Green Topics

South African mining engineer wins St Andrews prize

A mining engineer from South Africa, whose research has taken him to some of the world's deepest gold mines, is the winner of the St Andrews Prize.

Daniel Limpitlaw, 27, picked up a cheque for $25,000 for his dissertation on reversing the damage done by early mining technology, which he claims is partly responsible for blighting the urban environment in many South African cities.

Launched in October 1998 by the University of St Andrews and international energy company Conoco, the St Andrews Prize sought practical solutions to environmental problems.

It attracted interest from 450 individuals and groups from countries as diverse as China, Pakistan, Canada, New Zealand, Germany, the UK and the United States.

Mr Limpitlaw, who received his award at a ceremony in Parliament Hall, St Andrews today (Friday 21 May 1999) claims that, due to mining and the subsequent development of informal settlements, many South African cities have been left in a state of 'alarming environmental degradation'.

Giving an example, Mr Limpitlaw said, 'Johannesburg shows the effects of both mining and unsympathetic government policies. It developed haphazardly and rapidly from a mining camp into a city.

'As a result of conditions which were imposed during the colonial/apartheid era, many urban dwellers demonstrate a culture of acceptance of poor living conditions.

'Cities do not have the infrastructure to accommodate the flood of people from the rural areas. This lack and the land-hunger of the immigrants lead to unacceptable environmental conditions. People live on river banks below flood lines, on the perimeters of mine dumps, and any other available open land, unaware or dismissive of the dangers posed to them.

Mr Limpitlaw believes that donor funding should be directly targeted at environmental projects, but should not be diverted from other areas of funding.

He is also calling for First World representatives to be re-educated in the social, economic and political conditions of South African countries, an improvement in environmental education in schools and the creation of lobbies to pressure central government on housing issues.

Mr Limpitlaw is a lecturer in Environmental Engineering and Geographic Information Systems at the University of Witwatersrand, Johannesburg. He received an MSc in mining engineering from Witwatersrand in 1993 and then worked in the Witbank coalfields to obtain a Masters Degree with a dissertation on the effects of pollution on a natural wetland. His current PhD research, which he hopes to complete this year, deals with environmental impact assessment using satellite data and geographic information systems.

The St Andrews Prize was judged by an international committee of trustees led by Sir Crispin Tickell, Convener of the British Government's Panel on Sustainable Development and former Ambassador to the United Nations.

The runners-up are Dr Jack Barkenbus from Tennessee and Ronnie Horesh, an English agricultural economist who works in New Zealand. ◆

The environment in the southern African city

Shortened version of the winning essay, St Andrews Prize, 1999

A short walk through any southern African city reveals alarming environmental degradation. City-dwellers are both creators and victims of these environmental conditions. This dual role can be clarified by examining the effects of the growth of informal settlements in southern African cities and industries such as mining.

Traditional African land-usage systems were custodial and environmentally sound. However, under colonial regimes, indigenous populations were usually crowded into cramped reserves on marginal land where resources were unable to meet the demands of the population. Reserve dwellers had no choice but to deplete natural resources. It was a matter of survival. As the exploitation of minerals and the concomitant growth of industries led to increasing urbanization, the environmental problems and practices already present in the rural areas spread to the urban areas.

Southern African cities are relatively young, many having started as mining camps less than a century ago. These nascent cities developed for the benefit of investors who profited from the mines but did not live on or near them. Little attention was paid to town planning, so the poverty of the urban population was matched by squalid living conditions. This situation was perpetuated and aggravated by subsequent political oppression or economic exploitation. From the establishment of the cities to the current day, political and economic conditions have ensured that waste and pollution from the mines, aggravated by the growth of industries and informal settlements, became integrated into the urban landscape.

In most cases the liberation of African states from Western political domination has done little or nothing to improve the situation. African economies are marked by mismanagement. Producers, previously unwilling to invest in the environment, are now either under pressure, or are prepared, to do so. This willingness means little, as collapsing

commodity prices have reduced the ability of industries to correct the wrongs of the past or provide a proper infrastructure for the burgeoning population. This problem will become more acute, given the increase in the rate of sub-Saharan urbanisation.

As a result of conditions which were imposed during the colonial/apartheid era, many urban dwellers evince a culture of acceptance of poor living conditions. Cities do not have the infrastructure to accommodate the flood of people from the rural areas. The lack of infrastructure and the land-hunger of the immigrants lead to unacceptable environmental conditions. People live on river banks below flood lines, on the perimeters of mine dumps, and any other available open land, unaware or dismissive of the dangers posed to them.

Informal settlements, mostly spontaneous, are characteristic of southern African cities. These camps are an environmental affront in every respect—physically, biologically, chemically and aesthetically. The ignorance of most of the people living in these conditions makes them passive destroyers of the environment. They are unaware of the environmental hazards posed by their habitat and of the way in which they damage the environment. Compromised cityscapes are further degraded through environmentally unfriendly lifestyle practices. These practices arise largely from a lack of resources such as electricity, sanitation and efficient domestic waste disposal. Even where services such as electricity are provided, unsustainable practices such as the use of coal for domestic purposes prevails. Trees are felled, either to clear spaces, provide building materials or for use as firewood or conversion to charcoal. Charcoal manufacture is an environmental disaster in its own right as, for the convenience of smaller volumes of domestic fuel, half the calorific value of firewood is wasted. This loss of trees also reduces shade and pollution alleviation and exacerbates soil erosion.

Mining is a major component of the economies of most southern African states. Inevitably, mining was prioritised and also inevitably, it caused a significant degree of the environmental degradation which blights urban areas today. The best examples of interaction between mining and the environment are to be found in South Africa and Zambia, these being the countries with the largest contiguous mining regions.

Johannesburg shows the effects of both mining and unsympathetic government policies. It developed haphazardly and rapidly from a mining camp into a city, administered by a succession of white governments who showed little concern for urban workers. As the city's demand for land grew, communities were forcefully re-located to defunct mining areas. Coronationville, west of the city centre, is such a residential area. It borders on old mine dumps which were decommissioned in the 1930s.

When the Princess dump was decommissioned it was in the middle of the veld, and even its environmentally unfriendly design had little impact on the young Johannesburg. Urban sprawl and relocation forced people up against the dump. The original mining company had not envisaged such a possibility and the dump was neither designed nor decommissioned with this in mind. Houses were built right up against the retaining walls of the dump. The local authority, in spite of directives from the provincial Department of Minerals and Energy, allowed this development (Meintjes, pers. comm. 1999). Residents have been subjected to contaminated sludge washing into their homes. The dump is currently being reprocessed, so the locals are also exposed to heavy metal enriched sand and dust. Acid drainage from the dump seeps into a stream which runs through a small park, where it represents a recreational hazard to children. Current best practice is being applied to rehabilitate the dump, but over sixty years erosion and leaching have contaminated the surrounding soil, on which houses have been built. Remediating this soil is practically impossible given the financial constraints of the local authority and the acute housing shortage in South Africa.

Elsewhere on the subcontinent, similar trends can be identified. Zambia gained independence in 1964, at a time when South Africa was still firmly ruled by the apartheid government. In spite of the fact that Zambia now had a government which had vested interests in promoting sustainable urban environments, the environmental policies remained as dismissive as those which were promulgated by the government in South Africa. In both countries the disregard for the marginalised people living in unsustainable environments continued.

From independence onwards, Zambian governments encouraged greater and greater copper production without requiring investment in urban sustainability. Cities were further affected by the drop in global commodity prices which removed the means of improving conditions in the urban areas.

In 1900, what is now Kitwe, Zambia's second city, was part of a featureless valley on the central plateau of southern Africa. This was transformed into one of the world's greatest copper-producing regions in just thirty years. Like Johannesburg, the young Kitwe was envisaged as a mining town whose sole function was to generate revenue for absentee shareholders. It also quickly exceeded this limited function and acted as a nucleus for the urbanisation of the surrounding countryside. Continuing population growth and urbanization in Zambia has rendered colonial town-planning ineffective, and suburbs in Kitwe and her sister cities on the Copperbelt swarm around old tailings dams. Like other contemporary tailings dams world-wide, these were not designed to reduce the impact on the ecosystem.

In Kitwe, impoundments were built in the sensitive headwater areas of streams. These polluted streams run through formal suburbs and then informal settlements which mushroomed on the outskirts of Kitwe. Children play in this water, which is rich in heavy metals. The same water is also used for washing, drinking and cooking. Poor sanitation means the streams are further polluted by sewage. Rapid and uncontrolled urbanisation has created an environment sensitive to pollution right next to the source of pollution. These polluted streams not only impact on their immediate environments but also join Zambia's principal water-source, the Kafue River, in this condition. The river transports metal-rich sediment some 700 km downstream (Bäckström and Jonsson1996), affecting countless other individuals and ecosystems.

In the early, 80s, before the new environmental awareness swept through the Copperbelt mines, an incident occurred along the Mwambashi River, a tributary of the Kafue

and a major source of domestic and agricultural water in Kitwe. Mwale[1996] reports: '...chronic copper poisoning resulting in the death of about 270 cattle, 50 sheep and 140 goats from farms bordering the Mwambashi River—revealed that the source of copper were (sic) the sediments in the Mwambashi river bed, soil and grass from along the river'. This copper could only have come from the mines upstream.

Possibly the biggest impediment to sustainable environmental management in southern African cities is poverty. If this problem could be solved the problem of urban pollution would be greatly reduced and far more easily managed. However, the environmentalist has to work within this overarching restriction, and cannot afford to be intimidated by the fact that he can do little about it. Much can and must be done, on a micro-scale, to ameliorate urban environmental hazards.

To do this a reconsideration of both environmental philosophy and practice is required. The economic reality is that many projects in southern Africa cannot be contemplated unless funded by donor organisations. These donors often perceive African priorities in terms of First World circumstances and attempt to apply First World solutions in environments where they are neither affordable, understood, nor always correct. Donor funding should be channeled towards capacity building in regional tertiary institutions, many of which have skilled staff, but are constrained by funding cuts. First/Third World partnerships between donors and these institutions would result in more appropriate models for African conditions.

Two aspects of this partnership are important if resentment or accusations of neo-imperialism, and a resultant unwillingness to participate on the part of the recipient country, are to be avoided. Firstly, funds should be specifically allocated for environmental projects, and should not be diverted from other areas of funding. Secondly, First World representatives must arrive at a sound understanding of conditions, social, economic and political, in southern African countries, so that the objectives of projects are rooted firmly in the realities of the recipient countries. Parameters governing environmental stewardship have been developed in line with First World realities. New parameters must be developed for Africa. Environmental controls must be balanced against much-needed industrial activity or the resulting economic collapse would have a cataclysmic environmental impact as people attempt natural resource exploitation for a livelihood. This is likely to have a larger environmental impact than long-term pollution.

The building of capacity in tertiary institutions will influence the practice of environmental stewardship in the region. With affordable technology, many previously insurmountable problems can be solved, not least among these the huge information deficit.

It is at the level of local authorities that this information deficit needs to be addressed urgently. Administrators need to know where environmental hazards occur within their jurisdiction, and the change in the distribution of these hazards over time. They also need to be aware of the dangers associated with each of these hazards. This information will prevent the sanctioning of development in dangerous areas and will assist in prioritising the relocation of informal settlements which are under threat. Knowledge of such hazards must then be coupled with knowledge of sensitive environments, so that both the impact of development on the environment and that of the environment on developments can be ameliorated.

Local authorities need to be made accountable for development decisions. Currently much development takes place along the lines of expediency and vested interests. There is little strategic planning, only short-term solutions to cash-flow problems. Local authorities must accept their custodial obligation, both in terms of people and the environment.

Local authorities are also appropriate agents for disseminating education as they are in touch with local community organisations. Education—sadly lacking—needs to be introduced at school level and at the work-place for those out of the school system. This will empower citizens and convince them that they too have a vested interest in sound environmental practice. Knowledge will also mean they will be able to demand accountability of the local authority.

The cost of information gathering and processing is a major impediment to the realization of a sustainable city. In the past, this task would have required an army of officials to collect environmental data and another to process it. Today this task is considerably easier given the advent of powerful, cheap, personal computers and the sophisticated software packages designed to manage such geo-spatial data. These software-computer-operator systems are commonly referred to as geographic information systems (GIS). They permit the rapid processing of historical data collected by a local authority with subsequent updating by sophisticated modern data capture techniques such as satellite remote sensing. With a few PCs, some inexpensive software, a scanner and a digitizer, a small team of professionals can accomplish what would have required the entire budget of cities like Kitwe.

In this paper, two major aspects of urban pollution have been discussed—mining and informal settlements.

Large-scale mining is essentially an export industry in southern Africa and international trade requirements force mining companies to improve environmental performance. Environmental costs are acknowledged as a significant component of operating costs, and mines dedicate large sums to rehabilitation and the practice of minimum impact extraction. The prospect of re-mining old dumps also bodes well for the environment. Historically, commodities were produced using low-efficiency extraction techniques. As these processes improved, the residual metal concentrations in old dumps became valuable ore resources. The Nkana slag dump in Kitwe is proved to be the world's largest cobalt deposit, and mining companies vied to reprocess it. Old tailings dams around Johannesburg are disappearing into processing plants for recovery of gold. This is both profitable and removes major environmental hazards as new waste from reprocessing has to be disposed of in accordance with modern environmental standards. Thus, either through economic forces or local regulations, the mining industry is being forced to adopt environmentally sound practices.

Dumps that cannot be economically re-mined, given today's commodity prices, present an ongoing problem. Most of these dumps are the responsibility of the state, which doesn't have the necessary resources to apply best-practice stabilization techniques. The new capacity of tertiary institutions can be used to guide community-based rehabili-

tation projects, thereby reducing the high cost of professional environmental services. Recently, the South African Minister of Water Affairs and Forestry successfully used unemployed people to clear exotic vegetation from rivers. This approach can also be applied to dump rehabilitation, thereby alleviating urban poverty, improving environmental conditions and educating members of the community.

Lobbies must be formed to pressure central government with regard to the provision of housing. Currently most, if not all, southern African governments prioritise prestige and/or defence projects over housing, even where, as in South Africa, housing is a stated priority. Pressure groups need to enforce this priority, and this can only occur if the population is environmentally educated and thus empowered by a body of knowledge in terms of which they can call central government to account. A number of sub-economic housing developments have been established, but much more could be done to make these environmentally sustainable. These developments invariably arise on the outskirts of cities in virtual dust-bowls. Greening must be a mandatory part of each development. Planting of indigenous trees must be encouraged, this being environmentally sound. Parks are essential. A mentor system can be initiated, where local nurseries take over a new housing development, educate its inhabitants and subsidize the greening of the area.

Sub-economic housing, in spite of its temporary appearance, invariably outlasts high-rise buildings, which are demolished as soon as they are obsolete or can be replaced by a more profitable building. Yet far more money is spent on the design and building of a high-rise than on a housing development. An initial development phase which holds out the promise of an improved lifestyle will encourage residents to value and nurture the lifestyle. On an individual and small community scale, people need to experience, for themselves, that it is profitable (economically and socially) to care for the environment. With the support of central and local government, local business and the community, a tremendous difference can be made at comparatively little expense.

Urban landscapes are going to become increasingly important environments of human habitation in the next century. The need to ensure that these cities are sustainable habitats is paramount. Urban rehabilitation must be incorporated into the idea of an African Renaissance, or there can be no Renaissance. The prospect of the nightmare cities of science fiction is the alternative to urban nurture.

References

Bäckström, M. and B. Jonsson. *A Sediment Study in the Kafue River, Zambia* Master's Thesis Division of Applied Geology, LuleÜ University of Technology, Luleå, 1996. 96 pp.

Meintjes, S. (personal communication) Principal Environmental Officer, Gauteng *Department of Minerals and Energy*, South Africa.

Mwale, A.H. *'An Overview of the Environmental Impact of the Copper Industry on the Quality of the Water and Sediment of the Kafue River, Zambia'*, a paper presented at YES '96, EIZ, Luanshya District, 1996. 22 pp.

Star Newspaper Johannesburg, South Africa, Wednesday, January 27, 1999. p. 1. ◆

An environmental newsletter for the professions*

Eagle Bulletin is a useful little pamphlet providing an up-to-date review of what is going on nationally regarding environmental management with sorties internationally.

Typically its contents include a topical editorial; a focus article on, for instance, the Industrial Environmental Forum, a recently promulgated Act, or an interview with the new Director General in the Department of Environmental Affairs and Tourism.

It reports on: up-dates and provides critiques on environmental legislation, its implications and implementation, discussion documents through green and white papers and policies to Acts and Regulations. The past has seen developments leading up to the National Environmental Management Act and currently the National Waste Management Strategies and Action Plans. It also covers book reviews, forthcoming environmental conferences and seminars—it will publicize your event free of charge given three months' notice—environment on the internet, environmental awards and company environmental reports.

Now in its 10th year, Eagle Bulletin is also available electronically. As an additional service to subscribers an electronic archive of back numbers linked to a search facility has been made available on Eagle Environmental's website *http://www.eagleenv.com*. Subscribers will receive two passwords, one for access to the archive and the other to access the current bulletin electronically.

At R180 per annum for six issues this service offers good value for being kept aware of developments on the environmental management front. ◆

* *Issued by: Eagle Bulletin, Private Bag X1, Pavilion 3611, Tel: (031) 701-5315, Fax: (031) 701-5377, E-mail: arend@iafrica.com*