Management practices to optimise soil water content in Southern Africa

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FNSSA Meeting

23 January 2017

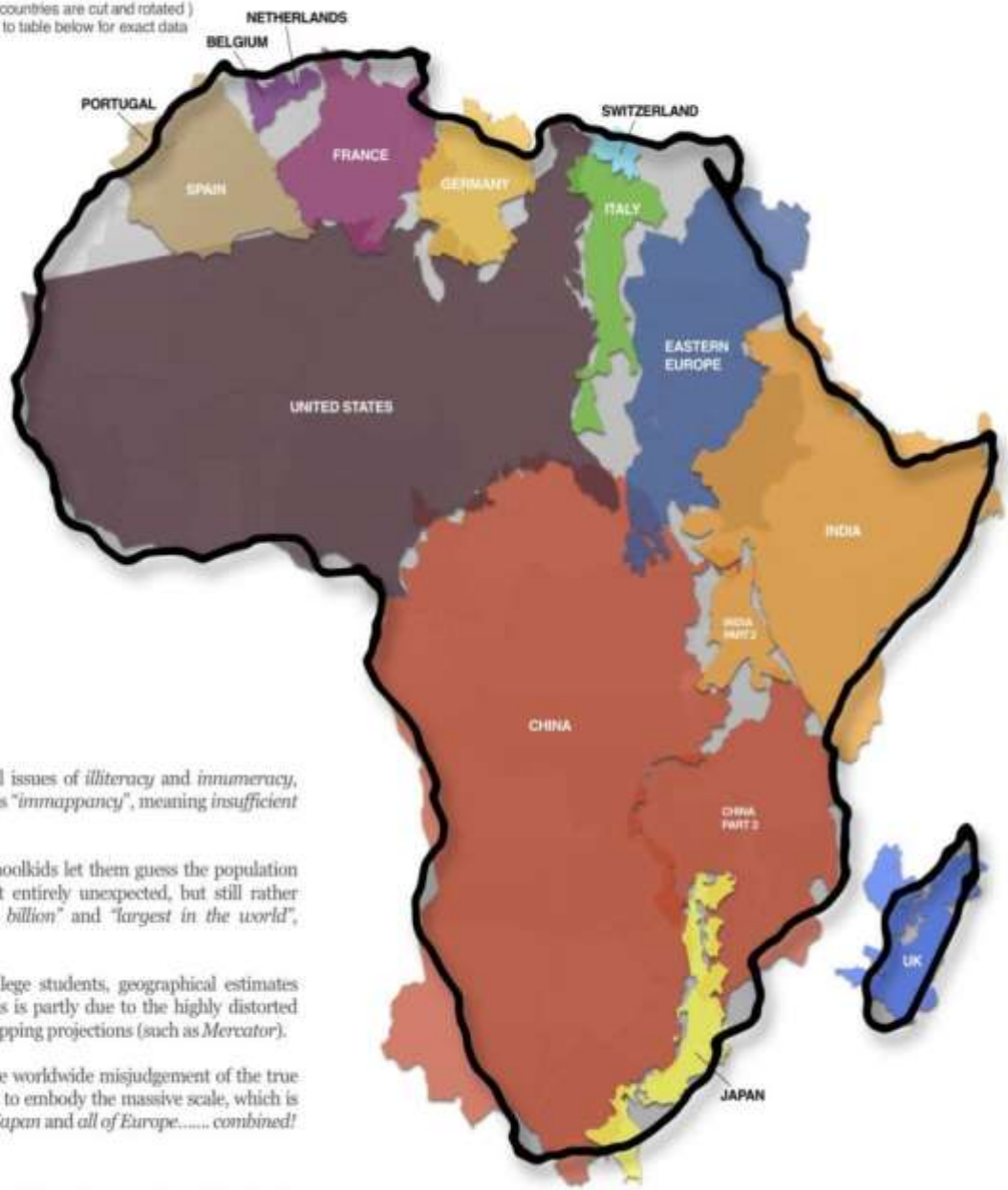
Brussels

The **True Size** of **Africa**

A small contribution in the fight against rampant *Immappancy*, by **Kai Krause**

Graphic layout for visualization only (some countries are cut and rotated)
But the conclusions are very accurate: refer to table below for exact data

COUNTRY	AREA x 1000 km²
China	9.597
USA	9.629
India	3.287
Mexico	1.964
Peru	1.285
France	633
Spain	506
Papua New Guinea	462
Sweden	441
Japan	378
Germany	357
Norway	324
Italy	301
New Zealand	270
United Kingdom	243
Nepal	147
Bangladesh	144
Greece	132
TOTAL	**30.102**
AFRICA	**30.221**



Top 100 Countries

Area in square kilometers, Percentage of World Total
Sources: Britannica, Wikipedia, Almanac 2010

		AREA km²	%
1	Russia	17.098.242	11.50
2	Canada	9.984.670	6.70
3	China	9.596.961	6.42
4	United States	9.629.091	6.40
5	Brazil	8.514.877	5.70
6	Australia	7.692.024	5.20
7	India	3.287.263	2.30
8	Argentina	2.780.400	2.00
9	Kazakhstan	2.724.900	1.80
10	Sudan	2.505.813	1.70
11	Algeria	2.381.741	1.60
12	Congo	2.344.858	1.60
13	Greenland	2.166.086	1.50
14	Saudi Arabia	2.149.690	1.40
15	Mexico	1.964.375	1.30
16	Indonesia	1.860.360	1.30
17	Libya	1.759.540	1.20
18	Iran	1.636.750	1.10
19	Mongolia	1.564.100	1.10
20	Peru	1.285.216	0.86
21	Chad	1.284.000	0.86
22	Niger	1.267.000	0.85
23	Angola	1.246.700	0.83
24	Mali	1.240.192	0.83
25	South Africa	1.221.037	0.82
26	Colombia	1.141.748	0.76
27	Ethiopia	1.104.300	0.74
28	Bolivia	1.098.581	0.74
29	Mauritania	1.025.520	0.69
30	Egypt	1.002.000	0.67
31	Tanzania	945.087	0.63
32	Nigeria	923.768	0.62
33	Venezuela	912.050	0.61
34	Namibia	824.116	0.55
35	Mozambique	801.590	0.54
36	Pakistan	796.095	0.53
37	Turkey	783.562	0.53
38	Chile	756.102	0.51
39	Zambia	752.612	0.51
40	Myanmar	676.578	0.45
41	Afghanistan	652.090	0.44
42	Somalia	637.657	0.43
43	France	632.834	0.43
44	C. African Rep	622.984	0.42
45	Ukraine	603.700	0.41
46	Madagascar	587.041	0.39
47	Botswana	582.000	0.39
48	Kenya	580.367	0.39
49	Yemen	527.968	0.35
50	Thailand	513.120	0.34
51	Spain	505.992	0.34
52	Turkmenistan	488.100	0.33
53	Cameroon	475.442	0.32
54	Papua New Guinea	462.840	0.31
55	Uzbekistan	447.400	0.30
56	Morocco	446.550	0.30
57	Sweden	441.370	0.30
58	Iraq	438.317	0.29
59	Paraguay	406.752	0.27
60	Zimbabwe	390.757	0.26
61	Japan	377.930	0.25
62	Germany	357.114	0.24
63	Rep o.t. Congo	342.000	0.23
64	Finland	338.418	0.23
65	Vietnam	331.212	0.22
66	Malaysia	330.803	0.22
67	Norway	323.802	0.22
68	Côte d'Ivoire	322.463	0.22
69	Poland	312.685	0.21
70	Oman	309.500	0.21
71	Italy	301.336	0.20
72	Philippines	300.000	0.20
73	Burkina Faso	274.200	0.18
74	New Zealand	270.467	0.18
75	Gabon	267.668	0.18
76	Western Sahara	266.000	0.18
77	Ecuador	256.369	0.20
78	Guinea	245.857	0.17
79	United Kingdom	242.900	0.16
80	Uganda	241.038	0.16
81	Ghana	239.539	0.16
82	Romania	238.391	0.16
83	Laos	236.800	0.16
84	Guyana	214.969	0.14
85	Belarus	207.600	0.14
86	Kyrgyzstan	199.951	0.13
87	Senegal	196.722	0.13
88	Syria	185.180	0.12
89	Cambodia	181.035	0.12
90	Uruguay	176.215	0.12
91	Suriname	163.820	0.11
92	Tunisia	163.610	0.11
93	Nepal	147.181	0.10
94	Bangladesh	143.998	0.10
95	Tajikistan	143.100	0.10
96	Greece	131.957	0.09
97	Nicaragua	130.370	0.09
98	North Korea	120.538	0.08
99	Malawi	118.484	0.08
100	Eritrea	117.600	0.08
	TOP 100 TOTAL	132.632.624	89.34

United States

Europe

India

Japan

China

In addition to the well known social issues of *illiteracy* and *innumeracy*, there also should be such a concept as "*immappancy*", meaning *insufficient geographical knowledge*.

A survey with random American schoolkids let them guess the population and land area of their country. Not entirely unexpected, but still rather unsettling, the majority chose "*1-2 billion*" and "*largest in the world*", respectively.

Even with Asian and European college students, geographical estimates were often off by factors of 2-3. This is partly due to the highly distorted nature of the predominantly used mapping projections (such as *Mercator*).

A particularly extreme example is the worldwide misjudgement of the true size of *Africa*. This single image tries to embody the massive scale, which is larger than the *USA, China, India, Japan* and *all of Europe..... combined!*

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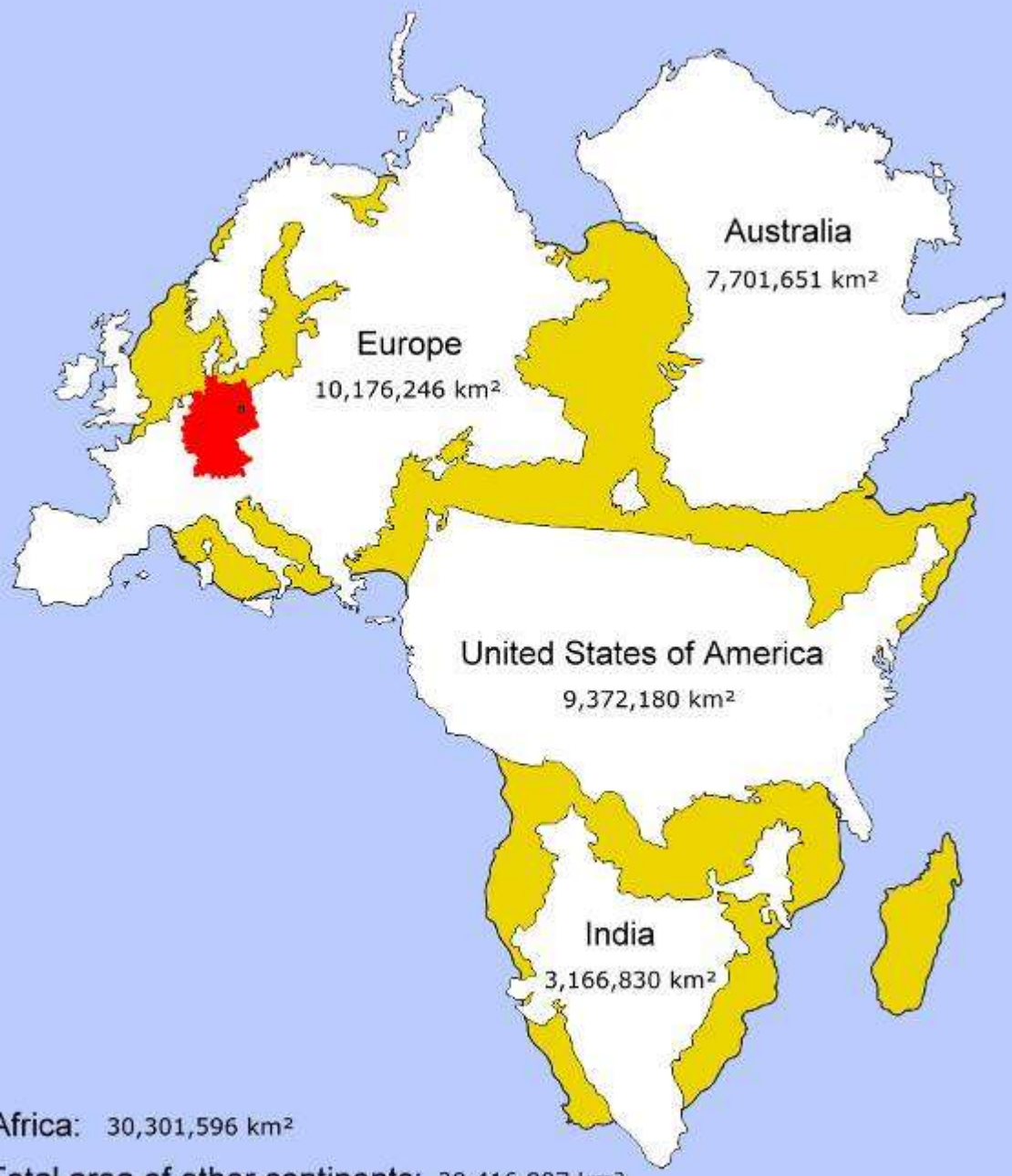
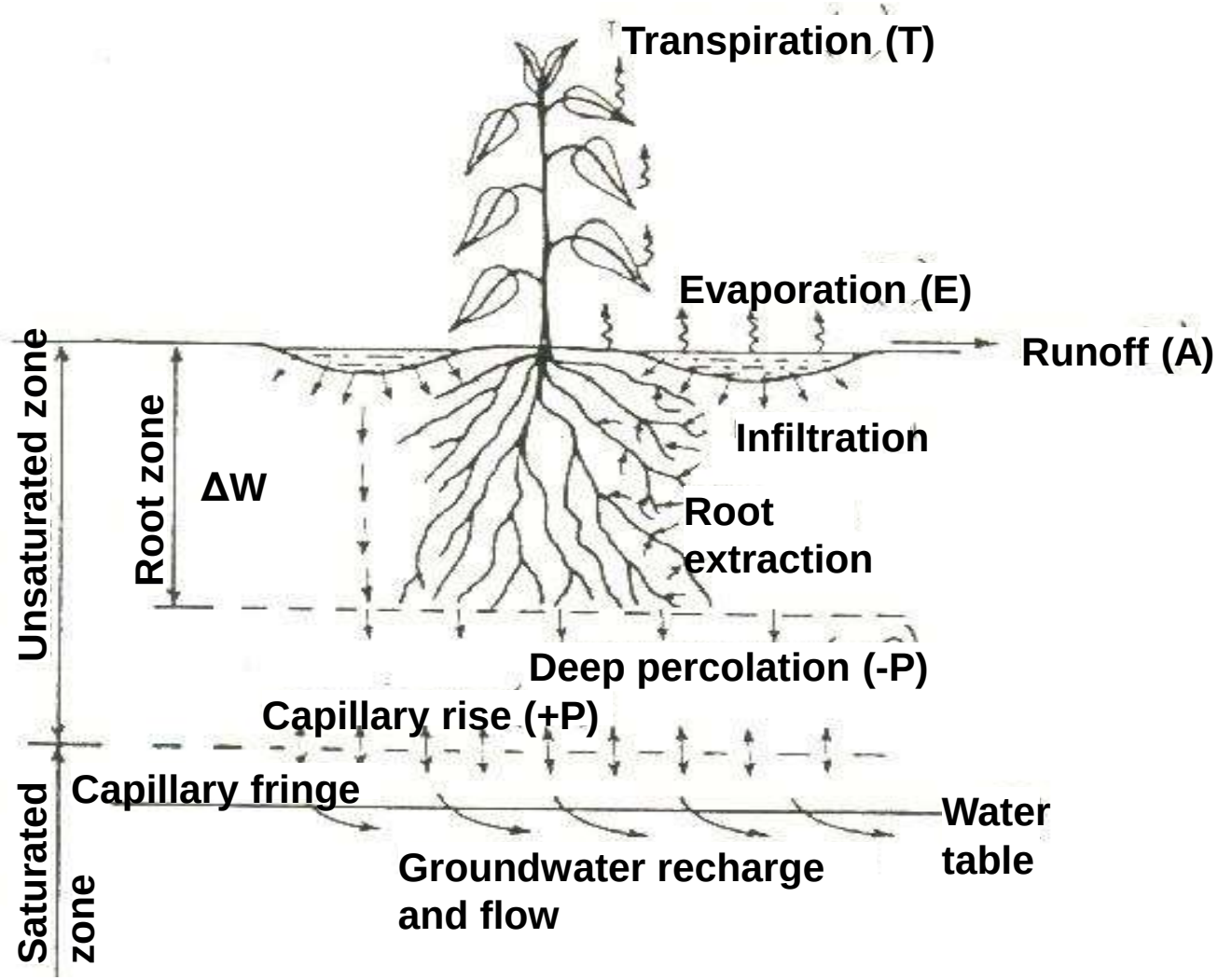


Africa: 30,301,596 km²

Total area of other continents: 30,416,907 km²

W = P+I-A+P-P-E-T


Transpiration (T)
Evaporation (E)
Runoff (A)
Infiltration
Root extraction
Unsaturated zone
Root zone
ΔW
Deep percolation (-P)
Capillary rise (+P)
Capillary fringe
Water table
Groundwater recharge and flow
Saturated zone

Increasing the soil water balance

- Rainfall: choice of planting date
  - critical periods of growth coincide with periods of higher rainfall probability
  - increased fallow periods to store more rainfall
  - water-storing capacity of the soil

- Irrigation: supplement rainfall
  - water available
  - apply correct amount at the right time

Increasing the soil water balance

- Decrease Run-off / Maximise infiltration
  - keep surface loose
  - protecting against crust formation – mulch
  - hydrologic planning
  - grazing must maintain good plant-cover
  - in-field rainwater harvesting

- Decrease Deep percolation:
  - select soils with clay layers
  - impede deep drainage - increased water storage

Increasing the soil water balance

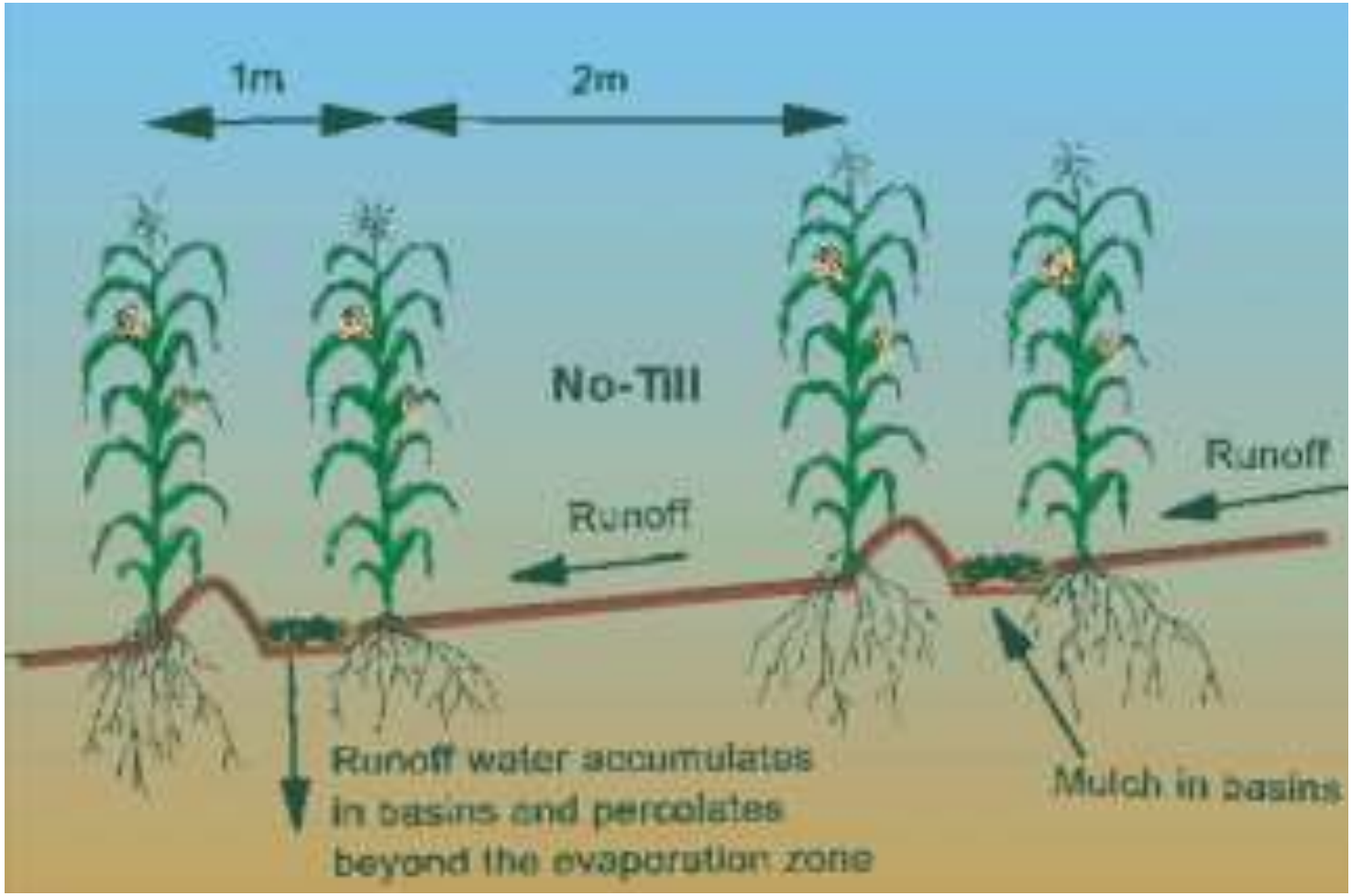
- Decrease Evaporation:
  - keep soil surface loose or covered (mulch)

- Decrease Transpiration:
  - keep land free of weeds & seedlings during fallow season
  - adapt plant density (plants/hectare) & row-spacing to available water

Decreasing the soil water balance

- restrict infiltration
- increase runoff
- increase evaporation
- increase transpiration
- select well-drained soils
- promote deep percolation by artificial drainage
- increase planting density
- etc.

In-field rainwater harvesting



Challenges

- Two economies in South Africa:
  - commercial agriculture:
    - maize yield: 4-12 Mg^{-1} ha (max = 23 Mg ha^{-1})
    - yield *vs.* profit
      - explore different metrics of productivity
  - subsistence agriculture:
    - maize yield: 0.4 - 0.8 Mg^{-1} ha