Annual TIPS Forum 2016
14-15 June, Johannesburg

Mining and the environment in South Africa: unpacking the key challenges

Ellen Davies, WWF
Georgina Ryan, TIPS

Outline

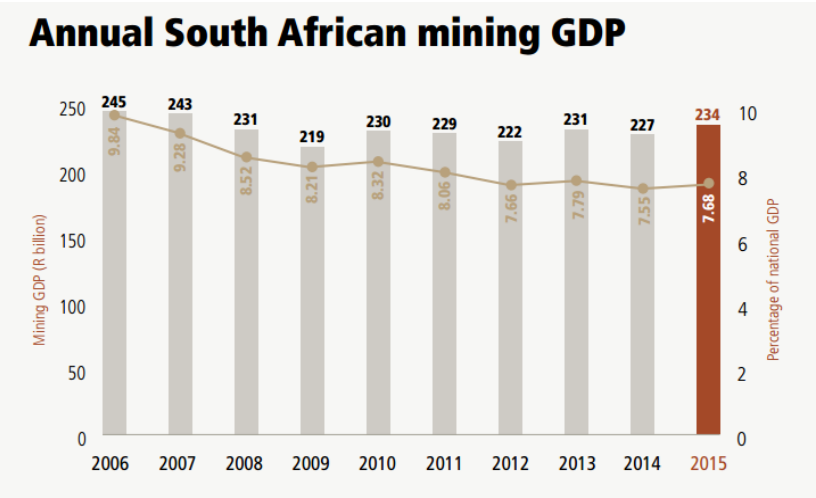
- Paper based on research for the mining lab- Mining Phakisa 2015
  - Research Team: TIPS (Gaylor Montmasson-Clair, Georgina Ryan) and WWF (Ellen Davies and Manisha Gulati)
- Context
- Analytical approach
- Policy framework and legislation
- The key environmental challenges
  - Water, waste, air quality, climate change, biodiversity and land, rehabilitation and financial provisioning
- Developments in the mining sector
  - Next generation mining, artisanal and small-scale mining, reprocessing of MPRD's
- Recommendations and further research

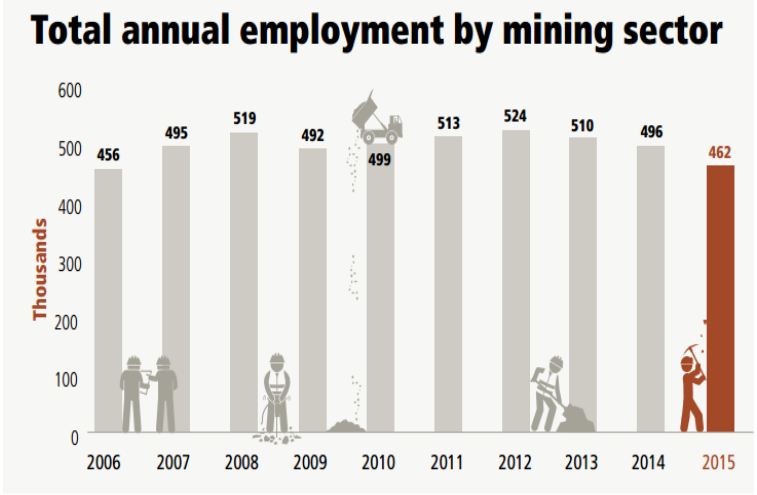
Mining and the environment

- Sustainable development hinges on three main pillars: economic, social, environmental
  - The environmental discourse in SA sidelined/underplayed
- Very nature of extractive industry- impacts environment and is affected by environmental challenges
  - Challenges common to resource users:
    - Climate change, land use and biodiversity challenges and water security
  - Mining specific: acid mine drainage, derelict and ownerless mines (rehabilitation)
  - Topics covered in the paper water, waste, air, land and biodiversity; rehabilitation and financial provisioning
  - 100 year mining history in South Africa
    - Knowledge, regulatory framework and technologies that did not exist/deemed necessary

Mining sector performance in South Africa

- Mining is still a key sector of the economy
  - GDP; foreign revenues; employment; manufacturing linkages

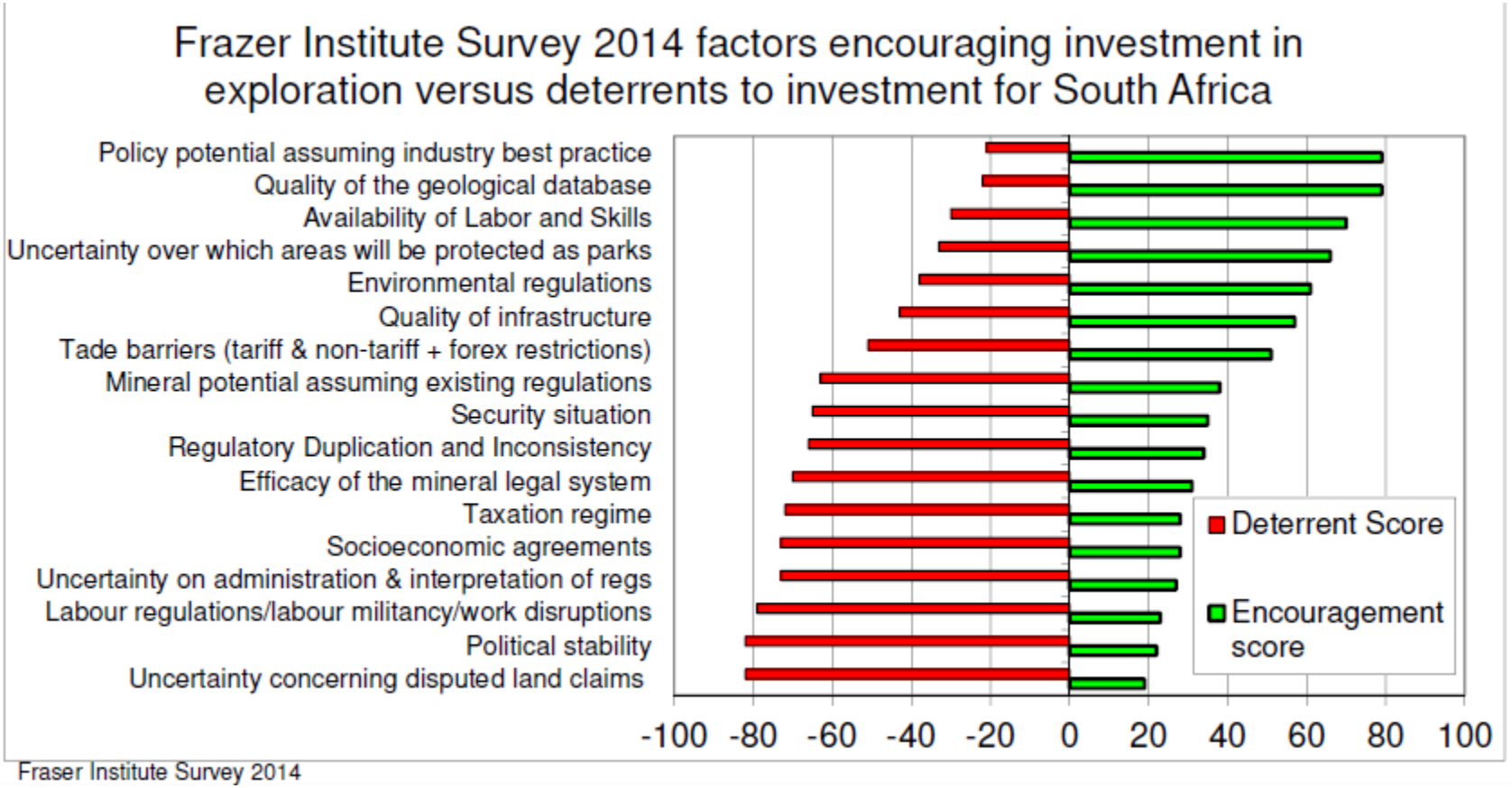




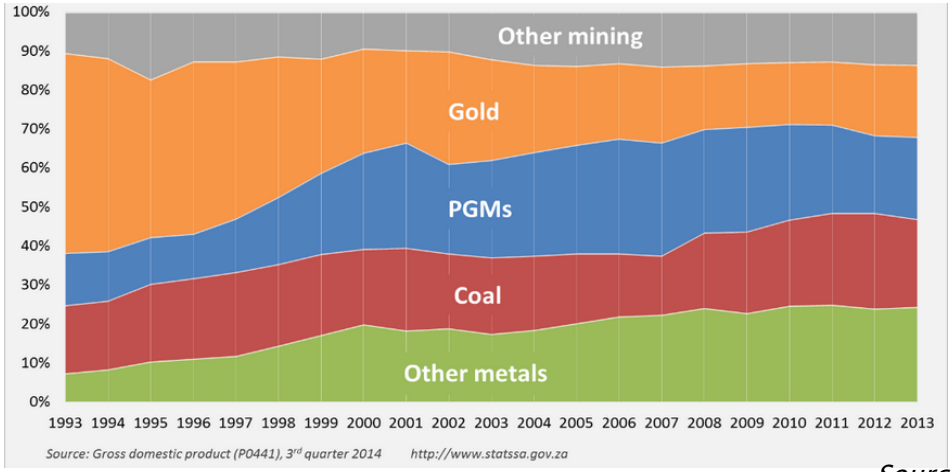
Source: Chamber of Mines Factsheet, 2016

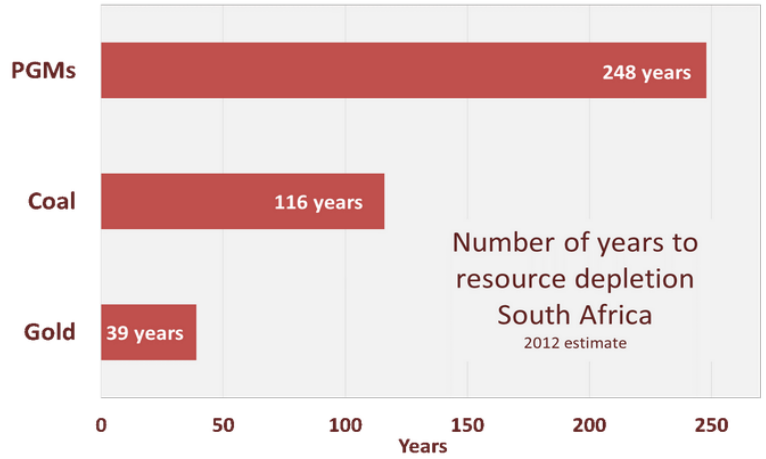
- Weak performance of the mining sector due to slow down in commodity prices and increased cost pressures

Attractiveness as a mining investment destination

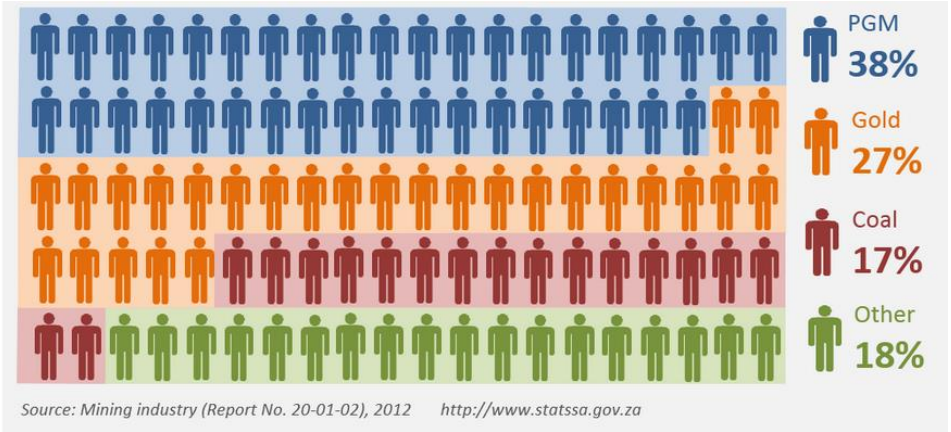


Mining sectoral breakdown and reserves of key commodities





Source: Environmental Economic Accounts Compendium, 2015 (StatsSA)



Analytical approach

- The relationship between mining and environment is a complex relationship
  - Cost/benefit analysis alone is not sufficient for understanding this complexity
  - A holistic approach needed to understand, context, history, specific environmental issues, the problems and the opportunities
  - Timeline: most recent developments (2004- present), understanding the history and impacts (legacy issues)
- Process of unpacking the key challenges
  - Data gaps
  - Major issues- regional impacts, case studies
  - Understand what is needed to make progress
  - A stock taking exercise
- Desktop study and interview with industry experts

Regulatory Framework

- Historic under-regulation of the environment in mining
  - Phases in regulatory history: pre-1994; between 1994-2004; and
    - Mines and Works Act 1956 (Act No 27 of 1956)
    - Minerals Act of 1991
      - requirement that companies must submit Environmental Management Programme Reports (EMPR)
    - Bill of Rights 1996
    - 1998 National Environmental Management Act (NEMA).
    - Minerals and Petroleum Resources Development (Act No. 28 of 2002)

Constitution (1996)

Article 24 of the Bills of Rights: "(a)n environment that is not harmful to people's health or well-being that is protected for the benefit of the present and future generation, that prevents pollution and ecological degradation, promotes conservation; and secures ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development"

National Environmental Act (NEMA)

Act No.107 of 1998; Amendment Act No.62 of 2008 **(DEA)**

Minerals and Petroleum Resources Development (MPRDA)

Act No.28 of 2002 ; Amendment Act No.49 of 2008 **(DMR)**

The One Environment System (OES) (2014)

National Water Act

Act No.36 of 1998

(DWS)

Waste Act

Act No. 59 of 2008; with 2014 amendments

Air Quality Act

Act No.37 of 2004

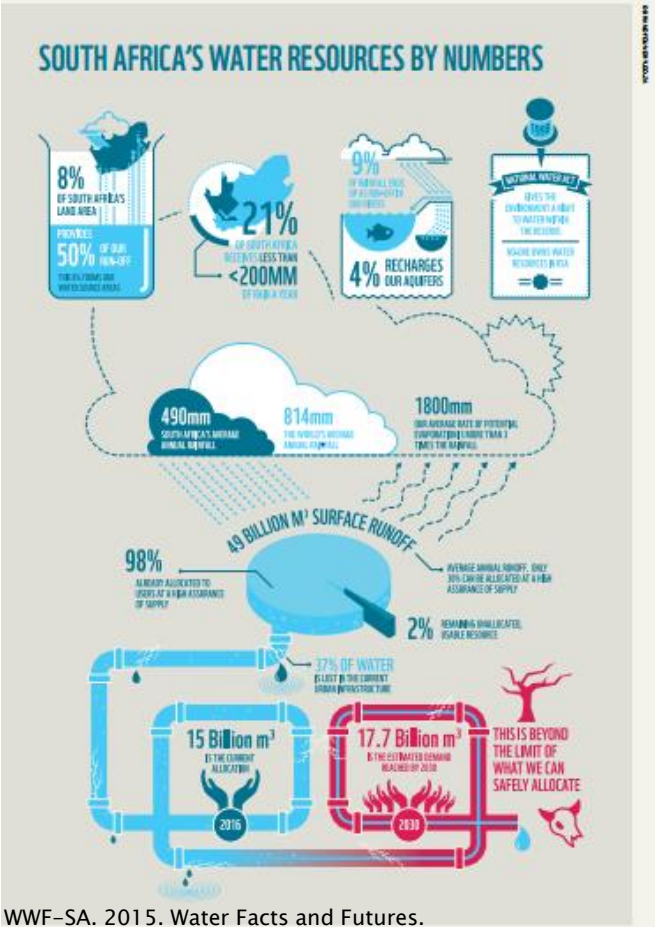
Financial Provisioning (2015)- under NEMA (R1147)

Land-use requirements

By other departments- Rural Development and Land Reform, DAFF

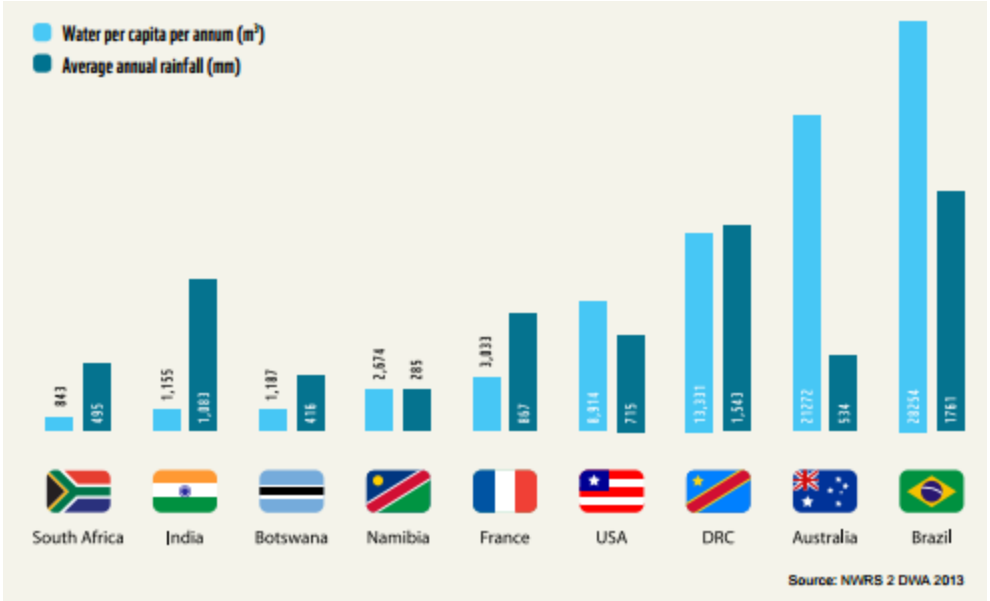
Laws on biodiversity and heritage resources

Water: South Africa's scarce resource



WWF-SA. 2015. Water Facts and Futures.

Water availability per capita per year in selected countries

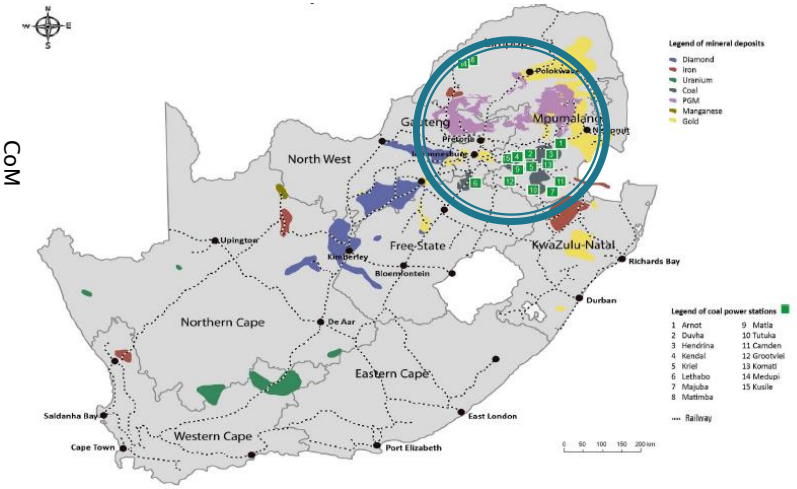


WWF-SA. 2015. Water Facts and Futures.

Water for mining

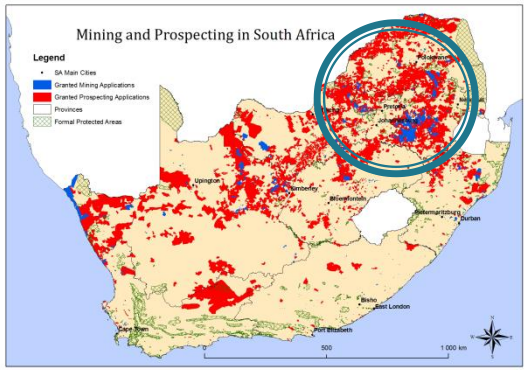
Overlap between mineral resources and water stressed areas

Location of mineral resources



CoM

Mining and prospecting applications



Endangered Wildlife Trust

WMAs with negative or low water balances

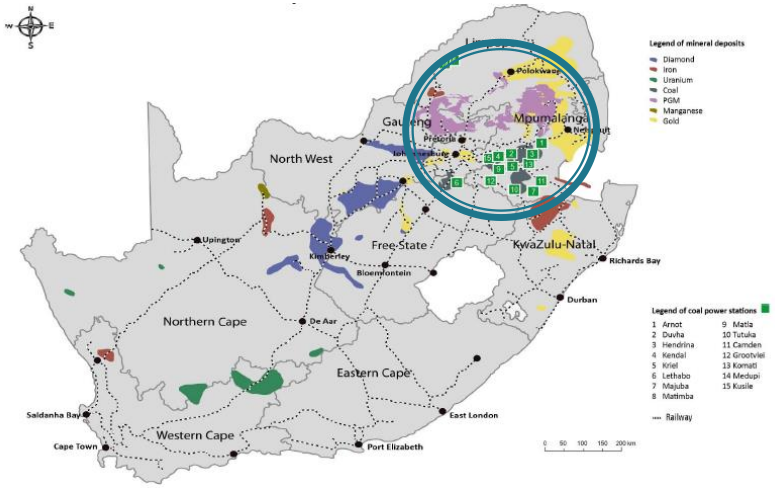
✖	**Negative balance** - indicates that water consumption is already exceeding sustainable water availability, despite existing water transfer schemes.
✖	**Low balance** - indicates that water consumption is already nearing sustainable water availability, despite existing water transfer schemes.

Adapted from SANEDI 2011, SA coal roadmap

Impact of mining on water

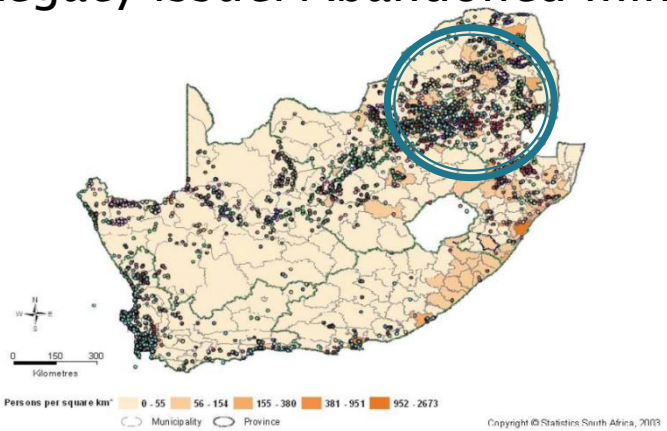
Clear overlap between mining and water quality issues

Location of mineral resources



CoM

Legacy issue: Abandoned mines



CGS, 2008 in Colvine et al, 2011.

Water quality issues identified in WMA's related to mining

	Salinisation*	Soil salinity, irrigation system clogging, costs of water treatment
	Acid Mine Drainage	Mobilisation of metals, fish and crocodile kills, bioaccumulation, low pH, elevated sulphur and iron, elevated salts and dissolved metals
	Metal Contamination	Mobilisation of metals; fish and crocodile kills, bioaccumulation, KNP mammals; potentially harmful for human health and for aquatic environment
	Suspended solids (turbinity, sedimentation)*	High suspended solids during high flows; silting up of rivers, weirs and dams; loss of habitat, increased water treatment costs, irrigation clogging
	Radioactivity (from discarded mine dumps)	Bioaccumulation fish, aquatic organisms, soils, humans. Carcinogenic effects

* Mining is not the only contributing factor

Adapted from SANEDI 2011, SA coal roadmap

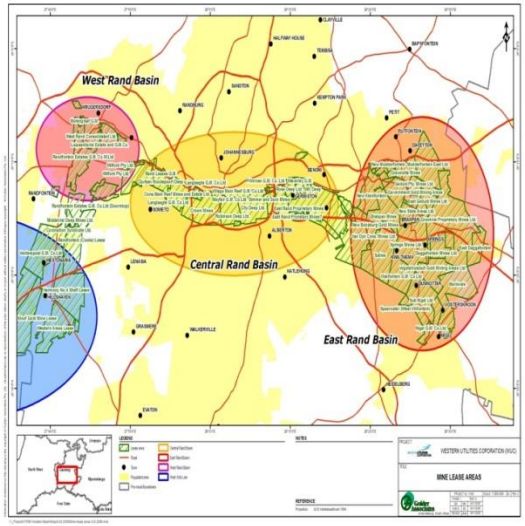
AMD- The biggest environmental threat facing SA

Legacy issue and future problem

Areas of concern

Highest Priority Areas	Vulnerable Areas	Low Priority Areas
Western Basin – limited pumping taking place	Mpumalanga Coal Fields	O'Kiep Copper District – appear to be localised
Central Basin – no pumping taking place	Free State Gold Field	Waterberg, Molteno and Limpopo coal fields
Eastern Basin – one mine pumping	KOSH Gold Field	South Rand Gold Field
	Far Western Basin	
	Evander Gold Field	

Highest Priority Areas for AMD



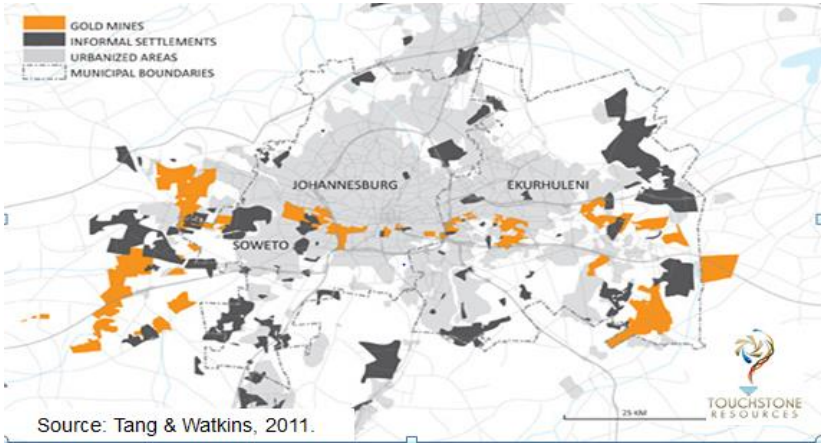
Witwatersrand Gold Fields

- 350 mega liters decanting per day into Witwatersrand Gold Fields – 10% of potable water distributed to municipalities by Rand Water daily
- ZAR 2.2 billion – phase 1
- ZAR 6.4 billion – phase 2
- ZAR 10 billion for Witwatersrand Gold Fields alone

Mining waste

Very little information available on mining waste

Proximity of gold mines to human settlements



Some estimates:

- 2001: I billion tonnes of coal slurry and discards covering 4000 hectares
- 2004: AngloGold Ashanti – estimated 270 gold tailing dams in Witwatersrand Basin – covering 400 km2

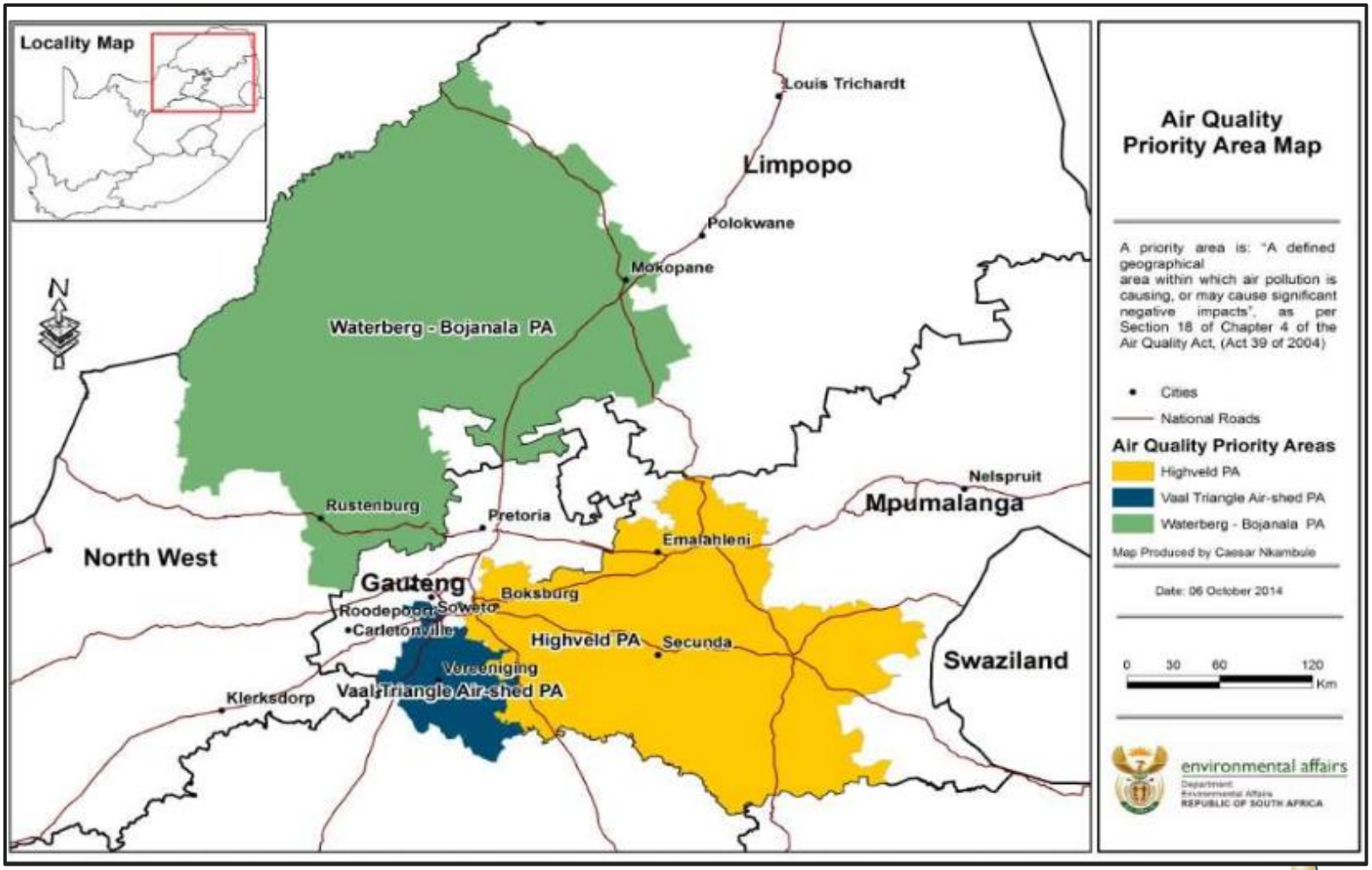
Tudor Shafts Informal Settlement

Source: Earthl.ife Africa.
http://earthlife.org.za/2011/04/an-action-plan-for-acid-mine-drainage/

Air Quality

- Air pollution has direct health costs estimated to ZAR4 billion per annum according to the Department of Environmental Affairs
- Air quality management is legislated in South Africa under the National Environmental Management: Air Quality Act, Act 37 of 2004
- Three priority areas identified – all mining areas
  - mining activities are only a major contributor to PM emissions, i.e. dust. In contrast, the contribution of mining to SO2 and NOx emissions is marginal
- In 2009, the cost of compliance with SO2 and NOx emissions standards was estimated at ZAR 678 million for ArcelorMittal South Africa and ZAR 137 million for Metalloy, largely due to SO_2 emissions

Air Quality

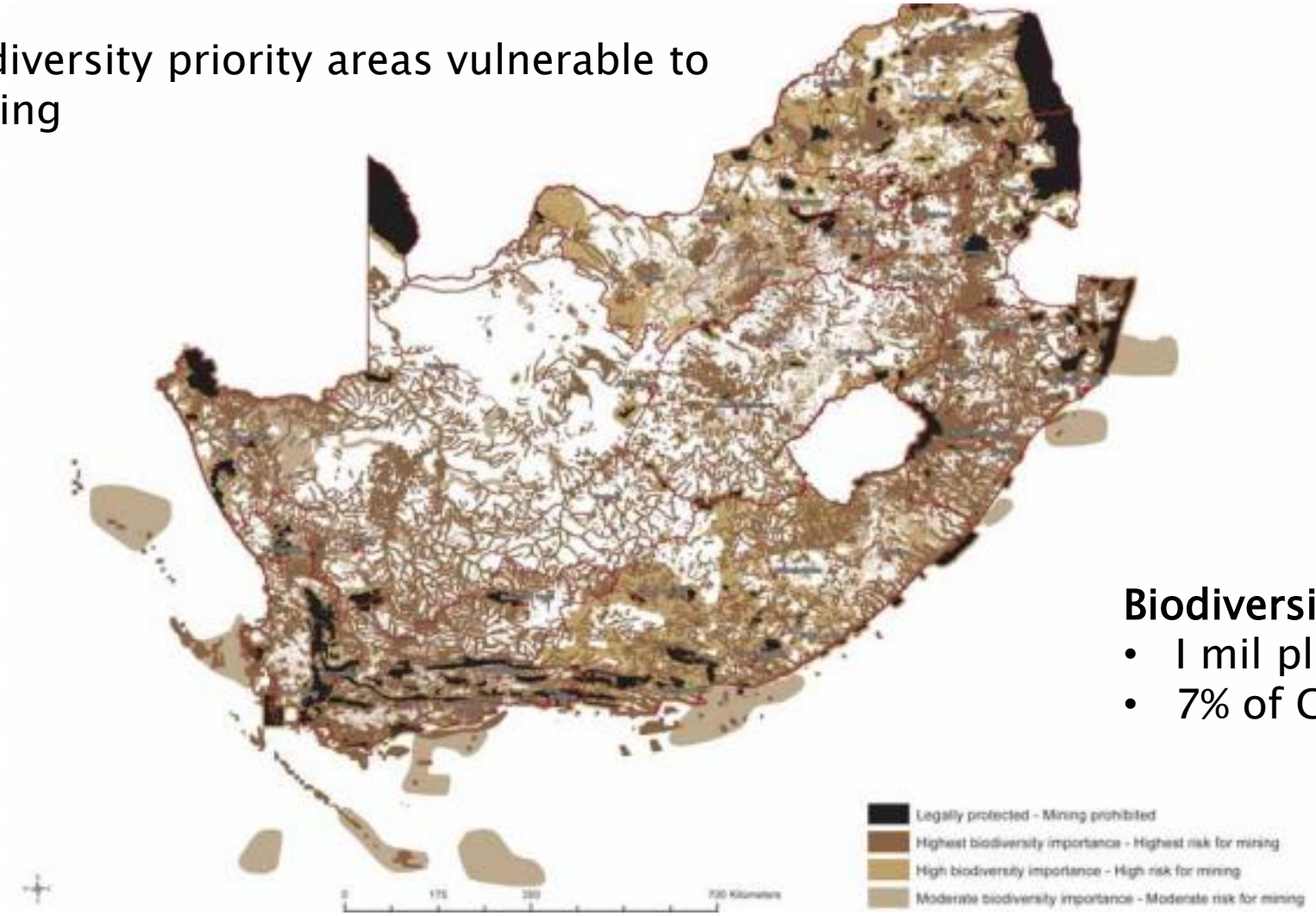

Locality Map
Louis Trichardt
Limpopo
Polokwane
Mokopane
Waterberg - Bojanala PA
N
Rustenburg
Pretoria
North West
Gauteng
Boksburg
Roodepoort
Soweto
Carletonville
Highveld PA
Secunda
Vereeniging
Vaal Triangle Air-shed PA
Klerksdorp
Nelspruit
Mpumalanga
Emalahleni
Swaziland
Air Quality Priority Area Map
A priority area is: "A defined geographical area within which air pollution is causing, or may cause significant negative impacts", as per Section 18 of Chapter 4 of the Air Quality Act, (Act 39 of 2004)
Cities
National Roads
Air Quality Priority Areas
Highveld PA
Vaal Triangle Air-shed PA
Waterberg - Bojanala PA
Map Produced by Caesar Nkambule
Date: 06 October 2014
0 30 60 120
Km
environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Climate Change

- South Africa the 13th largest GHG emitter in the world
- Energy sector indeed accounted for about 87% of South Africa's GHG emissions over the 2000-2010 period
  - largely results from coal-fired electricity generation, followed by road transportation
  - electricity generation accounted for more than 60% of the country's GHG emissions over the period
- South Africa's international climate change commitments- Peak, plateau and decline trajectory; and INDC commitments
- Carbon tax proposal by National Treasury- largely agreement on need for a carbon price
  - Planned for implementation in 2017
  - Issues on tax design and implementation; coordination with other proposed instruments (carbon budgets) etc.

Biodiversity and land

Biodiversity priority areas vulnerable to mining

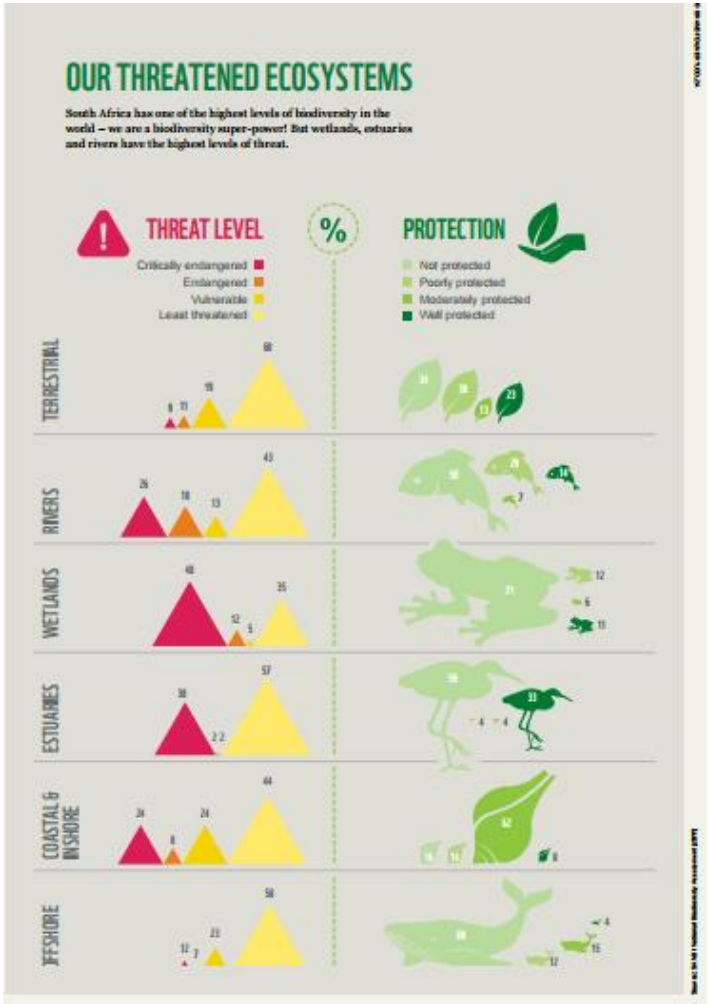


Biodiversity:

- I mil plus jobs
- 7% of GDP

DEA et al. 2013. Mining and Biodiversity Guideline.

Freshwater ecosystems particularly under threat



WWF-SA. 2015. Water Facts and Futures.

Key water source areas

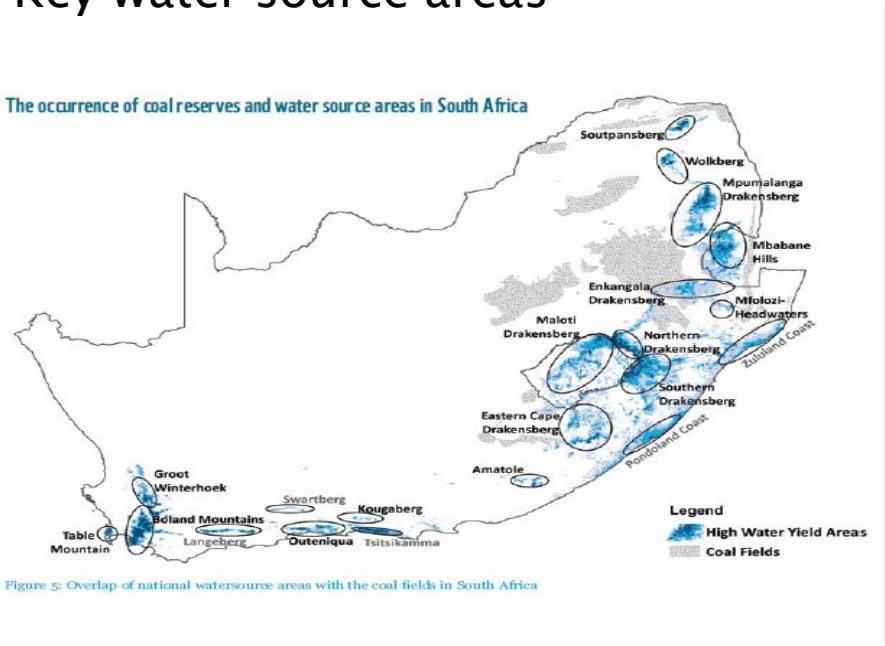
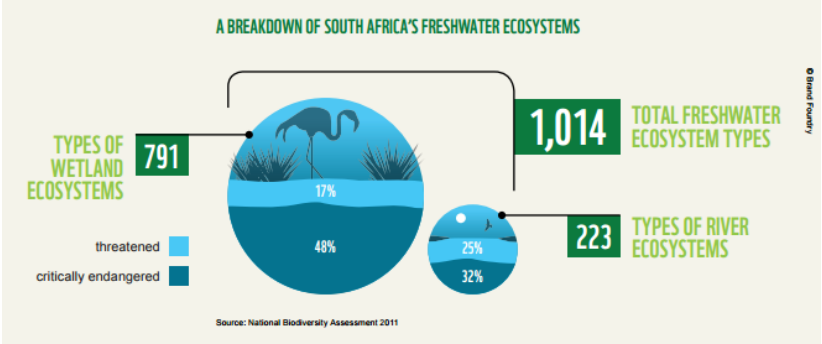


Figure 5: Overlap of national watersource areas with the coal fields in South Africa

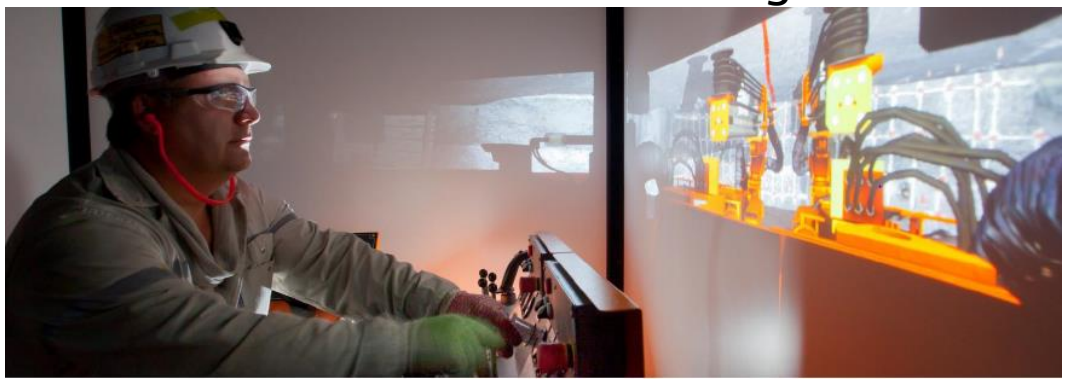
WWF-SA. 2015. Water Facts and Futures.



WWF-SA. 2015. Water Facts and Futures.

Developments in the Mining Space

Next Generation Mining



Source; CoM. 2015. Next Generation Mining: Presentation for Mining Phakisa – 8 Spet 2015.

Small-scale mining

A small mining operation near Garies in the Western Cape, South Africa (Photo: jbdodane, Creative Commons via Flickr)

Source: IEED. http://www.iied.org/stuck-between-deposit-hard-place

Re-processing of mining waste

Figure 3: Manual hydraulic monitor on a tailings facility in South Africa (Courtesy of Fraser Alexander)

Source; Tailings.info. http://www.tailings.info/technical/hydraulic.htm

Conclusion and further research

- Shift the paradigm – it is not either or but both
- Address trust deficit between different stakeholders
- Address the data gaps:
  - Better localised data
  - More accessible data – through centralised repositories
  - Use our resources – universities, communities, research organisations etc

Trade and Industrial Policy Strategies

Supporting policy development
through research and dialogue

www.tips.org.za
info@tips.org.za
+27 12 433 9340