# MPUMALANGA
## LAND & WATER USE

## TABLE 1
Areas and percentage change of land cover groups between 1990 and 2013/14.

| Land cover group | 1990 Area (km²) | 2013-14 Area (km²) | Change (%) |
|---|---|---|---|
| Waterbodies (WB) | 301 | 336 | 0.062 |
| Wetlands (WTL) | 1750 | 1503 | -0.439 |
| Indigenous Forest (INF) | 170 | 228 | 0.103 |
| Thicket / Dense bush (TDB) | 4623 | 6313 | 3.005 |
| Woodland / Open bush (WOB) | 9874 | 9411 | -0.824 |
| Grassland (GRS) | 21157 | 20671 | -0.863 |
| Low shrubland (LSB) | 567 | 305 | -0.466 |
| Mines (MNS) | 342 | 572 | 0.408 |
| Bare non-vegetated (BNV) | 54 | 181 | 0.226 |
| Plantations / Woodlots (PWD) | 5452 | 5521 | 0.123 |
| Cultivated commercial annuals (CCA) | 9746 | 8382 | -2.426 |
| Cultivated perennial (CPE) | 231 | 766 | 0.950 |
| Cultivated subsistence (CSB) | 672 | 490 | -0.324 |
| Low shrubland (LSB) | 0 | 0 | 0.000 |
| Urban | 1309 | 1570 | 0.464 |

### WARMS DATABASE (updated up to august 2016; excluding Inkomati-Usuthu water management area)

The highest water use volumes are registered in Mpumalanga for taking water (1.43 billion m² a⁻¹), storing water (0.92 billion m³), disposing waste (0.89 billion m³ a⁻¹), removing groundwater (0.62 billion m³ a⁻¹) and discharging wastewater (0.14 billion m³ a⁻¹).

By water resource types, water is taken mainly from boreholes (32.3%), rivers/streams (30.3%), scheme (24.4%) and dams (12.0%).

The highest water withdrawals per sector were for agricultural irrigation (0.70 billion m³ a⁻¹ or 49.0% of the total), mining (0.39 billion m³ a⁻¹ or 27.3%), water supply services (0.17 billion m³ a⁻¹ or 11.8%) and non-urban industry (0.10 billion m³ a⁻¹ or 6.9%).

Mpumalanga is the province with the highest water storage, water use in mining and dewatering mines, urban use (excluding industrial and domestic), and the highest water use for aquaculture. Within the Inkomati-Usuthu Water Management Area, a larger portion of water is allocated to afforestation, urban industry and less to mining; a larger portion of water is used from surface water compared to the rest of the province.

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

The largest areas in Mpumalanga are covered by grassland (20,671 km²), woodland/open bush (9,411 km²) and thicket/dense bush (8,382 km²) (Figure 1).

The main changes in land cover between 1990 and 2013/14 occurred for thicket/dense bush (+3.005%) and cultivated perennials (+0.950%) at the expense of cultivated commercial annuals (-2.426%), grassland (-0.863%) and woodland/open bush (-0.824%) (Table 1).

The largest areas in Two trends are discernible: **cultivated commercial annuals are making space for more profitable cultivated perennial crops and encroachment by thicket/dense bush.**

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

ET displays extreme variations depending on the geographical position in the Highveld, escarpment or Lowveld (Figure 2).

Besides waterbodies, the highest median annual water use per unit area was from indigenous forest (1039 mm a⁻¹), cultivated perennials (1037 mm a⁻¹), cultivated cane (1033 mm a⁻¹) and plantations/woodlots (918 mm a⁻¹) located mainly in high rainfall areas on the escarpment and lowveld (Table 2).

In absolute terms, the **largest water use was from grassland (17,925 Mm³ a⁻¹), cultivated commercial annuals (7,746 Mm³ a⁻¹) and plantations/woodlots (6,830 Mm³ a⁻¹)** that cover large areas.

## FIGURE 1
Land cover groups based on the National Land Cover (NLC) map of 2013/14 for Mpumalanga.
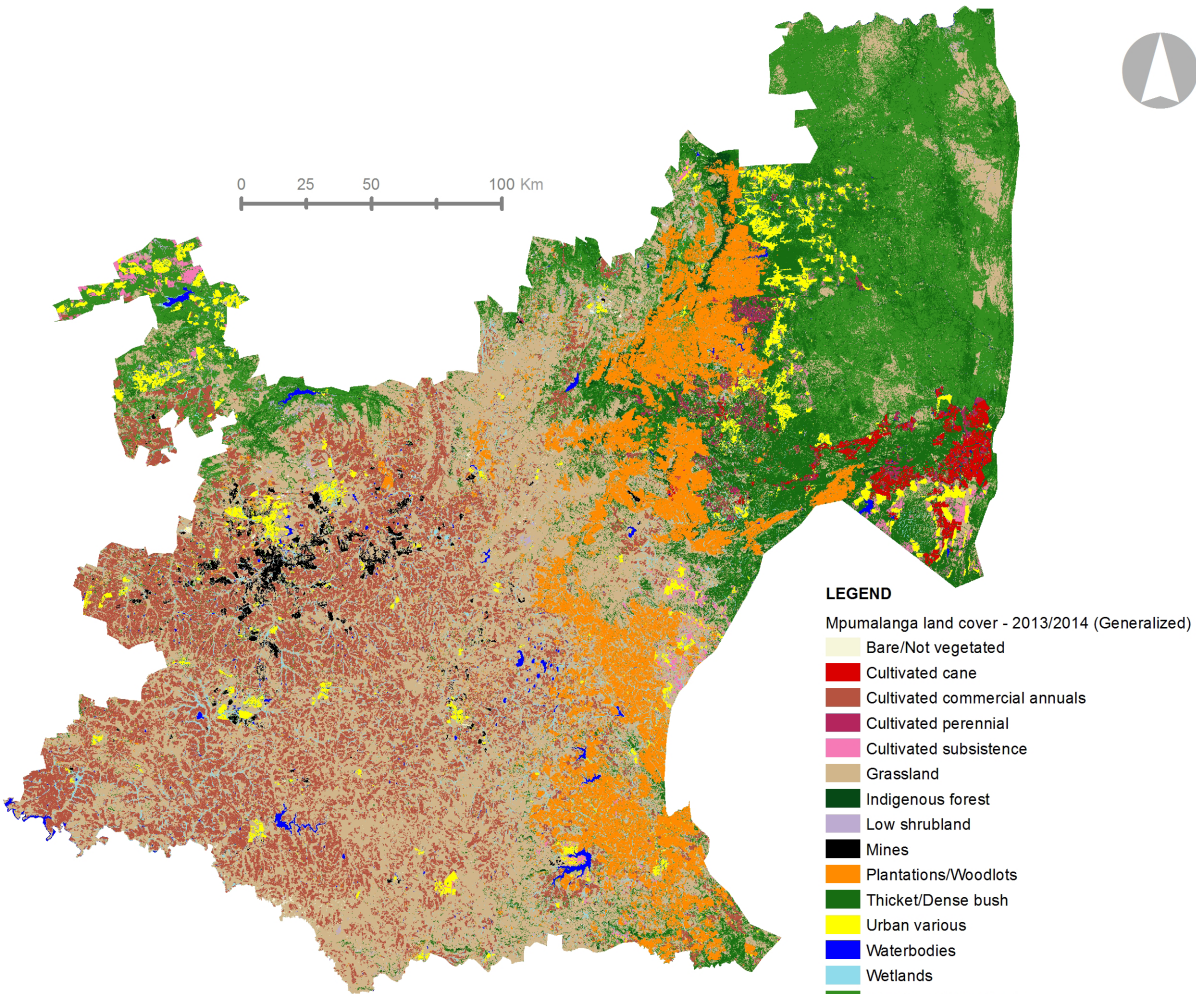


LEGEND
Mpumalanga land cover - 2013/2014 (Generalized)
- Bare:Not vegetated
- Cultivated cane
- Cultivated commercial annuals
- Cultivated perennial
- Cultivated subsistence
- Grassland
- Indigenous forest
- Low shrubland
- Mines
- Plantations/Woodlots
- Thicket/Dense bush
- Urban various
- Waterbodies
- Wetlands
- Woodland/Open bush

## FIGURE 2
Annual ETLook evapotranspiration (ET) in 2014/15 for Mpumalanga.



LEGEND
Actual evapotranspiration
Yearly cumulative ET (mm/year)
- < 200
- 200-400
- 400 - 600
- 600 - 800
- > 800

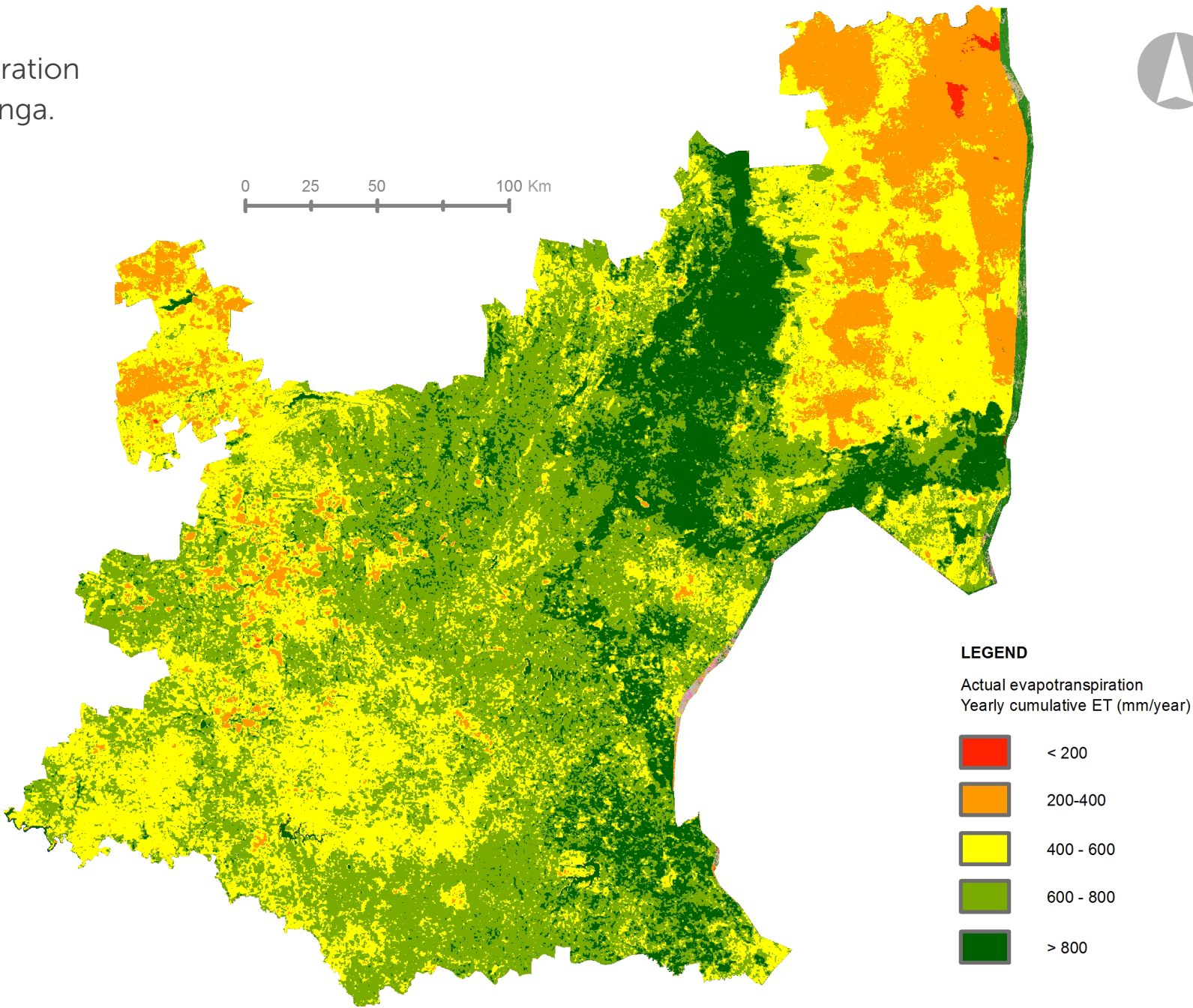## TABLE 2
Water use statistics for land cover groups based on annual ETLook data in 2014/15 for Mpumalanga:

| Land use | MEAN mm (a⁻¹) | MEDIAN (mm a⁻¹) | MIN (mm a⁻¹) | MAX (mm a⁻¹) | STD (mm a⁻¹) | AREA (km²) | CUM (Mm³ a⁻¹) |
|---|---|---|---|---|---|---|---|
| Waterbodies (WB) | 1546 | 1917 | 165 | 2658 | 686 | 464 | 889 |
| Wetlands (WTL) | 742 | 721 | 169 | 2525 | 193 | 2103 | 1517 |
| Indigenous Forest (INF) | 1014 | 1039 | 349 | 2409 | 181 | 308 | 320 |
| Thicket / Dense bush (TDB) | 628 | 616 | 116 | 2658 | 193 | 8453 | 5208 |
| Woodland / Open bush (WOB) | 481 | 451 | 139 | 2658 | 158 | 13587 | 6127 |
| Grassland (GRS) | 626 | 623 | 111 | 2658 | 127 | 28761 | 17925 |
| Shurbland fynbos (SHF) | - | - | - | - | - | - | - |
| Low shrubland (LSB) | 547 | 550 | 150 | 2650 | 158 | 540 | 297 |
| Cultivated commercial annuals (CCA) | 660 | 645 | 166 | 2481 | 116 | 12006 | 7746 |
| Cultivated perennial (CPE) | 1067 | 1037 | 353 | 2463 | 285 | 533 | 553 |
| Cultivated subsistence (CSB) | 595 | 579 | 168 | 2369 | 136 | 691 | 400 |
| Cultivated cane (CC) | 1026 | 1033 | 400 | 2378 | 233 | 615 | 635 |
| Plantations / Woodlots (PWD) | 915 | 918 | 111 | 2478 | 212 | 7443 | 6830 |
| Mines (MNS) | 409 | 392 | 149 | 2425 | 128 | 821 | 322 |
| Bare non-vegetated (BNV) | 575 | 538 | 149 | 2658 | 271 | 308 | 166 |
| Urban industrial (UIND) | 415 | 397 | 239 | 2166 | 131 | 33 | 13 |
| Urban commercial (UC) | 425 | 396 | 211 | 2201 | 160 | 71 | 28 |
| Urban residential (UR) | 387 | 365 | 200 | 2284 | 103 | 280 | 102 |
| Urban sport and recreation (ORS) | 485 | 466 | 244 | 2164 | 114 | 218 | 102 |
| Urban informal (UINF) | 613 | 604 | 225 | 2420 | 219 | 43 | 26 |
| Urban Others (UO) | 452 | 425 | 220 | 2392 | 133 | 1413 | 601 |

## FIGURE 3
Daily average air temperatures for different land covers in Mpumalanga based on NASA/GMAO Modern Era Retrospective Analysis (MERRA) from 2000 to 2012.
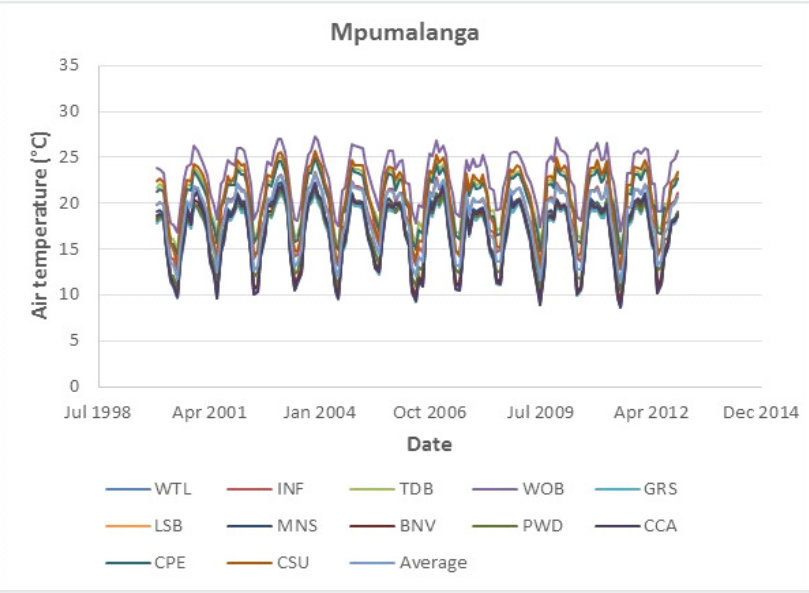


## FIGURE 4
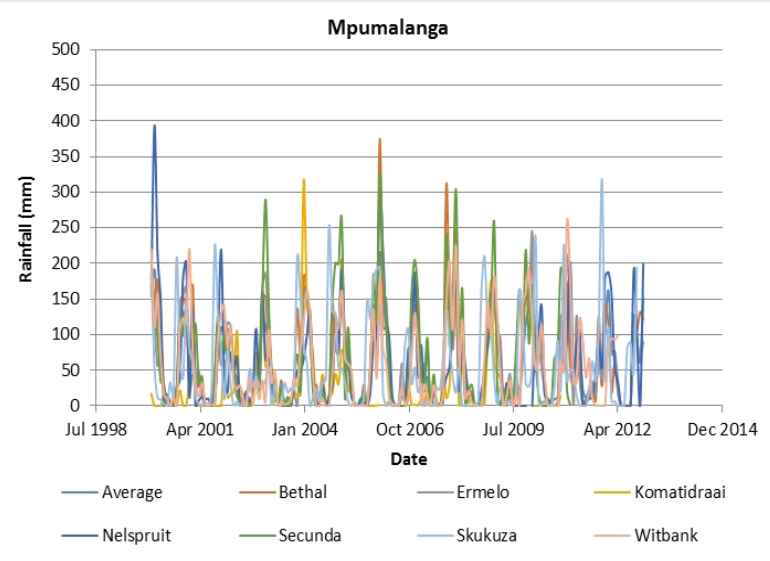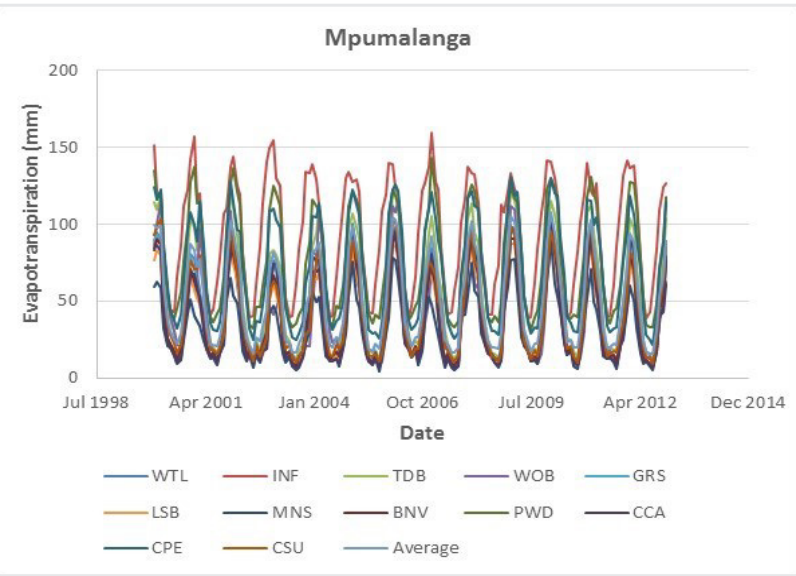Monthly rainfall at representative stations in Mpumalanga (South African Weather Services) from 2000 to 2012.



## FIGURE 5
Monthly MOD16 evapotranspiration for different land cover groups in Mpumalanga from 2000 to 2012.



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

- Daily average air temperatures in Mpumalanga range from about 10°C to 27°C (Figure 3) and they are tightly linked to the geographical area and associated land cover.
- Monthly rainfall shows large spatial variability with peaks >350 mm month⁻¹ occurring during summer months (Figure 4).
- MOD16 ET range from below 10 mm month-1 in winter up to peaks >150 mm month⁻¹ in summer (Figure 5), the latter especially in indigenous forests on the wet escarpment.

### GUIDELINES AND RECOMMENDATIONS

- Agriculture is the major water user. Incentivizing smart farming practices may reduce the volumes used in agriculture and hence reduce the burden on water resources, in particular with the shift from annual to perennial crops. Smart water use measures need also to be implemented in forestry to limit streamflow reduction.
- 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 0.3% of water abstracted is re-used for wastewater irrigation; 0.8% by IUCMA).
- Increased industrial development will likely impact on industrial water use as well as water schemes and supply. Rural unregistered users may impact the results more than urban activities as these may have never been accounted for.
- Although groundwater use is fairly large in Mpumalanga, there is potential for increasing conjunctive use of surface water and groundwater.
- Vast areas of thicket/dense bush (water use 616 mm a⁻¹) encroaching grassland (623 mm a⁻¹) and woodland/open bush (451 mm a⁻¹) can be traded-off in support of development. Vast areas, however, need strong conservation efforts such as wetlands.

CGA CENTRE FOR GEOGRAPHICAL ANALYSIS

CSIR our future through science

WATER RESEARCH COMMISSION