# Invasive Alien Plant Biomass in the Western Cape

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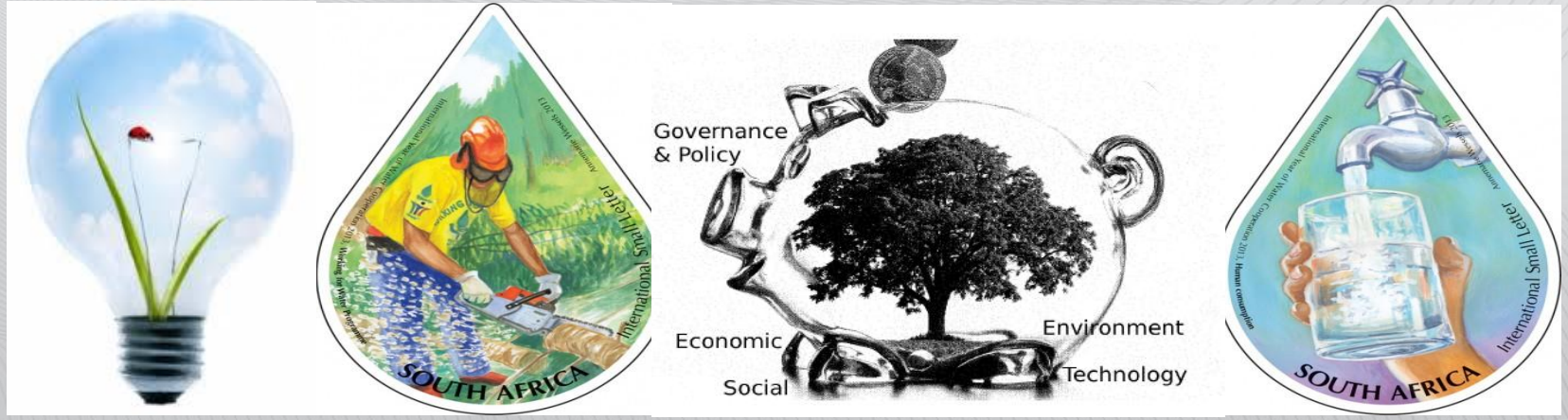


**Presented at:**
Western Cape Alien Vegetation Biomass Expo day
Stellenbosch Town Hall

11 June 2019

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# Invasive Alien Plants (IAPs)

Invasive alien plants (IAP) impact biodiversity, water security, productive use of land and the ecological functioning of natural systems. IAPs intensify the impact of fires and floods, increase soil erosion, and, if left unmanaged, will increasingly impact ecosystem services…..

- 750 tree species and close to 8 000 shrubby, succulent and herbaceous species are recorded as having been introduced into South Africa. Of these, 161 are regarded as invasive Listed species are deemed either Category 1a or 1b, 2 or 3. Category 1a SAFII http://www.saflii.org/za/journals/DEREBUS/2015/18.html
- The majority (approx. 68%) of these invasive alien plants are woody* trees and have been the focus of control efforts.

*Woody is defined as biomass that has >20% lignin content.

# Plant invasions:
# value-adding to IAP biomass during clearing and restoration?

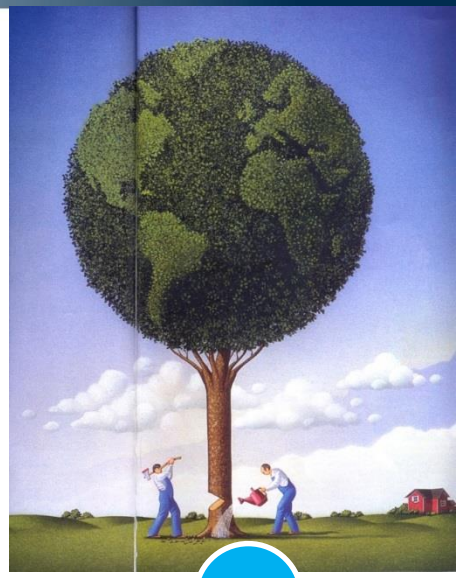
REVIEWS REVIEWS REVIEWS

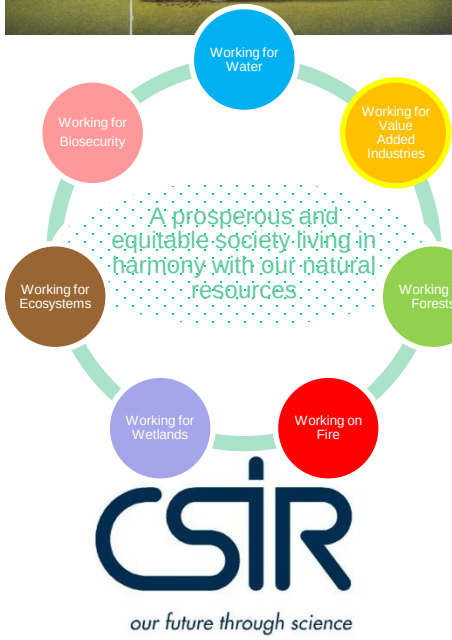
## A place for alien species in ecosystem restoration

John J Ewel[1] and Francis E Putz[2]

Blanket condemnation of alien species in restoration efforts is counterproductive. Where their presence does not unduly threaten surrounding ecosystems, alien species can be tolerated or even used to good advantage, if they provide essential ecological or socioeconomic services. By speeding restoration or making it more effective, non-native species can provide economic and ecological payoffs. Risk is always an issue when alien species are involved, but greater risk taking is warranted where environmental conditions have been severely modified through human activity than where reassembly of a biological community is the sole goal of restoration.

*Front Ecol Environ* 2004; 2(7): 354–360






- NEM:BA regulates the management of IAP species
- DEA- Natural Resources Management Programmes has an annual budget of ca. R1.8billion with includes value added industries (VAI)

**Optimal use of cleared invasive alien plants**



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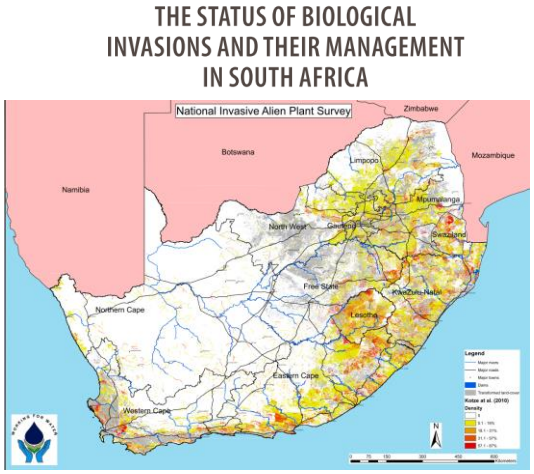
# Department of Environmental Affairs
# Natural Resource management programmes (DEA-NRM)

- **Add value** to IAP biomass that is **cleared and left to waste**
- **Avoid** perverse incentives of '**cherry picking**' or creating **dependent value added industries**
- **Revenue from biomass utilisation and value added industries VAI as cost-recovery in landscape restoration**
- **Benefits** from managing IAPs and restoring landscapes **shared equitably**

# Inventory of IAP biomass

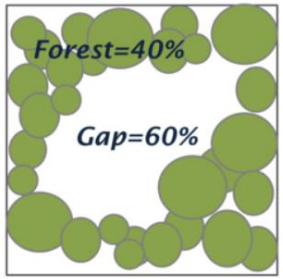
## Amount of invasive alien plant biomass?



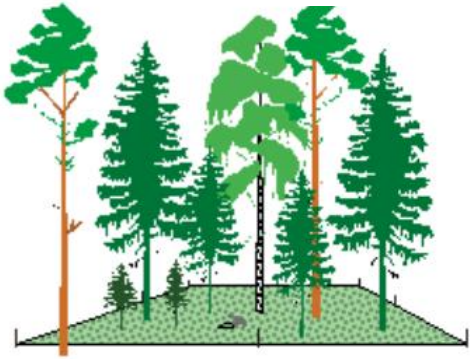

❖ **Identify IAP tree species:**
NIAPS 2010- Kotze et al. 2010
http://bgis.sanbi.org/EDRR/NIAPS.asp

❖ **Estimate IAP biomass:**
Tree cover>tree density> (condensed area)>
Tree height>Biomas

**10 ha of 40%=**
**4 ha condensed**

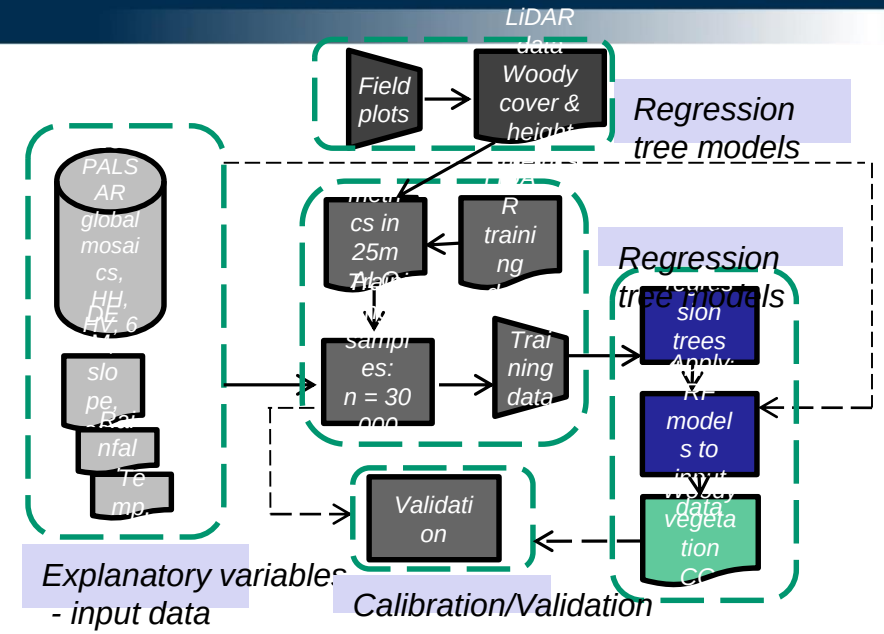


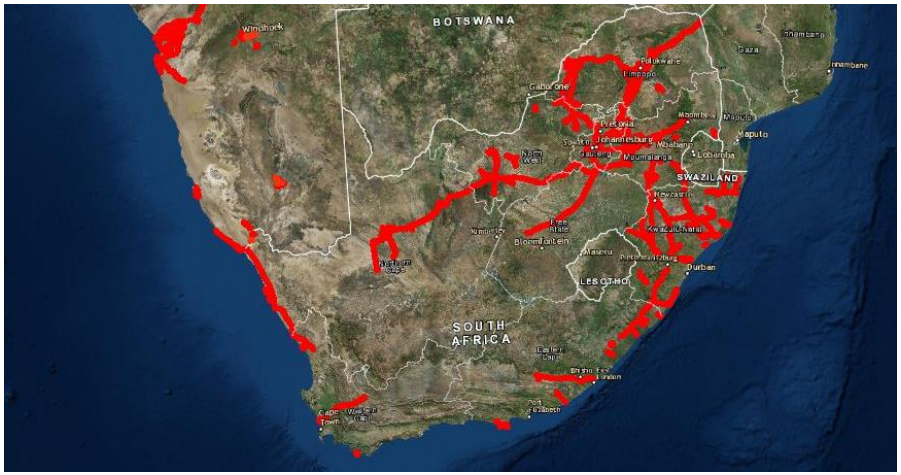

**Most recent data**: national scale IAP species mappir~
(NAPS Kotze et al 2010) and biomass data 2010
(CSIR_Biomassv1.1)



# How much Invasive Alien Plant biomass?

## Remote sensing approach using SAR

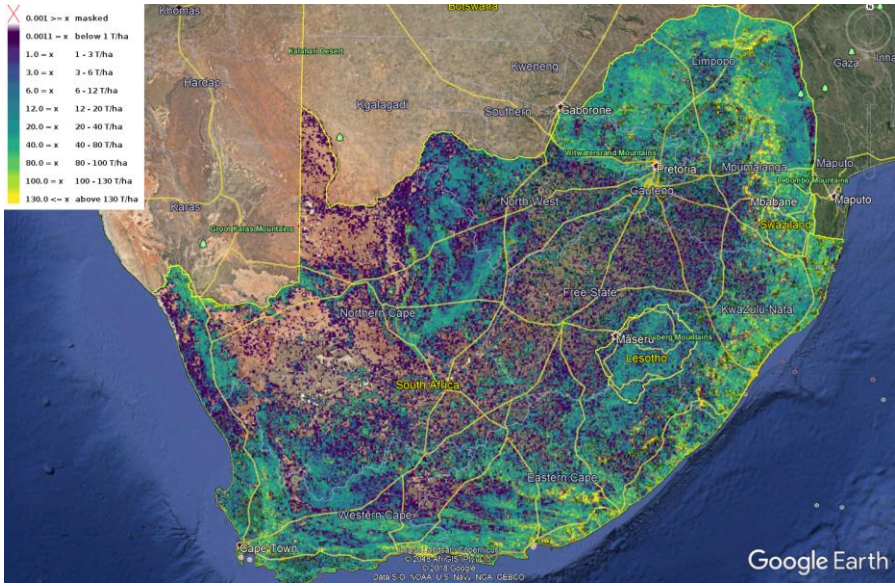



- Tree cover and distribution can be seen by aerial photography or satellite imagery, but not tree volume or biomass
- Biomass requires plant volume (height and shape).
- Remote sensing SAR uses scattering to determine volume
- SAR data (ALOS_PALSAR) validated and calibrated with LiDAR and on ground measurements (DBH)

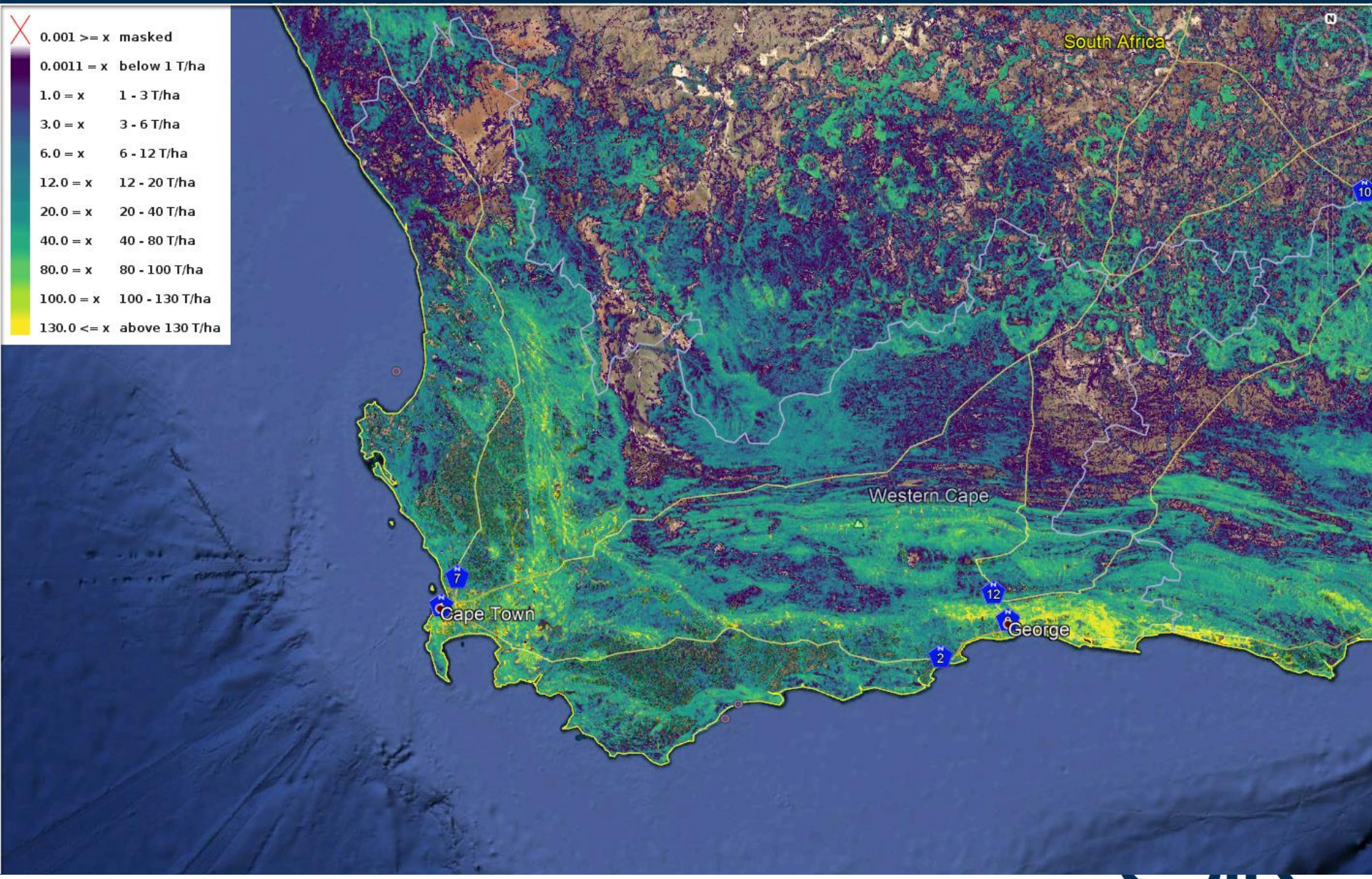
# National biomass map (dry tonnes/ha)-AGB

- First national assessment AGB
- Date of biomass map is 2010 (2015 in pipeline…)
- 25m resolution
- Agriculture and urban areas masked out
- Saturates above 120 t/ha
- Bias on western and southern slopes and overestimates in western parts of SA




** Does not distinguish indigenous from Invasive vegetation**….
*Worldview multi-spectral imaging project in progress for species ID*

# National biomass map (dry tonnes/ha):



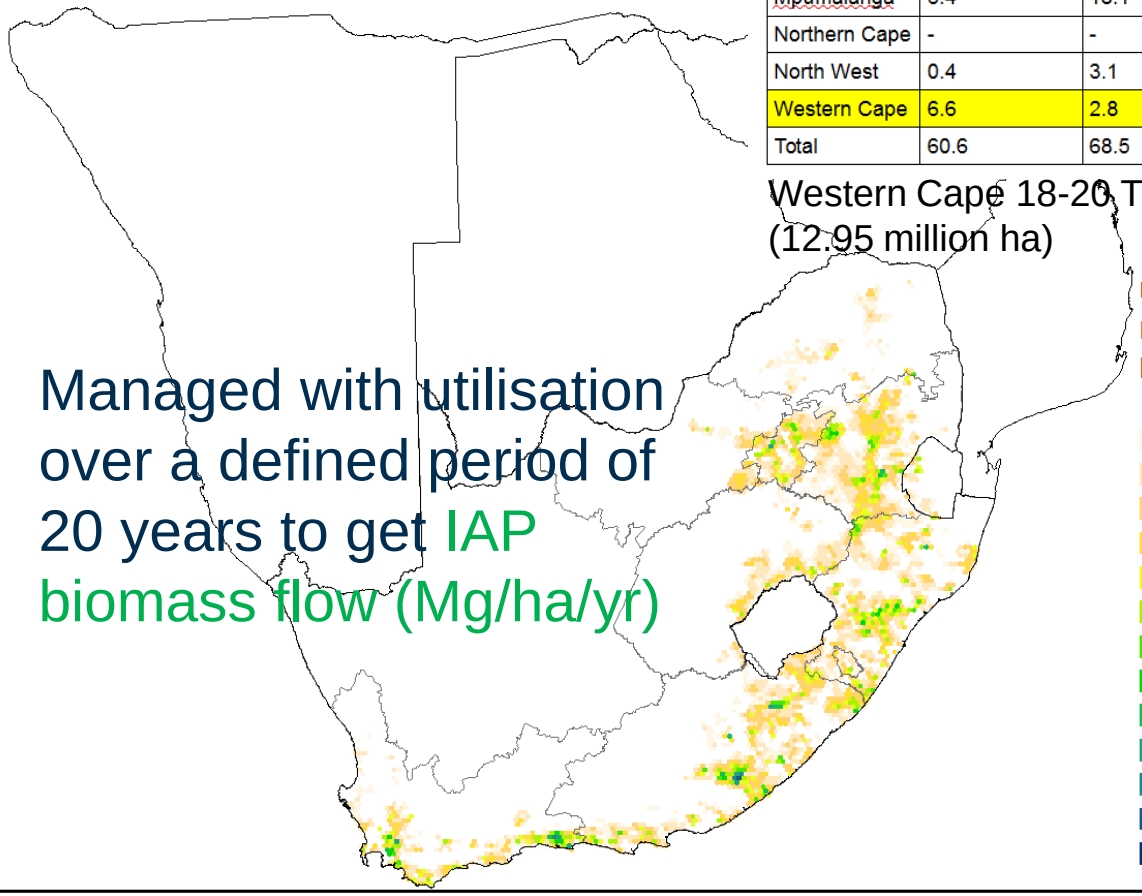
# Biomass mapping: Western Cape

- IAP Biomass standing stock (Tg) (**oven dry**). 1 Tg= 1 million tonnes

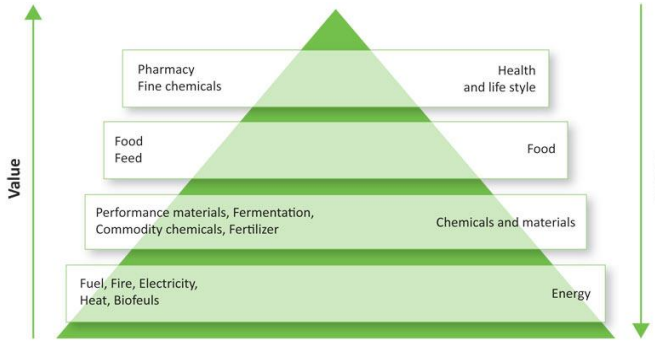
| Province | Acacia | Eucalyptus | Pine | Poplar, willow & *Prosopis* | Total |
|---|---|---|---|---|---|
| Eastern Cape | 28.7 | 9.4 | 5.5 | 3.8 | 47.3 |
| Free State | 0.8 | 7.2 | 1.1 | 3.6 | 12.6 |
| Gauteng | 1.5 | 7.7 | 0.4 | 0.9 | 10.5 |
| KwaZulu-Natal | 15.1 | 16.5 | 2.7 | 0.7 | 35.0 |
| Limpopo | 1.1 | 3.7 | 0.8 | 0.7 | 6.4 |
| Mpumalanga | 6.4 | 18.1 | 2.8 | 3.6 | 30.9 |
| Northern Cape | - | - | - | 2.9 | 2.9 |
| North West | 0.4 | 3.1 | 0.1 | 0.5 | 4.1 |
| Western Cape | 6.6 | 2.8 | 8.5 | 0.4 | 18.3 |
| Total | 60.6 | 68.5 | 21.9 | 17 | 168.1 |

Western Cape 18-20 Tg IAPs in a total area of 129 462 km$^2$ (12.95 million ha)

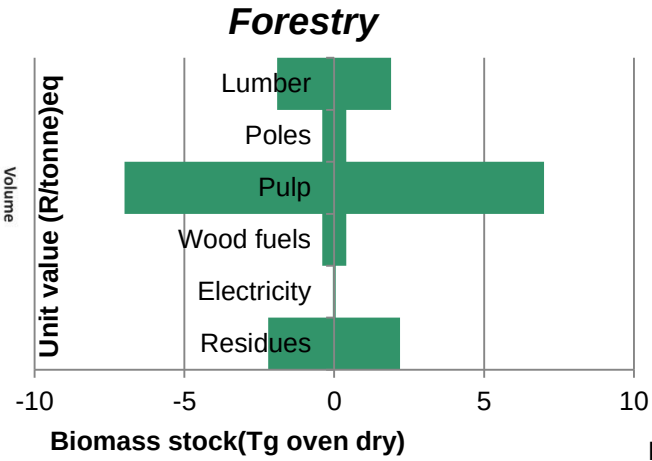
- Managed with utilisation over a defined period of 20 years to get IAP biomass flow (Mg/ha/yr)

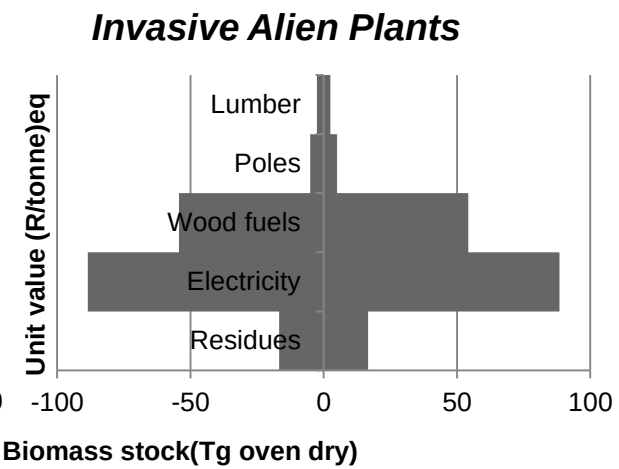


# Biomass suited to certain products
# Optimal economic benefits from IAP biomass ?




Biomass value hierarchy




Forestry industry: 12 Tg, IAPs: 167 Tg

- Biomass suited for various value added products: low value-high volume….high value-low volume
- Heterogeneous woody biomass age and species
- Limited lifetime of Value Added Industry (local supply, movable or mobile)
- Diversified biomaterials and bioenergy products- : bio-refinery approach

# Bio-material and bio-energy products from woody Invasive Alien Plants (IAPs)

## Energy products

**Heat and power**

**Wood chips**

**Torrefied wood chips**

**Wood pellets**

**Torrefied wood pellets**

**Firewood**

**Compressed logs**

**Lump charcoal**

**Charcoal briquettes**

**Bio-oil and syncrude**

## Material products

**Timber**

**Wood-plastic Composite**

**Fibre-cement**

**Wood Poles**

**Wood laths**

**Biochar**

**Mulch**

**Game feed**


*All established commercial technologies with developed-developing markets…..*



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# Agulhas plains case study

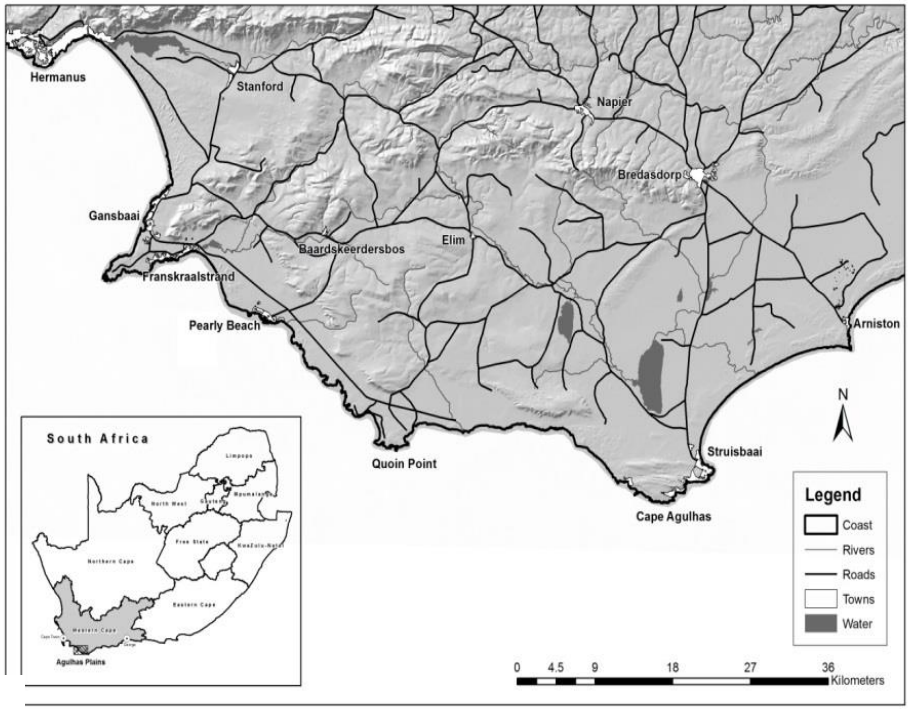
**Value-Added Industries on the Agulhas Plains:**
Techno-economic feasibility study for the production of wood-fuels, heat, electricity and biochar from Invasive Alien Plant biomass

Wood biomass gasifier

Electricity

Heat

Household wood fuels




Southern most tip of Africa
270 000ha and approx. 40 000 people

ELSEVIER

Ecosystem Services
Volume 27, Part B, October 2017, Pages 224-231

Reducing landscape restoration costs: Feasibility of generating electricity from invasive alien plant biomass on the Agulhas Plain, South Africa

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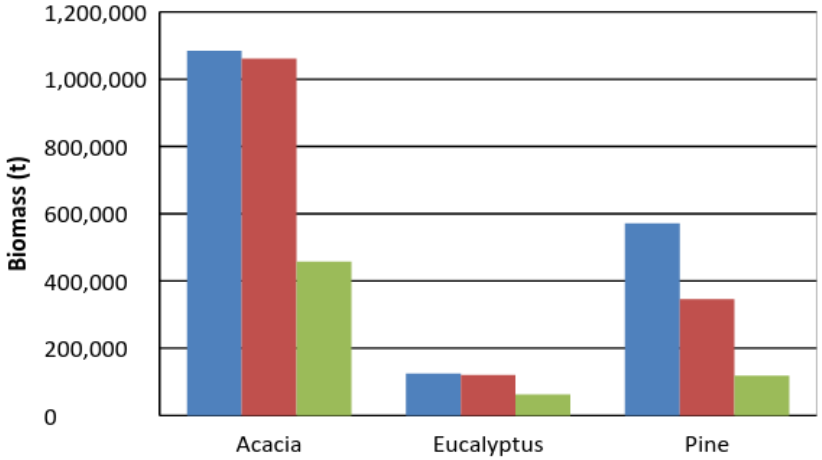
# *Available, accessible and suitable biomass for VAI*

## A. Available and accessible biomass for VAI



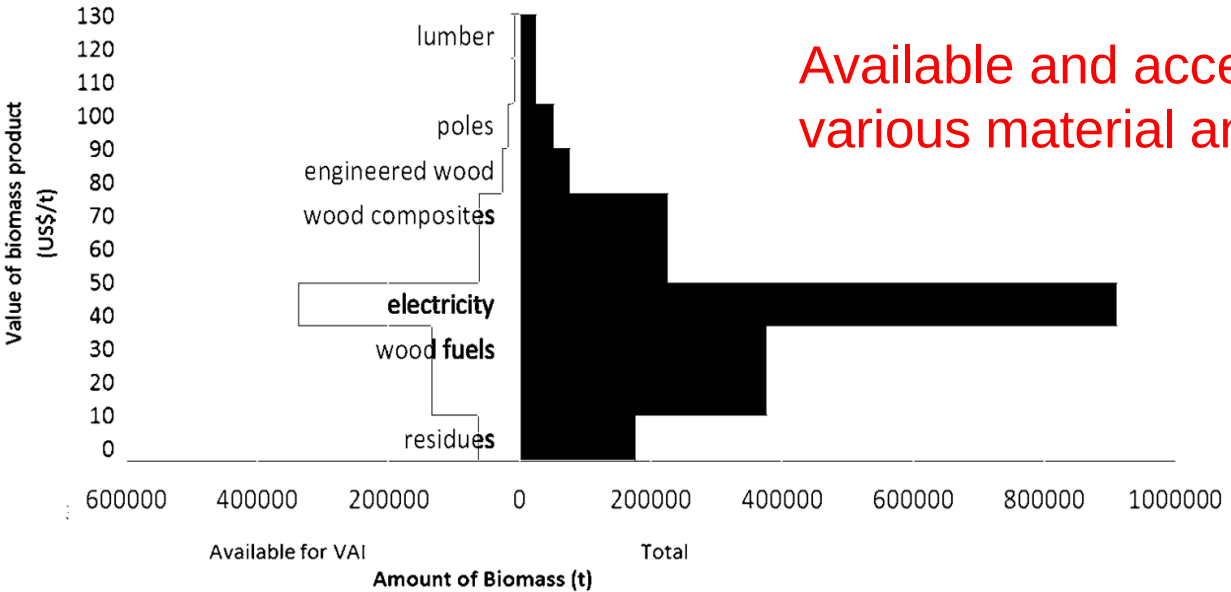

**Total**

Available: slope <20$^0$

Accessible: <200m from road/track

Only ca. 30% biomass *available and accessible* for VAI

## B. Suitability and viability of biomass for VAI




Available and accessible biomass suitable for various material and energy products

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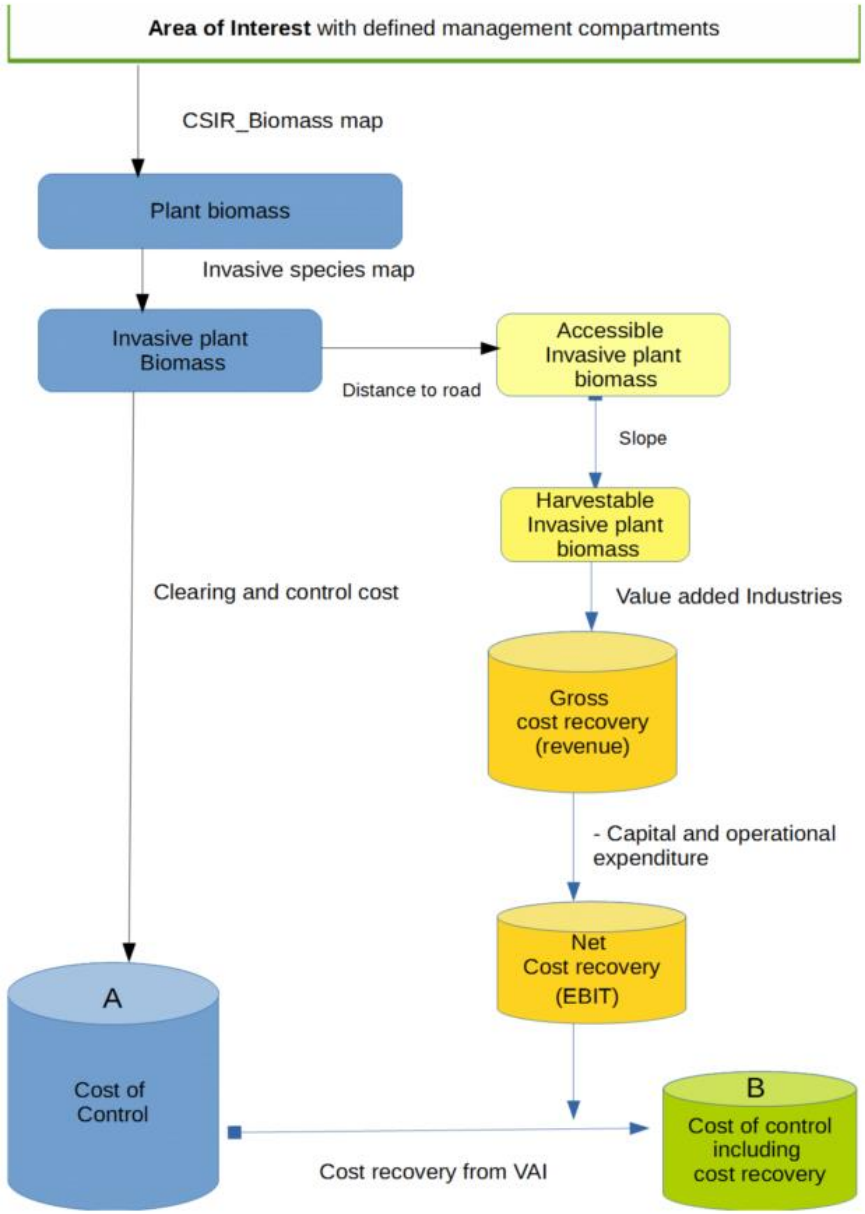
# Optimal use(s) for Invasive Alien Plant biomass? What are the complete costs and benefits?




Many **ecosystem service** benefits **of restored landscapes** are long-lasting and have **significant economic value**…

- Increase water availability and reduce flood and siltation risks
- Enhance biodiversity/land-productivity (eco-tourism)
- Mitigate and manage fire risks
- etc

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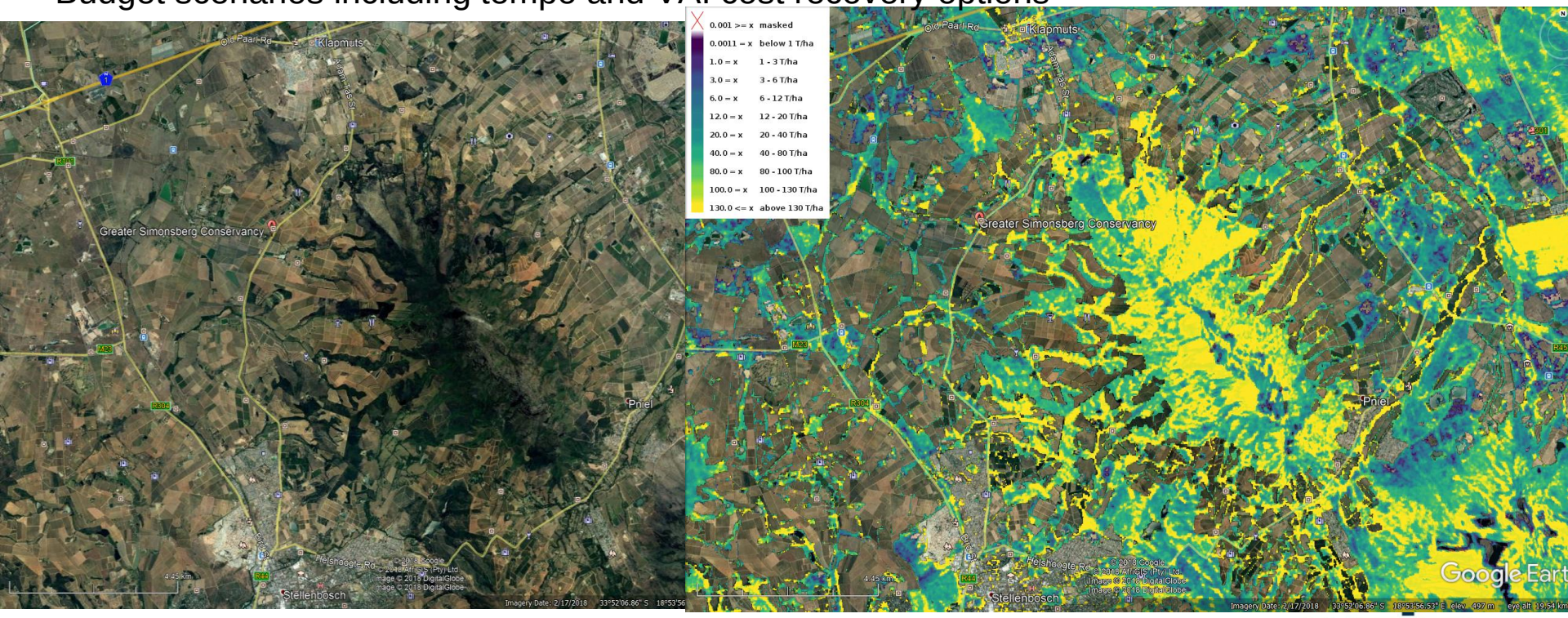
# Define area of Interest, assess biomass of IAPs

## Management plan for Area of Interest

20 year plan with scheduled treatments

Based on priorities and invasion characteristics

Budget scenarios including tempo and VAI cost recovery options




Ground validation of IAP biomass needed!



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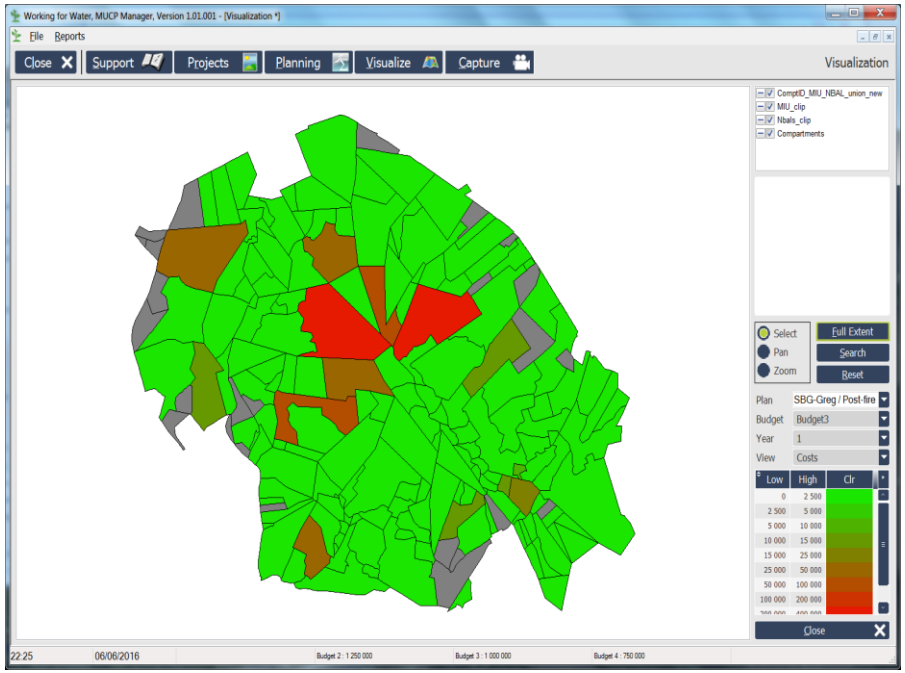
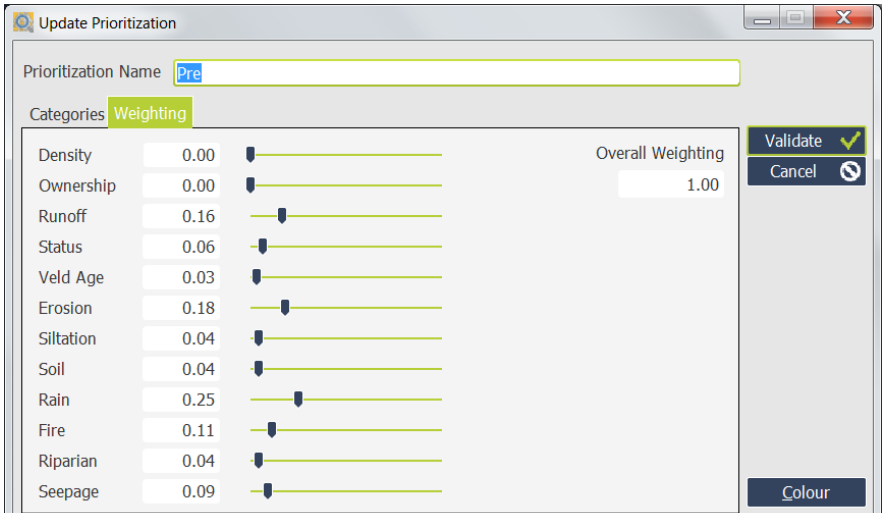
# Defining management units and setting priorities




## Defining management compartments




## Prioritising clearing operations

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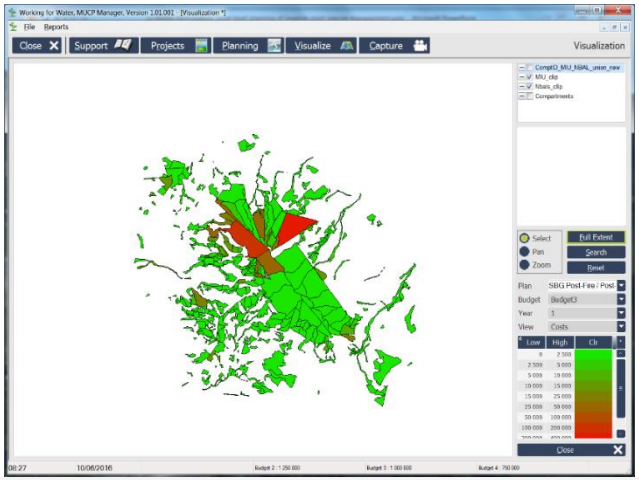
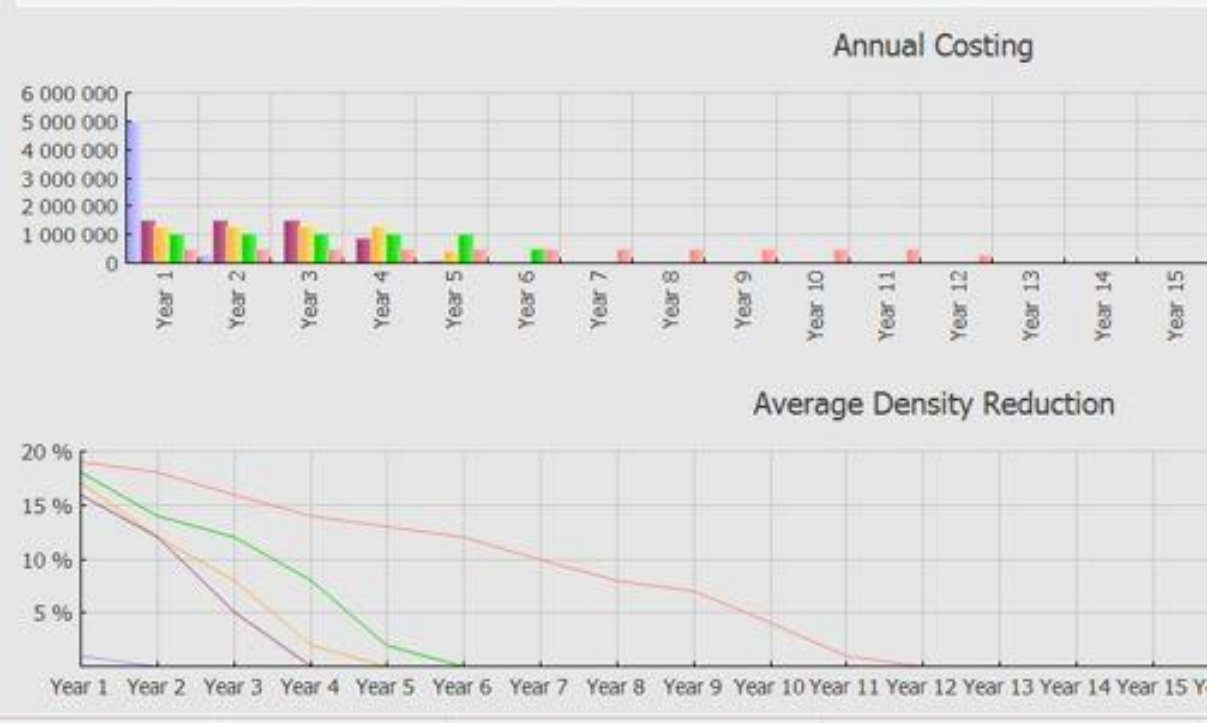
# Determine clearing costs per management unit and cost recovery from VAI




**Determine clearing costs per management unit**
***and***
**cost recovery from VAI**




**VAI can recover costs and enhance IAP clearing and restoration**

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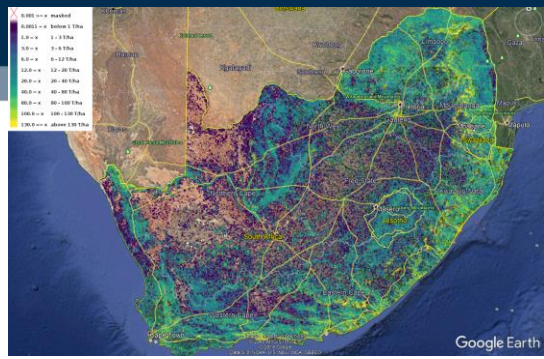
# Summary:
# VAI can reduce the costs of restoration





- Development of a biomass inventory can facilitate management of IAPs in terms of monitoring and control.
- Beta version of SA Biomass map 2010 v1.1 kml- in pipeline: 2015, 2018 and web version with analysis
- The techno-economic feasibility of VAI depend on locality and the IAP biomass suitability, availability and accessibility (only a portion of biomass can be extracted for various products)
- The economic benefits of ecosystem services from restored landscapes extend well beyond the transitory benefits of the VAI
- Incorporation of VAI into management unit control plan (MUCUP) helps to ensure that the utilisation of IAP biomass, further enables IAP management and control

  ……and enhances restoration potential.

# Thanks!

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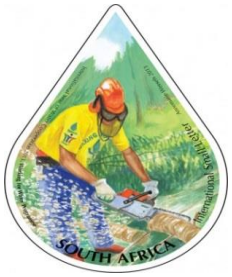
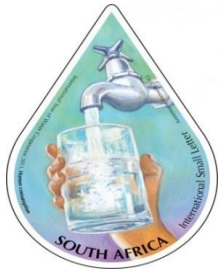
**Acknowledgements:**
Renaud Mathieu, Russell Main, Laven Naidoo, Konrad Wessels, Frans van den Bergh, Riaan van den Dool, Kirodh Boodhraj
David Le Maitre, Greg Forsyth, Ryan Blanchard, Graham von Maltitz, James Blignaut,

***Funding from:*** *Department Science and Technology and Department Environmental Affairs****, (****Natural Resource Management Programme)*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