

# GAUTENG

## LAND & WATER USE



**TABLE 1**

Areas and percentage change of land cover groups between 1990 and 2013/14 for Gauteng.

Land cover group	1990 Area (km <sup>2</sup> )	2013-14 Area (km <sup>2</sup> )	Change (%)
Waterbodies (WB)	74	74	-0.002
Wetlands (WTL)	465	396	-0.520
Indigenous Forest (INF)	0	0	0.000
Thicket / Dense bush (TDB)	725	804	0.584
Woodland / Open bush (WOB)	1197	1431	1.750
Grassland (GRS)	4852	4639	-1.593
Low shrubland (LSB)	182	91	-0.677
Mines (MNS)	181	154	-0.205
Bare non-vegetated (BNV)	9	18	0.068
Plantations / Woodlots (PWD)	330	214	-0.867
Cultivated commercial annuals (CCA)	3008	2966	-0.315
Cultivated perennial (CPE)	8	12	0.033
Cultivated subsistence (CSB)	20	9	-0.085
Low shrubland (LSB)	0	0	0.000
Urban	2339	2584	1.830

### WARMS DATABASE (updated up to August 2016)

Most water volumes are registered in Gauteng for taking water (2.01 billion m<sup>3</sup> a<sup>-1</sup>), disposing waste (1.50 billion m<sup>3</sup>), storing water (0.72 billion m<sup>3</sup>), discharging wastewater (0.38 billion m<sup>3</sup>) and removing underground water (0.10 billion m<sup>3</sup>).

By water resource types, water is taken mainly from water schemes (57.8%), rivers/streams (31.7%) and boreholes (4.7%).

The highest water withdrawals per sector were for industry (urban) (1.51 billion m<sup>3</sup> a<sup>-1</sup> or 73.5% of the total), agriculture – irrigation (0.42 billion m<sup>3</sup> a<sup>-1</sup> or 20.2%), mining (0.07 billion m<sup>3</sup> a<sup>-1</sup> or 3.3%) and industry (non-urban) (0.04 billion m<sup>3</sup> a<sup>-1</sup> or 1.7%).

### NATIONAL LAND COVER (NLC) MAPS of 1990 & 2013/14:

The main changes in land cover between 1990 and 2013/14 occurred for urban areas (+1.830%) and woodland/open bush (+1.750%) at the expense of grassland (-1.593%), plantations/woodlots (-0.867%), low shrubland (-0.677%) and wetlands (-0.520%) (Table 1).

**Gauteng is the highest ranked province in discharging wastewater, the second highest in total water withdrawals and the third highest in removing groundwater.**

### ETLOOK ANNUAL EVAPOTRANSPIRATION (ET) DATA (from August 2014 to July 2015):

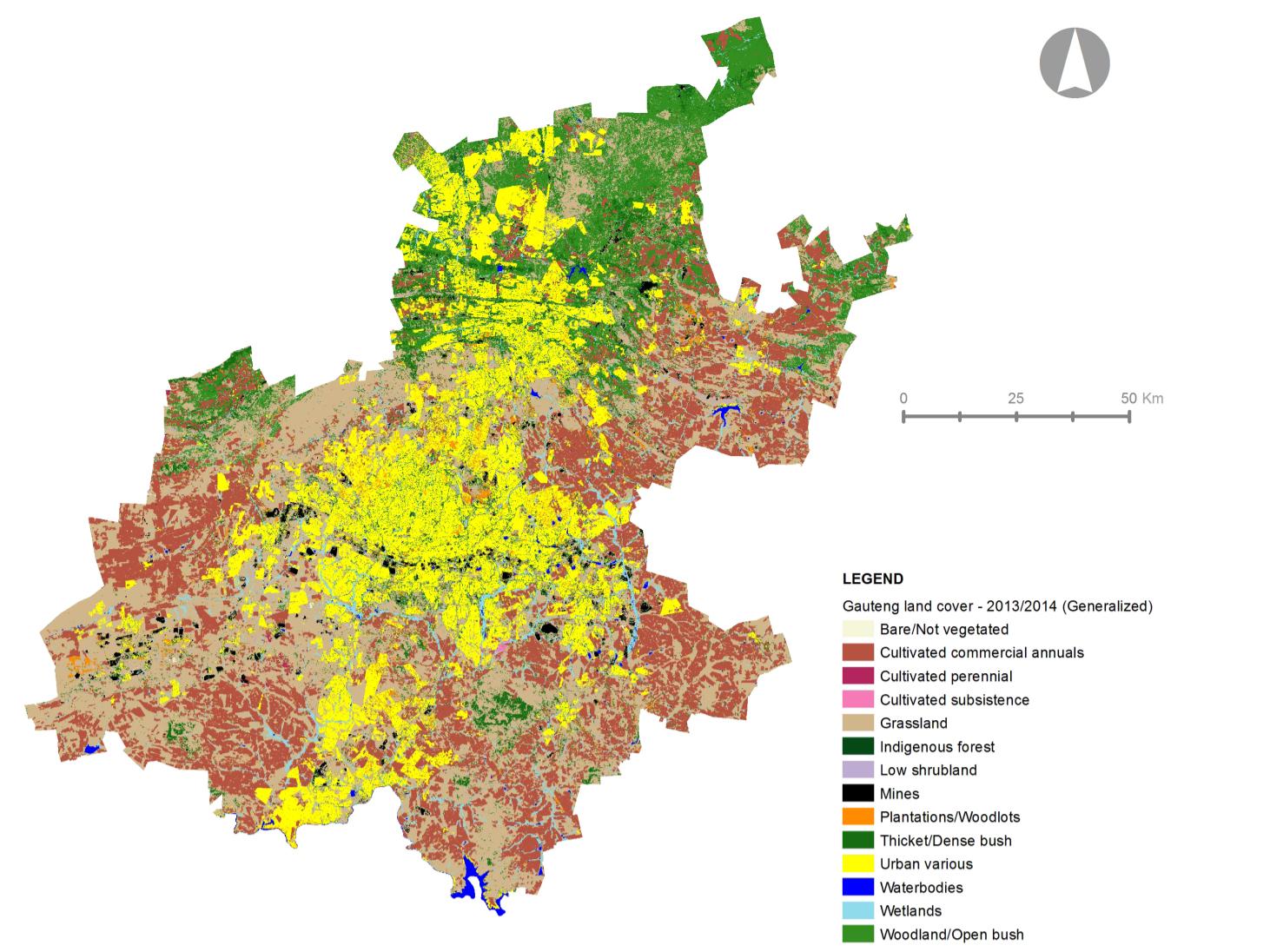
ET is relatively uniform spatially given the small size of the province (Figure 2).

Besides waterbodies, the highest median annual water use per unit area was from wetlands (655 mm a<sup>-1</sup>), indigenous forests (614 mm a<sup>-1</sup>) and cultivated land (610-639 mm a<sup>-1</sup>) and the lowest from residential urban areas (336 mm a<sup>-1</sup>) (Table 2).

In absolute terms, the largest water use was from grassland (3,223 Mm<sup>3</sup> a<sup>-1</sup>) and cultivated commercial annuals (2,340 Mm<sup>3</sup> a<sup>-1</sup>).

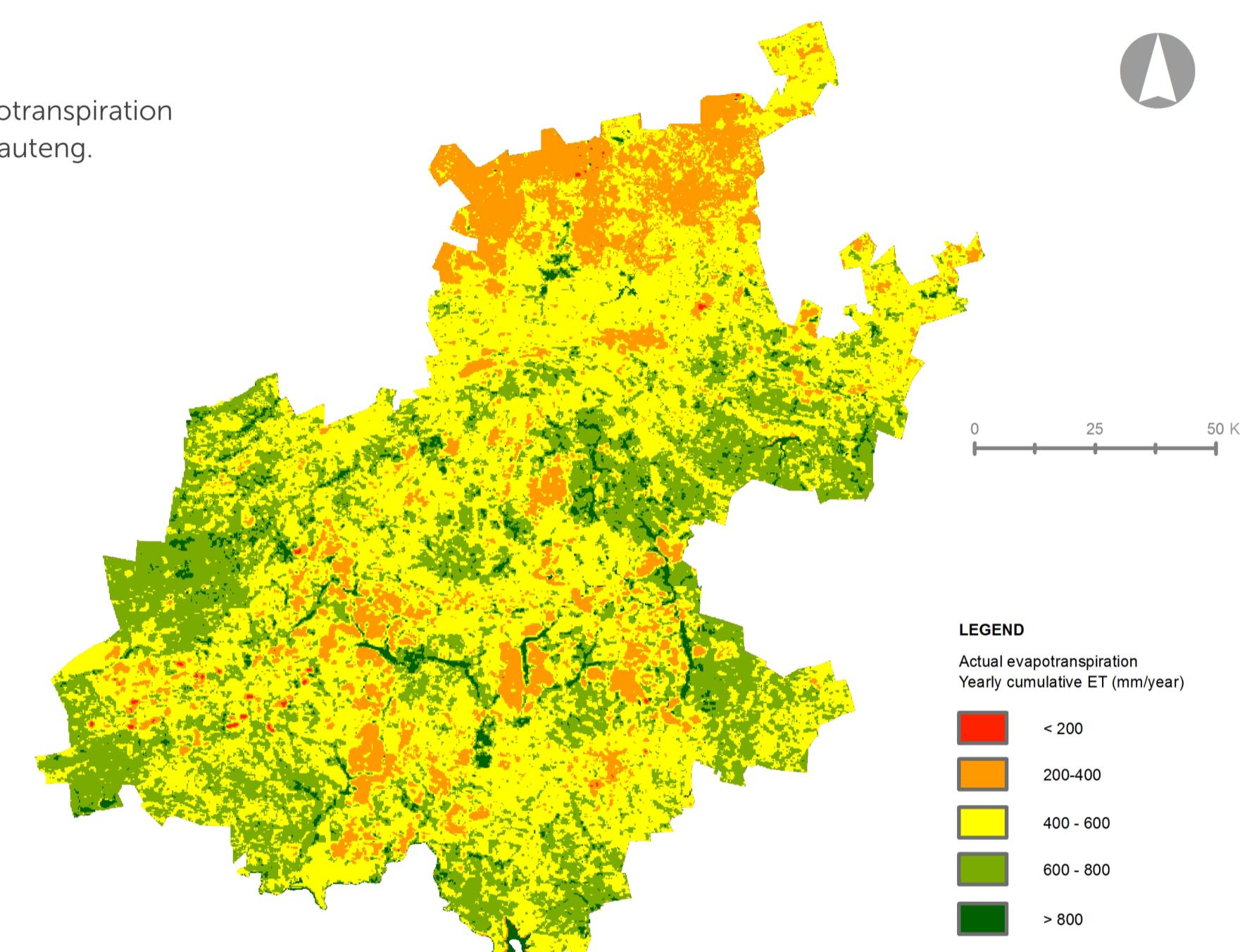
**FIGURE 1**

Land cover groups based on the National Land Cover (NLC) map of 2013/14 for Gauteng.



**FIGURE 2**

Annual ETLook evapotranspiration (ET) in 2014/15 for Gauteng.



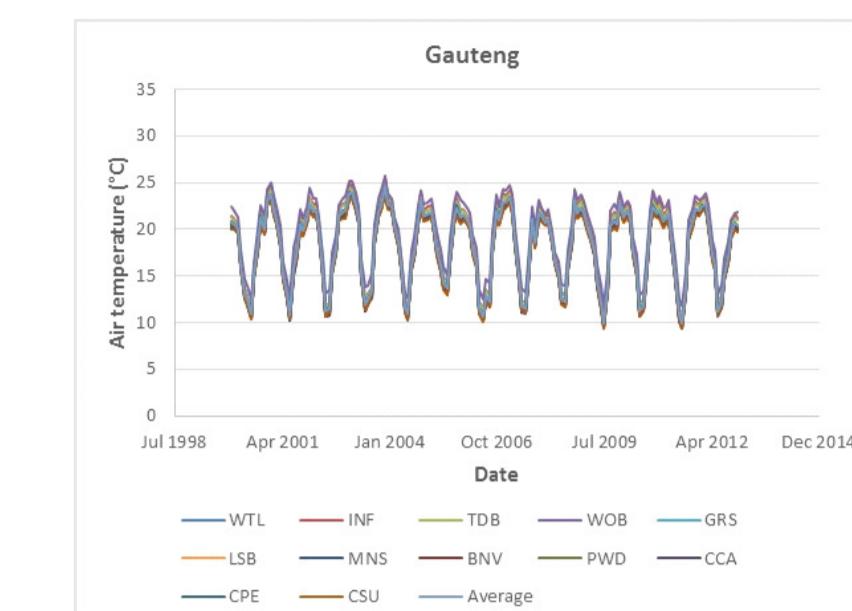
**TABLE 2**

Water use statistics for land cover groups based on annual ETLook data in 2014/15 for Gauteng:

Land use	Water use statistics						
	MEAN mm (a <sup>-1</sup> )	MEDIAN (mm a <sup>-1</sup> )	MIN (mm a <sup>-1</sup> )	MAX (mm a <sup>-1</sup> )	STD (mm a <sup>-1</sup> )	AREA (km <sup>2</sup> )	CUM (Mm <sup>3</sup> a <sup>-1</sup> )
Waterbodies (WB)	1546	1979	2448	2448	722	93	184
Wetlands (WTL)	725	685	2435	2435	260	516	353
Indigenous Forest (INF)	589	614	686	686	73	0	0
Thicket / Dense bush (TDB)	531	514	2448	2448	148	1039	534
Woodland / Open bush (WOB)	453	435	2448	2448	110	1837	798
Grassland (GRS)	561	561	2448	2448	115	5741	3223
Shrubland fynbos (SHF)	-	-	-	-	-	-	-
Low shrubland (LSB)	469	466	2426	2426	118	114	53
Cultivated commercial annuals (CCA)	631	627	2435	2435	107	3731	2340
Cultivated perennial (CPE)	657	639	1097	1097	138	17	11
Cultivated subsistence (CSB)	610	610	1166	1166	149	9	6
Cultivated cane (CC)	-	-	-	-	-	-	-
Plantations / Woodlots (PWD)	572	557	2374	2374	147	285	159
Mines (MNS)	378	373	2368	2368	124	198	74
Bare non-vegetated (BNV)	522	471	2448	2448	313	22	10
Urban industrial (UIND)	435	432	2278	2278	110	139	60
Urban commercial (UC)	390	385	2263	2263	87	149	58
Urban residential (UR)	349	336	2213	2213	82	491	165
Urban sport and recreation (ORS)	496	492	2364	2364	101	1006	495
Urban informal (UINF)	545	526	2390	2390	201	199	105
Urban Others (UO)	464	458	2410	2410	103	1341	614

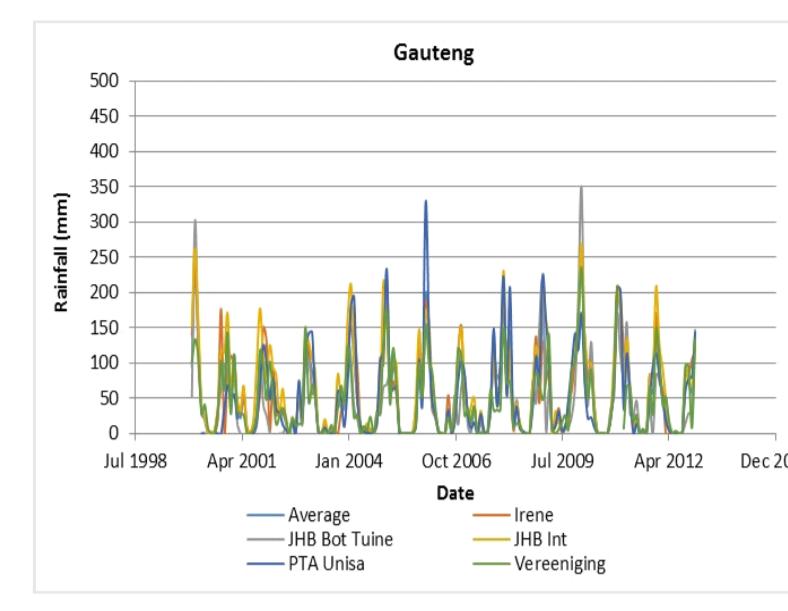
**FIGURE 3**

Daily average air temperatures for different land covers in Gauteng based on NASA/GMAO Modern Era Retrospective Analysis (MERRA) from 2000 to 2012.



**FIGURE 4**

Monthly rainfall at representative stations in Gauteng (South African Weather Services) from 2000 to 2012.



**FIGURE 5**

Monthly MOD16 evapotranspiration for different land cover groups in Gauteng from 2000 to 2012.



### MOD16 MONTHLY EVAPOTRANSPIRATION (ET) DATA (FROM 2000 TO 2012)

• Daily average air temperatures in Gauteng range from about 10°C to 25°C (Figure 3).

• Monthly rainfall shows little spatial variability with evident peaks occurring during summer months (Figure 4).

• MOD16 ET range from below 10 mm month<sup>-1</sup> in winter up to peaks of 90 mm month<sup>-1</sup> in summer (Figure 5).

### GUIDELINES AND RECOMMENDATIONS

- Gauteng is the province with the highest industrial water use. It is the only province where agricultural water withdrawals are not the highest amongst water use sectors.
- Discharging wastewater, removing underground water and especially disposing waste are substantial water uses due to industrial and mining activities. It is recommended that mining houses try and remediate wastewater and re-use it for irrigation and power generation in close vicinity to the waste generating streams.
- The existing pool of wastewater streams can potentially become a valuable water-reuse source (currently 0.2% of water abstracted is re-used for wastewater irrigation).
- The limited use of boreholes leaves scope for increased groundwater use.
- Changes in land use are very dynamic due to urban sprawl. Logical trade-offs for urban development are grassland (water use 561 mm a<sup>-1</sup> on a vast area) and informal settlements (water use 526 mm a<sup>-1</sup>). There is a particular need to protect wetlands and indigenous vegetation that are shrinking in size.

#### ACKNOWLEDGMENTS AND SOURCES OF INFORMATION:

Water Authorisation and Registration Management System (WARMS)  
National Land Cover (NLC) maps for 1990 and 2013/14  
Satellite-derived images and products (ETLook and MOD16 evapotranspiration)  
Ground measurements of climatic variables (SAWS)  
NASA/GMAO Modern Era Retrospective Analysis (MERRA)