

Managing Natural Resources for Sustainability in Artisanal and Small Scale Mining Communities

Mike Burns
CSIR, South Africa



STRUCTURE OF PRESENTATION



Natural Resources – one of the main spheres of sustainable development

Valuing Natural Resources

Human well-being & state of natural resources (ecosystem services)

State of Southern Africa's ecosystem services (which determine the sustainability of ASM and society in general)

Relationship between ecosystem services and human freedom

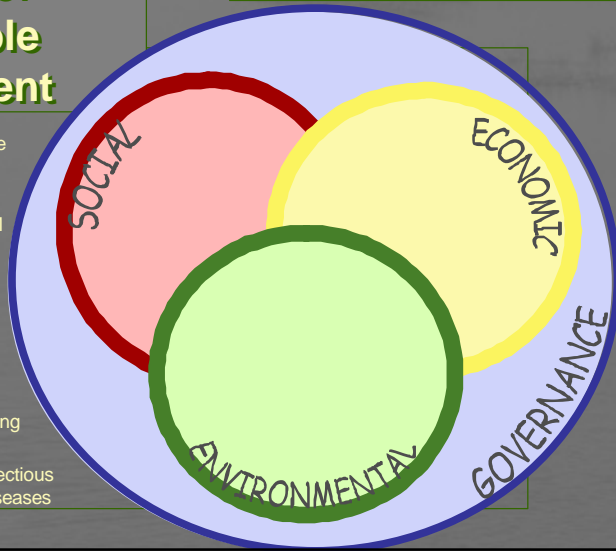
Key interventions necessary for sustainability in ASM

Conclusion: it's about managing complex *socio-ecological systems* (rather than managing natural resources)

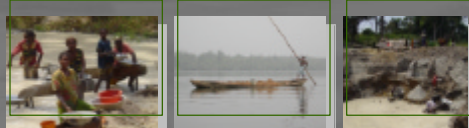
Natural resources: one of the spheres of sustainable development



Government response
to managing ASM
Community
Education in ASM
Gender Interests
Value chain issues
(beneficiation – e.g.
jewelry manufacture)
Exploration,
production, processing
Child Labour Infectious
 Diseases



Valuing Natural Resources



- *Intrinsic* environmental value
- *Instrumental* environmental value: the concept of ecosystem services

Valuing Natural Resources



Environmental security



Ecosystem Services

Provisioning Service
Food
Water
Wood

Regulating Services
Climate
Floods
Diseases

Cultural Services
Aesthetic
Spiritual
Recreation

Supporting Services
e.g. Soil nutrients

Biodiversity: the variety of life

Human well-being related to state of ecosystem services



Ecosystem Services

Millennium Ecosystem Assessment focuses on state of environment & the enabling conditions for human wellbeing – also, with application to ASM

Human Well-being

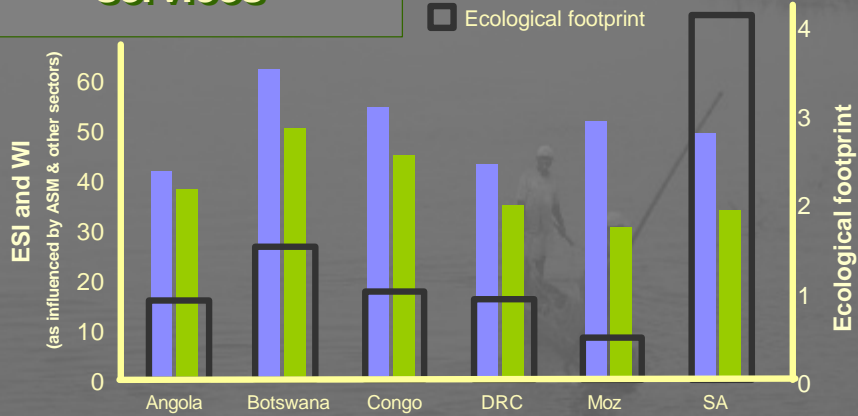
Millennium Development Goals (MDGs) focus on priorities for human well-being – also, with application to ASM



Human well-being related to state of ecosystem services



■ ESI = Environmental Sustainability Index
■ WI = Human well-being index
 Ecological footprint



Closely coupled socio-ecological systems

Human well-being related to state of ecosystem services



Ecological Footprint

- Measure of the "load" imposed by a given population on natural resources.
- Represents land area necessary to sustain current levels of resource consumption and waste discharge by that population.



Human well-being related to state of ecosystem services



Country	Footprint in hectares
USA	9.57 ha
Sweden	7.95 ha
South Africa	3.52 ha
China	1.36 ha
India	0.76 ha
Bangladesh	0.5 ha
World average	2.3 ha
World availability	1.89 ha *

* With no spare capacity for other species

State of the region's ecosystem services



Indices of general state of natural resource base

What is the capacity of key ecosystem services to support ASM?

- Water availability
- Food production
- Fuel wood (energy source)
- Biodiversity

State of the region's ecosystem services

Water availability



- Region has abundant, largely unpolluted freshwater resources
- Distribution doesn't correlate with demand – water-rich north, water-scarce south
- Waterborne diseases in the north, industrial pollution in the south.

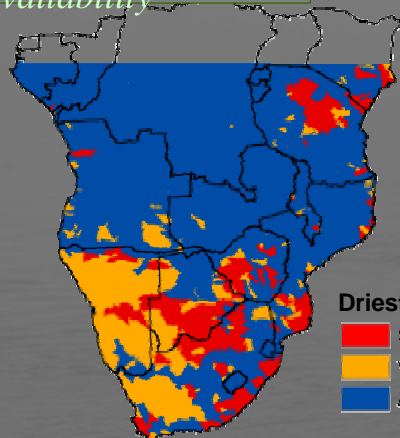
State of the region's ecosystem services

Water availability



North: water-rich
South: water-scarce

All major river basins are shared - international cooperation is imperative



Driest month

- Severe shortages
- Vulnerable areas
- Adequate supply

State of the region's ecosystem services

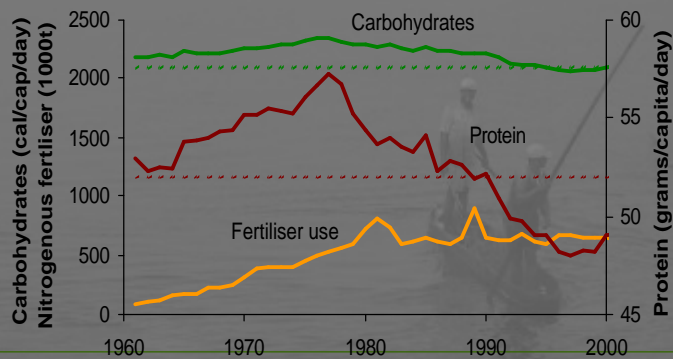
Food production



- Biophysical potential to produce sufficient food for growing population

State of the region's ecosystem services

Food production



- *Serious protein deficiency north of the Zambezi*

State of the region's ecosystem services



Biodiversity

Region's biodiversity is relatively intact

	Plants	Mammals	Birds	Reptiles	Amphibia	ALL TAXA
Forest	0.75	0.75	0.92	0.86	0.85	0.78
Savanna	0.86	0.73	0.96	0.89	0.96	0.87
Grassland	0.72	0.55	0.90	0.76	0.81	0.74
Shrubland	0.86	0.72	1.06	0.93	1.27	0.89
Fynbos	0.75	0.78	0.91	0.77	0.79	0.76
Wetland	0.91	0.83	0.94	0.92	0.95	0.91
All Biomes	0.82	0.71	0.96	0.88	0.95	0.84

State of the region's ecosystem services

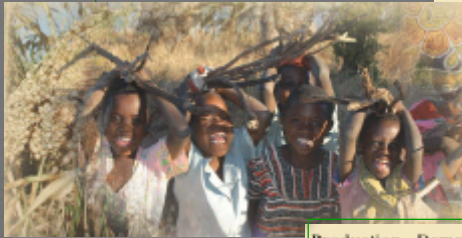


Fuel wood

- High dependency on biomass for energy – wood, charcoal
- Net production of fuel biomass exceeds consumption; but
- Severe local fuel shortages are anticipated

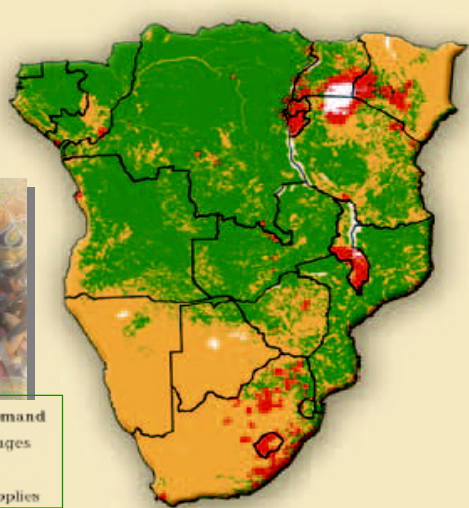
State of the region's ecosystem services

Fuel wood



Production - Demand

- Severe shortages
- Vulnerable
- Adequate supplies



State of the region's ecosystem services

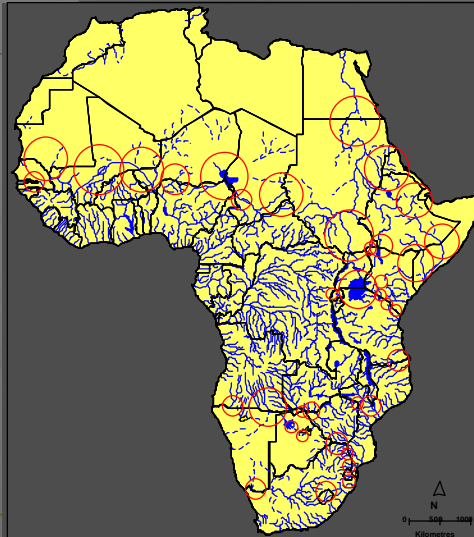


IN SUMMARY

- Southern Africa – ecosystem services in a declining but *not unrecoverable state*
- Widespread irreversible damage has *not occurred*
- Situation at local scale may be at variance with that at regional scale

Relationship between ecosystem services and human freedom

Disputes arise over scarce resources; e.g. water



Relationship between ecosystem services and human freedom



Key interventions affecting ASM



Key interventions in management of ecosystem services and other issues if MDGs affecting ASM are to be achieved (eradication of extreme poverty and hunger, reduction of child mortality, etc.)

Key interventions: ecosystem services



- Intensified, coordinated action regarding ASM access to potable water
- Chronic hunger in ASM communities requires intervention to address production deficiencies in protein and carbohydrates to meet basic nutritional needs
- Energy supply: Biodiversity-compatible management of ecosystems that support sustainability of ASM (e.g. sustainable harvesting of fuel wood)
- Complexity of socio-ecological systems requires *adaptive management* (also, a focus on processes, scale and interconnectedness)

Key interventions: other issues



Considering non-ecological system issues – which are probably more important management issues:

- ASM must become organised to increase the sector's political bargaining power
- Sector must become attractive to stakeholders (investors, government, etc.)



Key interventions: other issues



- Acquire skills to inform technology and business development choices – grow sector's politico-economic status
- Promotion of human rights, specifically with respect to women and children in ASM communities – earn political credence
- Regional coordination in ASM policies - e.g. to counteract exploitation of migrant ASM communities

**Conclusion:
ASM as part of a
complex socio-
ecological system**



Sustainability of ASM: less to do with managing natural resources than managing complex, closely coupled socio-ecological systems

