

4.4. Evapotranspiration and water deficit

4.4.1. Potential evapotranspiration

The evaporative demand of the atmosphere can be represented by the potential evapotranspiration (PET), which is the evapotranspiration of a reference crop, a grass cover. The PET can be calculated by the Penman-Monteith method from elementary climatic parameters, such as temperature, air humidity, radiation, and wind speed (Allen et al., 1998). The PET concept is the basis for the assessment of crop water requirements and for scheduling irrigation.

The pattern of mean annual PET throughout the region (Figure 17) is very similar to the pattern of mean annual temperature (Figure 12) and shows the same trends, as governed by altitude and latitude. The PET is very high in the interior of the Peninsula and decreases towards the edges.

4.4.2. Aridity

The Arabian Peninsula is characterized by a severe deficit of precipitation over atmospheric water demand. The UNESCO (1979) 'aridity index' can be used to quantify this deficit and map the severity of 'dryness' based on the ratio of annual precipitation to annual potential evapotranspiration.

Figure 18 shows the distribution of the aridity index, corresponding with the thresholds for the hyper-arid (<0.03), arid (0.03-0.25), semi-arid (0.25-0.5), and sub-humid climatic regimes (>0.5). The areas under each moisture regime are summarized in Table 3. Nearly 99% of the Peninsula is either hyper-arid (HA) or arid (A). Only part of the Yemen highlands is in the semi-arid (SA) class. A very small area is sub-humid (SH). The relationships between moisture regimes (as expressed by aridity index) and agriculture are discussed further in section 4.5.1.

Table 3. Areas under different moisture regimes

Moisture regime	Aridity index	%	km ²
Hyper-arid (HA)	< 0.03	32.02	1,020,107
Arid (A)	0.03 - 0.2	66.72	2,125,415
Semi-arid (SA)	0.2 - 0.5	1.22	38,788
Sub-humid (SH)	> 0.5	0.04	1,199

These results reflect the huge negative balance between water supply from precipitation and the evaporative demand of the atmosphere. The size of the hydrological deficit on an annual basis is shown in figure 19.

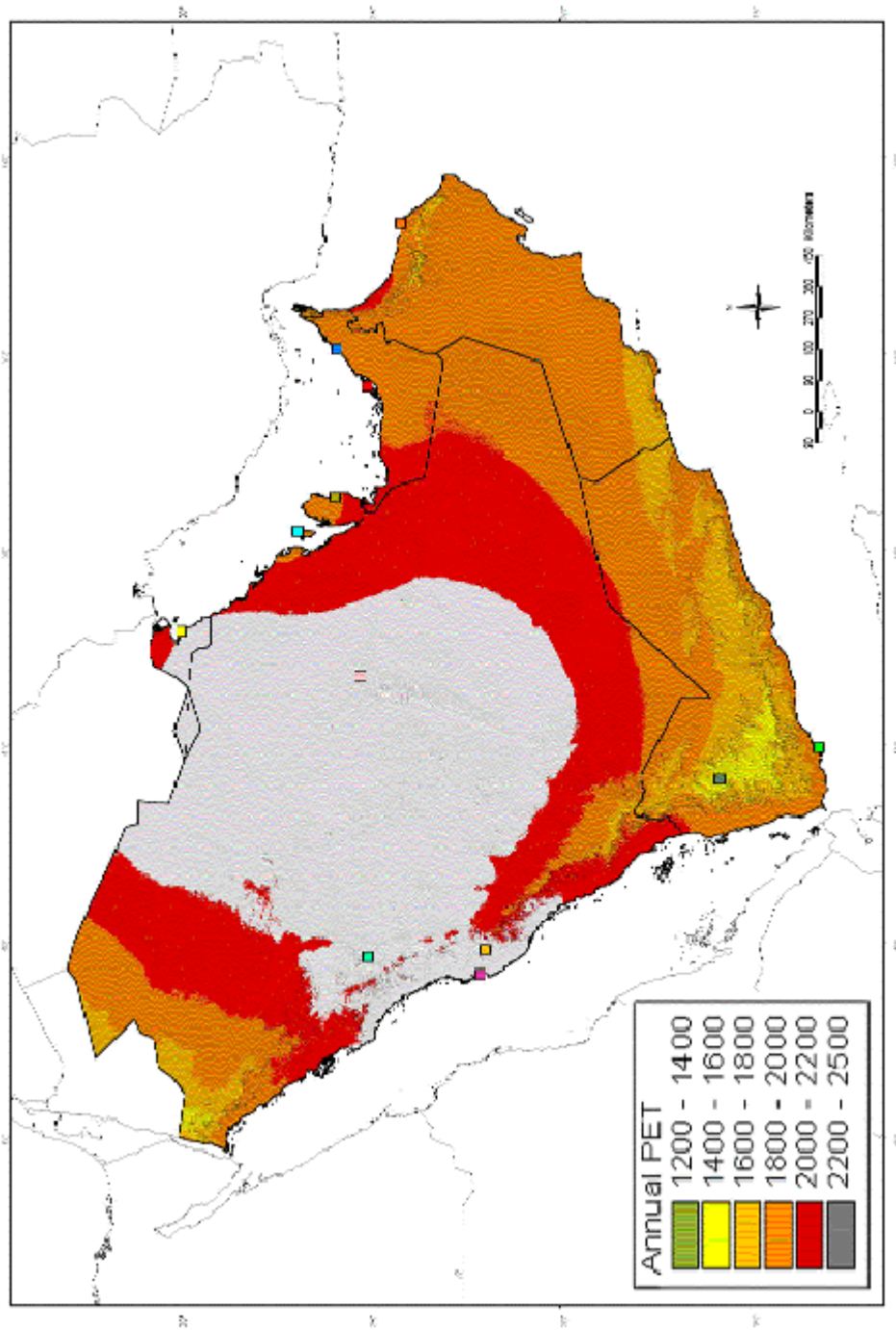


Fig. 17: Mean annual potential evapotranspiration (mm)

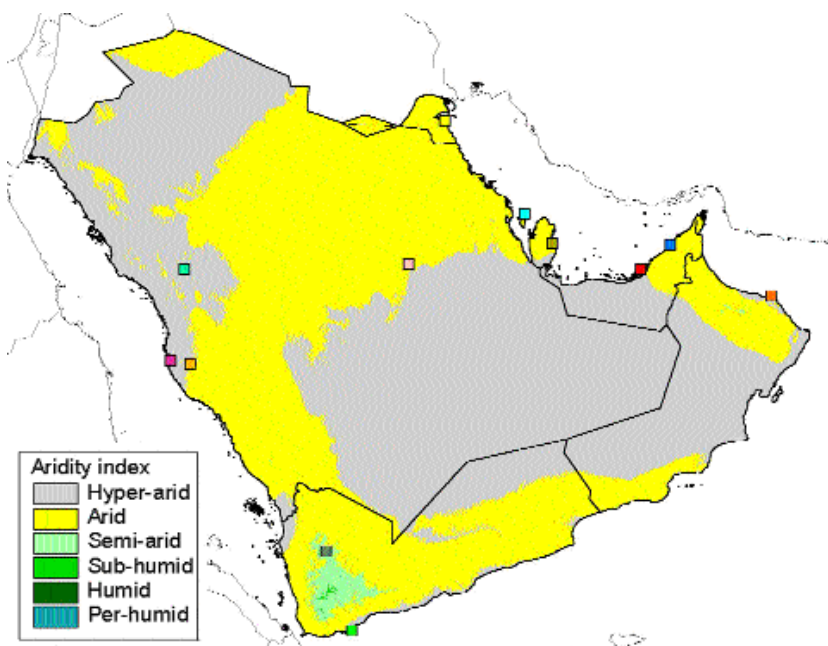


Fig. 18: Aridity index

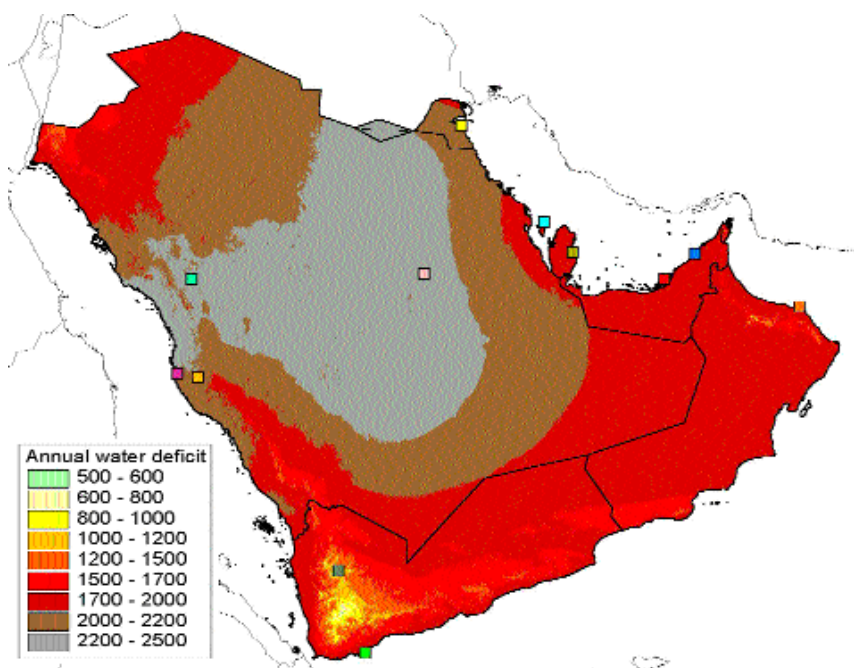


Fig. 19: Annual precipitation deficit (mm)