

# NORTH-WEST PROVINCE

## 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)	233	181	-0.067
Wetlands (WTL)	670	253	-0.539
Indigenous Forest (INF)	5	7	0.002
Thicket / Dense bush (TDB)	2265	1677	-0.760
Woodland / Open bush (WOB)	11849	12827	1.264
Grassland (GRS)	21867	18547	-4.291
Low shrubland (LSB)	20518	25316	6.201
Mines (MNS)	327	430	0.133
Bare non-vegetated (BNV)	14	325	0.402
Plantations / Woodlots (PWD)	128	108	-0.026
Cultivated commercial annuals (CCA)	16119	14389	-2.236
Cultivated perennial (CPE)	39	39	0.000
Cultivated subsistence (CSB)	1972	1713	-0.335
Low shrubland (LSB)	0	0	0.000
Urban	1369	1563	0.251

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

Most water volumes are registered in the North-West province for taking water (1.14 billion m³ a⁻¹), disposing waste (0.16 billion m³ a⁻¹), discharging wastewater (0.13 billion m³ a⁻¹), storing water (0.08 billion m³) and removing groundwater (0.02 billion m³ a⁻¹).

By water resource types, water is taken mainly from water schemes (40.6%), boreholes (33.2%), river/streams (14.5%) and dams (8.6%).

The highest water withdrawals per sector were for agricultural irrigation (0.73 billion m³ a⁻¹ or 64.2% of the total), urban industry (0.20 billion m³ a⁻¹ or 17.5%), mining (0.10 billion m³ a⁻¹ or 8.8%).

North-West had the lowest water withdrawal and storage of all provinces given the rural areas and small size, but the highest volumes registered for Schedule 1 and the second highest water use in mining. It also had the largest volumes of water registered for recreation, however the values are in general much lower compared to the other sectors (0.04% of total countrywide).

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

The main changes in land cover between 1990 and 2013/14 occurred through the increase of low shrubland (+6.201%) and woodland/ open bush (+1.264%) and the decrease of grassland (-4.291%) and cultivated commercial annuals (-2.236%), which may indicate bush encroachment (Table 1).

The largest areas in the North-West province are covered by **low shrubland (25,316 km²)**, **grassland (18,547 km²)**, **cultivated commercial annuals (14,389 km²)** and **woodland/open bush (12,827 km²)** (Figure 1).

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

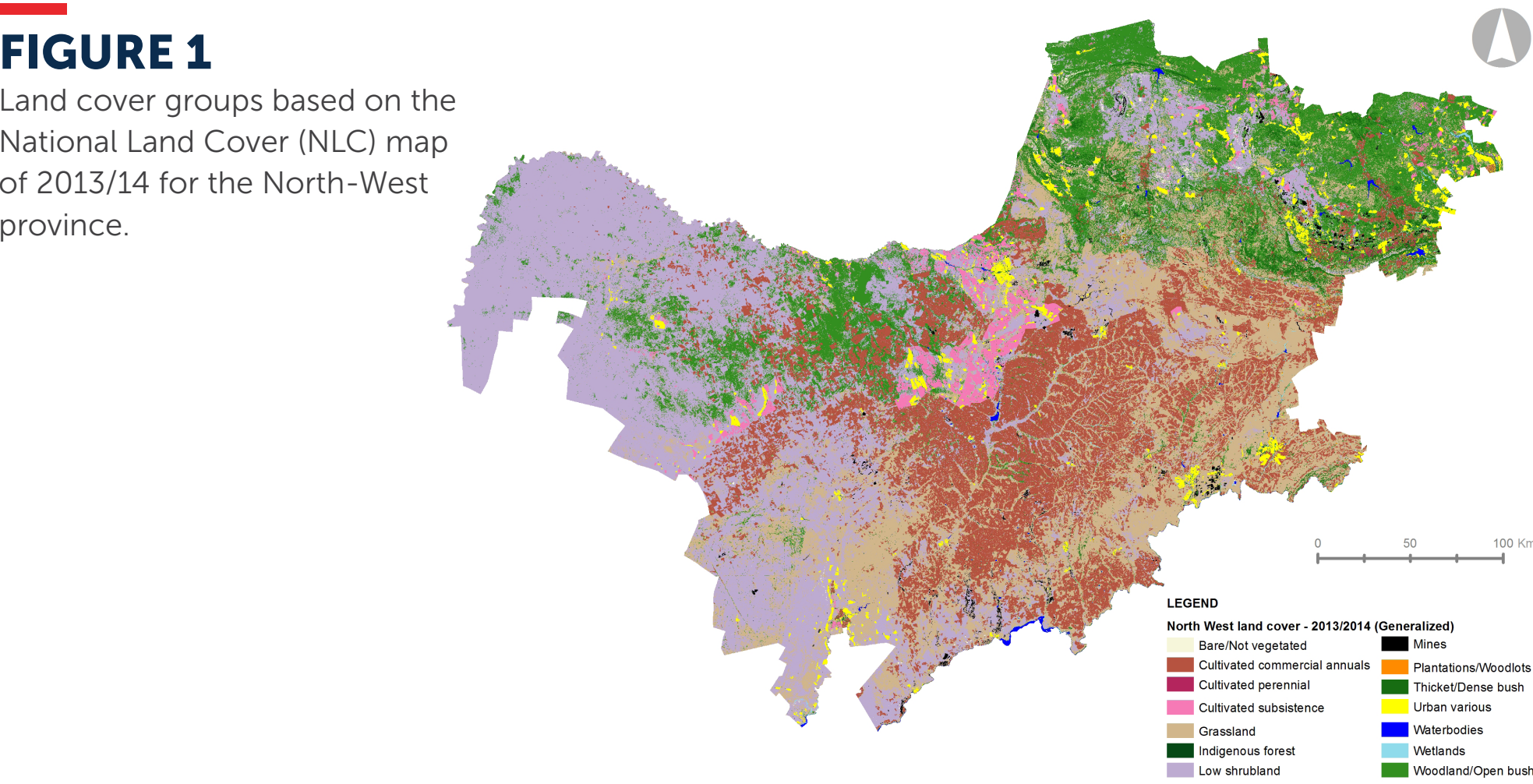
ET is relatively uniform spatially with an increasing gradient from west to east depending on rainfall (Figure 2).

Besides waterbodies, the highest median annual water use per unit area was from cultivated perennials(735 mm a⁻¹), wetlands (627 mm a⁻¹), plantations/woodlots (575 mm a⁻¹) and indigenous forest (573 mm a⁻¹) (Table 2).

In absolute terms, the largest water use was from **low shrubland (16,481 Mm³ a⁻¹)**, **grassland (13,314 Mm³ a⁻¹)**, **cultivated commercial annuals (9,557 Mm³ a⁻¹)** and **woodland/open bush (7,445 Mm³ a⁻¹)**.

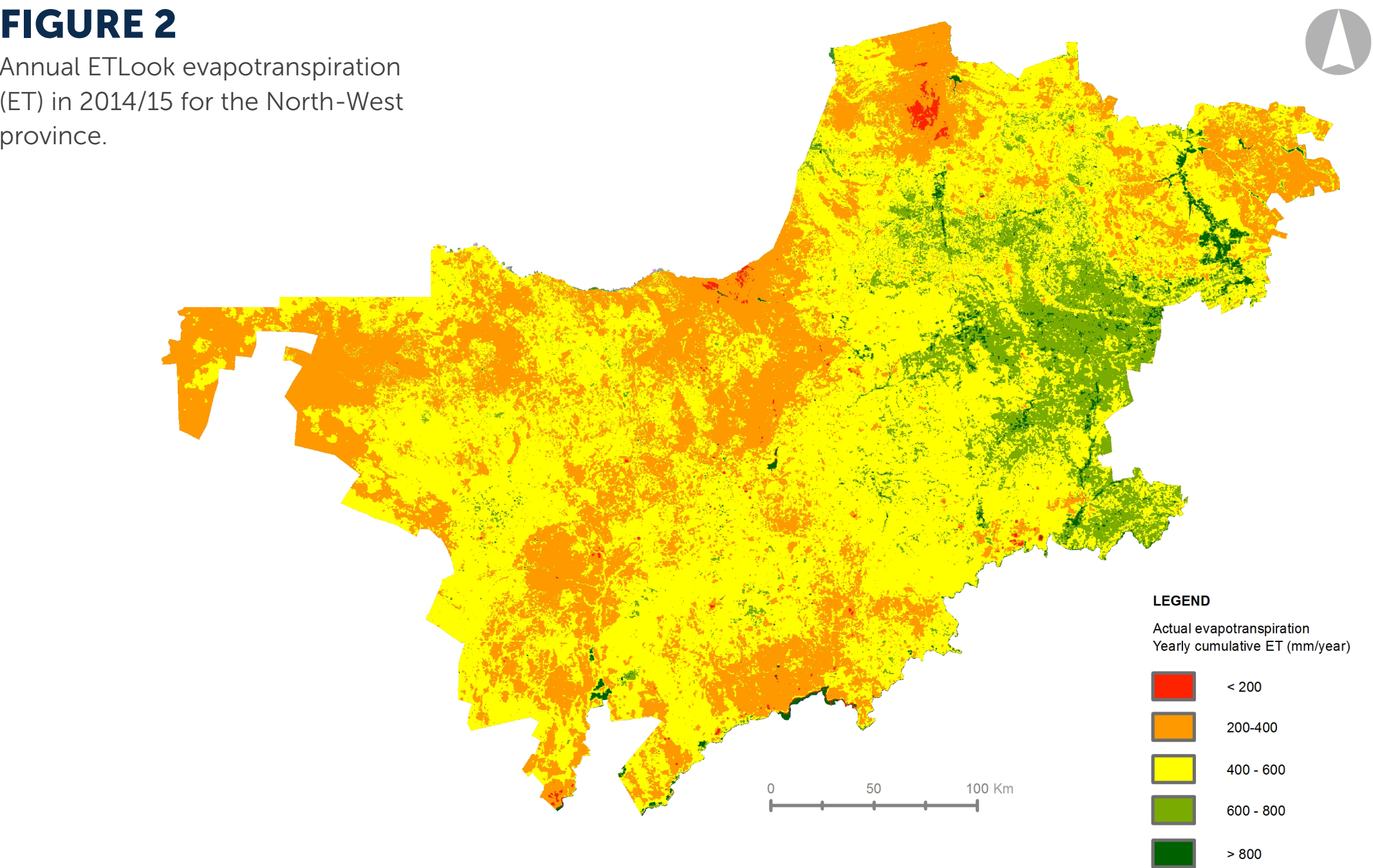
**FIGURE 1**

Land cover groups based on the National Land Cover (NLC) map of 2013/14 for the North-West province.



**FIGURE 2**

Annual ETLook evapotranspiration (ET) in 2014/15 for the North-West province.



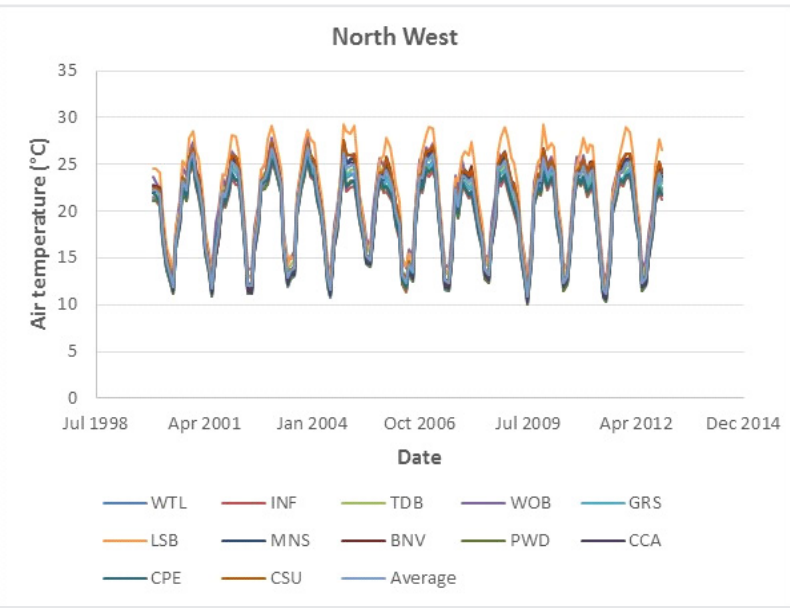
**TABLE 2**

Water use statistics for land cover groups based on annual ETLook data in 2014/15 for the North-West province.

Land use	Water use statistics						
	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)	1819	2288	80	3066	908	249	569
Wetlands (WTL)	668	627	82	2969	331	358	225
Indigenous Forest (INF)	584	573	412	1108	81	10	6
Thicket / Dense bush (TDB)	552	543	71	3066	175	2340	1270
Woodland / Open bush (WOB)	429	419	71	3066	111	17765	7445
Grassland (GRS)	496	488	72	3036	110	27311	13314
Shrubland fynbos (SHF)	-	-	-	-	-	-	-
Low shrubland (LSB)	398	391	72	3066	74	42160	16481
Cultivated commercial annuals (CCA)	508	485	79	2926	123	19711	9557
Cultivated perennial (CPE)	760	735	233	2444	194	54	39
Cultivated subsistence (CSB)	401	388	126	2965	93	2326	902
Cultivated cane (CC)	-	-	-	-	-	-	-
Plantations / Woodlots (PWD)	581	575	101	2637	146	151	87
Mines (MNS)	350	350	72	2999	118	594	208
Bare non-vegetated (BNV)	384	377	80	3036	182	550	208
Urban industrial (UIND)	358	345	113	2371	126	46	16
Urban commercial (UC)	405	380	107	2652	155	38	14
Urban residential (UR)	294	286	123	2695	64	347	99
Urban sport and recreation (ORS)	419	400	118	2669	136	154	62
Urban informal (UINF)	479	430	130	2669	256	54	23
Urban Others (UO)	319	306	127	2909	82	1860	570

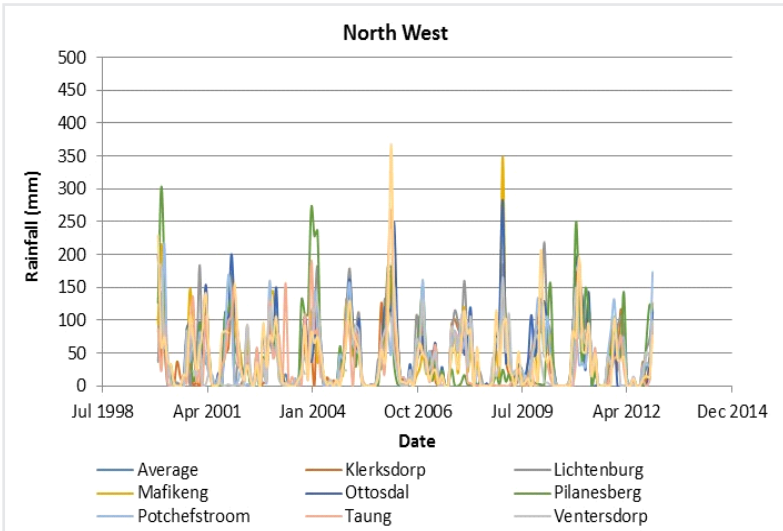
**FIGURE 3**

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



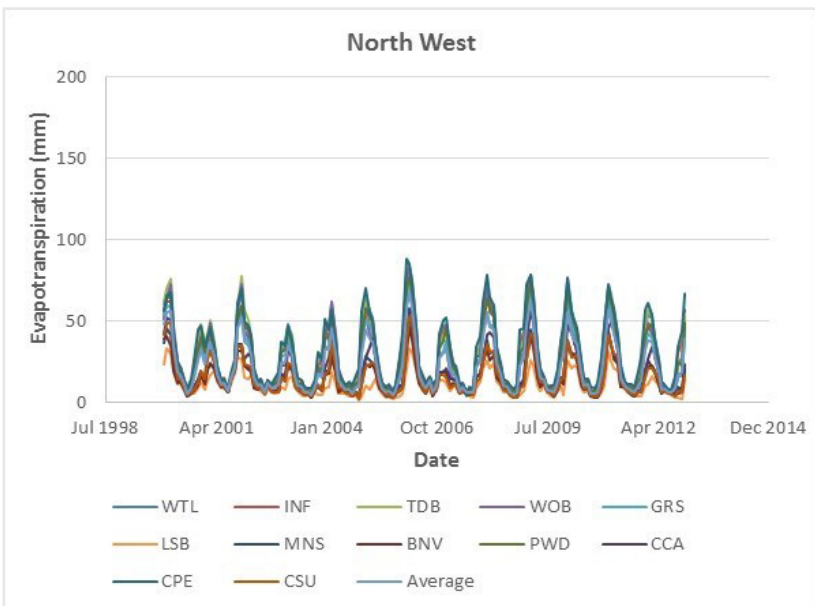
**FIGURE 4**

Monthly rainfall at representative stations in the North-West province (South African Weather Services) from 2000 to 2012.



**FIGURE 5**

Monthly MOD16 evapotranspiration for different land cover groups in the North-West province from 2000 to 2012.



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

- Daily average air temperatures in the North-West province range from about 10°C to 28°C (Figure 3).
- Monthly rainfall shows spatial variability with evident peaks occurring during summer months (Figure 4).
- MOD16 ET range from below 10 mm month⁻¹ in winter up to peaks of 80 mm month⁻¹ in summer (Figure 5).

### GUIDELINES AND RECOMMENDATIONS

- Incentivizing smart farming practices may reduce the volumes used in agriculture and the burden on water resources.
- 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 only 0.1% of water abstracted is re-used for wastewater irrigation).
- There is potential for increasing groundwater use and conjunctive use of surface water and groundwater.
- Rural unregistered users may impact the results more than urban activities as these may have never been accounted for.
- Given rainfall is the main driver of ET, trade-offs in land use will not bring substantial benefits in water saving. However, indigenous grassland (water use 488 mm a⁻¹) needs to be conserved at the expense of encroaching low shrubland (water use 391 mm a⁻¹) and woodland/open bush (water use 391 mm a⁻¹) to prevent desertification.
- Non-commercial and non-conservation land under vast low shrubland and woodland/ open bush can be traded off to reduce encroachment and water use.

#### 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)



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