# Article title:

# Diversity of psammophyte communities on sand dunes and sandy soils of the northern Sahara Desert

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**Table S1.** Location and climatic information (classifications and indices) of the regions of Ouargla, Touggourt, Hassi Messouad, and Ghardaia in the Sahara Desert of Algeria.

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| --- | --- | --- | --- | --- |
| **Climatic Information** | **Ouargla** | **Touggourt** | **Hassi Messouad** | **Ghardaia** |
| **Location** |  |  |  |  |
| Longitude (East) | 5.333° | 6.13° | 6.15° | 3.817° |
| Latitude (North) | 31.933° | 33.11° | 31.66° | 32.333° |
| Altitude [m] | 140 | 140 | 140 | 440 |
| **Climate characteristics** |  | | | |
| Köppen Class | BWh | | | |
| B = Arid Climate | | | |
| D = Desert | | | |
| h = hot | | | |
| Budyko climate | Desert | Desert | Desert | Desert |
| Radiational index of dryness | 36.064 | 19.886 | 36.794 | 23.826 |
| Budyko evaporation [mm/year] | 40 | 77 | 36 | 64 |
| Budyko runoff [mm/year] | 0 | 0 | 0 | 0 |
| Budyko evaporation [%] | 100 | 100 | 99.9 | 100 |
| Budyko runoff [%] | 0 | 0 | 0.1 | 0 |
| Aridity | Hyperarid | Arid | Hyperarid | Hyperarid |
| Aridity index | 0.02 | 0.05 | 0.02 | 0.04 |
| Moisture index [%] | -98 | -95 | -98 | -96 |
| De Martonne index | 1 | 2 | 1 | 2 |
| Precipitation deficit [mm/year] | 1639 | 1383 | 1643 | 1371 |
| Climatic NPP \* | 79 | 150 | 71 | 125 |
| NPP(Temperature) | 2363 | 2320 | 2384 | 2316 |
| NPP(Precipitation) | 79 | 150 | 71 | 125 |
| NPP limitation | NPP is precipitation limited | | | |
| Gorczynski continentality index | 53.2 | 51.8 | 57.0 | 52.1 |

\* NPP: Climatic net primary production in g(DM)/m2/year.

**Table S2.** Long-term monthly climatic data of the regions of Ouargla, Touggourt, Hassi Messouad, and Ghardaia in the Sahara Desert of Algeria. Values are expressed as means ± standard errors

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ouargla** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Parameters** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** | **Average** |
| Mean temperature [°C] | 11.1±1.51 | 13.6±1.17 | 16.8±1.42 | 21±1.6 | 25.7±1.44 | 31.2±1.75 | 33.7±1.41 | 34±1.24 | 28.6±1.11 | 22.2±1.31 | 15.8±1.19 | 11.1±1.31 | 22.07±1.37 |
| Maximum temperature [°C] | 17.2±1.65 | 20±2.15 | 23.2±2.22 | 28.8±2.22 | 32.7±1.91 | 39.4±2.01 | 42.7±1.81 | 41.7±1.59 | 37.2±1.89 | 30.5±2.62 | 23.2±2.01 | 18.2±1.55 | 29.57±1.97 |
| Minimum temperature [°C] | 4.4±1.95 | 6.6±2.02 | 9.3±2.32 | 13.8±2.82 | 17.7±2.89 | 23.2±3.23 | 25.5±3.27 | 25±3.03 | 22.2±2.51 | 16.1±2.48 | 10±1.88 | 6±1.89 | 14.98±2.52 |
| Precipitation [mm] | 7±3.72 | 5±4.08 | 8±1.94 | 1±4.67 | 1±4.11 | 0±2.49 | 0±0.63 | 0±33.54 | 4±5.05 | 3±4.57 | 6±3.58 | 5±4.35 | 3.33±6.06 |
| Potential evapotranspiration [mm] | 56.8±16.33 | 74±18.6 | 119.8±28.12 | 147.4±25.97 | 193.4±31.6 | 219.7±30.48 | 233.9±29.47 | 228.2±25.41 | 171.6±19.96 | 125.1±22.05 | 61.9±17.19 | 46.9±13.66 | 139.89±23.24 |
| Water vapor pressure [hPa] | 8.2±2 | 8.8±3.17 | 8.2±4.01 | 12.3±4.49 | 13.9±6.54 | 16.5±8.17 | 20.5±7.65 | 21.8±8.37 | 19.7±5.12 | 15.3±2.66 | 13.7±3.23 | 9.6±1.96 | 14.04±4.78 |
| Wind speed [km/h] | 7.2±1.84 | 7.92±3.1 | 7.2±4.5 | 9±3.83 | 9±3.74 | 8.64±3.43 | 7.2±2.38 | 7.2±2.13 | 7.92±1.86 | 8.64±2.76 | 7.2±2.13 | 7.2±2.35 | 7.86±2.84 |
| Sunshine frequency [%] | 67±6.92 | 73±5.22 | 74±5.83 | 72±7.6 | 70±4.01 | 67±3.41 | 80±2.31 | 78±4.32 | 73±7.95 | 71±4.02 | 66±7.45 | 67±9.69 | 71.5±5.73 |
| Day length [h] | 10:16 | 11:00 | 11:57 | 12:55 | 13:44 | 14:09 | 13:57 | 13:15 | 12:20 | 11:21 | 10:30 | 10:03 | 12:07 |
| Sunshine hours [h] | 06:53 | 08:02 | 08:50 | 09:18 | 09:37 | 09:28 | 11:10 | 10:20 | 09:00 | 08:04 | 06:55 | 06:44 | 08:42 |
| Ground frost frequency [%] | 13 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 2 |
| Effective rain [mm] | 7 | 5 | 8 | 1 | 1 | 0 | 0 | 0 | 4 | 3 | 6 | 5 | Σ=40 |
| Effective rain ratio [%] | 99 | 99 | 99 | 100 | 100 | 100 | 100 | 100 | 99 | 100 | 99 | 99 | 99 |
| Number of rainy days | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Σ=5 |
| Solid precipitation ratio [%] | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |
| **Touggourt** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Parameters** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** | **Average** |
| Mean temperature [°C] | 10±2.23 | 12.5±2.41 | 16.1±1.98 | 20.5±1.99 | 25±2.22 | 30.2±2.26 | 33.2±2.36 | 32.2±2.14 | 28.6±1.54 | 21.8±1.71 | 15.5±1.87 | 10.8±2.29 | 21.37±2.08 |
| Maximum temperature [°C] | 16.7±3.13 | 19.3±3.58 | 23.2±3.53 | 28.2±3.55 | 32.7±3.47 | 37.7±3.48 | 41.7±3.49 | 40.5±3.32 | 36±3.07 | 28.8±3.73 | 22.2±3.23 | 17.2±2.97 | 28.68±3.38 |
| Minimum temperature [°C] | 3.2±2.58 | 5.5±3.02 | 8.8±3.56 | 12.8±4.18 | 17.2±4.22 | 22.7±4.75 | 25±4.63 | 23.8±4.38 | 21.1±3.9 | 15±3.76 | 8.8±2.91 | 4.4±2.65 | 14.03±3.71 |
| Precipitation [mm] | 15±7.14 | 3±5.27 | 7±5.4 | 4±3.47 | 12±3.46 | 1±2.69 | 1±0.47 | 0±1.87 | 4±2.3 | 4±5.44 | 8±4.38 | 18±8.94 | 6.42±4.23 |
| Potential evapotranspiration [mm] | 39.5±15.95 | 56.5±16.64 | 96.8±27.16 | 126.9±25.54 | 174.6±30.39 | 200.8±27.4 | 223±24.93 | 200.5±22.38 | 154.8±18.31 | 102±21.77 | 50.9±17.93 | 33.9±13.73 | 121.68±21.85 |
| Water vapor pressure [hPa] | 9.6±1.55 | 10.8±2.44 | 12.6±3.31 | 16.2±4.08 | 19.4±5.58 | 25.5±6.79 | 23.4±6.45 | 28.1±7.64 | 23.3±5.33 | 18.7±2.89 | 15±3.29 | 11.2±1.75 | 17.82±4.26 |
| Wind speed [km/h] | 6.48±2.99 | 9±3.79 | 10.44±4.71 | 10.44±3.93 | 10.44±3.64 | 10.44±3.38 | 6.12±2.45 | 6.12±2.2 | 6.12±1.86 | 6.48±2.7 | 6.12±2.4 | 5.76±2.91 | 7.83±3.08 |
| Sunshine frequency [%] | 65±8.2 | 75±6.8 | 71±7.37 | 70±8.5 | 75±4.52 | 71±3.56 | 81±1.49 | 82±5.07 | 78±6.7 | 70±5.73 | 64±6.91 | 66±10.93 | 72.33±6.32 |
| Day length [h] | 10:11 | 10:57 | 11:56 | 12:57 | 13:49 | 14:15 | 14:02 | 13:19 | 12:20 | 11:19 | 10:25 | 09:57 | 12:07 |
| Sunshine hours [h] | 06:37 | 08:13 | 08:28 | 09:04 | 10:21 | 10:07 | 11:22 | 10:55 | 09:37 | 07:55 | 06:40 | 06:34 | 08:49 |
| Ground frost frequency [%] | 19 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 3 |
| Effective rain [mm] | 15 | 3 | 7 | 4 | 12 | 1 | 1 | 0 | 4 | 4 | 8 | 17 | Σ=76 |
| Effective rain ratio [%] | 98 | 100 | 99 | 99 | 98 | 100 | 100 | 100 | 99 | 99 | 99 | 97 | 98 |
| Number of rainy days | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | Σ=12 |
| Solid precipitation ratio [%] | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |
| **Hassi Messouad** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Parameters** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** | **Average** |
| Mean temperature [°C] | 10.6±1.22 | 13.1±0.54 | 16.8±1.06 | 21.3±0.62 | 27.3±0.93 | 32.7±0.94 | 34.2±0.8 | 34.5±0.55 | 29.5±0.55 | 22.7±0.65 | 15.8±0.71 | 10.6±0.94 | 22.43±0.79 |
| Maximum temperature [°C] | 17.2±1.48 | 20±1.77 | 23.2±1.84 | 28.8±2.04 | 32.7±2.37 | 39.4±2.3 | 42.7±2.39 | 41.7±2.35 | 37.2±2 | 30.5±2.13 | 23.2±1.92 | 18.2±1.5 | 29.57±2.01 |
| Minimum temperature [°C] | 4.4±1.59 | 6.6±1.5 | 9.3±1.49 | 13.8±1.76 | 17.7±1.92 | 23.2±2.17 | 25.5±2.26 | 25±2.41 | 22.2±2.11 | 16.1±1.78 | 10±1.73 | 6±1.43 | 14.98±1.85 |
| Precipitation [mm] | 4±4 | 2±3.02 | 8±2.01 | 4±3.64 | 2±3.93 | 1±2.26 | 0±1.15 | 0±0.82 | 1±3.66 | 4±3.2 | 4±4.14 | 6±3.83 | 3±2.97 |
| Potential evapotranspiration [mm] | 56.8±16.59 | 74±19.28 | 119.8±32.29 | 147.4±36.86 | 193.4±41.53 | 219.7±44.3 | 233.9±42.9 | 228.2±34.55 | 171.6±28.22 | 125.1±28.98 | 61.9±22.53 | 46.9±17.79 | 139.89±30.49 |
| Water vapor pressure [hPa] | 7.1±2.08 | 6.4±3.21 | 7.4±4.09 | 7.6±4.5 | 9.1±6.58 | 11.4±8.22 | 11.6±7.71 | 12.3±8.42 | 12.5±5.15 | 12.4±2.78 | 9.4±3.27 | 7.3±2.02 | 9.54±4.84 |
| Wind speed [km/h] | 7.2±1.84 | 7.92±2.81 | 7.2±4.34 | 9±3.76 | 9±3.8 | 8.64±3.79 | 7.2±2.7 | 7.2±2.13 | 7.92±2.05 | 8.64±2.71 | 7.2±2.24 | 7.2±2.09 | 7.86±2.86 |
| Sunshine frequency [%] | 67±7.13 | 73±6.77 | 74±3.23 | 72±6.43 | 70±7.5 | 67±8.13 | 80±7.72 | 78±6.2 | 73±9.04 | 71±4.94 | 66±8.37 | 67±9.06 | 71.5±7.04 |
| Day length [h] | 10:18 | 11:01 | 11:57 | 12:55 | 13:43 | 14:07 | 13:56 | 13:14 | 12:20 | 11:22 | 10:31 | 10:04 | 12:07 |
| Sunshine hours [h] | 06:54 | 08:02 | 08:50 | 09:18 | 09:36 | 09:28 | 11:09 | 10:20 | 09:00 | 08:04 | 06:56 | 06:45 | 08:42 |
| Ground frost frequency [%] | 13 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 2 |
| Effective rain [mm] | 4 | 2 | 8 | 4 | 2 | 1 | 0 | 0 | 1 | 4 | 4 | 6 | Σ=36 |
| Effective rain ratio [%] | 99 | 100 | 99 | 99 | 100 | 100 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| Number of rainy days | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | Σ=6 |
| Solid precipitation ratio [%] | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 1 |
| **Ghardaia** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Parameters** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** | **Average** |
| Mean temperature [°C] | 10.6±1.23 | 12.8±1.6 | 15.8±1.61 | 20.1±1.33 | 24.7±1.85 | 30.2±1.66 | 33.4±1.74 | 32.7±1.54 | 27.8±1.61 | 21.3±1.16 | 15±1.16 | 11.1±0.94 | 21.29±1.45 |
| Maximum temperature [°C] | 16.7±2.75 | 19.3±2.95 | 22.7±3.15 | 28.2±3.33 | 32.7±3.06 | 38.2±3.48 | 42.7±3.47 | 41.7±3.23 | 35±3.23 | 27.7±3.44 | 20.5±2.98 | 17.2±2.72 | 28.55±3.15 |
| Minimum temperature [°C] | 4.4±2.75 | 6±2.94 | 8.8±3.39 | 12.8±3.9 | 16.7±3.89 | 21.7±4.55 | 25±4.39 | 24.3±3.95 | 21.1±3.68 | 14.3±3.61 | 8.8±2.76 | 5±2.66 | 14.08±3.54 |
| Precipitation [mm] | 7±3.88 | 3±1.89 | 9±2.75 | 7±4.86 | 4±2.83 | 3±4.43 | 1±1.52 | 1±46.2 | 4±1.63 | 5±2.98 | 13±3.78 | 7±6.44 | 5.33±6.93 |
| Potential evapotranspiration [mm] | 35.9±16.04 | 45.5±18.2 | 80.5±22.54 | 124.5±17.01 | 157.8±19.09 | 190.9±16.32 | 216.5±15.37 | 210.5±17.77 | 157±11.97 | 116.4±14.49 | 60.4±13.78 | 38.8±11.67 | 119.56±16.19 |
| Water vapor pressure [hPa] | 11.2±1.96 | 13.3±3.14 | 14.9±3.94 | 15.4±4.47 | 20.9±6.33 | 26.3±8.09 | 29±7.6 | 27.4±8.22 | 20.2±5.23 | 15.7±2.72 | 12.6±3.23 | 11±1.97 | 18.16±4.74 |
| Wind speed [km/h] | 7.2±2.89 | 7.92±3.42 | 7.2±3.76 | 9±3.61 | 9±3.69 | 8.64±3.28 | 7.2±2.78 | 7.2±2.51 | 7.92±2.24 | 8.64±2.63 | 7.2±1.94 | 7.2±2.44 | 7.86±2.93 |
| Sunshine frequency [%] | 65±8.04 | 73±8.01 | 72±8.58 | 69±10.22 | 70±5.53 | 72±5.01 | 78±2.96 | 80±4.58 | 61±9.61 | 69±6.48 | 56±8.8 | 66±11.06 | 69.25±7.41 |
| Day length [h] | 10:15 | 10:59 | 11:56 | 12:56 | 13:46 | 14:11 | 13:59 | 13:16 | 12:20 | 11:21 | 10:28 | 10:01 | 12:07 |
| Sunshine hours [h] | 06:39 | 08:01 | 08:36 | 08:55 | 09:38 | 10:12 | 10:54 | 10:37 | 07:31 | 07:49 | 05:52 | 06:36 | 08:27 |
| Ground frost frequency [%] | 13 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 3 |
| Effective rain [mm] | 7 | 3 | 9 | 7 | 4 | 3 | 1 | 1 | 4 | 5 | 13 | 7 | Σ=63 |
| Effective rain ratio [%] | 99 | 100 | 99 | 99 | 99 | 100 | 100 | 100 | 99 | 99 | 98 | 99 | 99 |
| Number of rainy days | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | Σ=8 |
| Solid precipitation ratio [%] | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |