiversity, we need to work with these sectors that depend on biodiversity and whose activities have a considerable impact on the variety of life on our planet," said Dr Bráulio Ferreira de Souza Dias, Executive Secretary of the Convention. "Agriculture, forestry, fisheries and tourism are important sectors whose activities need to take biodiversity conservation and sustainable use into account in a coherent manner."

Since 2010, Parties to the CBD have been working to achieve 20 biodiversity goals known as the Aichi Targets, named after the Japanese prefecture in which they were adopted. However, the CBD has warned that around two-thirds of these targets are not on track to being met by their 2020 deadline.

"Governments have made ambitious commitments to achievement of the Aichi Biodiversity Targets, but these declarations need to be matched with actions at the national level," Erik Solheim, Chief of UN

Environment said. "If countries do not ensure that national targets are set and achieved, their ambition will only remain on paper."

The Aichi Targets address issues ranging from the loss of natural habitats, sustainable agriculture and declining fish stocks, to access and sharing of the benefits from the use of genetic resources, indigenous knowledge and awareness of the values of biodiversity.

Achieving the Aichi Targets goes hand in hand with achieving the Sustainable Development Goals (SDGs), the CBD has stressed. While the protection of biodiversity is specifically mentioned in Goal 15 of the SDGs, biodiversity affects other goals as it is a source of economic growth, provides livelihoods for vulnerable populations, and can help eradicate poverty and hunger. Its protection is also crucial to climate change, and will help countries limit the global average temperature increase as specified in the Paris Agreement, which entered into force last month.



New WRC reports



Development and testing of an optimisation model at selected Eskom sites for an integrated water solution

This is a consolidated account of both Phase 1 and Phase 2 of the project. Phase 1 is focused on integrated water and membrane network systems, whilst Phase 2 is dedicated to cooling water system design that is characterised by multiple

cooling towers. A cooling water system, in the context of this investigation, refers to a cooling tower with its associated set of heat exchangers. In Phase 1, the developed model was validated using Eskom Kriel Power Station. The choice of this 110 Ml/day site was informed by the availability of data and willingness of personnel to give guidance on testing and implementation of results. Preliminary results have shown potential savings of more than 12% in freshwater use. This facility operates on a zero liquid effluent discharge philosophy. Consequently, no mention is made of wastewater savings.

Report No. TT 672/16

The current rain-fed and irrigated production of food crops and its potential to meet the year-round nutritional requirements of rural poor people in North West, Limpopo, Kwazulu-Natal and the Eastern Cape

While there is not much evidence of widespread starvation and extreme undernutrition in South Africa, national surveys provide evidence of multiple forms of deprivation related to the experience of hunger, widespread manifestation of hidden hunger or micronutrient deficiencies and increasing rates of overweight and obesity. Moreover, the co-existence of adult (especially female) overweight and obesity with hidden hunger and child malnutrition raises serious concerns over household food security. A previous WRC study revealed numerous knowledge gaps with regard to smallholder production and food security in South Africa. This project set out to address this significant and longstanding gap in knowledge and to propose a set of options for strengthening rain-fed and irrigated crop production in the rural areas investigated to identify the research focus areas related to efficient water use that could directly overcome dietary inadequacies and lead to better nutrition of rural household members. This unique study drew on a trans-disciplinary research approach to investigate the consumption and production patterns of rural households in communities in four selected sites in the poorest local municipalities in South Africa. This report presents the findings of this study.

Report No. 2172/1/16

Exploring the value of integrating green innovations in business

South Africa faces significant challenges related to water scarcity and poor quality in most of its water-supply systems. The growing demand for water, coupled with the deteriorating state of water infrastructure, due to lack of adequate investments, poses significant risks to water users. The resultant risks for business, broadly speaking, can be classified as reputational, physical, regulatory, financial and governance risks. The experience of these risks however varies according to sector. There is increasing recognition by businesses to reduce their water risks through interventions that help to green their operations and value chains in order to respond to the challenges they face. A strategic approach to managing water risk exposure also helps businesses to identify new opportunities and build long-term competitiveness. Due to the fact that water poses a shared risk to business, the public sector and the general public, there is an opportunity to explore measures that promote action by business to create shared value. Green innovations provide an excellent opportunity to create shared value in the context of water management through promoting interventions that result in improved business performance and the broader landscape and socio-economic outcomes. The purpose of this study was therefore to begin to explore the opportunities through which companies could create shared value, by effectively understanding their relationship with water and in turn invest in interventions that add value both to the business and to their broader stakeholders. It is envisioned that this report will be used by corporate organisations as a guide in assessing the water risks in their value chains and to consider possible interventions. We also envision the report being used, although to a lesser extent, by government to understand the context of water management in business, which in turn can inform policy.

Report No. 2349/1/16

The VitaSOFT Process: A sustainable, long-term treatment option for mining impacted water

The VitaSOFT process was developed in response to further development requirements that were identified during the development and full-scale demonstration of the Rhodes BioSURE Process, a biological sulphate reducing process for the treatment of mine impacted water with a high sulphate concentration. One of the disadvantages of the BioSURE Process was its reliance on primary sewage sludge (PSS), which may not always be available, as well as on a continuous supply of iron hydroxide, and the associated disposal requirements for large amounts of iron sulphide sludge. This study addressed these shortcomings and developed a more robust process with broader and more flexible application potential: VitaSOFT. Maize silage was identified as an alternative carbon source, with

advantages over PSS such as long shelf life, a higher percentage biodegradability, and lower nitrogen content. The validity of the new process was conclusively demonstrated. It differs significantly from the original patents by Rose *et al.*, and the BioSURE process as applied at the Ancor site for Grootvlei mine, and a new patent was filed in July 2014, leading to a patent application in July 2015, as well as a full patent application in Argentina. Because the newly developed process differs sufficiently from the initial patents and original BioSURE Process, the decision was taken to change the name of the process to VitaSOFT, as acronym that refers to the four integrated biological processes.

Report No. 2232/1/16

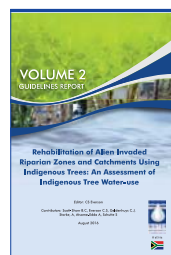


Water sector risk governance: An implementation guide for South African water utilities

Water resources remain one of the most critical issues for economic growth, the integrity of natural ecosystems and human societies that depend on them. Therefore, the implementation of sound risk management and governance practices is critical to finding meaningful solutions

that contribute to sustainable water management. A paradigm shift in water sector risk management and governance is also required in order to secure the efficient provision of water services in South Africa. Moreover, a change in the water sector governance structures is required to improve accountability and foster a shared responsibility and ownership of risks. An assessment of the risk maturity of water institutions in South Africa has shown that the overall average maturity varied from 2.4 (initial) to 3.9 (managed) on a scale of 5. The results obtained are encouraging as they suggest that some organisations that are already practicing reasonably good risk governance. The Water Boards and the metropolitan municipalities were observed to have a higher maturity level compared to the small municipalities and municipal entities. The journey to risk governance excellence requires strong leadership; a clear vision; a policy, framework and implementation plan; commitment and resources to implement the plan; good governance structures; open and transparent reporting mechanisms and regular engagement with all stakeholders. This implementation guideline serves as a primer to provide guidance in the planning, implementing and improvement of risk governance activities, irrespective of the utilities' size, legal entity or experience. It focuses on the practical steps that can be taken to achieve best practice and the main competencies required.

Report No. TT 669/16 (The other reports in the series are *Risk Governance in the South African Water Services Sector: Business Value Creation & Best Practice* (Report No. TT 667/16), and *Water Sector Risk Governance: A compendium of South African and international case studies* (Report No. TT 668/16)



Rehabilitation of alien invaded riparian zone and catchments using indigenous trees: An assessment of indigenous tree water-use

There are many different views on how invasive alien plant (IAP) stands should be managed, but the general perception is that IAPs impact negatively on biodiversity and should be cleared. In recent years there were several studies and papers

that indicated the opposite trend in terms of natural forest species, i.e. that planted and naturalising stands of introduced tree species can facilitate the regeneration and establishment of indigenous tree species on a disturbed site. This would therefore require a different approach to the rehabilitation of areas of IAPs towards natural forest. This WRC project had two main components: a hydrological component to compare the water use of indigenous tree species versus introduced tree species; and an ecological component to determine how natural forest species become established within invader plant stands. The general concept of the ecological study was that natural forest species have the potential to regenerate within IAP stands. This challenged the perception that invasive plants nullify the capacity of native species to regenerate in IAP vegetation systems. The aim of the study was to understand the dynamics of the spread of native regeneration within IAP stands and how adjacent natural forest influences such regeneration. Several hypotheses on the regeneration processes were tested to provide a sound scientific rationale into the ecology of indigenous tree species establishing in IAP stands, particularly the development and expansion of clusters of native forest species, and the influence of distance to native seed sources. The purpose of this report is to give a brief overview of the results from the different ecological and hydrological studies within this project, as a basis for improving the forest rehabilitation guidelines for practical conversion of IAP stands towards recovery of mixed indigenous forest.

Report No. TT 677/16

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