Drought monitoring and adaptation strategies in agriculture at local scale

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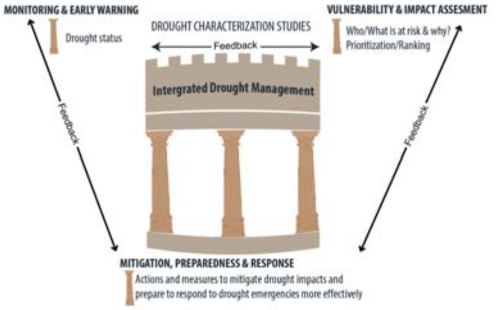

Figure 1: The integrated drought management pillars. (Adapted from : IDPM, WMO and GWP)

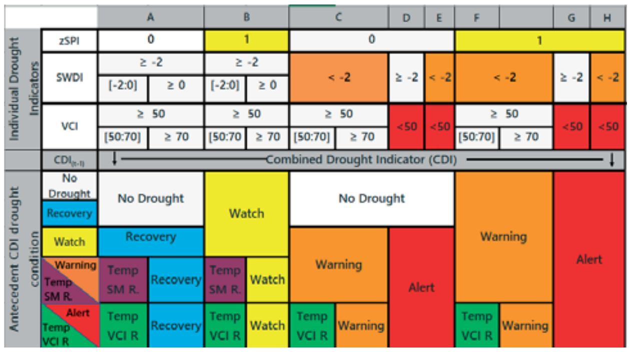

Figure 4: Modified combined drought indicator

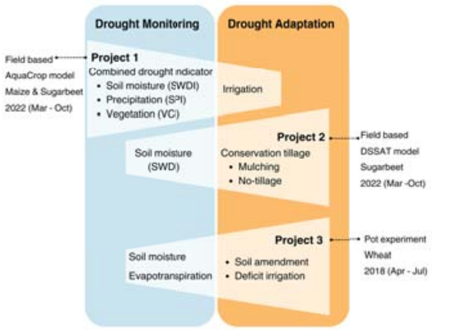

Figure2: Project outline corresponding to the two integrated drought management pillars as overarching objectives

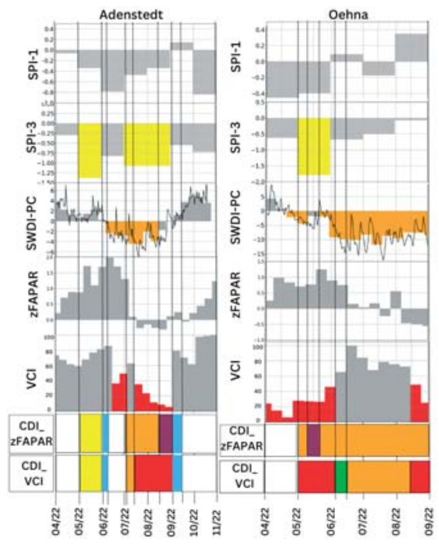

Figure 5: Drought monitoring using the modified combined drought indicator

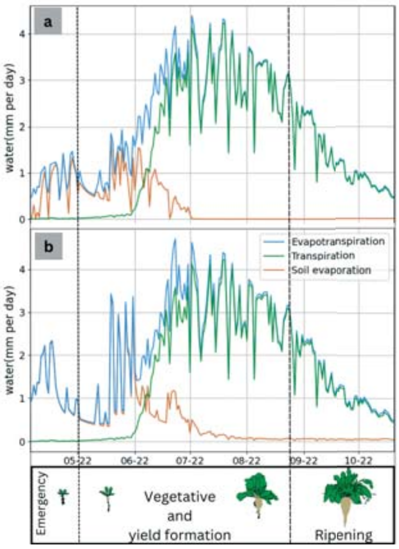

Figure 6: Evapotranspiration a) with mulching, b) without mulching

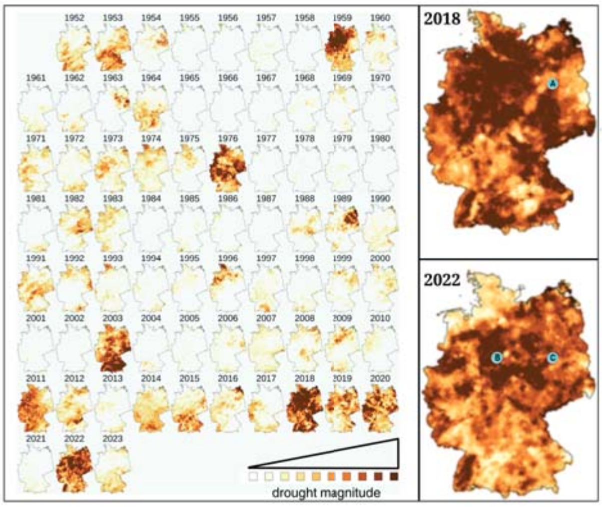

Figure 3: Soil moisture drought magnitude for the upper soil layer (0-25 cm) in Germany from 1952 to 2023 for vegetation active months (April to October) Zoomed in layers for the years 2018 and 2022 corresponding to this Project study periods and locations, where A) Marquardt, Brandenburg B) Adenstedt,Lower Saxony C) Oehna, Brandenburg (Adapted from: https://www.ufz.de/index.php?de=47252.)

Crop type	Treatment	Shoot mass (g)	Root mass (g)	Grain count	Grain weight (g)	ET$_a$ (L)	WUE (g/L)
Spring wheat	FI	2.75	0.23	45	1.33	5.92	0.22
	DI_1	1.54	0.16	17	0.52	4.98	0.10
	DI_2	2.28	0.26	45	0.57	4.05	0.14
	FI + SAM	8.18	0.70	74	2.47	6.10	0.40
	DI_1 +SAM	4.90	0.79	11	0.30	5.00	0.06
	DI_2 +SAM	6.69	1.99	72	0.89	3.78	0.24
Winter	FI	2.84	0.96	32	0.94	6.91	0.14
	DI_1	2.07	1.15	11	0.33	5.48	0.06
	DI_2	2.75	1.26	38	0.59	2.92	0.20
	DI_1 +SAM	2.85	1.42	6	0.26	5.61	0.05
	DI_2 +SAM	4.92	2.42	52	0.70	2.69	0.26

Table 1: Influences of deficit irrigation (DI) and soil amendment material (SAM) on water use efficiency

Key Messages

- Drought monitoring and adaptation strategies together are pillars of a risk-based drought management approach, which is proactive and more sustainable than a crisis-driven responsive approach (Fig. 1 & Fig. 2).
- Germany is experiencing more frequent and severe drought (Fig. 3).
- The modified combined drought indicator (Fig. 4) which integrate in situ soil moisture measurements, captures the influences of local practices (Fig. 5). This could enable local stakeholders to adapt their practices to reduce the impact of drought on agricultural crop production.
- Conventional tillage, exacerbates the impact of drought on crop growth by compacting the soil and impeding soil water movement. Therefore, conservation tillage approaches (such as mulching and reduced tillage) should be considered to reduce soil moisture loss during drought periods (Fig. 6).
- When soils with lower water retention capacities are exposed to drought, increasing the water supply via irrigation alone might not be a definitive solution. In such cases, the use of soil amendment products that enhance the water retention capacity of the soil could be beneficial by improving water use efficiency (Tab. 1).

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