System of Environmental Economic Accounting

United Nations

UN environment

PILOT MONETARY ECOYSTEM ACCOUNTS FOR KWAZULU-NATAL, SOUTH AFRICA Progress Nov 2019

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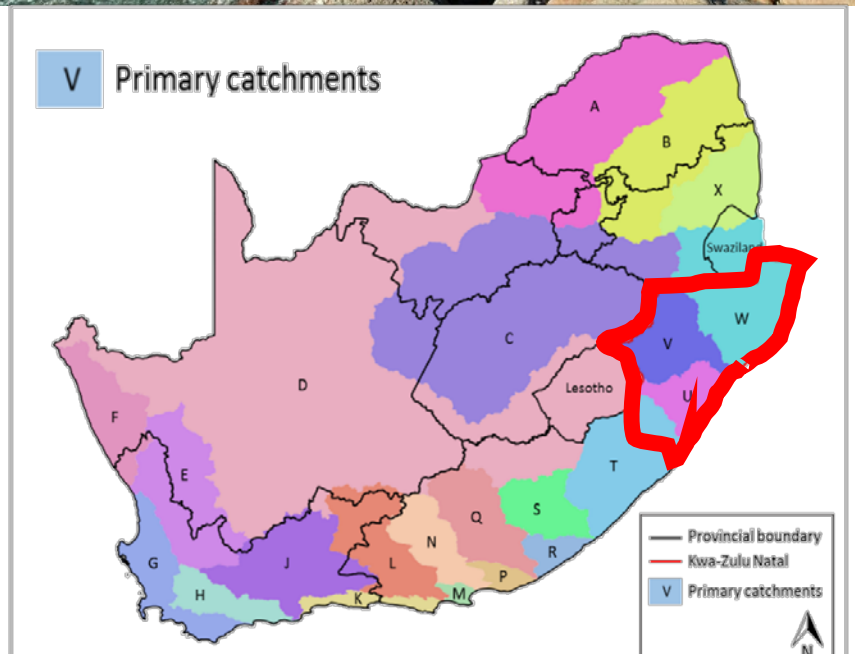
ANCHOR environmental research & monitoring

Introduction

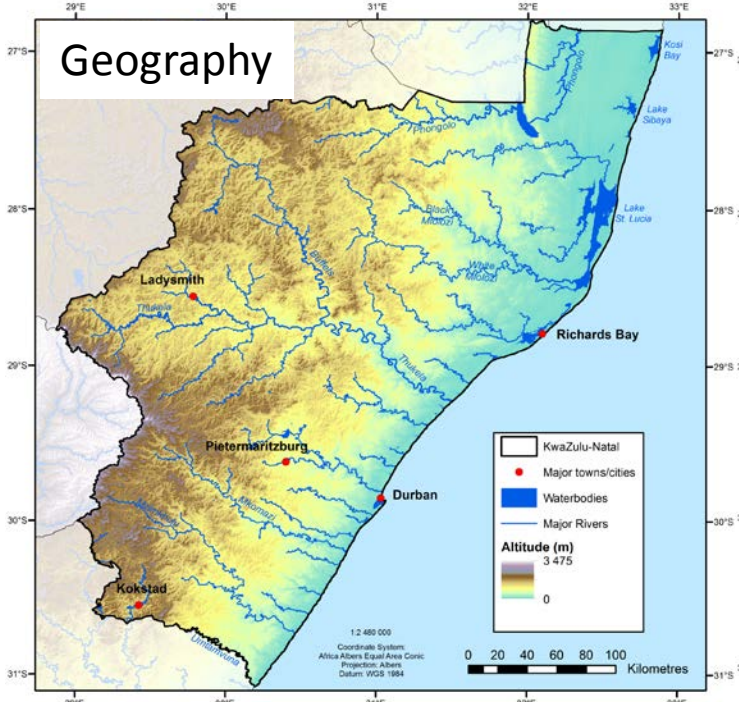
- Pilot study commissioned as a part of the NCA&VES project being undertaken in 5 countries
- Produce monetary ecosystem accounts at regional scale using available data
- Provide recommendations, input into the development of the SEEA EEA and input into South Africa's National Capital Accounting Strategy
- Still in progress, completion Dec 2019

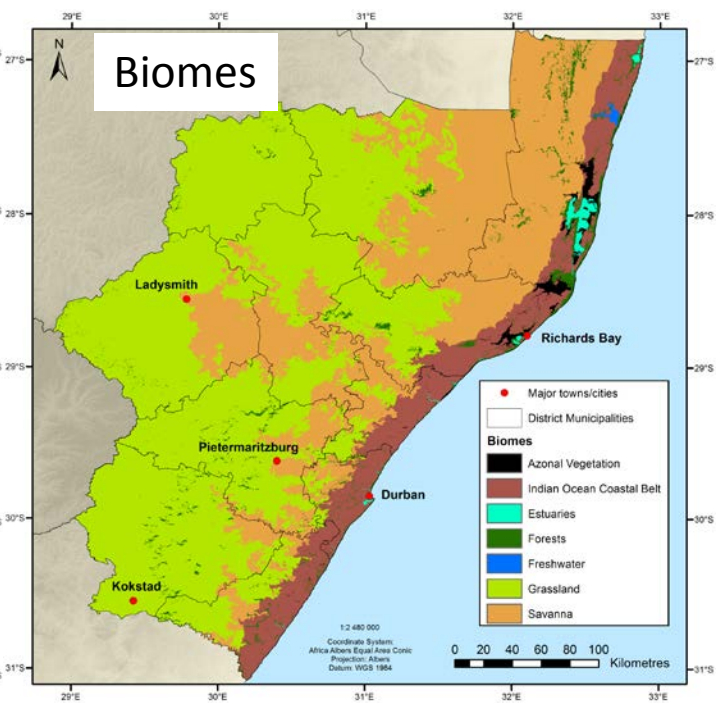


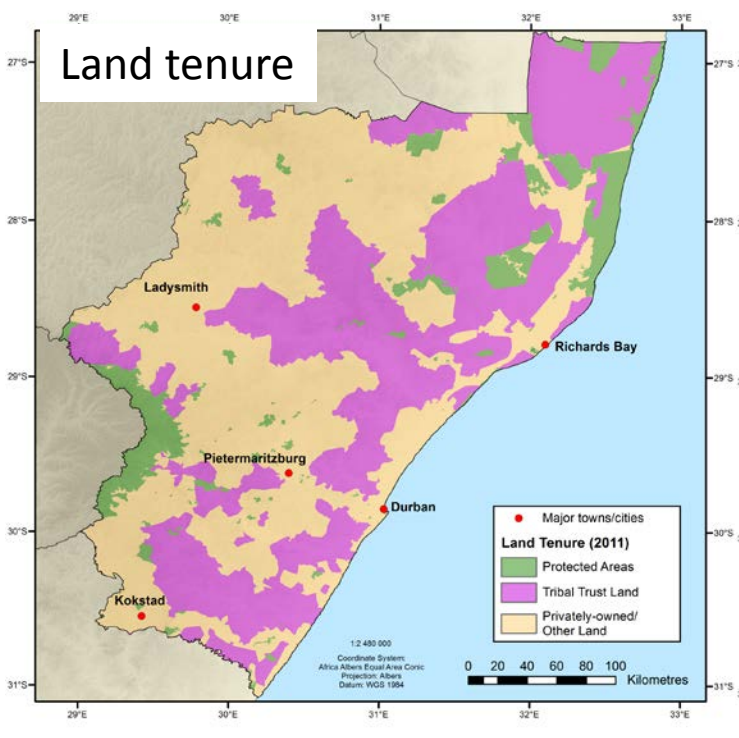
Study area and methodological framework

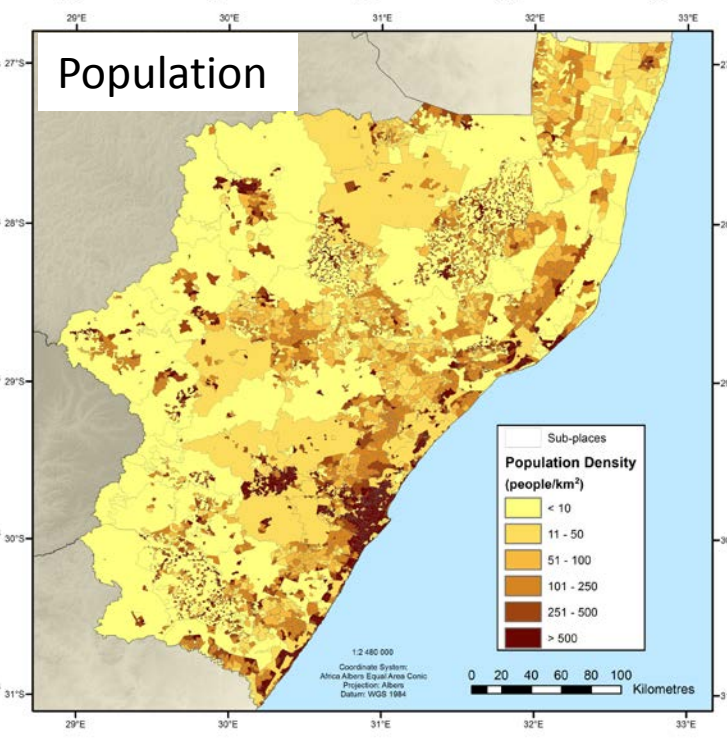
Study area

- Watershed to coast
- Grasslands,
  savanna,
  coastal bush/forest
- 8.7% protected,
  39.4% tribal,
  51.9% private
- Population (2011)
  - 10m (109/ km²),
  - one major city (Durban)
- GDP (2011) R450 bn



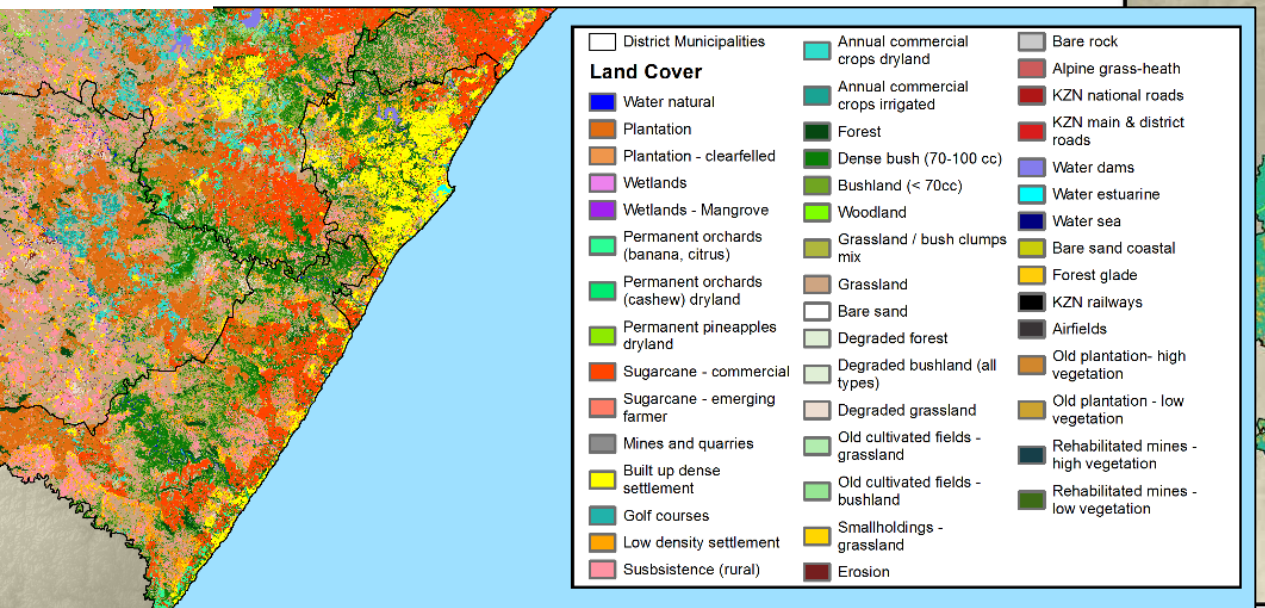


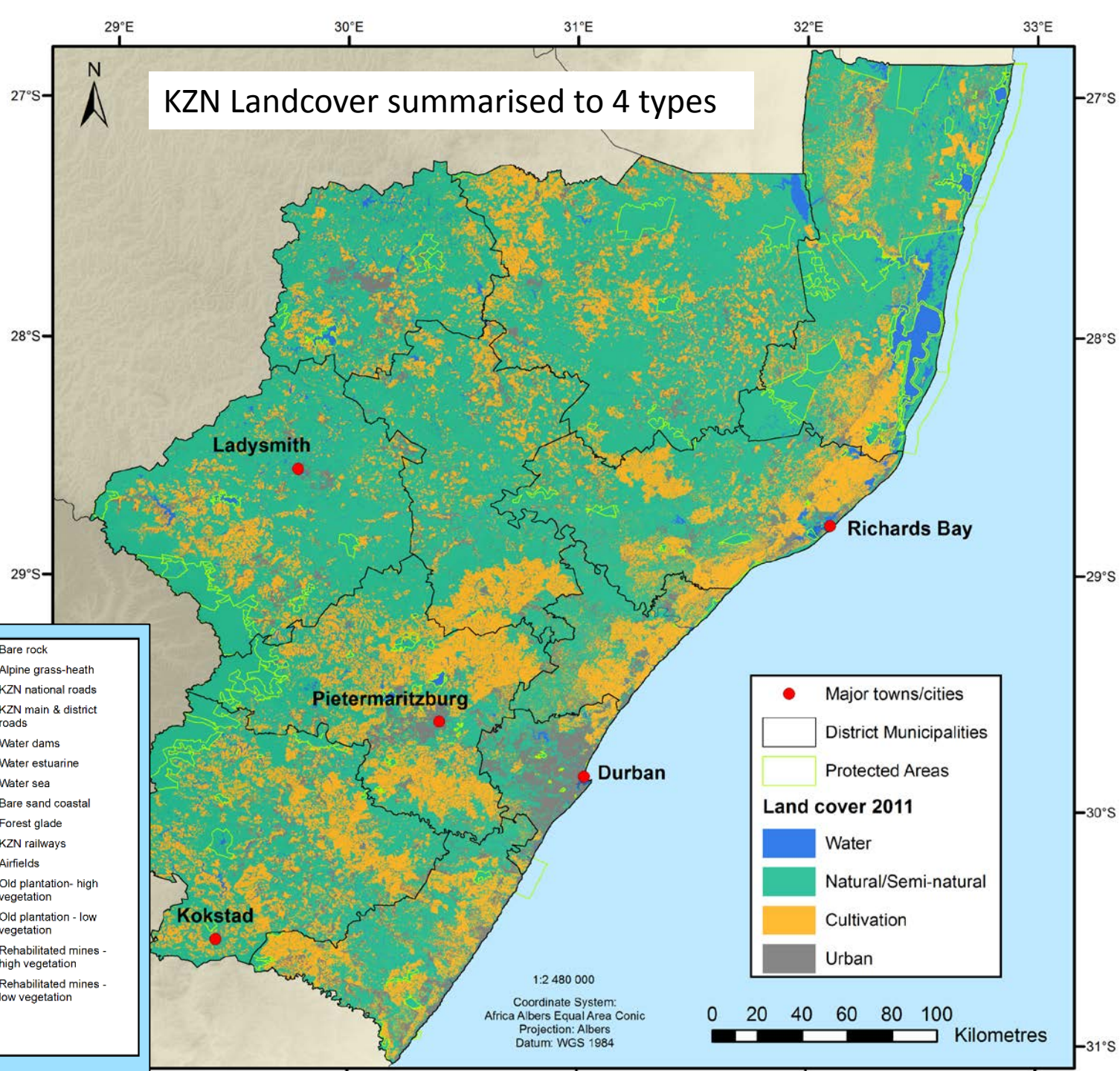




Land cover

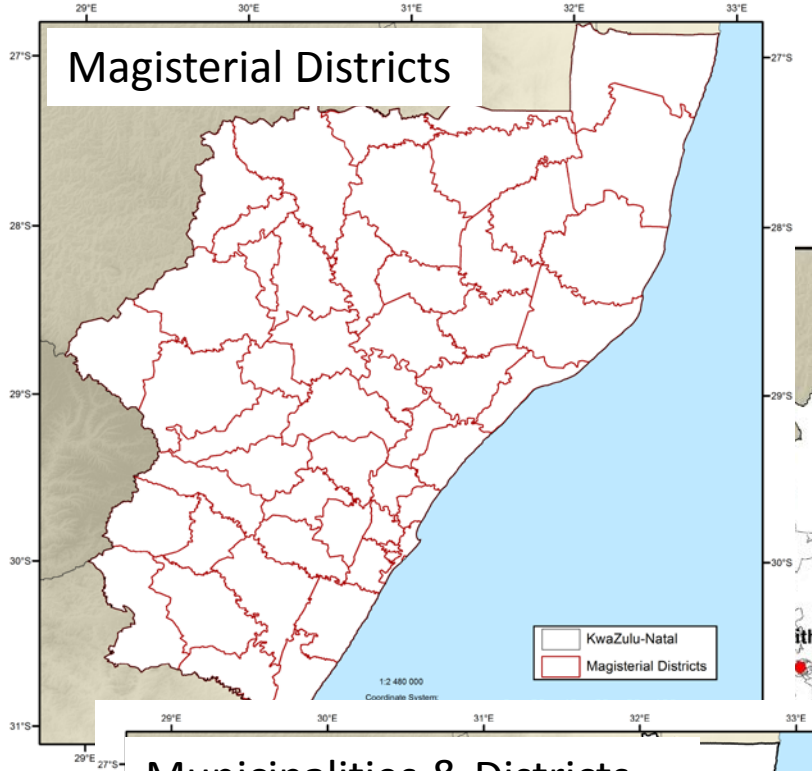
- National Land Cover 1990, 2013/4
  - 72 classes
- KZN land cover 2005, 2008, 2011
  - Includes condition
  - But fewer urban classes

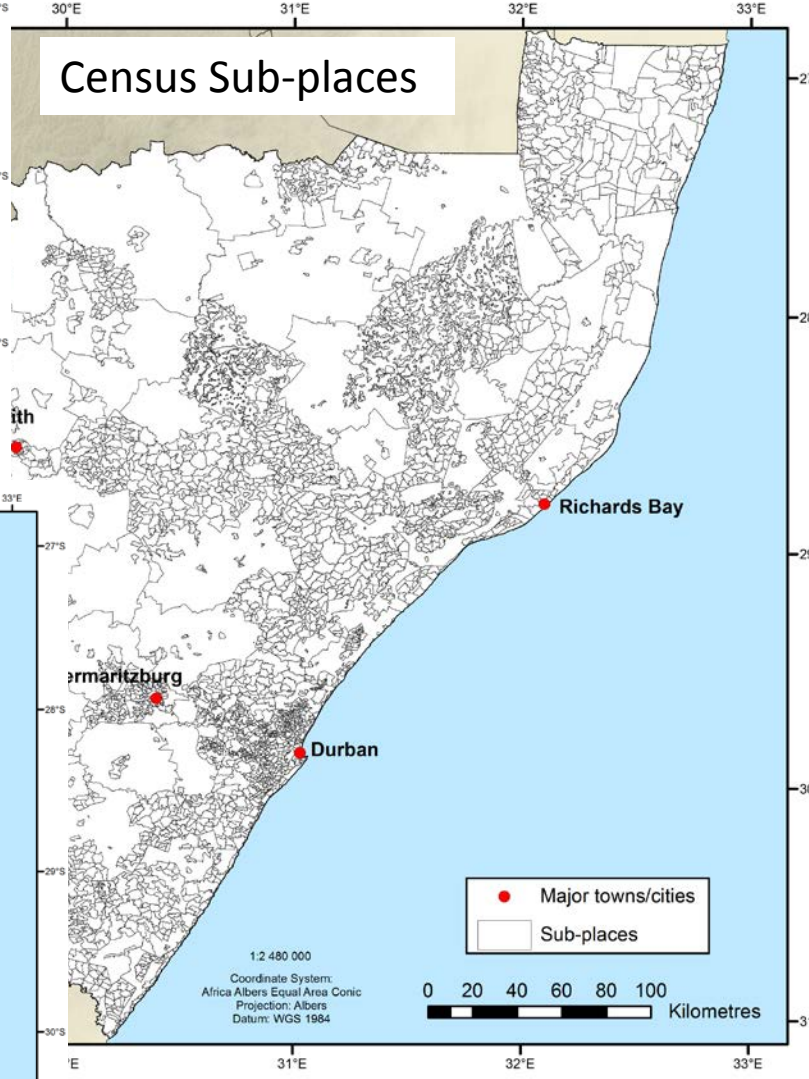


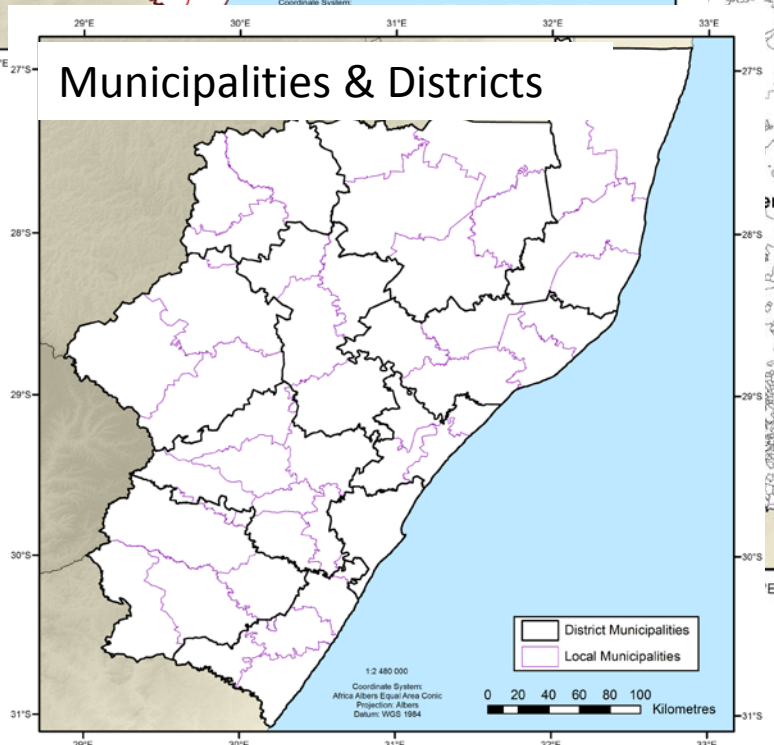


Administrative & census units

- 52 Magisterial Districts
- 43 Local municipalities + 1 Metro
- 11 Districts
- 4198 Census sub-places

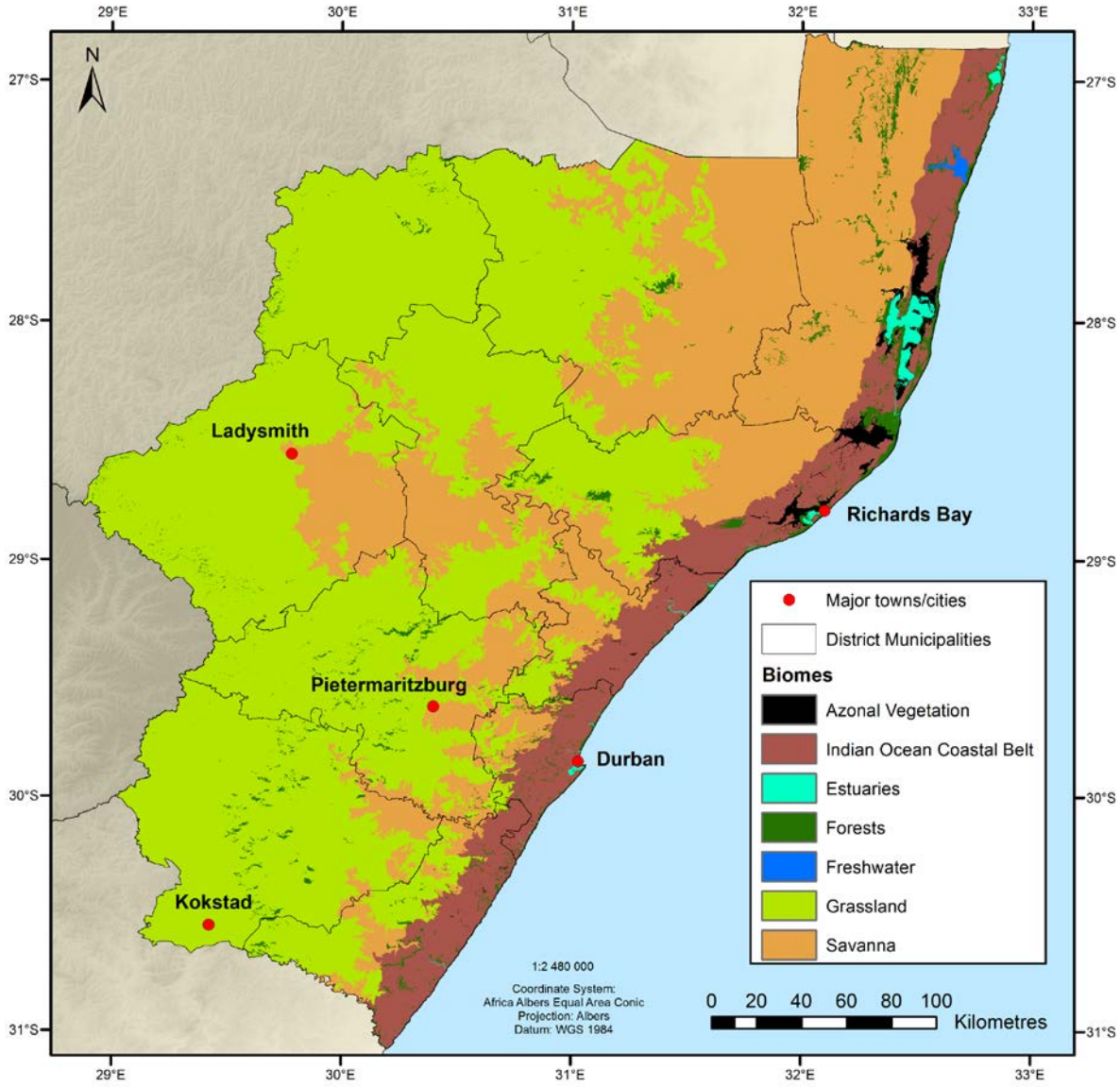






Accounting framework

- Basic spatial unit = 1 ha grid cell
  - Official South African BSU grid created by StatsSA
  - Base layers were projected and then snapped to the BSU grid
- Physical and monetary supply and use tables summarised by biome
- 2005 and 2011
- All monetary values converted to constant 2010 prices



Ecosystem services

- Natural, cultivated, reservoirs and urban parks.
- Classification used here is modified from MEA & CICES;
  - excludes water and minerals
- Study included provisional estimates of a broad range of services*, rather than narrow focus

Broad category	**Ecosystem service**
Provisioning services	Harvested wild biomass*
	Reared animal production*
	Cultivated production*
	Genetic resources
Cultural services	Experiential value associated with active or passive use*
	Existence (non-use) value
Regulating services	Sediment retention*
	Water quality amelioration*
	Seasonal flow regulation*
	Flood attenuation
	Carbon sequestration*
	Crop pollination & pest control
	Refugia and nursery functions

Valuation

- **Provisioning and cultural services** are used directly, through joint contribution of natural and man-made capital and labour.
  - Ecosystem contribution can be valued in terms of net income (gross income less input costs)
- **Regulating services** make an indirect contribution. If lost could result in damages, or replaceable by engineering solutions,
  - Value = min (avoided damage cost, avoided replacement costs)
  - Net of human inputs where services are enhanced

Values

- Ecosystem service flows = R/ha/y
- Asset value = R/ha, R
  - discounted annual flows over 20 years (R/ha), social rate of discount (NPV)
  - Values per ha aggregated by ecosystem type (R)

Ecosystem services & benefits

Wild resources

About the service

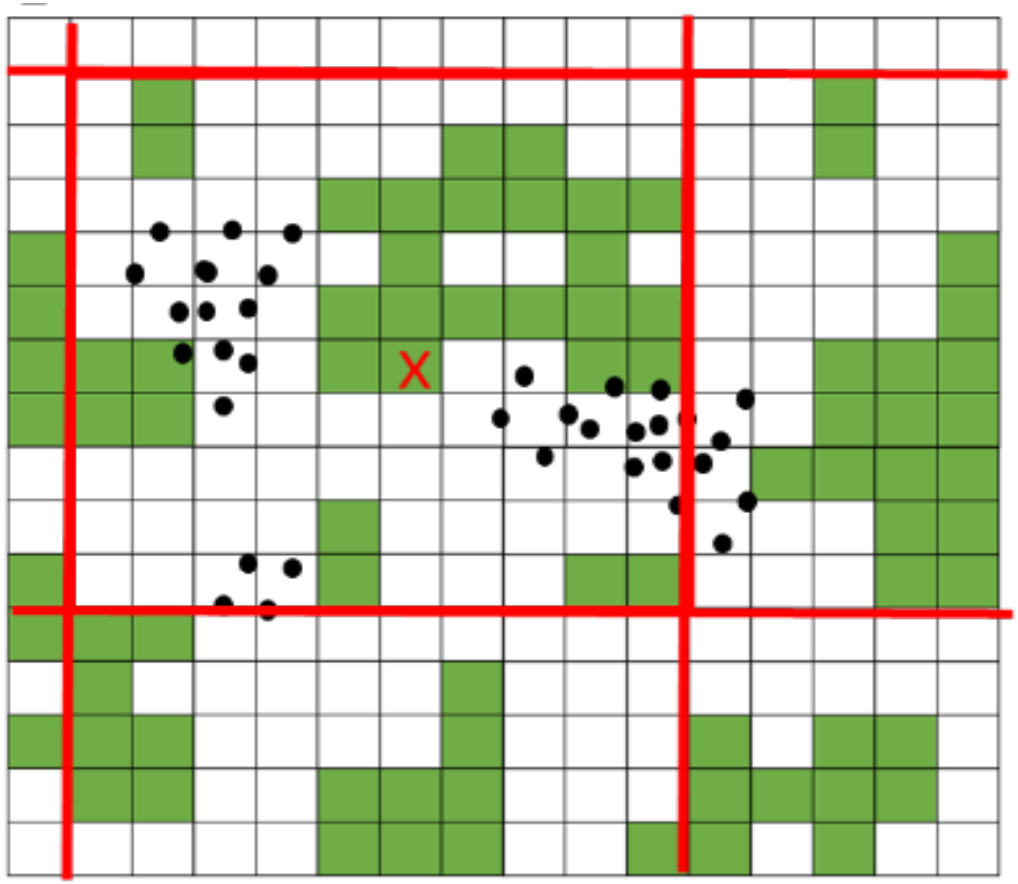
- Major benefit in KZN, millions of people rely on harvesting wild resources
- Large numbers of species involved, grouped based on function

Wild plant resources	Nutrition and health	Wild plant foods and medicines
	Energy	Wood fuel
	Raw materials	Grass
		Reeds and sedges
		Palm leaves
		Poles and withies
		Timber
Wild animal resources	Nutrition	Bush meat
		Fisheries

Wild resources

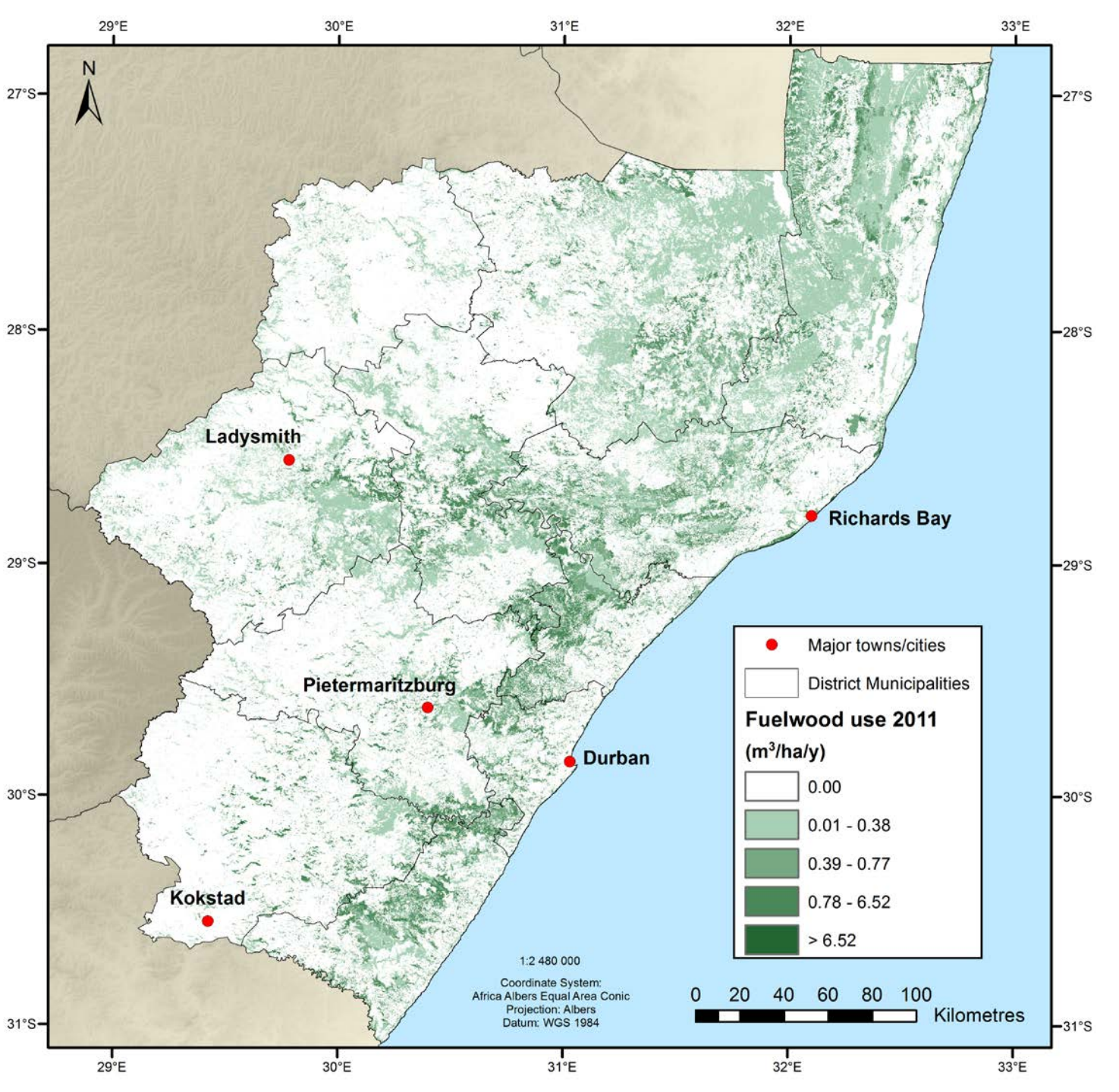
Data & methods

- **Availability** mapped in physical units/ha based on
  - land cover type
  - average stocks per ha from literature,
  - land tenure.
- **Demand** based on survey data, mapped to residential areas
- **Use** estimated using a rolling average method, under assumption of 5-10 km range of collection, limited by availability



Wild resources

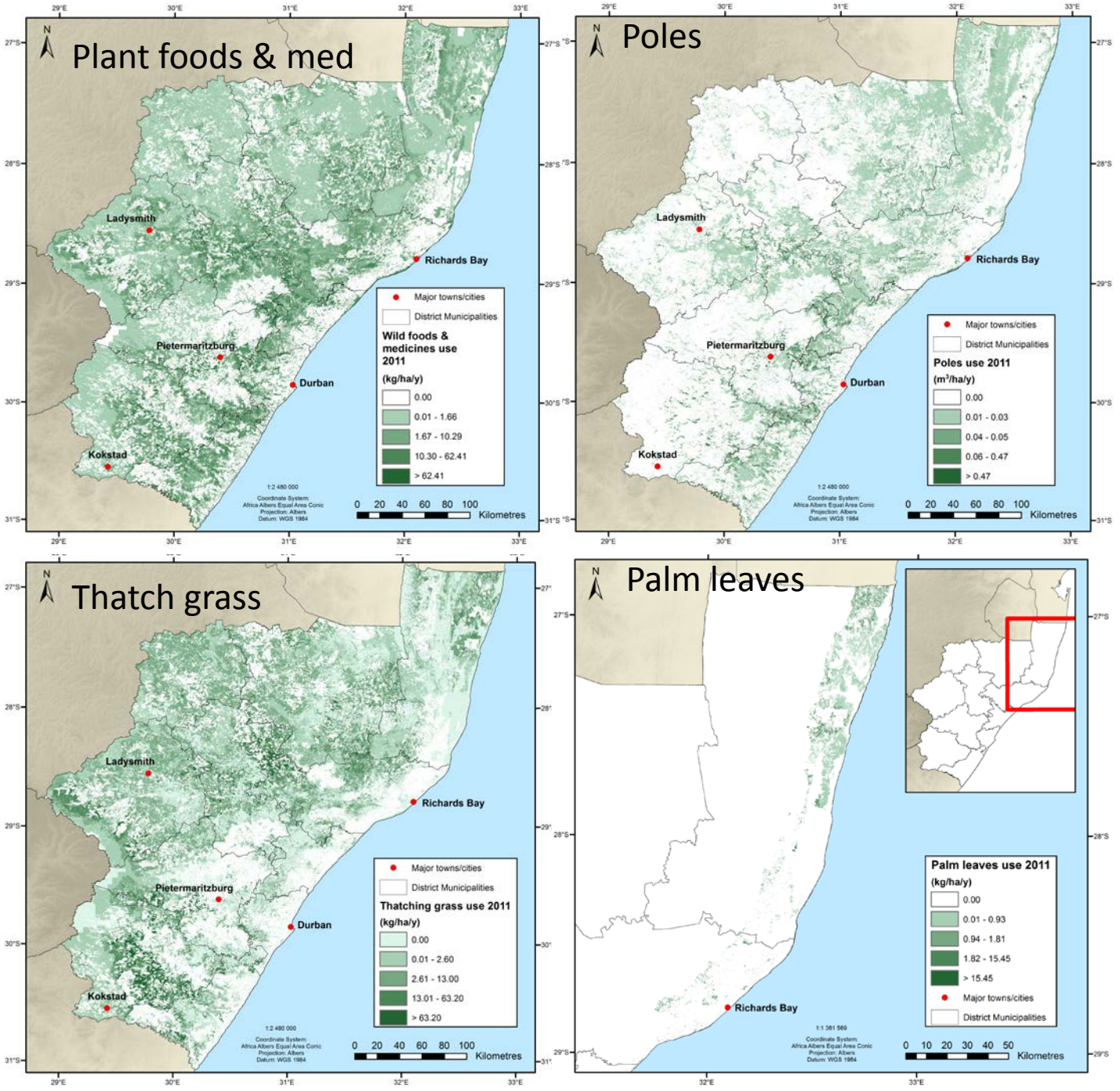
- Estimated use mapped as kg or m^3/ha/y
- Converted to R/ha/y using average prices and input costs from literature



Wild resources

Comments

- Limited data in census, relied on data from previous studies
- Limited info on stocks and availability
- Difficult to produce accurate spatial estimates – beyond some point people will transport and trade



Wild resources – physical supply tables by biome

Biome / PHYSICAL SUPPLY 2005	Azonal Vegetation (seashore & alluvial)	Freshwater	Grassland	Indian Ocean Coastal Belt	Savanna	Forests	Estuaries	TOTAL
Fuelwood (m^3)	3 124	216	663 349	223 178	755 244	247 315	158	1 892 584
Poles (m^3)	156	7	29 645	10 948	28 560	11 165	8	80 489
Timber (m^3)	17	3	2 643	999	3 491	8 567	3	15 723
Thatching grass (tonnes)	27	10	43 871	6 068	26 676	70	2	76 724
Reeds & sedges (tonnes)	740	13	3 801	1 508	2 371	324	22	8 779
Palm leaves (tonnes)	-	-	-	292	-	-	-	292
Wild foods/med (tonnes)	118	4	14 483	4 951	13 113	2 327	6	35 001
Bushmeat (tonnes)	5	1	1 542	338	1 934	179	0	3 998
Fish (tonnes) (see note above)	35	7	315	75	298	22	8	759

Biome / PHYSICAL SUPPLY 2011	Azonal Vegetation (seashore & alluvial)	Freshwater	Grassland	Indian Ocean Coastal Belt	Savanna	Forests	Estuaries	TOTAL
Fuelwood (m^3)	3 419	204	577 156	199 665	684 019	228 188	181	1 692 832
Poles (m^3)	157	5	27 922	9 231	25 318	10 504	7	73 144
Timber (m^3)	14	2	1 359	415	2 516	8 410	2	12 719
Thatching grass (tonnes)	15	7	35 145	3 870	18 970	42	1	58 052
Reeds & sedges (tonnes)	591	7	3 796	1 176	2 578	192	14	8 355
Palm leaves (tonnes)	-	-	-	235	-	-	-	235
Wild foods/med (tonnes)	143	3	14 311	3 984	11 265	2 681	7	32 393
Bushmeat (tonnes)	3	1	1 161	220	1 404	138	0	2 926
Fish (tonnes) (see note above)	24	5	389	65	271	14	6	774

Wild resources – monetary supply tables by biome (R millions)

Biome / MONETARY SUPPLY TABLE 2005	Azonal Vegetation (seashore & alluvial)	Freshwater	Grassland	Indian Ocean Coastal Belt	Savanna	Forests	Estuaries	TOTAL
Fuelwood	2.70	0.19	573.13	192.83	652.53	213.68	0.14	1 635.19
Poles	0.11	0.00	21.40	7.90	20.62	8.06	0.01	58.11
Timber	0.02	0.00	3.59	1.36	4.75	11.65	0.00	21.38
Thatching grass	0.64	0.24	1 052.90	145.64	640.23	1.68	0.04	1 841.38
Reeds & Sedges	18.49	0.32	95.03	37.71	59.28	8.09	0.56	219.49
Palm leaves	-	-	-	12.86	-	-	-	12.86
Wild foods & Medicines	1.85	0.06	228.10	77.98	206.54	36.64	0.10	551.27
Bushmeat	0.07	0.01	23.12	5.07	29.01	2.68	0.00	59.97
Fish	0.28	0.06	2.52	0.60	2.39	0.17	0.06	6.07
Total	23.89	0.83	1 997.29	481.35	1 612.96	282.48	0.85	4 405.73

Biome / MONETARY SUPPLY TABLE 2011	Azonal Vegetation (seashore & alluvial)	Freshwater	Grassland	Indian Ocean Coastal Belt	Savanna	Forests	Estuaries	TOTAL
Fuelwood	2.95	0.18	498.66	172.51	590.99	197.15	0.16	1 462.61
Poles	0.11	0.00	20.16	6.66	18.28	7.58	0.01	52.81
Timber	0.02	0.00	1.85	0.56	3.42	11.44	0.00	17.30
Thatching grass	0.37	0.17	843.47	92.89	455.29	1.01	0.03	1 393.24
Reeds & Sedges	14.78	0.17	94.90	29.40	64.46	4.81	0.35	208.88
Palm leaves	-	-	-	10.34	-	-	-	10.34
Wild foods & Medicines	2.25	0.04	225.39	62.75	177.42	42.23	0.10	510.19
Bushmeat	0.05	0.01	17.41	3.30	21.06	2.06	0.00	43.90
Fish	0.27	0.05	4.28	0.72	2.98	0.15	0.07	8.51
Total	20.80	0.63	1 706.13	379.14	1 333.90	266.45	0.71	3 707.76

Reared animal production

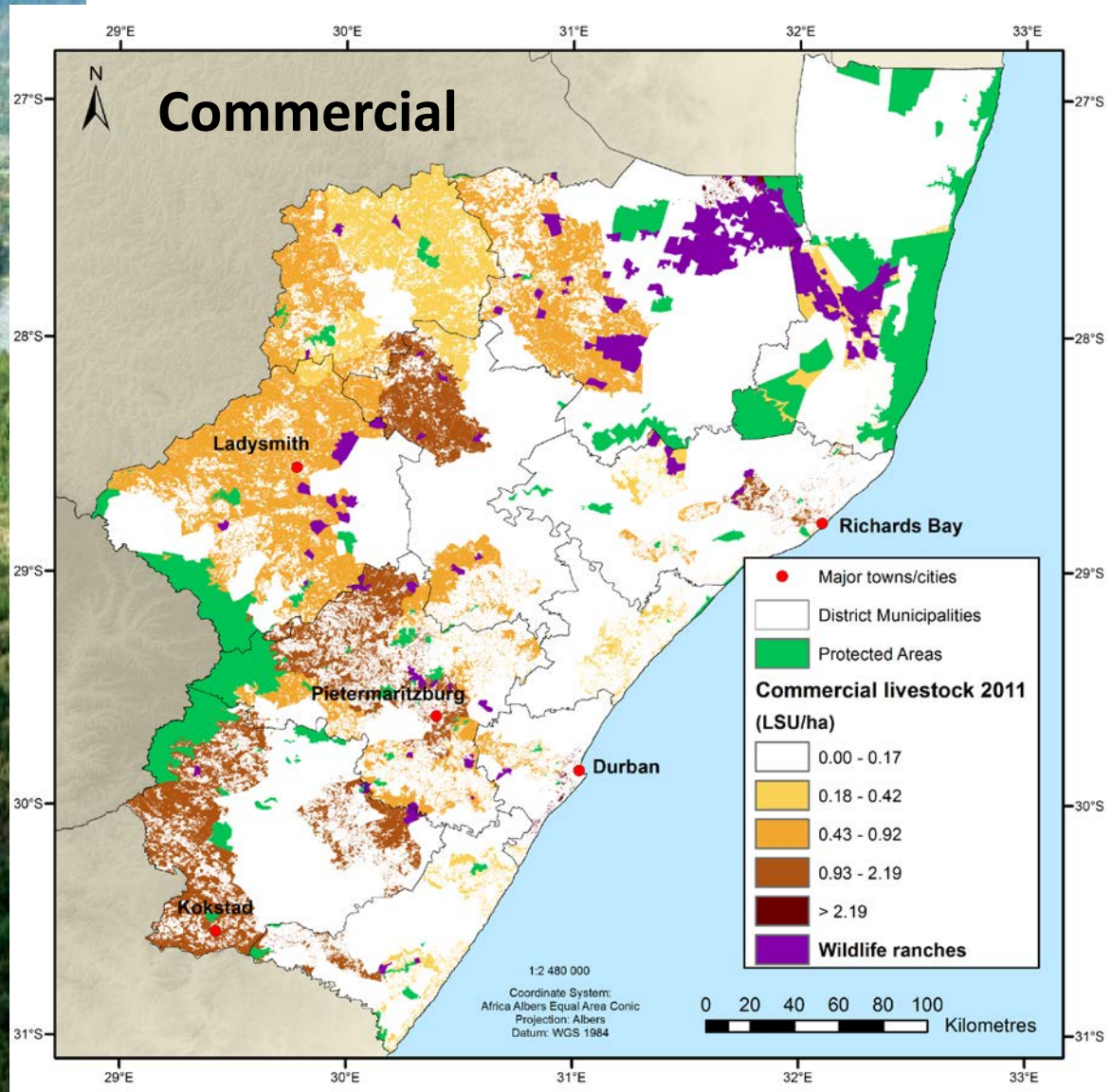
About the service

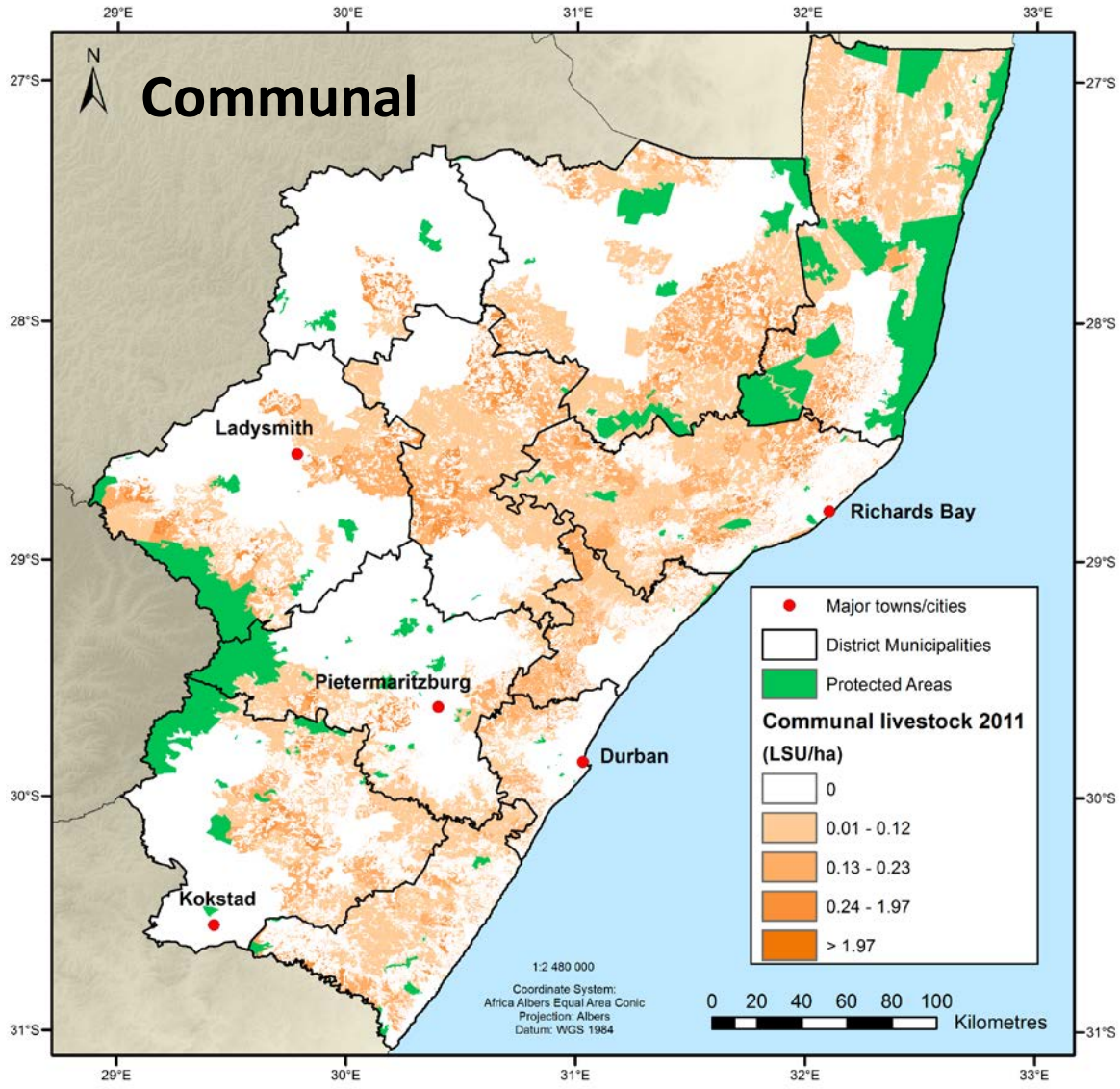
- Extensive production of livestock & wildlife
- High input production in private lands,
- Low input-output systems on communal land
- Lower production on private wildlife ranches as some for tourism

Data & methods

- Commercial livestock
  - Census of Commercial Agriculture 2002, 2007 (Magisterial Districts)
  - Long term quarterly provincial statistics
- Communal livestock
  - Agric hh survey (Census 2011) by ward
  - Single estimate for province
  - 2005 estimate based on census data
- Wildlife ranching
  - Offtake/ha in KZN, values from single report

Reared animal production





Cultivation

The service

- Land inputs to cultivated production including crops, orchards and timber plantations
- Mapped in physical terms as production (tonnes) per ha
- Provisionally valued as production at farm gate price less human inputs
- Will later also subtract **intermediate service inputs** attributed to adjacent habitats (pollination, pest control), and **externalities** (downstream impacts of soil loss)

Data and methods

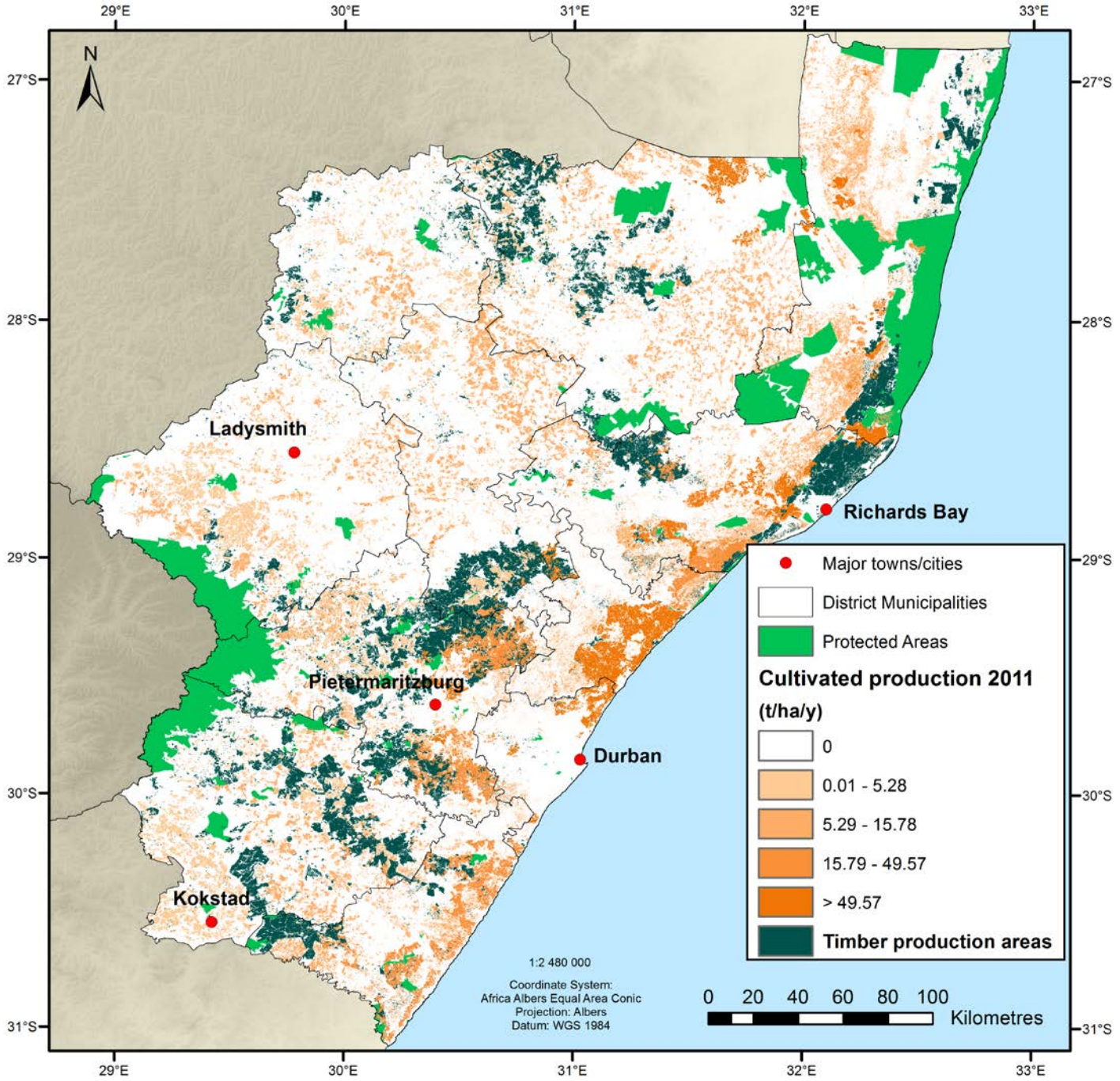
- Commercial crop production and prices from 2002 and 2007 Agricultural Census, at Magisterial District scale (selected crops) and provincial scale (all crops)
  - Ave per crop grouping (aligned to land cover classes), per district
- Commercial silviculture production and prices for KZN from Forestry South Africa (2011 data)
  - Single average value per ha for province
- Communal crop production and prices from literature from N KZN
  - Single average value per ha for province

Cultivation

Results and comments

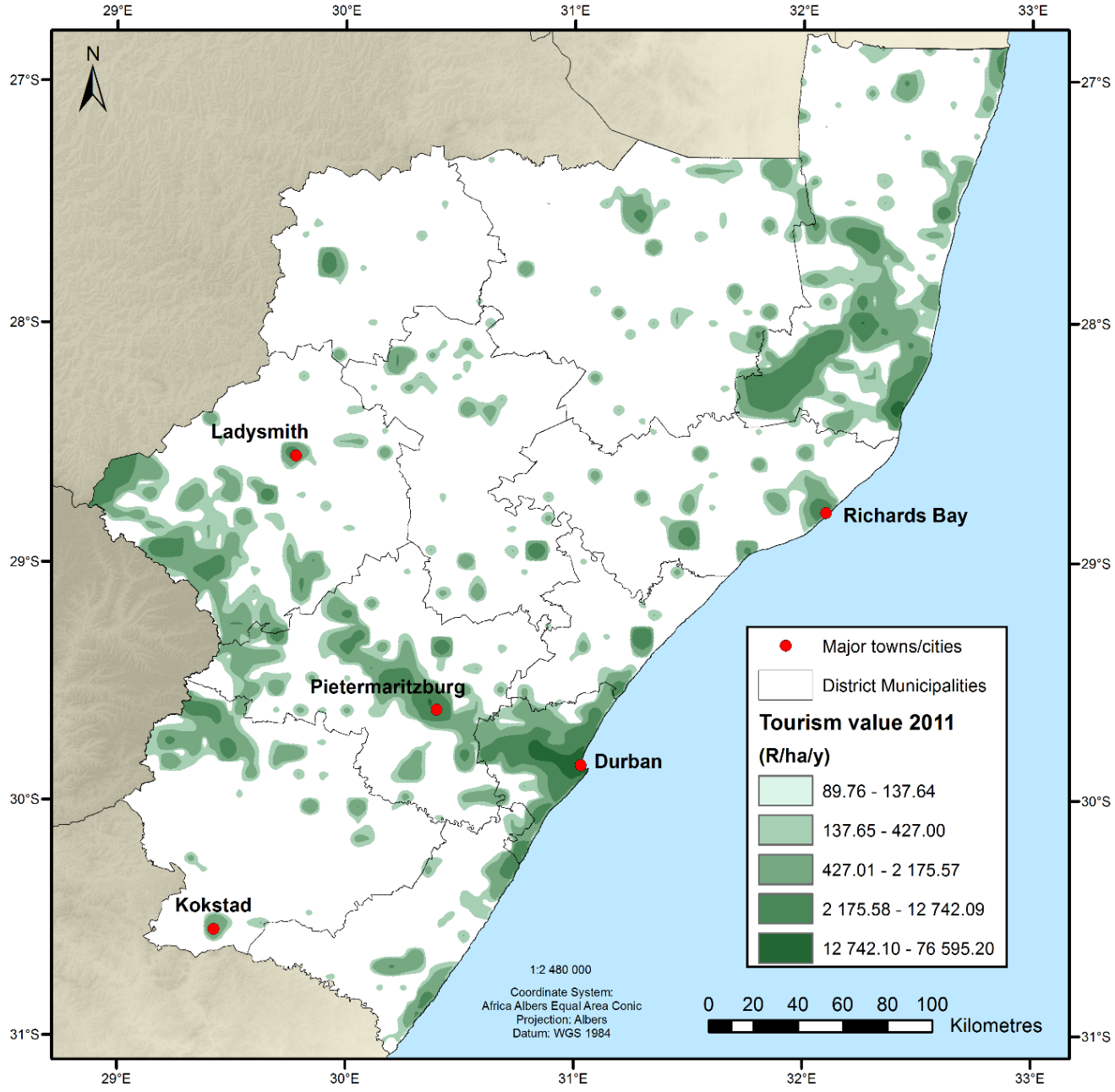
- In 2011, roughly 25% of KZN was cultivated
- Value grew from R18.5 bn in 2005 to R21.2 bn in 2011

- Low spatial resolution of statistical data (district or province)
- Last agric census 2007



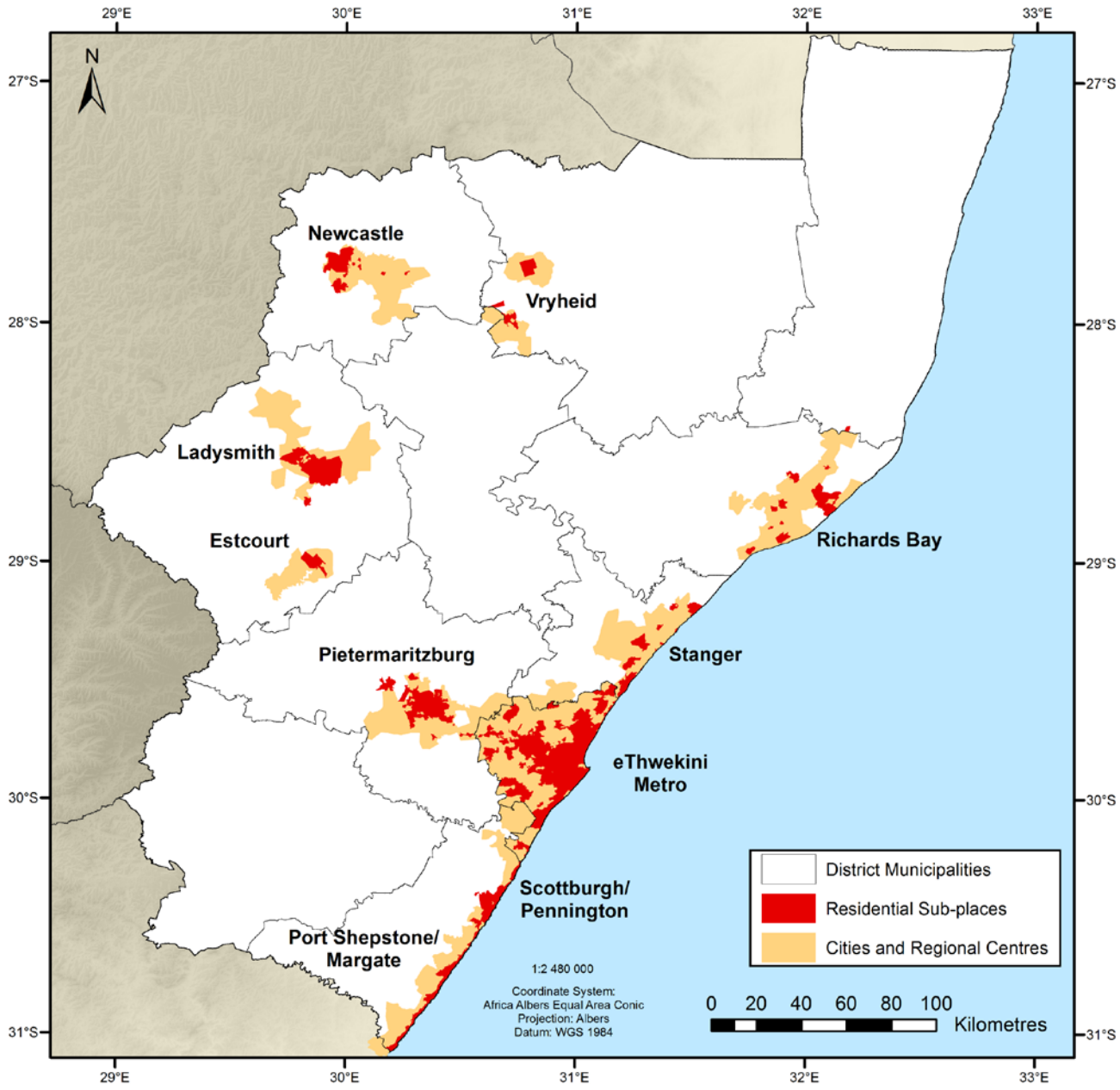
Tourism value

- The total leisure tourism value for KZN was spatialised using density of geotagged photos
  - Panoramio, Flickr
- Total value for inland KZN was **R2 billion** in 2005 and **R3.2 billion** in 2011
- Value from natural/semi-natural areas made up 64% and 57% of this, respectively
  - Mostly protected areas, urban green space.
- Not enough temporal resolution to reliably track changes in land cover



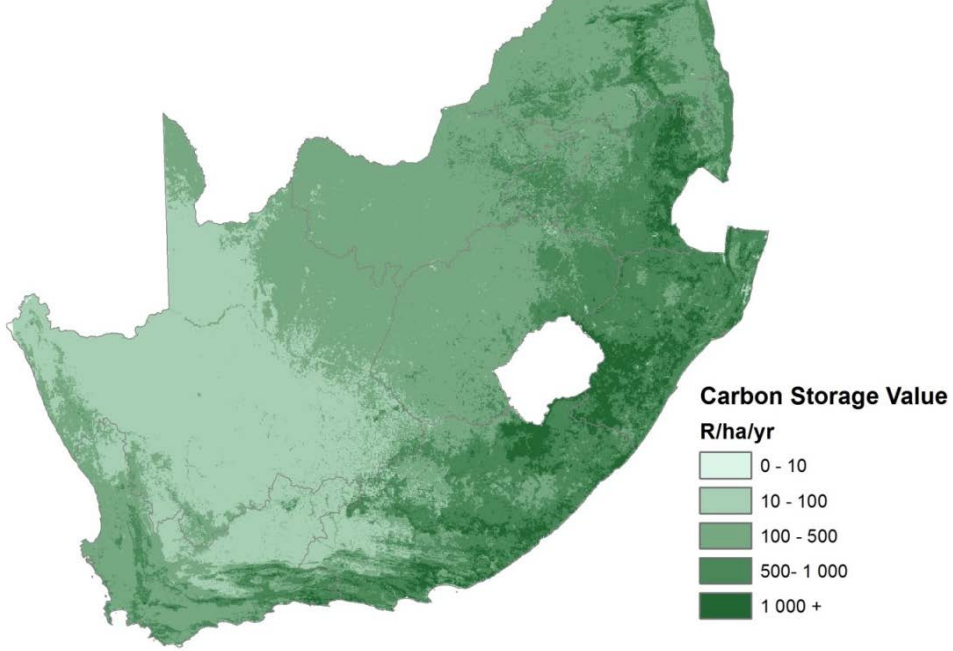
Property premiums from urban green space

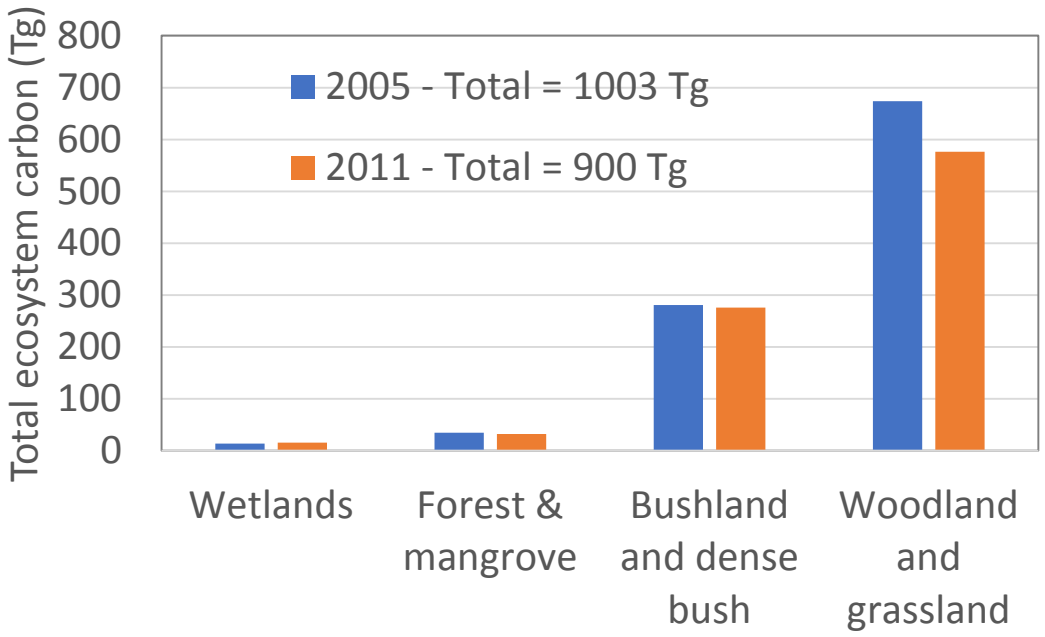
- Estimated based on a hedonic study of Durban, giving average values per suburb.
- Derived statistical model of R/ha vs household income
- Applied to KZN's 10 main towns at subplace scale
  - Not likely to be applicable to smaller towns
- Total contribution **R1.9 bn per year**, 68% in Durban.
  - Excludes coastal/beach values
- Values could not be mapped using the KZN land cover map



Carbon

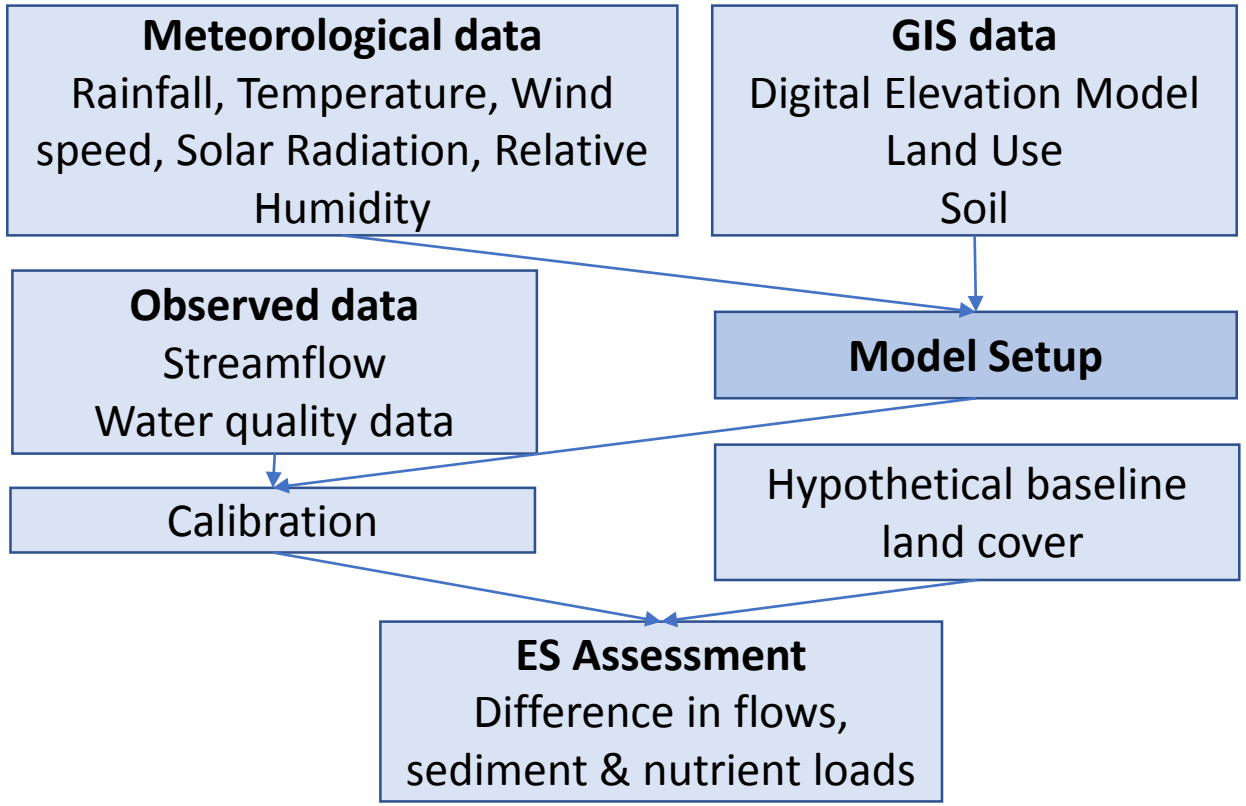
- Based on spatial data from South African National Carbon Sink Assessment (DEA, 2015)
  - mean g C/m^2 for each natural land cover type
- 10% loss of stored carbon from 2005 to 2011
  - mainly from reduced area/health of grassland, woodland and bushland,
  - offset by bush densification in some areas
- Only net change is estimated in this study.
  - Future studies should attempt to estimate gains and losses
- Valued in terms of SA share (0.35%) of global social cost of carbon (R/tonne)
  - Value and African share from Nordhaus
  - South African sub-share based on relative vulnerability within Africa

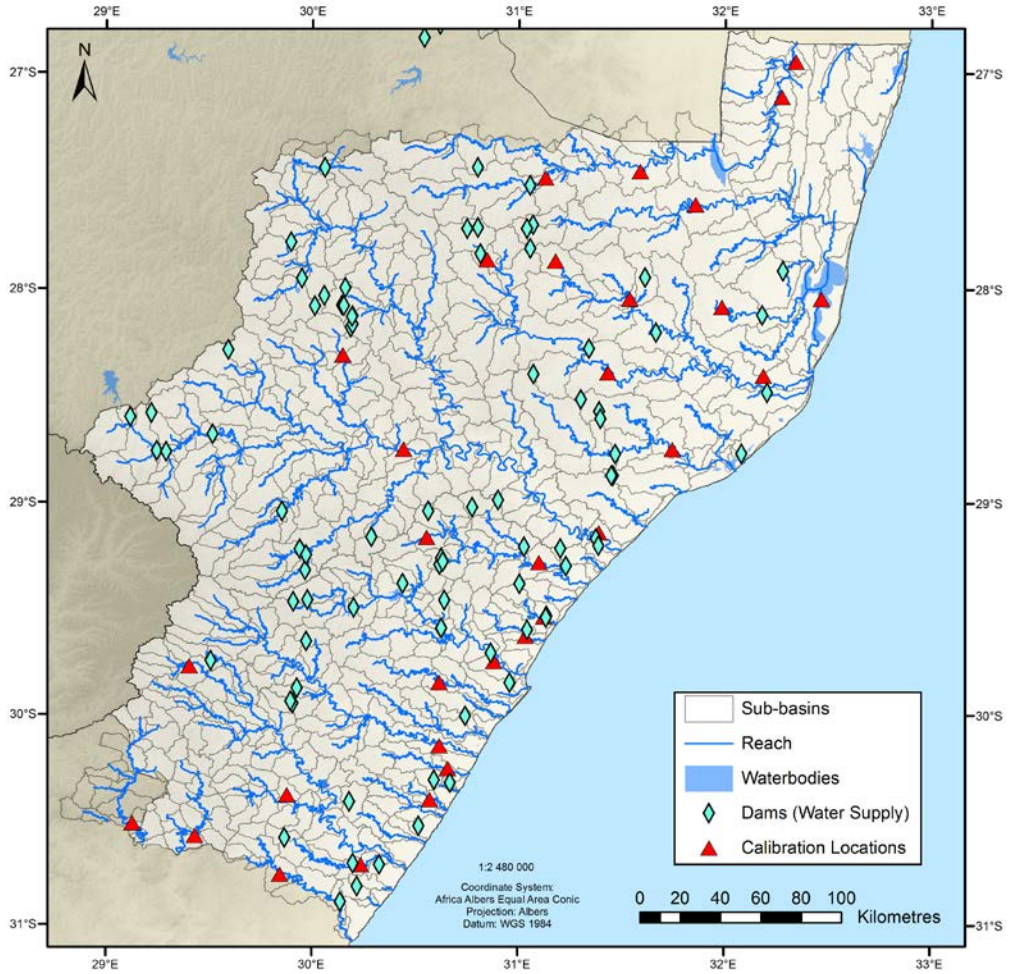




Hydro-regulating services (in progress)

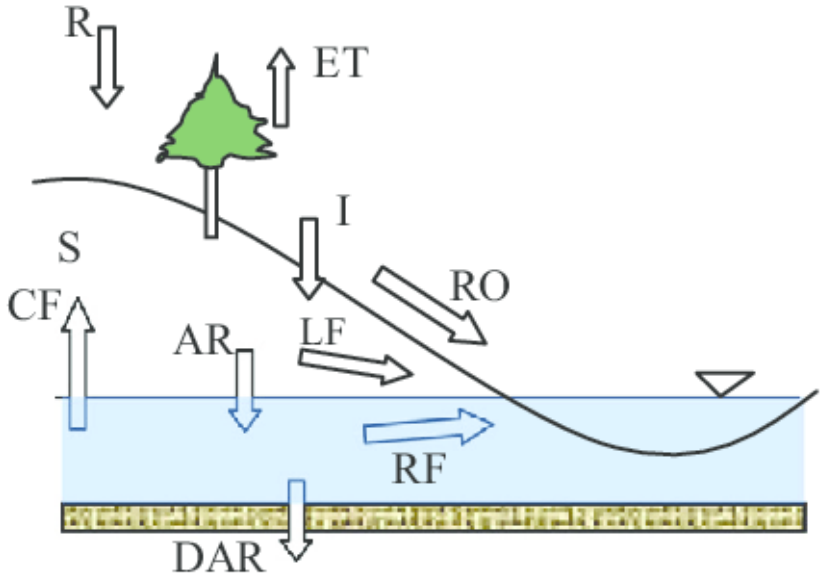
- SWAT models of the river catchments in KZN
  - ~564 sub-basins
- Theoretical comparison for ecosystem services = degraded (types run separately)



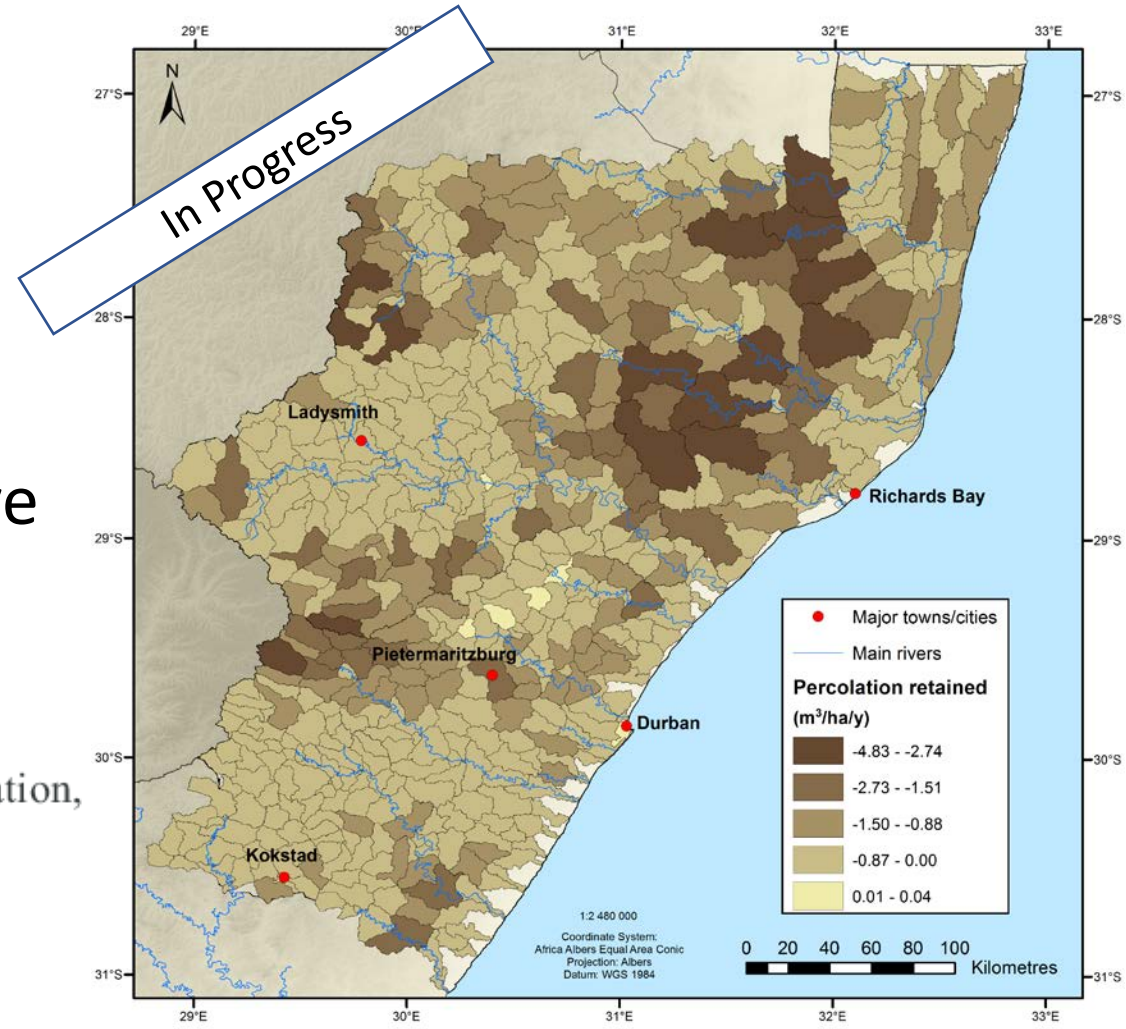


Flow regulation

- Infiltration delays water entering streams and reservoirs, reducing infrastructure required to maintain given system yield.
- Service = amount of infiltration relative to degraded scenario (m^3/ha)



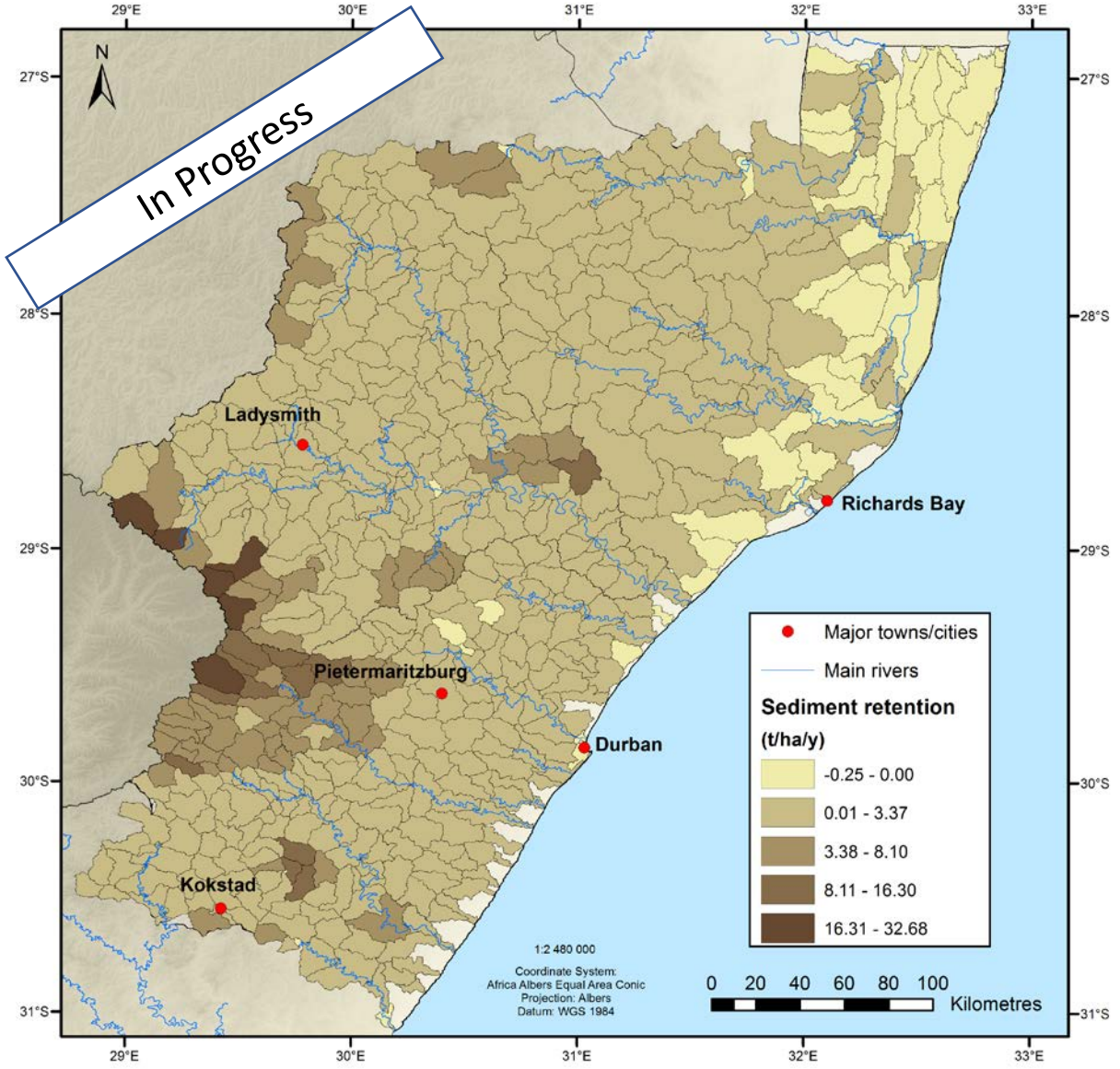
R=rainfall,
ET=evapotranspiration,
I=infiltration,
RO=runoff,
RF=return flow,
LF=Lateral flow
CF=capillary flow,
AR=aquifer recharge,
DAR=deep aquifer recharge
S=Soil moisture



- Valued in terms of constructing equivalent storage (not perfect)

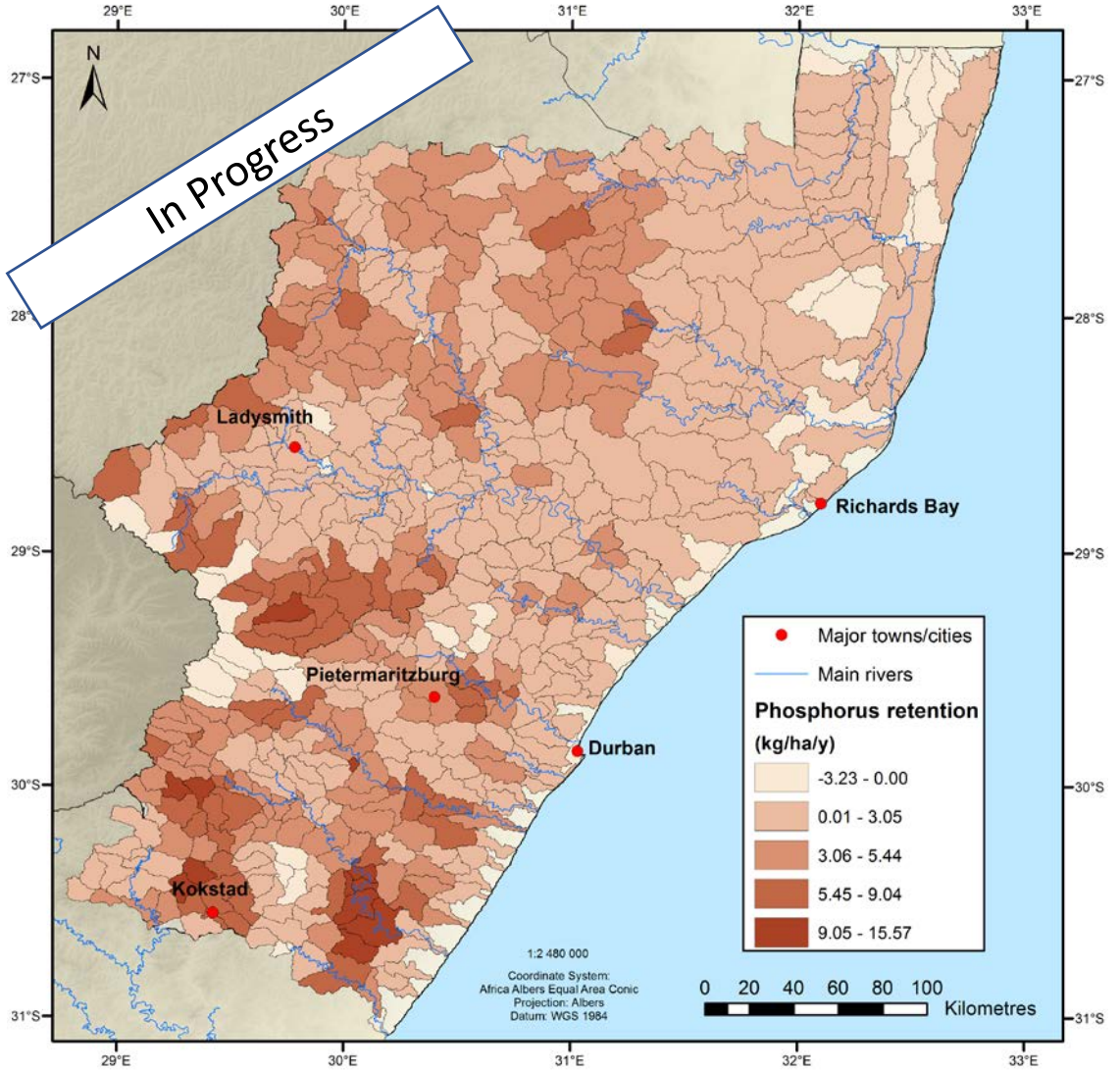
Sediment retention

- In situ sediment retained and eroded sediment loads trapped by vegetated ecosystems
- Difference in sediment yields relative to degraded baseline (t/ha, m^3/ha)
  - Issues to resolve – what is the baseline for cultivated areas?
- Valued in terms of hypothetical storage losses (R/m^3)



Water quality amelioration

- Natural and anthropogenic nutrient loads trapped by vegetated ecosystems, reducing eutrophication effects downstream ecosystems
  - P for freshwater, N for marine
- Difference in nutrient and suspended sediment loads relative to degraded baseline (kg/y)
- P retention valued using model of water treatment costs



Thank you!

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