

DEA National Wind and Solar PV SEAs

To facilitate the efficient and effective rollout of wind and solar PV energy in SA

Webpage: www.csir.co.za/nationalwindsolaresea

22 Oct 2013
DEA GIS DAY

Presented by:

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environmental affairs

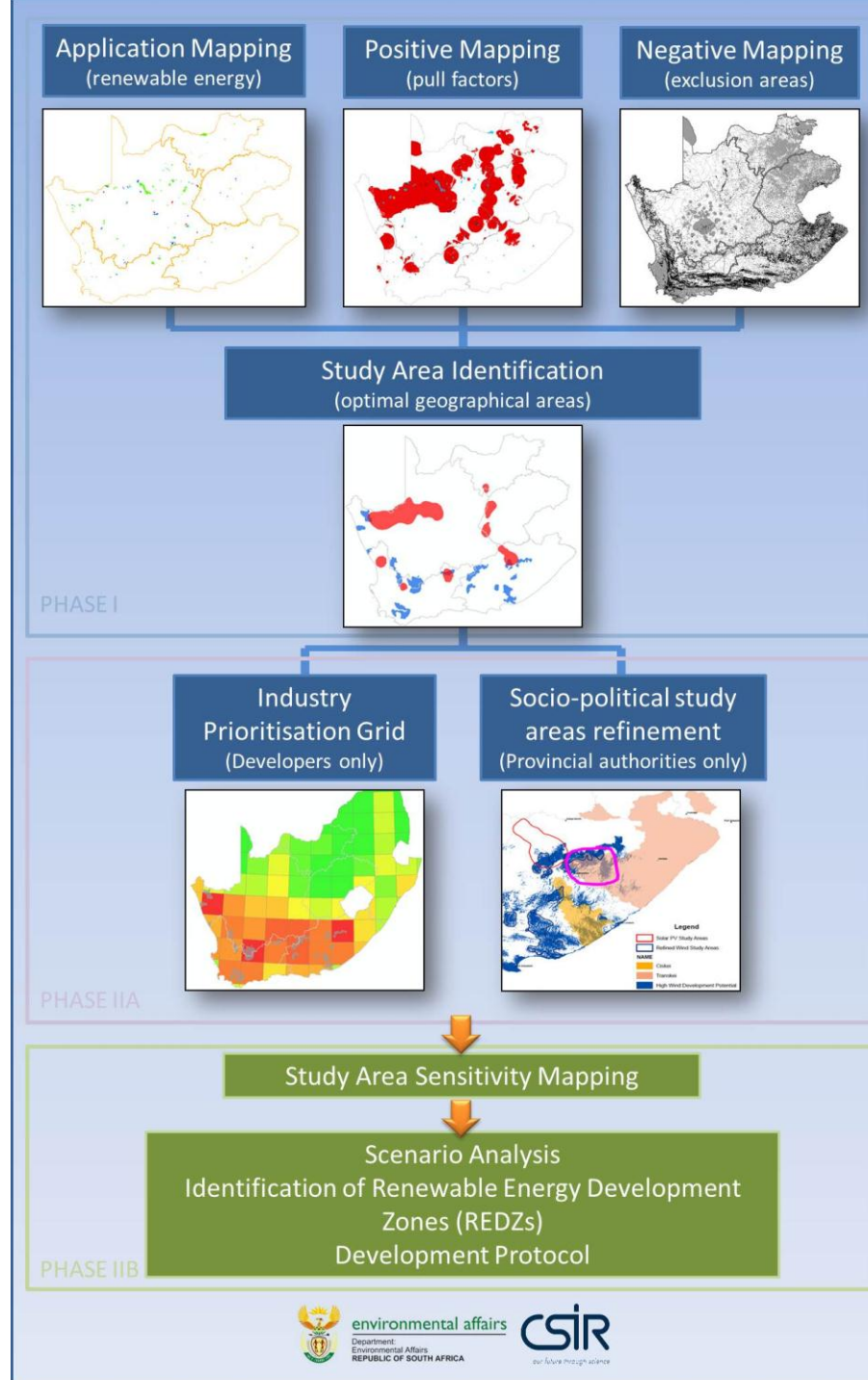
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Key objectives of the study

- **Identify geographical areas : Renewable Energy Development Zones (REDZs)** in which medium to long term (5 – 20 years) large scale (several projects) will have the lowest negative impact on the environment while yielding the highest possible social and economic benefit to the country;
- **Decrease the risk of development in the REDZs** by doing regional level assessments and obtaining wide authority and private sector buy-in;
- **Streamlining the environmental authorisation process** in the REDZs by replacing the legislated Environmental Impact Assessment (EIA) process with a more focused (through the regional level SEA pre-screening) and streamlined (through inter-departmental agreement and cooperative governance) legislated process; and
- **Enable strategic planning and investment** that would in the medium to long term facilitate efficient and effective development e.g. strategic investment on Eskom's behalf that would enable the unlocking of high development potential areas, lower the cost of grid access, and provide time-efficient electricity grid access to renewable energy facilities.

SEA Technical Process Diagram



Positive Mapping

(Pull Factor Mapping)



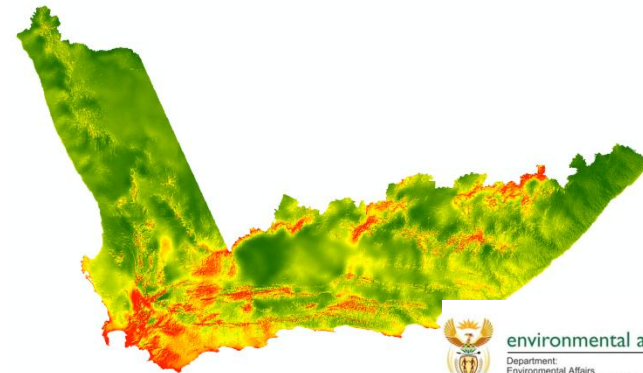
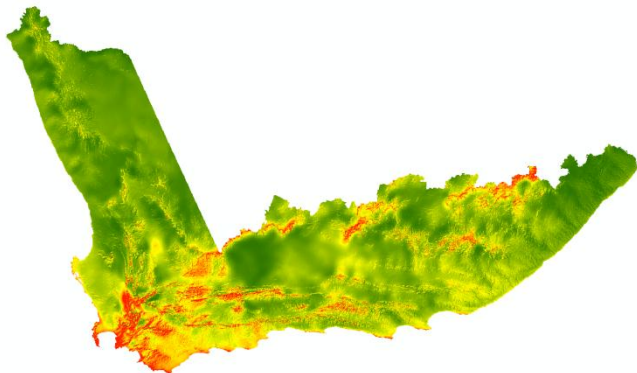
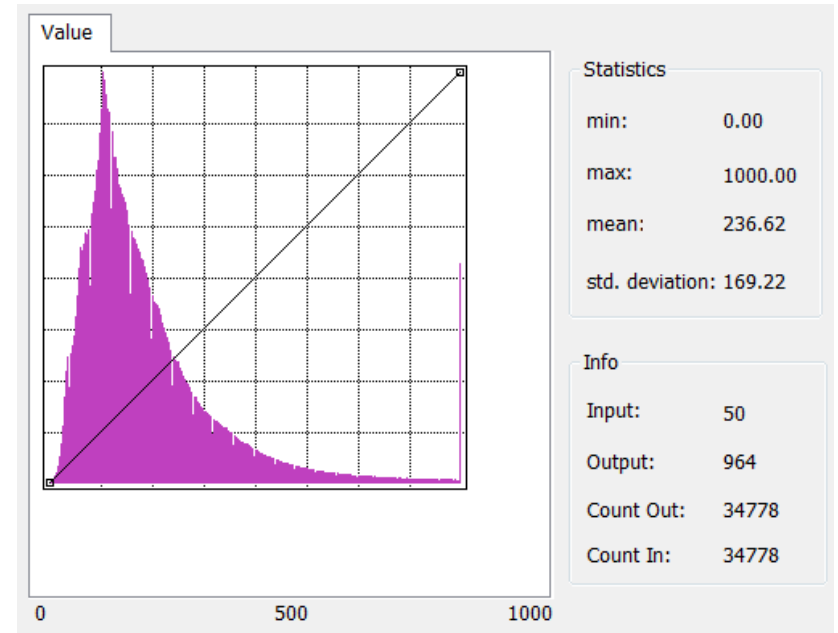
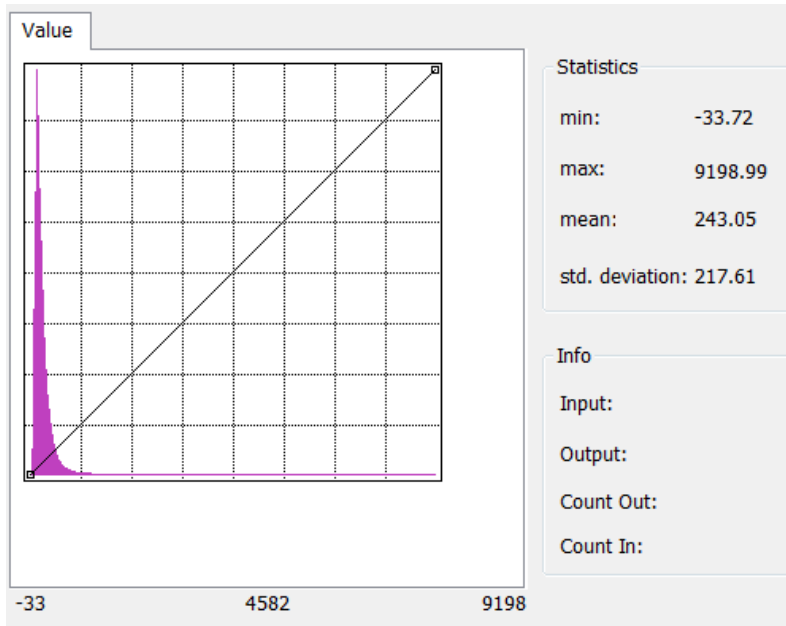
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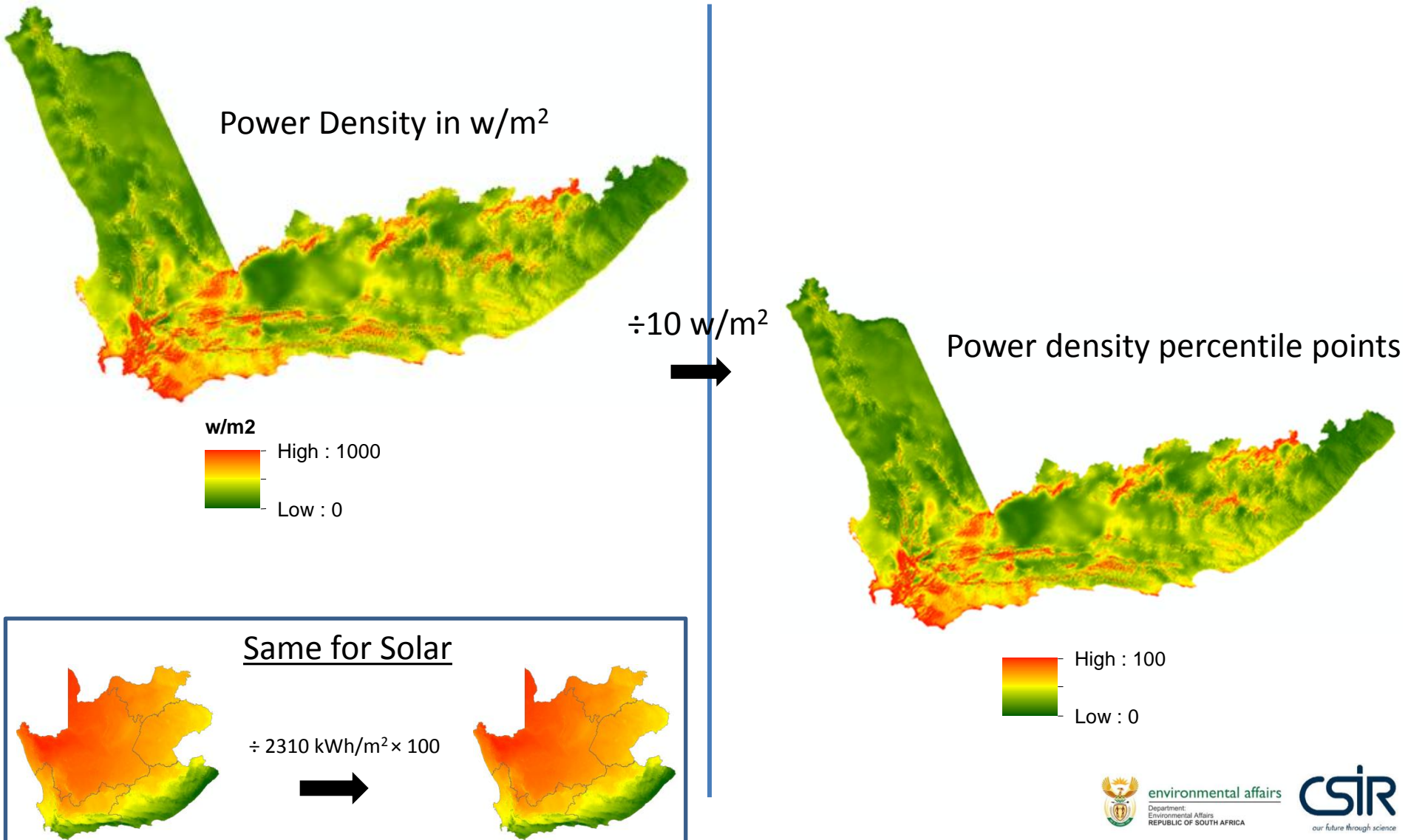
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Conditioning of data - Reclassify

Power density values < 0 reclassified to 0
Power density values > 1000 reclassified to 1000



Normalisation of resource – Raster Calculation

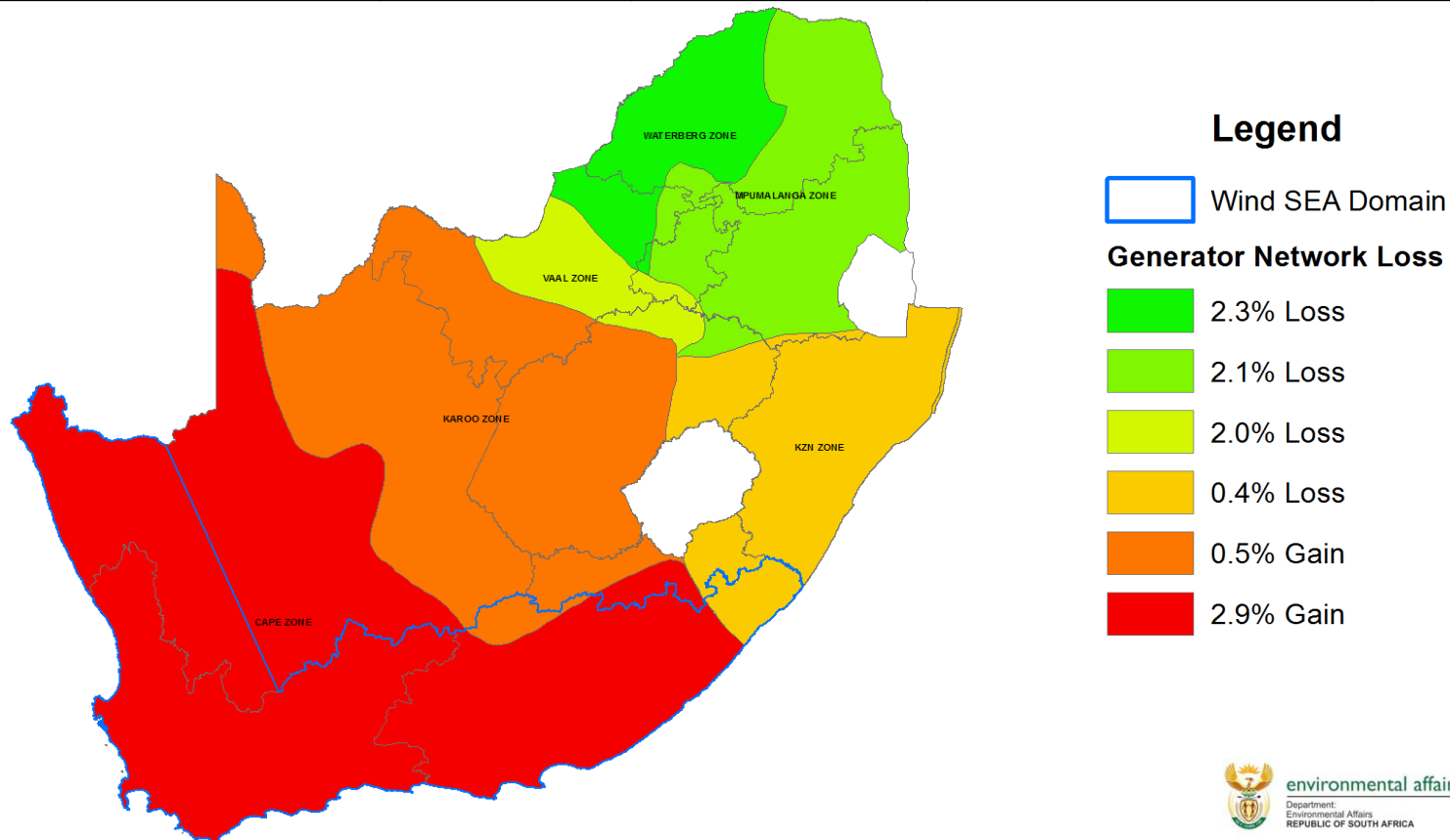


Determination of Development Potential - Raster Calculation

- **Pull factors considered through normalization of resource to determine development potential**
- **Normalization Criteria (pull factors):**
 1. Generator network losses;
 2. DTI proposed renewable energy related Special Economic Zones (SEZs);
 3. Industrial ports;
 4. Solar and Wind corridors;
 5. Seat of local municipalities with high social need; and
 6. Network capacity (as per GCCA substation).
- **Normalization by adding or subtracting development potential percentiles**

Determination of Development Potential (Positive Mapping): Generator Network Loss Normalization (1)

Eskom Network Losses (Wind & Solar)	Zones	Normalization Factor	Data Source	Scale
	Cape	+2.9%	Eskom 2013/14 Tariffs & Charges	National
	Karoo	+0.5%		
	Kwazulu-Natal	-0.4%		
	Vaal	-2%		
	Mpumalanga	-2.1%		
	Waterberg	-2.3%		

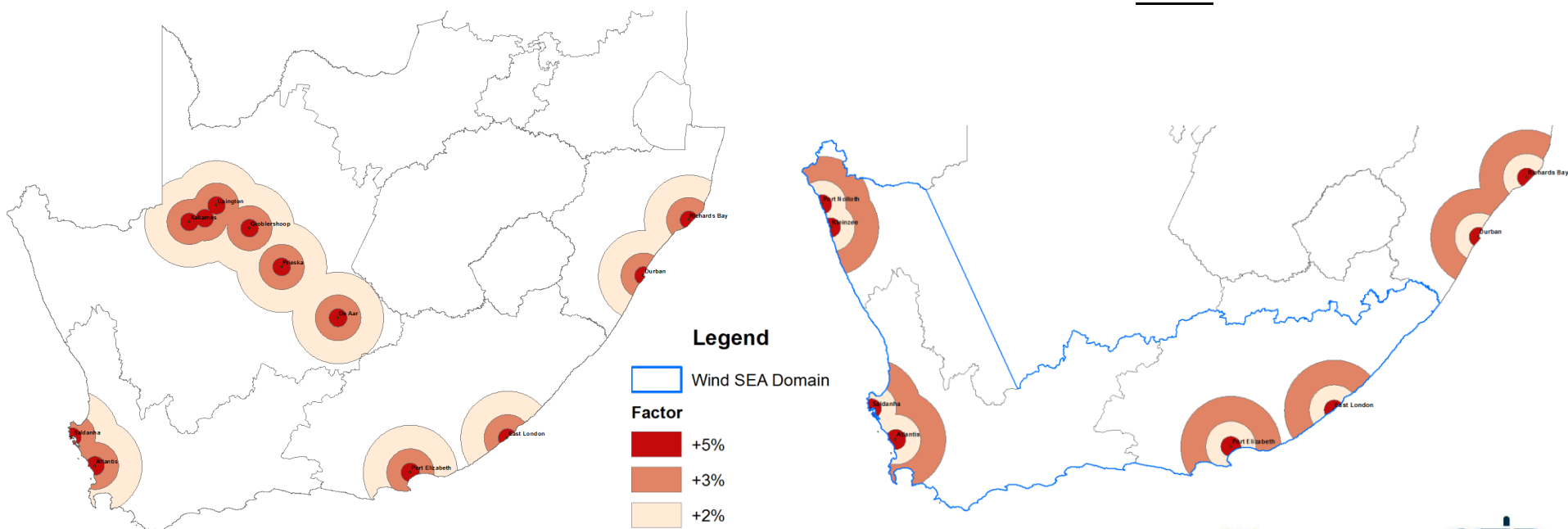


Determination of Development Potential (Positive Mapping): SEZs, Industrial Ports and Corridors Normalization (2)

DTI Proposed RE SEZ (<u>Wind & Solar</u>): Atlantis), NC Solar Corridor (<u>Solar only</u>): Upington, Kakamas, Keimoes, Groblershoop, Prieska & De Aar NC Wind Corridor (<u>Wind only</u>): Port Nolloth & Keinzee) and Industrial Ports (<u>Wind & Solar</u>): Saldanha, Port Elizabeth, East London, Durban & Richards Bay)	Distance	Normalization Factor	Data Source	Scale
	< 20km	+ 5 %	SEZs: Special Economic Zones Planning presented to the Portfolio Committee on Trade and Industry on 26 April 2013. Solar and Wind Corridor: Northern Cape Provincial Spatial Development Framework 2012.	National
	20 – 50km	+ 3 %		
	50 - 100km	+ 1 %		
> 100km	+ 0%			

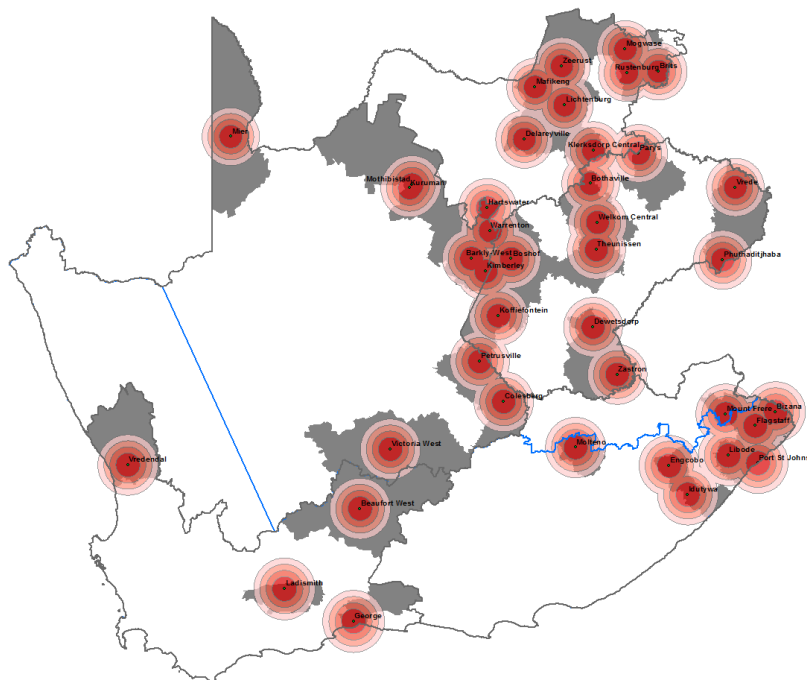
Solar

Wind

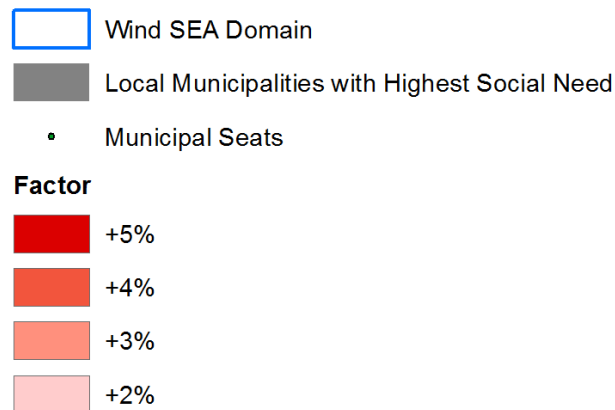


Determination of Development Potential (Positive Mapping): Seats of Local Municipalities with High Social Need Normalization (3)

Seats of local municipalities with high social need (Wind & Solar):	Distance	Normalization Factor	Data Source	Scale
	EC: Bizana, Engcobo, Flagstaff, Idutywa, Libode, Molteno, Mount Frere and Port St Johns FS: Zastron, Boshof, Reitz, Bothaville and Bultfontein NC: Barkly-West, Colesberg, Hartswater, Mier, Petrusville, Warrenton, Kimberley, Victoria West, Mothibistad and Kuruman NW: Mafikeng, Klerksdorp, Delareyville, Lichtenburg, Brits, Zeerust, Rustenburg and Mogwase WC: Beaufort West, Ladismith, Vredendal, George	0 – 20km	+ 5 %	FS: Draft Free State Rural Development Plan 2013. EC: Regional Global Insights Data 2013 NC: Northern Cape Provincial Spatial Development Framework 2012. WC: Growth Potential Study of Towns in the Western Cape (Van der Merwe et al. 2004) and revision thereof in 2010 NW: North West Provincial Spatial Development Framework 2008.
20 - 30km		+ 4 %		
30 - 40km		+ 3 %		
40 - 50km		+ 2 %		
> 50km		+ 0 %		



Legend



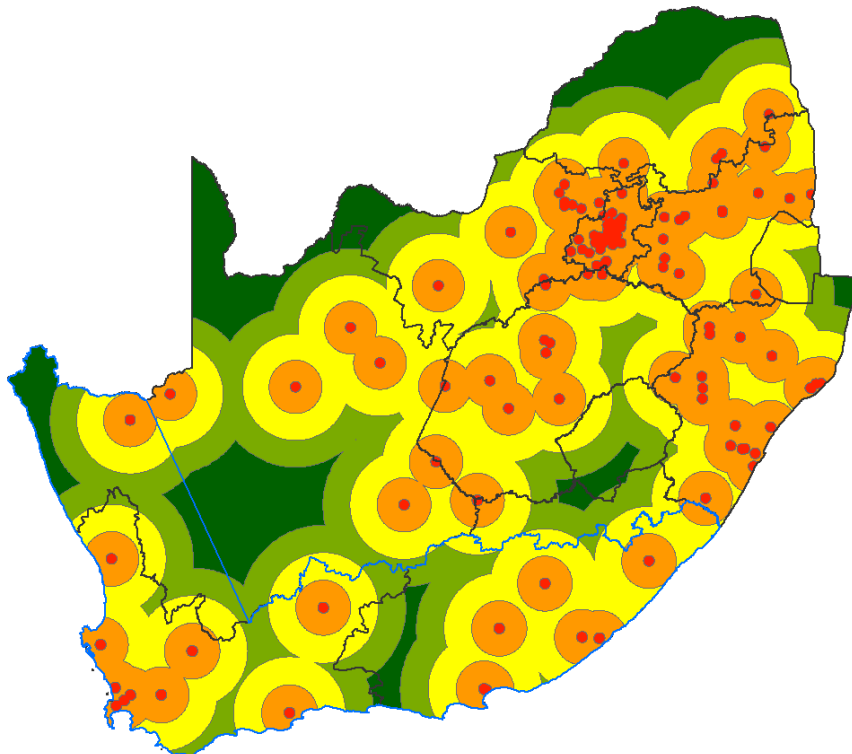
Network Capacity Normalization (4)

Network Capacity 2016 Transmission Substations (Wind & Solar)


Assumptions:

- 1) Substations in areas with Area Stability Limit >1000MW included;
- 2) Substations with Transformer N-1 Limit indicated as N/A were assigned the Busbar N-1 Limit;
- 3) Substations with only one transformer were assigned that transformer's capacity; and
- 4) Substations with Transformer limit as determined >100MW included.

Distance	Normalization Factor	Data Source	Scale
< 10 km	+ 5 %	Eskom Generation Connection Capacity Assessment of the 2016 Transmission Network 2013 (GCCA-2016)	National
10 - 50 km	+2.5 %		
50 - 100 km	+ 0 %		
100 – 150 km	- 2.5 %		
> 150 km	- 5 %		



Legend

 Wind SEA Domain

Factor

 +5%

 +2.5%

 0%

 -2.5%

 -5%

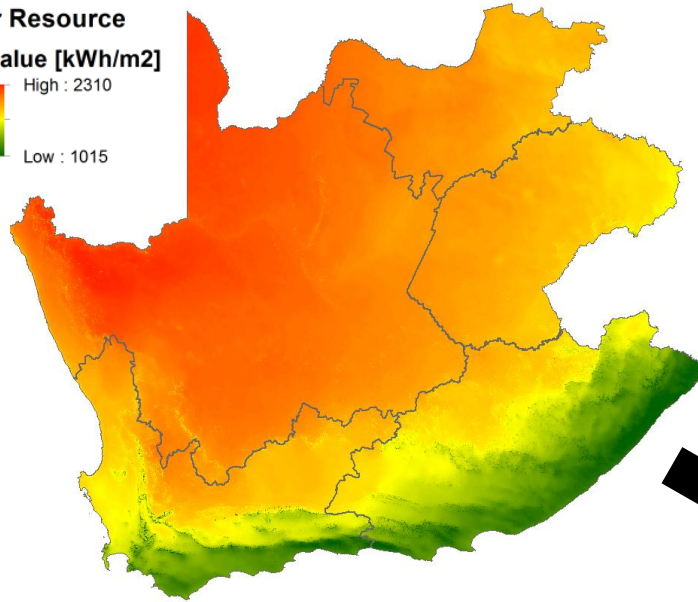
Final Development Potential (1_Solar)

Solar Resource

GHI value [kWh/m²]

High : 2310

Low : 1015



Solar Projects

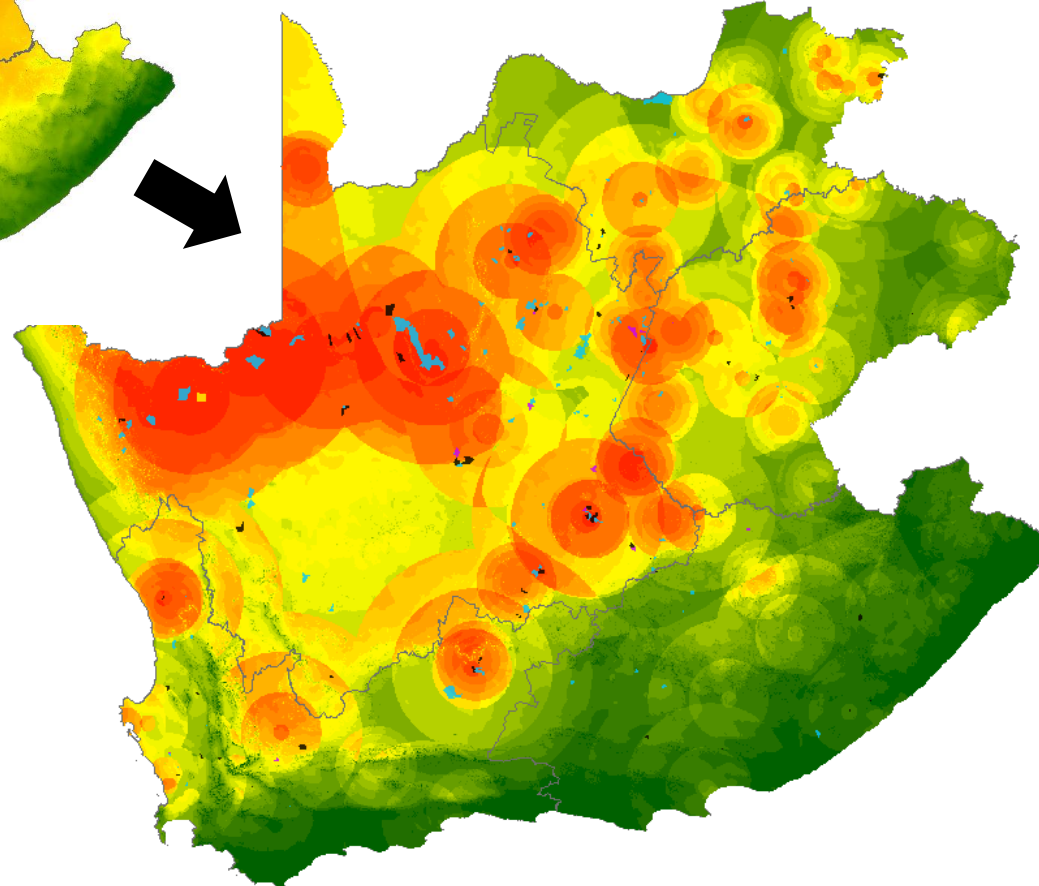
Status

- Approved
- Preferred Bidder R1
- Preferred Bidder R2
- In process
- Withdrawn/Lapsed

Development Potential

Quantile (Area %)

- 100
- 95
- 90
- 85
- 80
- 75
- 70
- 65
- 60
- 55
- 50
- 45
- 40
- 35
- 30
- 25
- 20
- 15
- 10
- 5

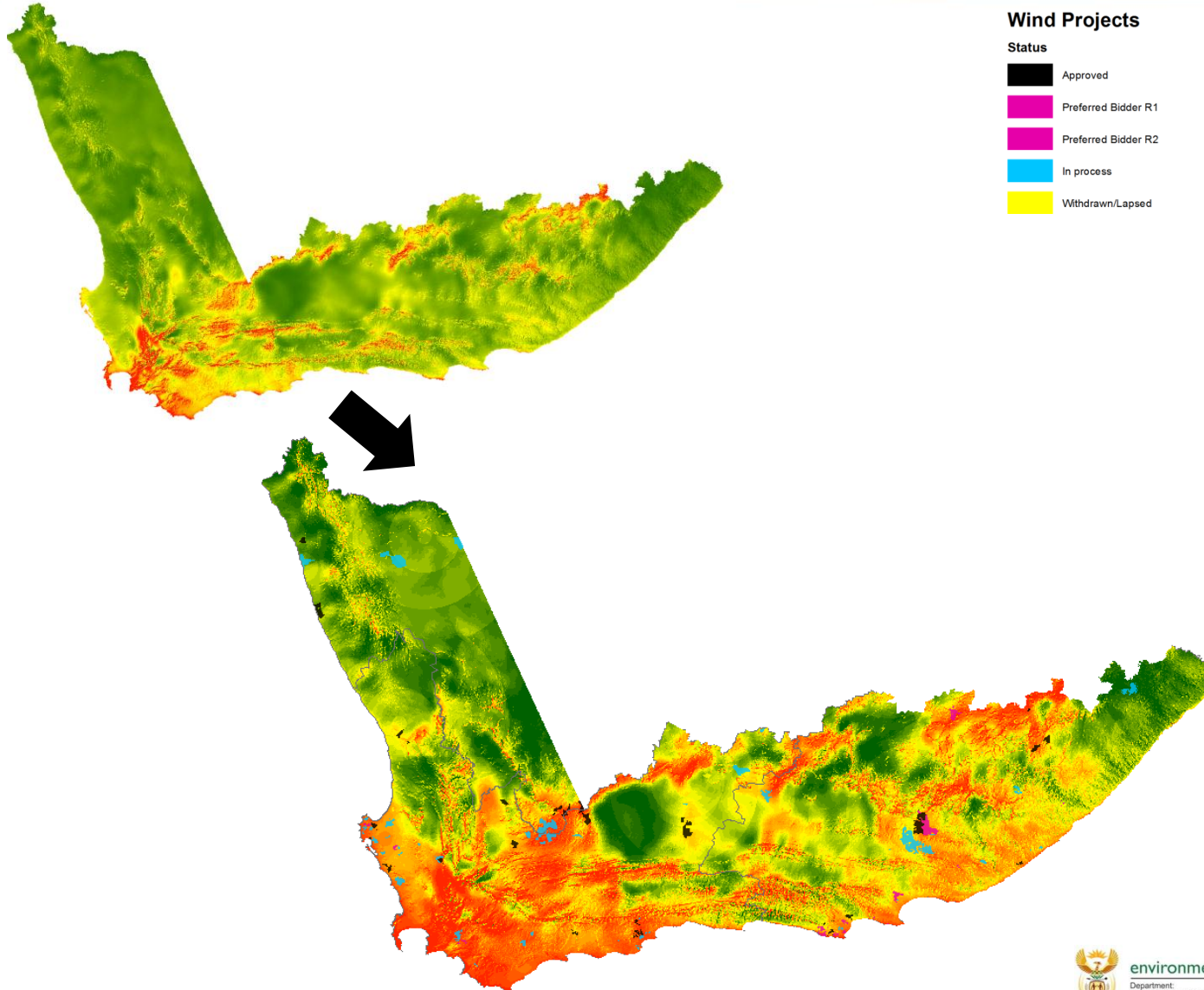
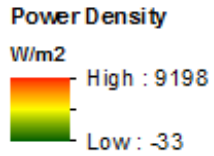


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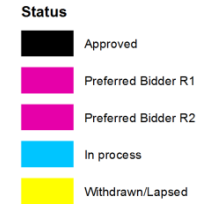
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Final Development Potential (2_Wind)

Legend

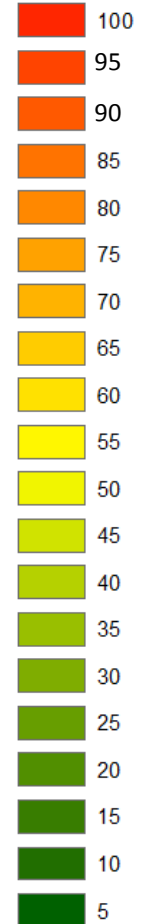


Wind Projects



Development Potential

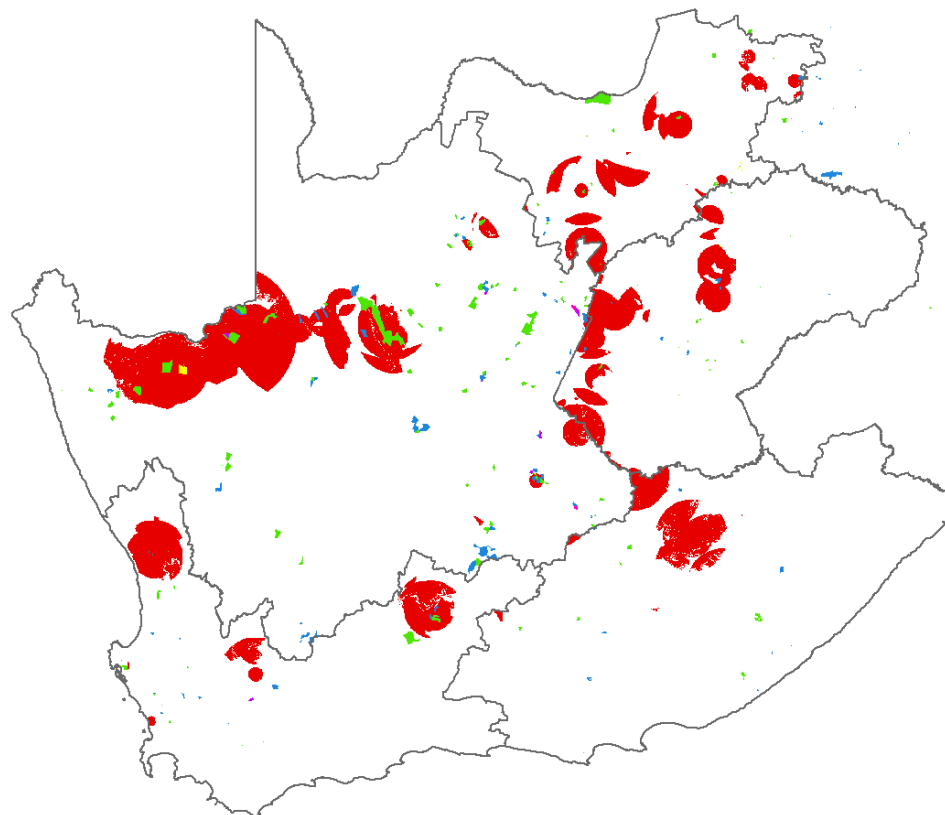
Quantile (Area %)



Identification of Top Development Potential Per Province (1_Solar)

- Reclassify

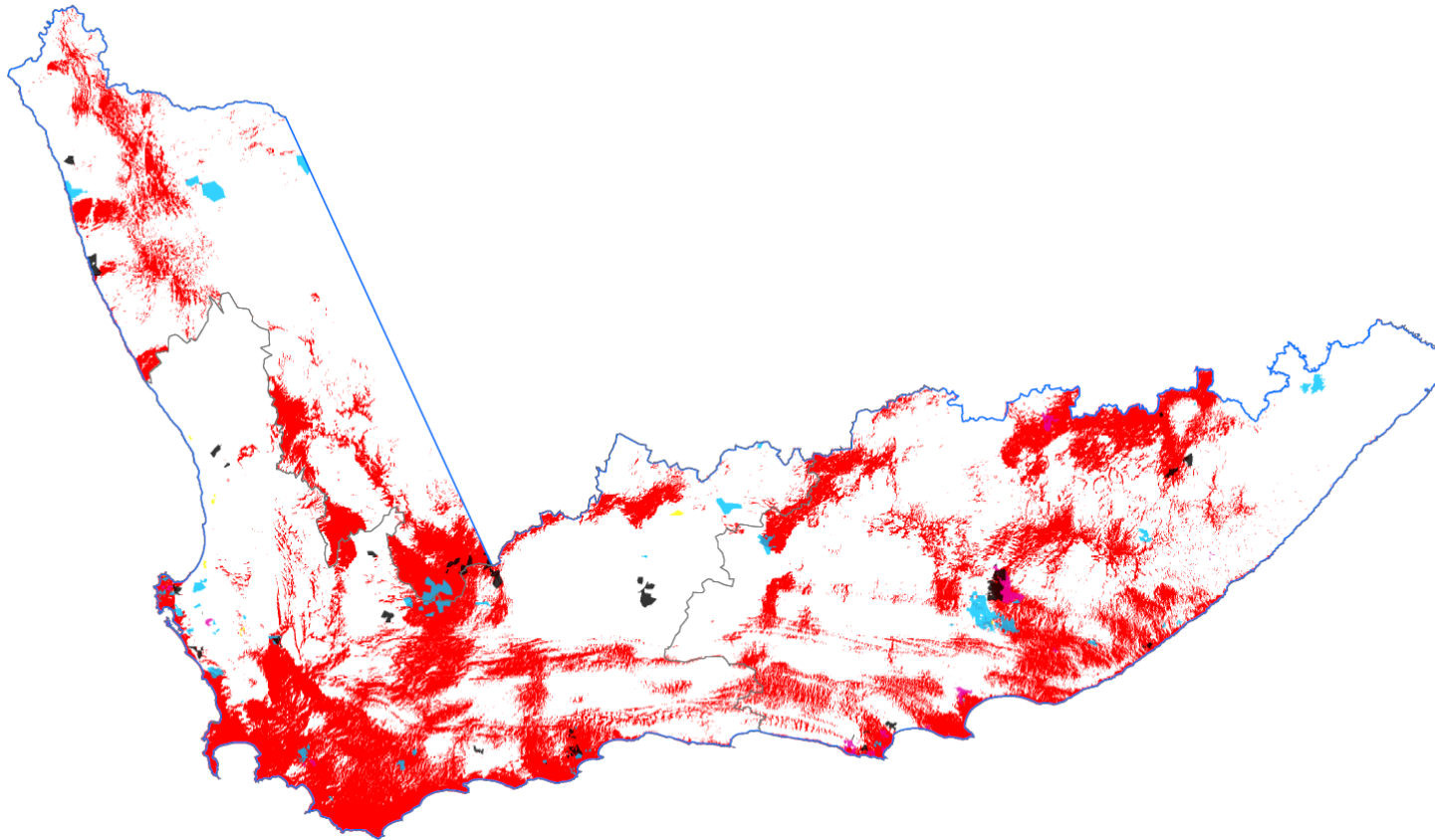
Identification of top development potential per province (Solar)	Province	Percentage of province with feasible resource (GHI>1850 kWh/m ²)	Area Considered (Top Development Potential)	Scale
	Northern Cape	100%	10%	Provincial
	North West	100%	10%	
	Free State	100%	10%	
	Western Cape	78%	8%	
	Eastern Cape	50%	5%	




- Areas for Consideration
- Solar EIA Applications Status**
- Approved
- Preferred Bidder Round 1
- Preferred Bidder Round 2
- In progress
- Withdrawn/Lapsed

Identification of Top Development Potential Per Province (2_Wind) - Reclassify






Identification of top development potential per province (Wind)	Province	Percentage of province with feasible resource (PD>400 W/m2)	Area Considered (Top Development Potential)	Scale
	Western Cape	24%	35%	Provincial
	Eastern Cape	8%	25%	
	Northern Cape	2%	15%	



 Areas for Consideration

Wind Projects

Status

-  Approved
-  Preferred Bidder R1
-  Preferred Bidder R2
-  In process
-  Withdrawn/Lapsed

Negative Mapping

(Exclusion Mapping)



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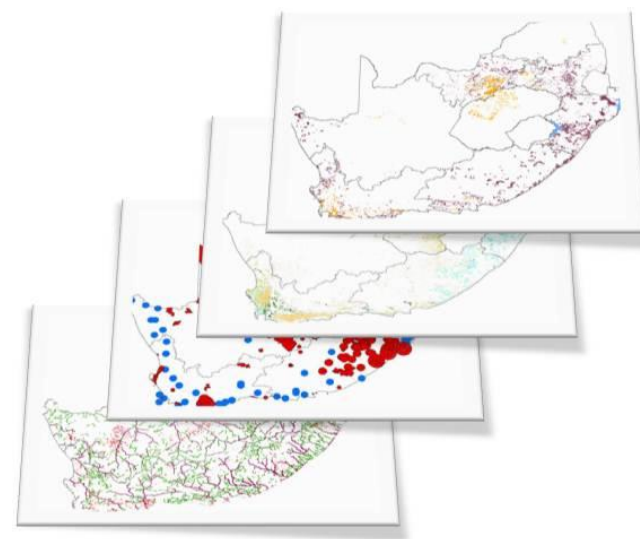
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Identification of no-go areas (Negative Mapping)

	Attributes	Wind Buffer	Solar Buffer
RE Applications			
National RE Applications		n/a	n/a
Natural			
SANBI Core Protected Areas	Forest Act Protected Areas	500m	500m
	Island Reserves	500m	500m
	Local Nature Reserves	500m	500m
	Marine Protected Areas	500m	500m
	Mountain Catchment Areas	500m	500m
	National Botanical Gardens	500m	500m
	Protected Environment	500m	500m
	Provincial Nature Reserves	500m	500m
	Special Nature Reserves	500m	500m
	World Heritage Sites	500m	500m
DEA Protected Areas	National Parks	500m	500m
	Special Nature Reserves	not considered	not considered
	Forest Nature Reserves	not considered	not considered
	Forest Wilderness Areas	not considered	not considered
	Marine Protected Areas	not considered	not considered
	Mountain Catchment Areas	not considered	not considered
	Nature Reserves	not considered	not considered
	Protected Environment	not considered	not considered
	World Heritage Sites	not considered	not considered
	National Parks	not considered	not considered
Ramsar sites	All	500m	500m
Critical Biodiversity Areas (CBAs)	Irreplaceable	none	none
Remaining Threatened Ecosystems	Critically Endangered Ecosystems	none	none
	Endangered and Poorly Protected Ecosystems	none	none
Threatened Forests	All	none	none
Coast (including estuaries)	Coastline & Estuaries	1km	1km
Strategic Water Source Areas	>135 mm/annum rainfall (8% of country contributing 50% Rainfall)	not considered	not considered
	>220 mm/annum rainfall (30% of county's rainfall)	not considered	none
Rivers	River FEPAs	100m	100m
	NFEPA Rivers Order 3-7	100m	100m
	River FEPAs Sub-Catchment	not considered	not considered
Wetlands	Wetland FEPAs	100m	100m
	Wetland clusters	none	none
Birds	Wetland non-FEPAs	not considered	not considered
	Specific IBAs in whole	none	not considered
	Amur falcon colonies	10km	1km
	Bearded vulture nests	20km	2km
	Lesser Kestrel colonies	10km	1km
	Priority vulture colonies	20km	2km
	Largest vulture colonies	40km	4km
	Potberg vulture colonies	40km	4km
	Transkei vulture IBA	none	not considered
	Saldanha flyway	none	not considered
Verlorenvlei flyway	none	not considered	
Bats	Lower Breede River	20km	not considered
	Major Bat Roosts (> 500 bats)	20km	2km

	Attributes	Wind Buffer	Solar Buffer
Land Use			
Land Capability	Class 1-3	none	none
Field Crop Boundaries	Horticulture & Viticulture	none	none
	Pivots	none	none
	Shadenet	none	none
	Tea Plantations	none	none
	Annual Crop Cultivation / Planted Pastures Rotation	not considered	none
Square Kilometer Array	Telescope Sites	20km	10km
South African Astronomical Observatory			
	All	5km	5km
Buildings	All	300m	300m
	Major Roads (national, arterial, main)	500m	500m
Roads	Secondary Roads (secondary)	500m	500m
	Tourist Routes (WC)	2km	2km
Railway	All	300m	300m
Power lines and substations	Existing Transmission & Distribution + 2022 Planned		
	Transmission	300m	300m
Airports	Major Airports	35km	not considered
	Landing Strips	1km	not considered
	Military Airforce Bases	27 km	not considered
Telecommunication towers	>20 m	500m	500m
Mining Rights	All	not considered	not considered
Technical			
Slope	Slope > 10%	none	none
Resource	Wind Power Density	n/a	n/a
	Global Horizontal Irradiance	n/a	n/a

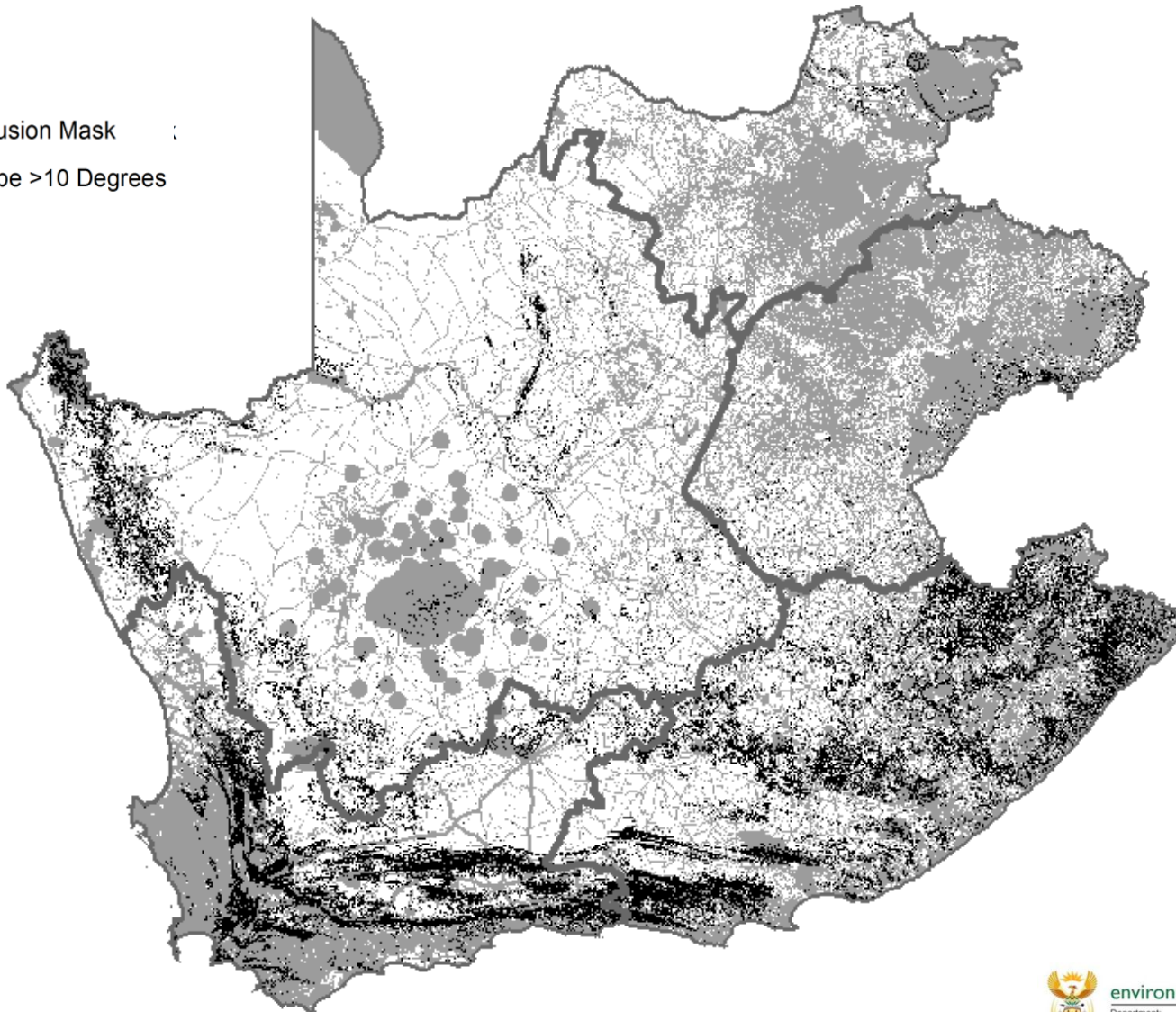


GIS OVERLAY

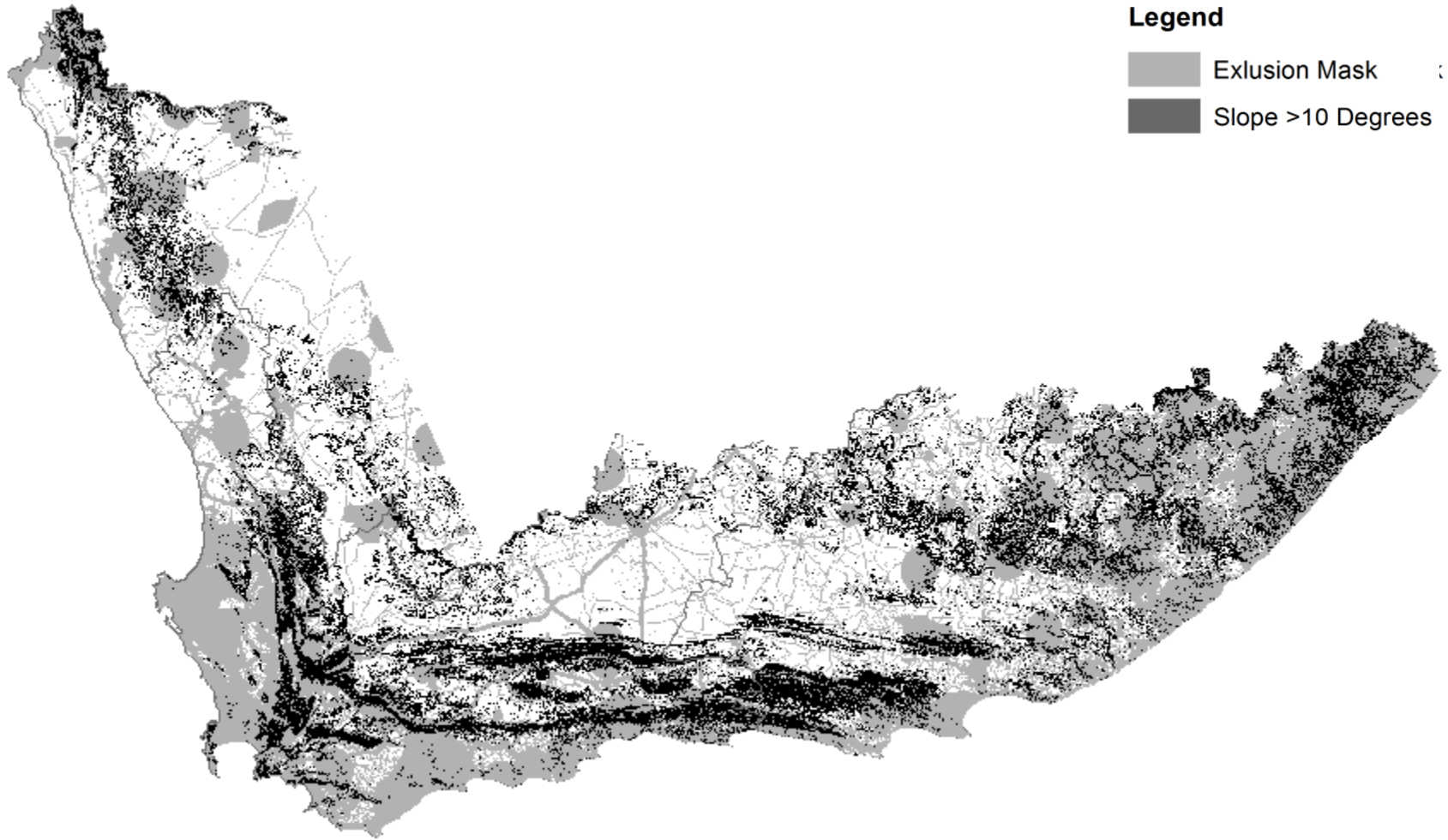
Exclusion Mask: Solar

Legend



- Exclusion Mask
- Slope >10 Degrees



Exclusion Mask: Wind



Legend

-  Exclusion Mask
-  Slope >10 Degrees

Identification of Study Areas



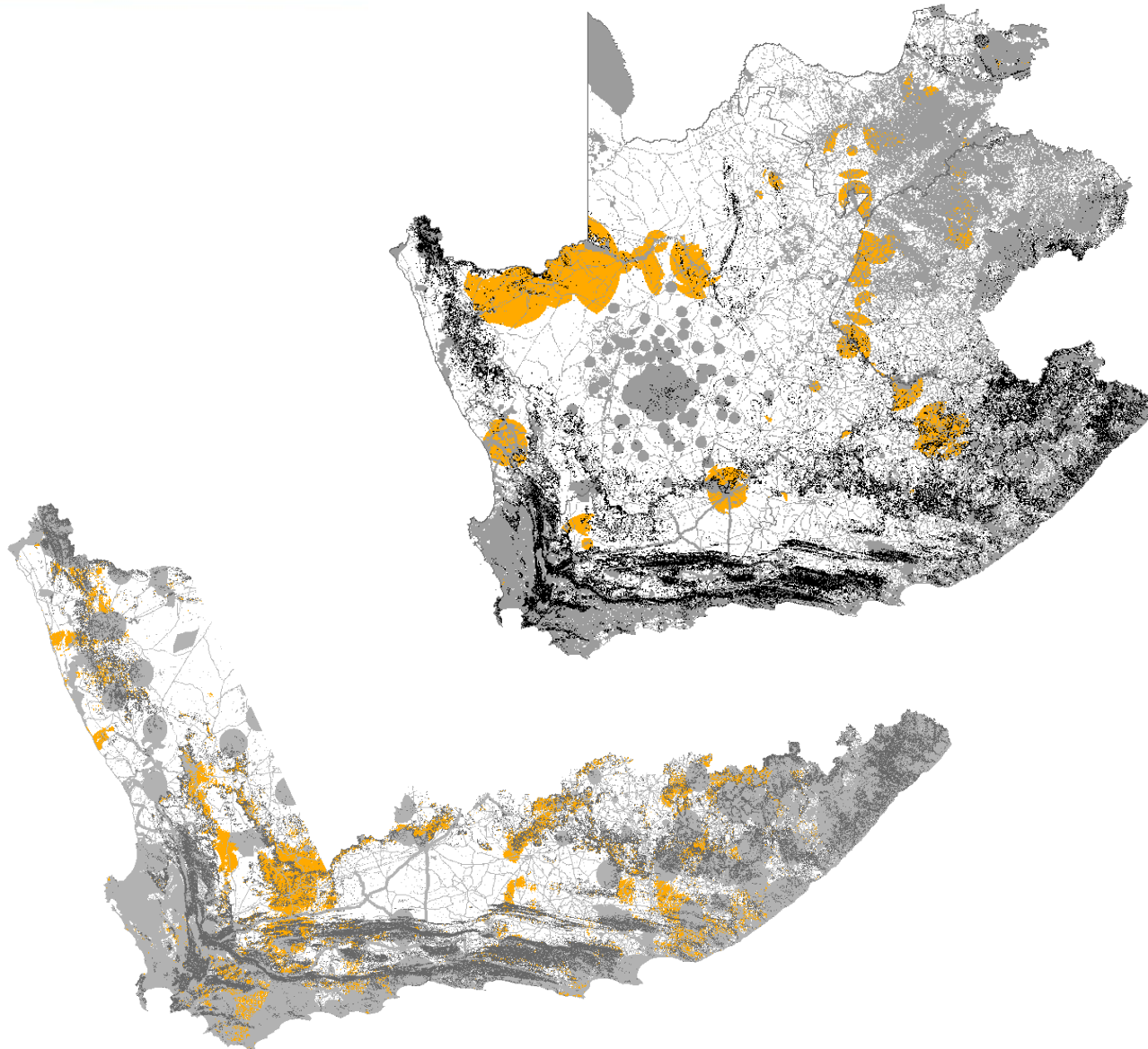
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


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High Wind Development Potential with Exclusion Mask

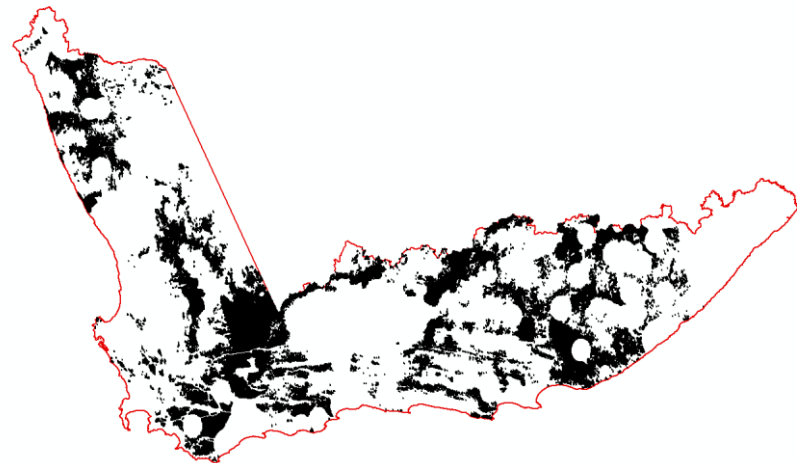
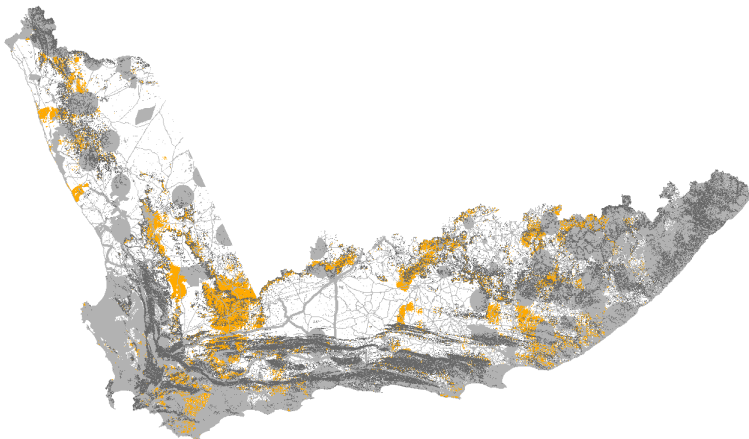
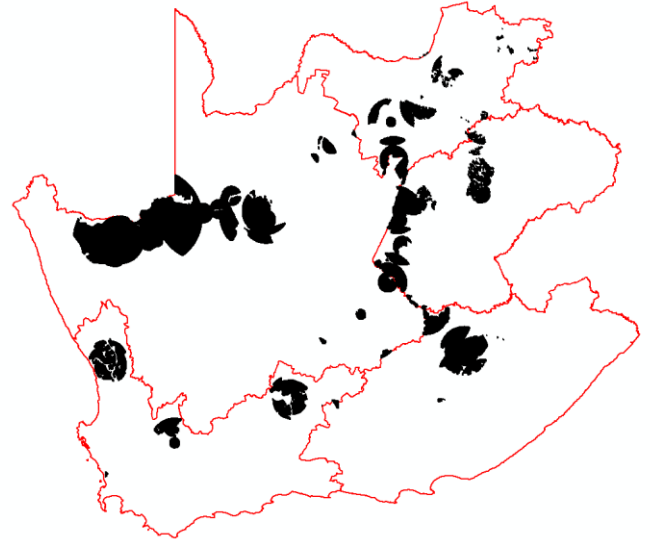
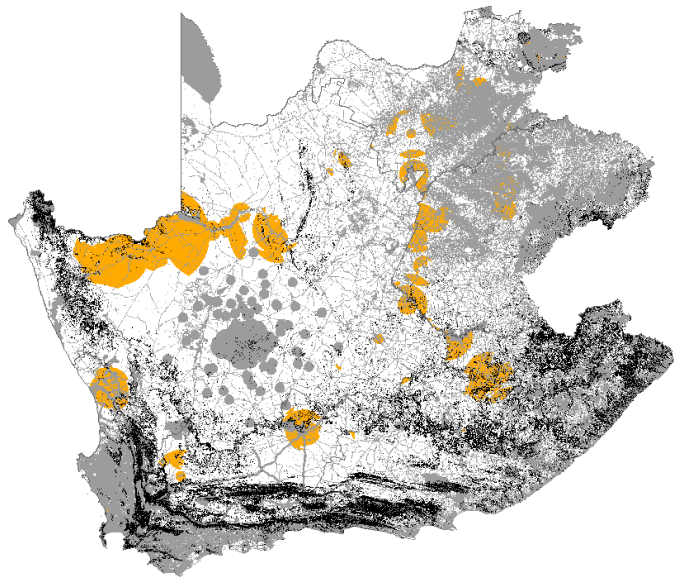
-Extract by Mask



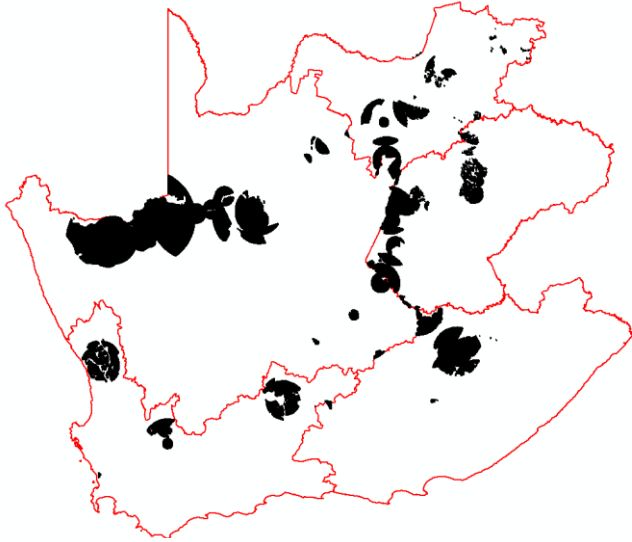
Legend

-  Slope >10 Degrees
-  Solar PV Exclusion Mask
-  High Development Potential

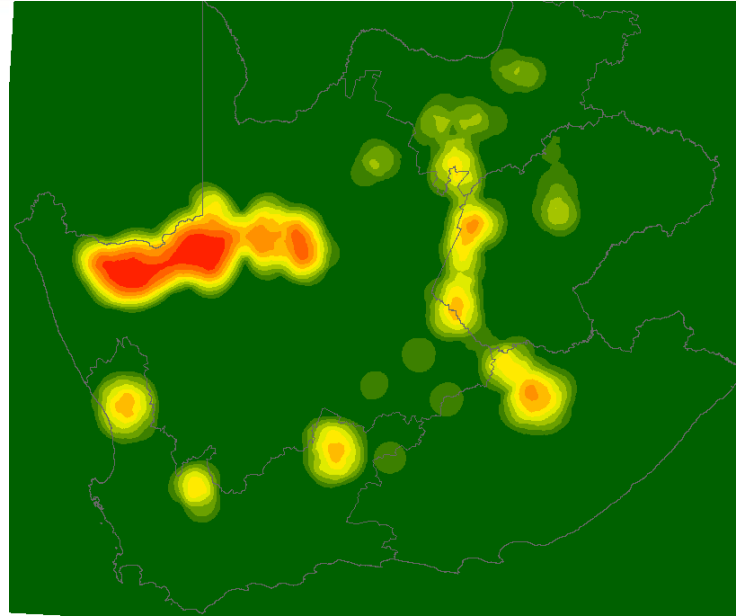
Point Cloud - Raster to Point



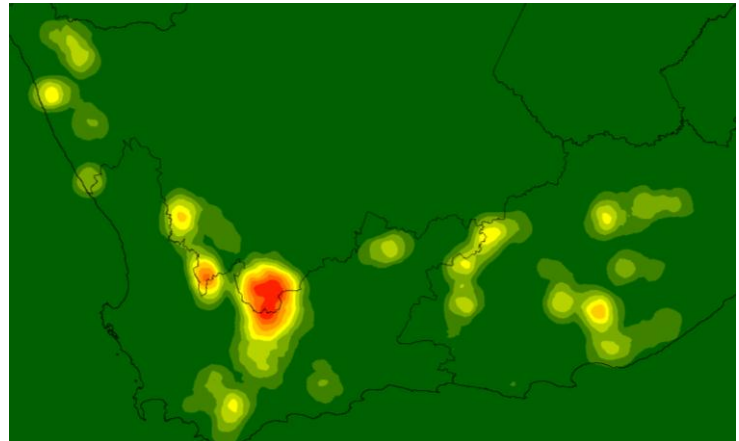
Cluster Analysis - Point Density



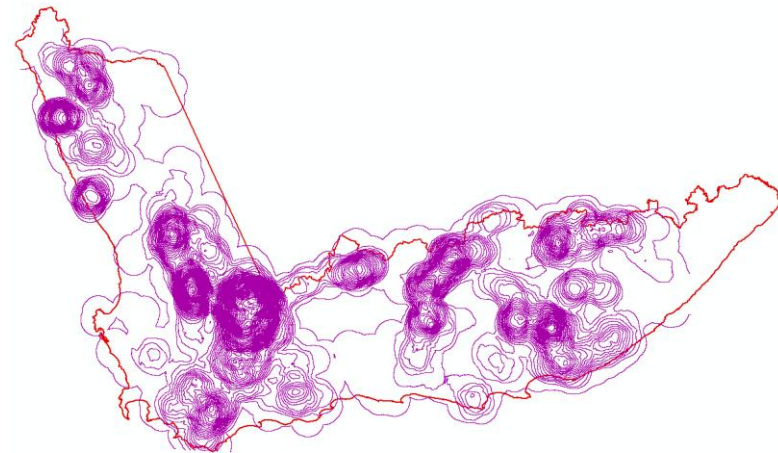
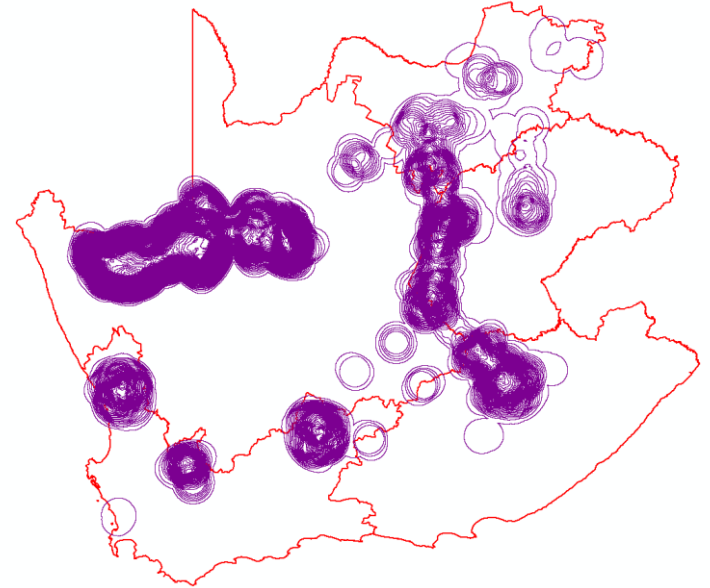
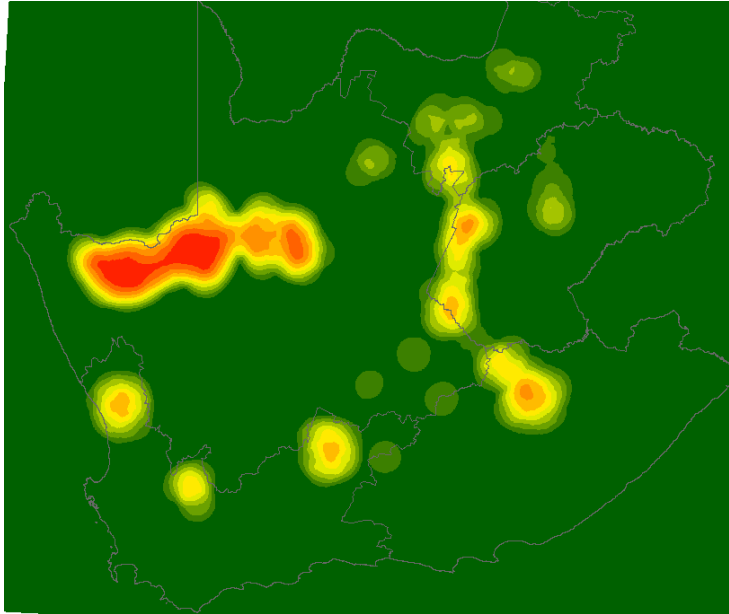
→
30 km radius



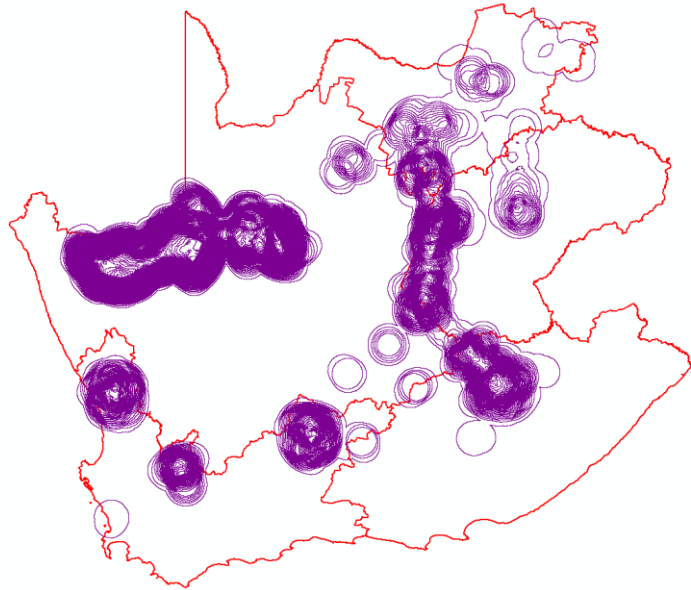
→
20 km radius



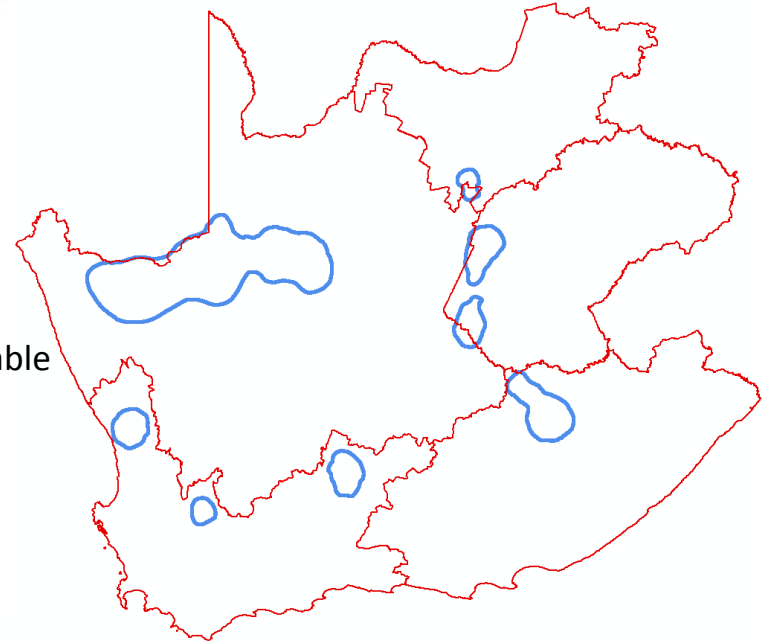
Contour - Contour



Boundary Selection



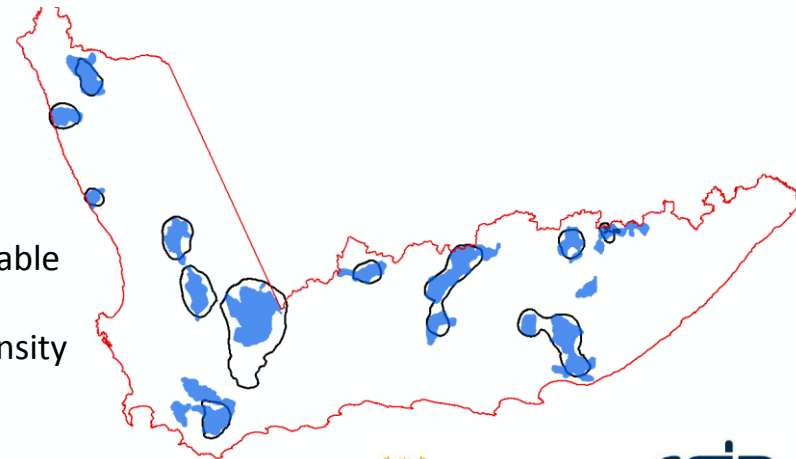
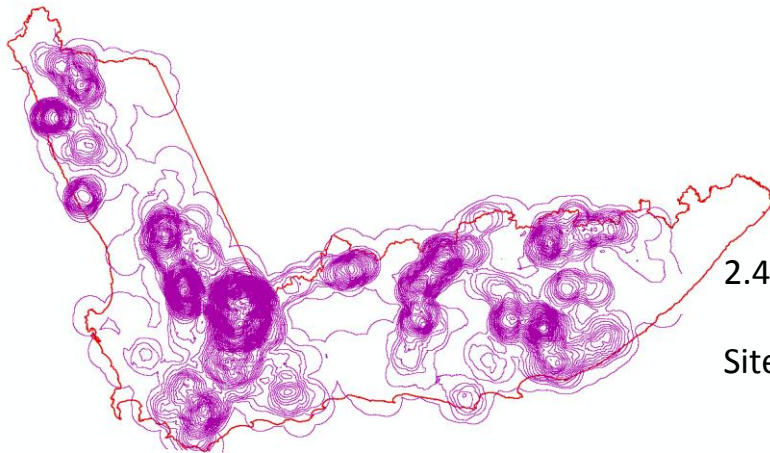
4 Contour = >25% available



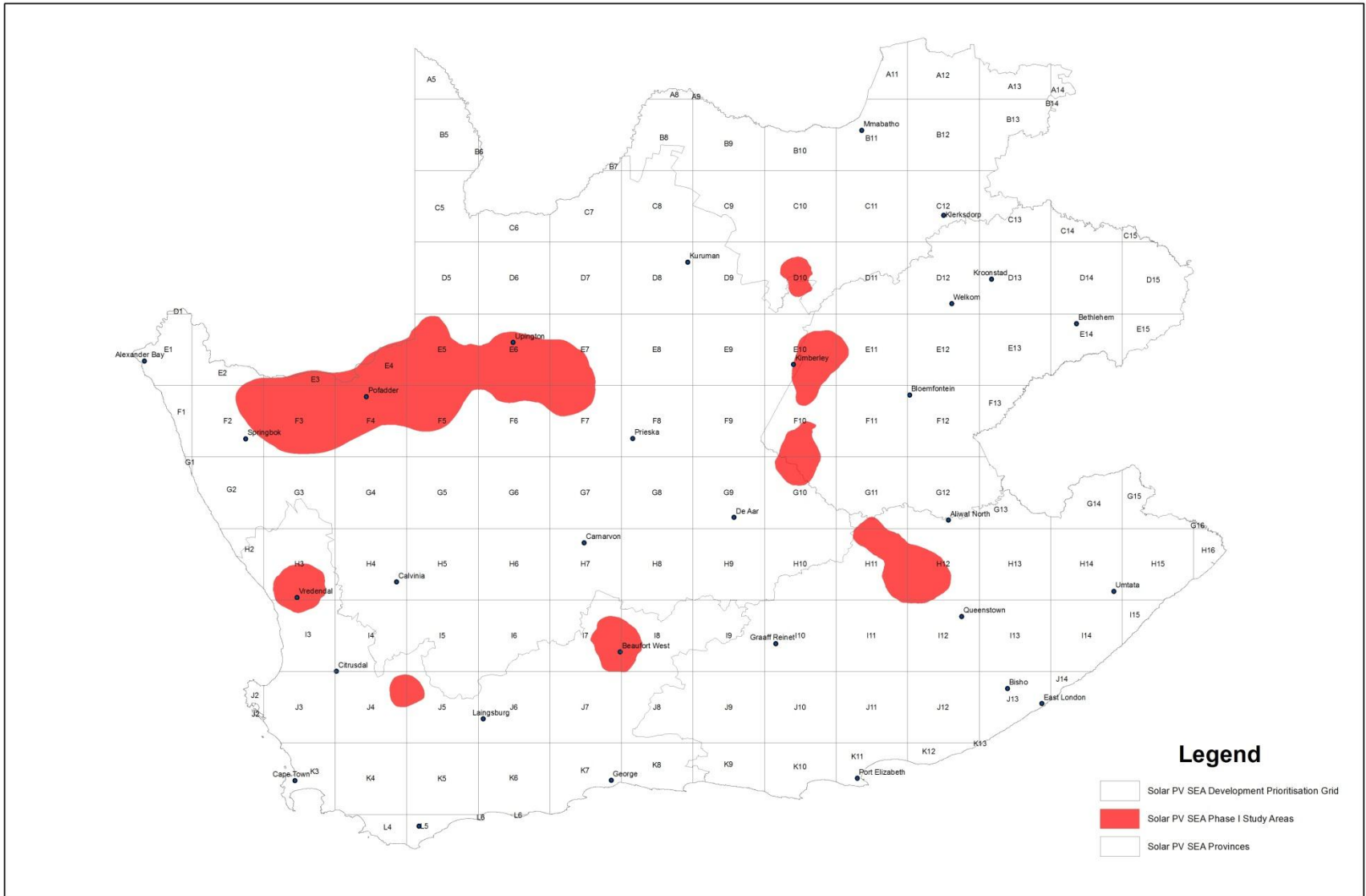
2.4 Contour = >15% available



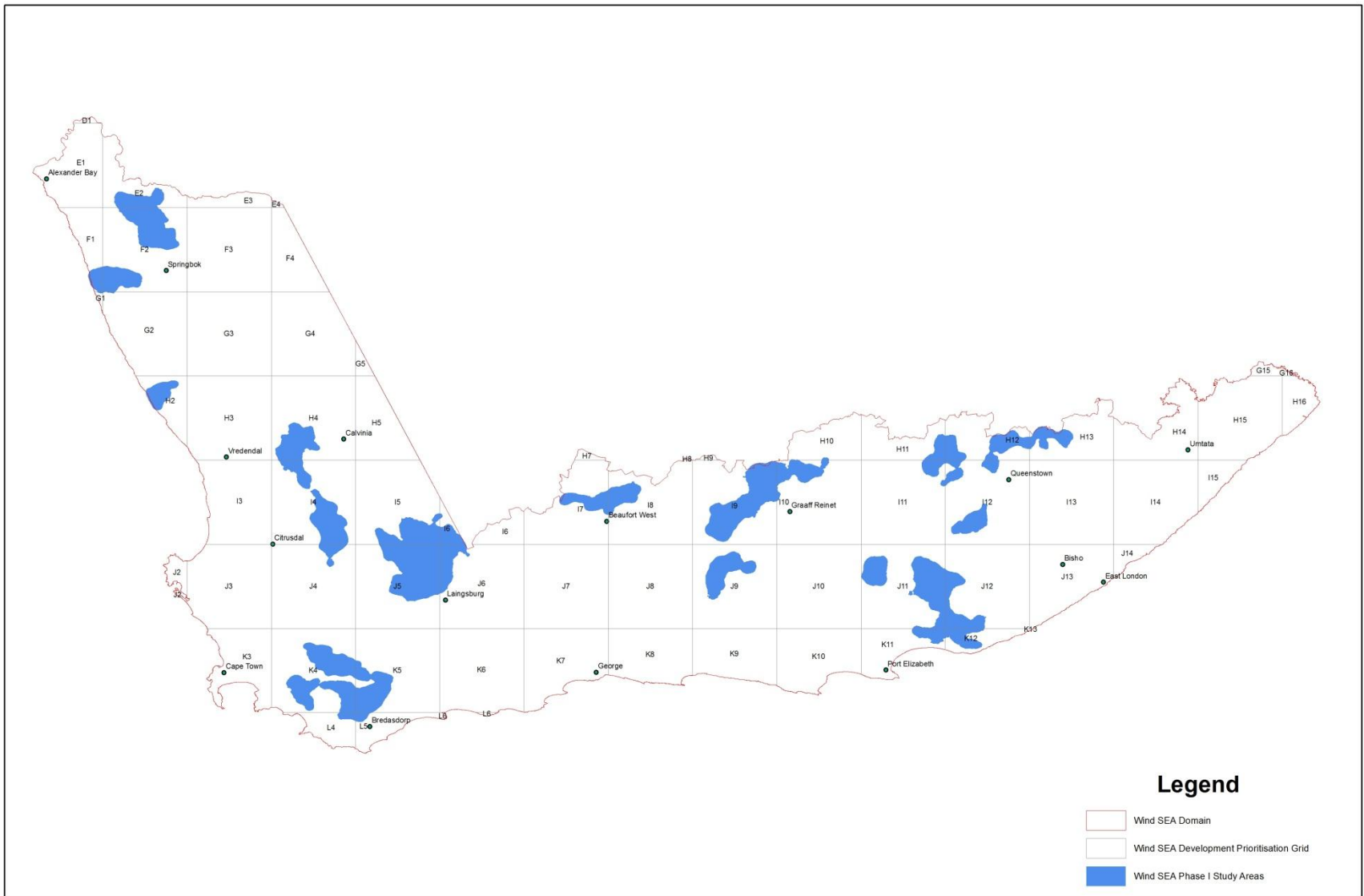
Site 5 km radius point density



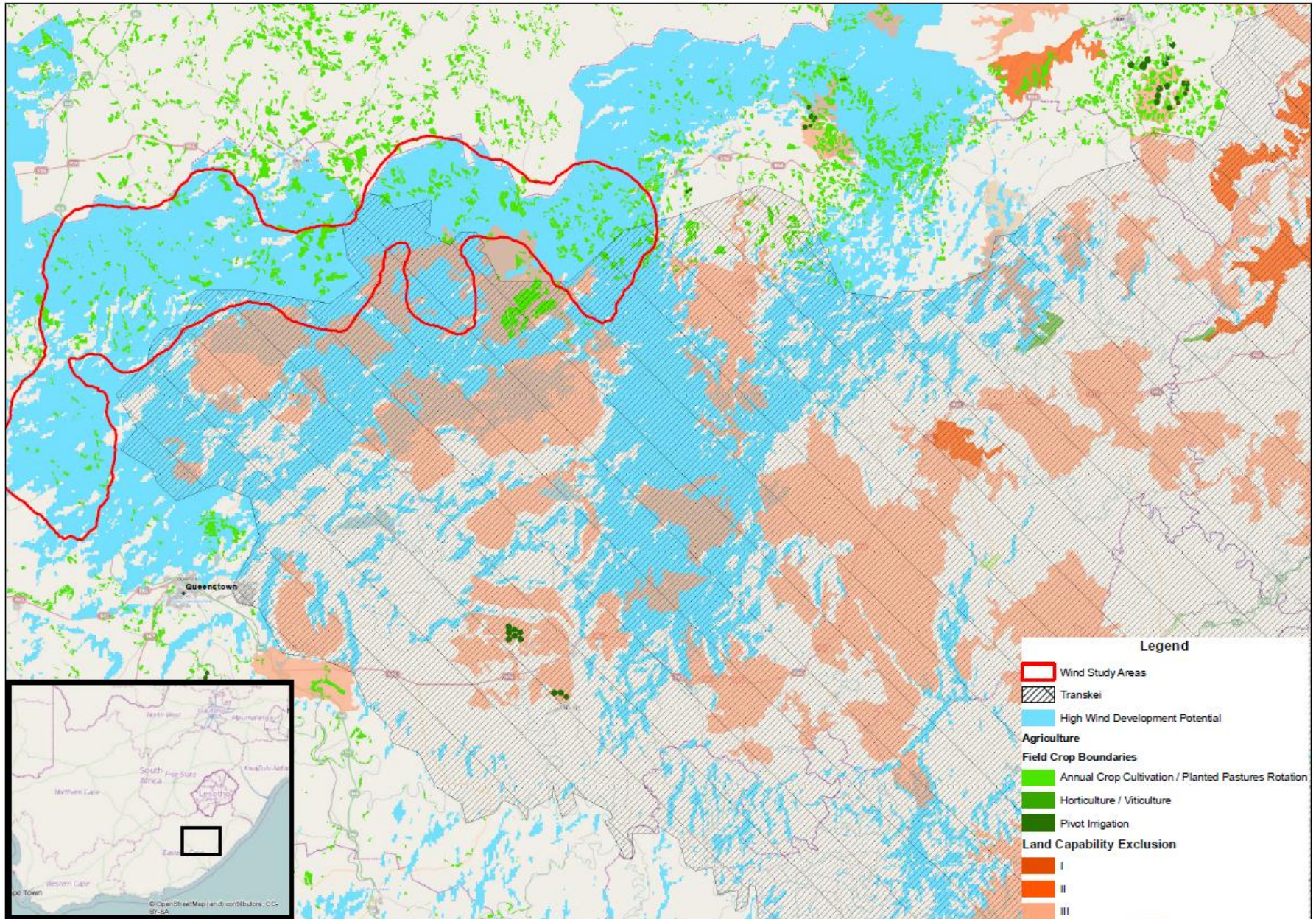
National Solar PV SEA Development Prioritisation Grid



National Wind SEA Development Prioritisation Grid



National Wind and Solar PV SEA: Loss of High Wind Development Potential in Transkei due to Agricultural Exclusion



Produced: 06/09/2013