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# An approach to the Concept of Water Poverty Line

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- Total amount of available water (or which can be made available) in a certain country divided by the number of population = The per capita share of water per year.

- For Jordan the total amount of water = 900 MCM/yr.

- Inhabitants = 3.2 Million

A: The per capita share = $\frac{900}{3.2}$ = 281 $m^3$/capita and year.

- Present needs to cover domestic uses = 36 $m^3$/capita and year
- Needs to cover food production = 1450 $m^3$/capita and year

B: Total needs to cover domestic uses and to cover (100%) food production = 36 + 1450 = 1486 $m^3$/capita and year.

$\frac{A}{B}$ for Jordan = 0.19

If the per capita share of water covers the per capita needs A=B the country is said to possess enough water A=B or $\frac{A}{B}$ = 1, if A is less than 1 the country is water poor.

if $\frac{A}{B}$ = 1 - 0.75 poor

0.75 - 0.5 very poor

0.5 - 0.25 extreemly poor

0.25 - 0 disastrous conditions

If $\frac{A}{B}$ = 1 - 1.5 satisfactorily rich

1.5 - 2.0 rich

> 2 very rich

for Jordan $\frac{A}{B}$ = 0.19 Indicating that its case is disastrous

The above shows one way of looking at things but, if the country depends on dry farming the produced food by dry farming (including meat) should be also taken into consideration.

In the case of Jordan 33% of the food needs are covered by dry farming. Therefore, this amount should be subtracted from the needs for food production .

1450 $m^3$/capita and year (needed for 100% food production)

33% x 1450 = 483 $m^3$ of water per capita and year are effectively covered by dry irrigation.

The rest = 1450 - 483 = 967 $m^3$ of water will be needed to cover (100% - 33%) 67% of the food needs (which can not be supplied by dry farming).

Again in the case of Jordan the amount of water needed to cover irrigated agriculture (which is addtion to dry farming will totally cover food needs) will be 967 $m^3$/capita and year.

The domestic needs are 36 $m^3$/capita and year

C: The total amount needed to cover domestic demand and to supplement food production = 967 + 1003 $m^3$/capita and year.

The per capita share of water = 281 $m^3$/year (see above A)

The $\frac{A}{C}$ ratio for Jordan = $\frac{281}{1003}$ = 0.28 indicating that it is extreemly poor in water resouras.

Now the water line is defined as $\frac{A}{C}$

if $\frac{A}{C}$ = 1 the country is at the water poverty line

| | | | |
|---|---|---|---|
| $\frac{A}{C}$ | = 1 | - 0.75 | water poor |
| | 0.75 | - 0.5 | very poor |
| | 0.5 | - 0.25 | extreemly poor |
| | 0.25 | - 0 | disastrous conditions |
| | 1 | - 1.5 | satisfactorily rich |
| | 1.5 | - 2.0 | rich |
| | > 2 | | very rich |

Form this concept (Taking into consideration the dry farming) one can obtain real figures about water poverty. e.g. Egypt has almost no dry farming therefore $\frac{A}{B} = \frac{A}{C}$

but Syria has large areas of dry farming $\frac{A}{C}$ larger than $\frac{A}{B}$

A Recommendation can be made to direct the different conutries to increase the use and effeciency of dry farming.

# Water Poverty Index (WPI)

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$$WPI = \frac{0.66}{f}\left(\frac{\frac{A1}{3} + \frac{A2}{2} + \frac{A3}{1.5} + A4}{125P} + \frac{WR}{100P} - 1 + T\right)$$

A1 = area (m2 ) of rainfed agriculture receiving an average amount of precipitation of 300-400 mm/yr.

A2 = (the same as A1) with precipitation of 400-500 mm/yr.

A3 = (the same as A1) with precipitation of 500-600 mm/yr.

A4 = (the same as A1) with precipitation of more than 600mm/yr.

P = population (persons)

WR = available renewable surface and groundwater resources (in m3).

T = ratio of the amount of treated waste water used in irrigation to the total amount of water supplied for household uses (domestic water).

0.66 : generalized land productivity factor for agricultural and animal production.

f : climatic factor depending on the average temperature during the rainy season according to the following :

| C° | f | C° | f |
|---|---|---|---|
| 8 | 0.8 | 16 | 1.365 |
| 9 | 9.85 | 17 | 1.455 |
| 10 | 0.905 | 18 | 1.55 |
| 11 | 0.975 | 19 | 1.65 |
| 12 | 1.045 | 20 | 1.76 |
| 13 | 1.115 | 21 | 1.875 |
| 14 | 1.205 | 22 | 2.00 |
| 15 | 1.285 | | |

This may be a more clear form:

$$WPI = \frac{0.66}{f}\left(\frac{\frac{A1}{3} + \frac{A2}{2} + \frac{A3}{1.5} + A4}{125P} + \frac{WR}{100P} - 1 + T\right)$$

m3 – cubic meter
m2 – square meter

Scale: WPI

catastrophically poor | extremely poor | Very Poor | Poor | rich | moderately rich | Very rich | extremely rich

0 0.25 0.5 0.75 1 1.5 2 3

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