OCP Policy Center Conference series

A global view of managing water resources in Tunisia

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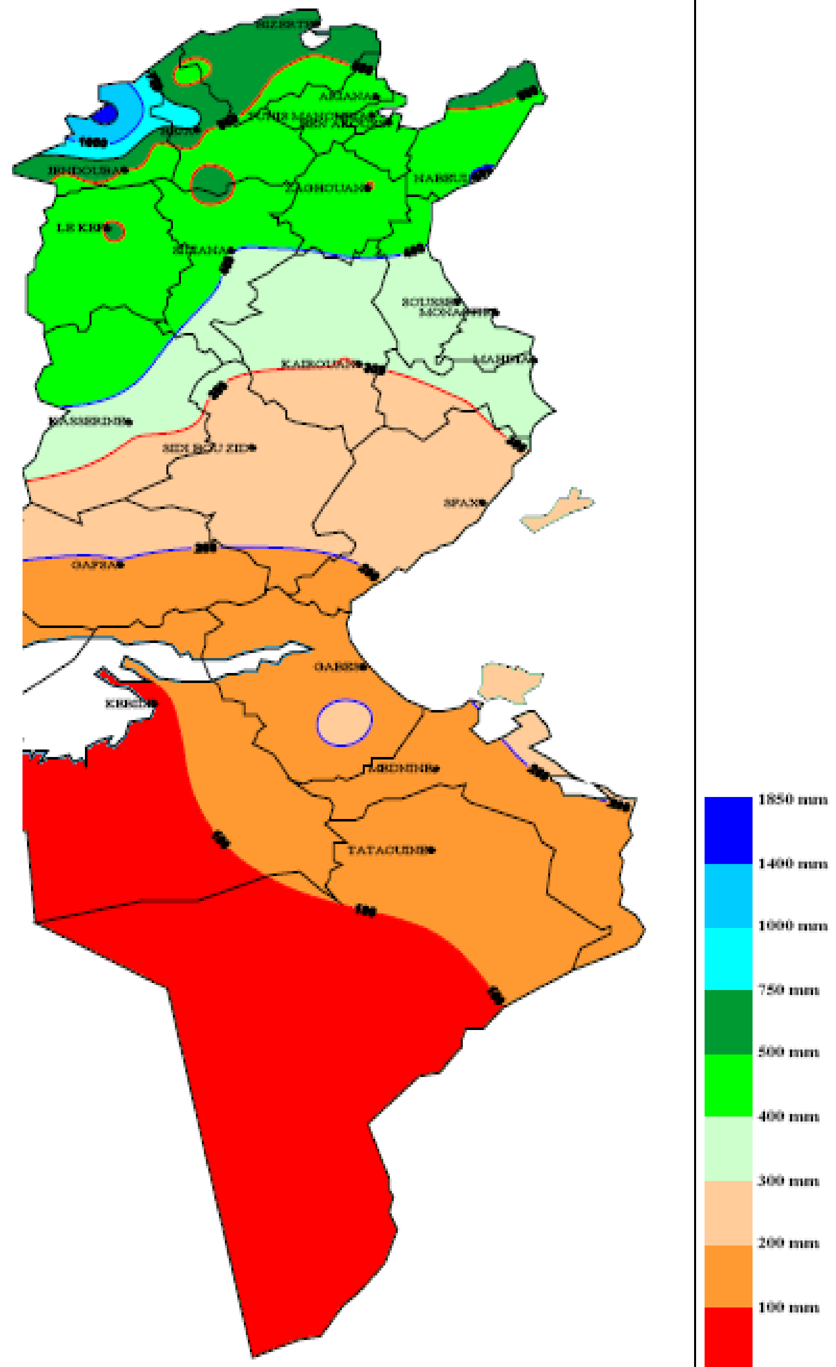
Tunisian water resources

Average rainfall



Pluvial water resources

36000 Mm^3 225 mm/year

Renwable Water Resources

4850 Mm^3 < 500 m3/cap/year

- **Surface water** : 2700 Mm^3
- **Ground water** : 2150 Mm3

Non-Conventional water resources

- 120 Mm^3 TWW (Treated Waste Water)

Tunisian water resources : Transfers and Water uses

Water Uses

Drinking Water:
400 $Mm^3 \approx$ (40 m^3/Cap/year)

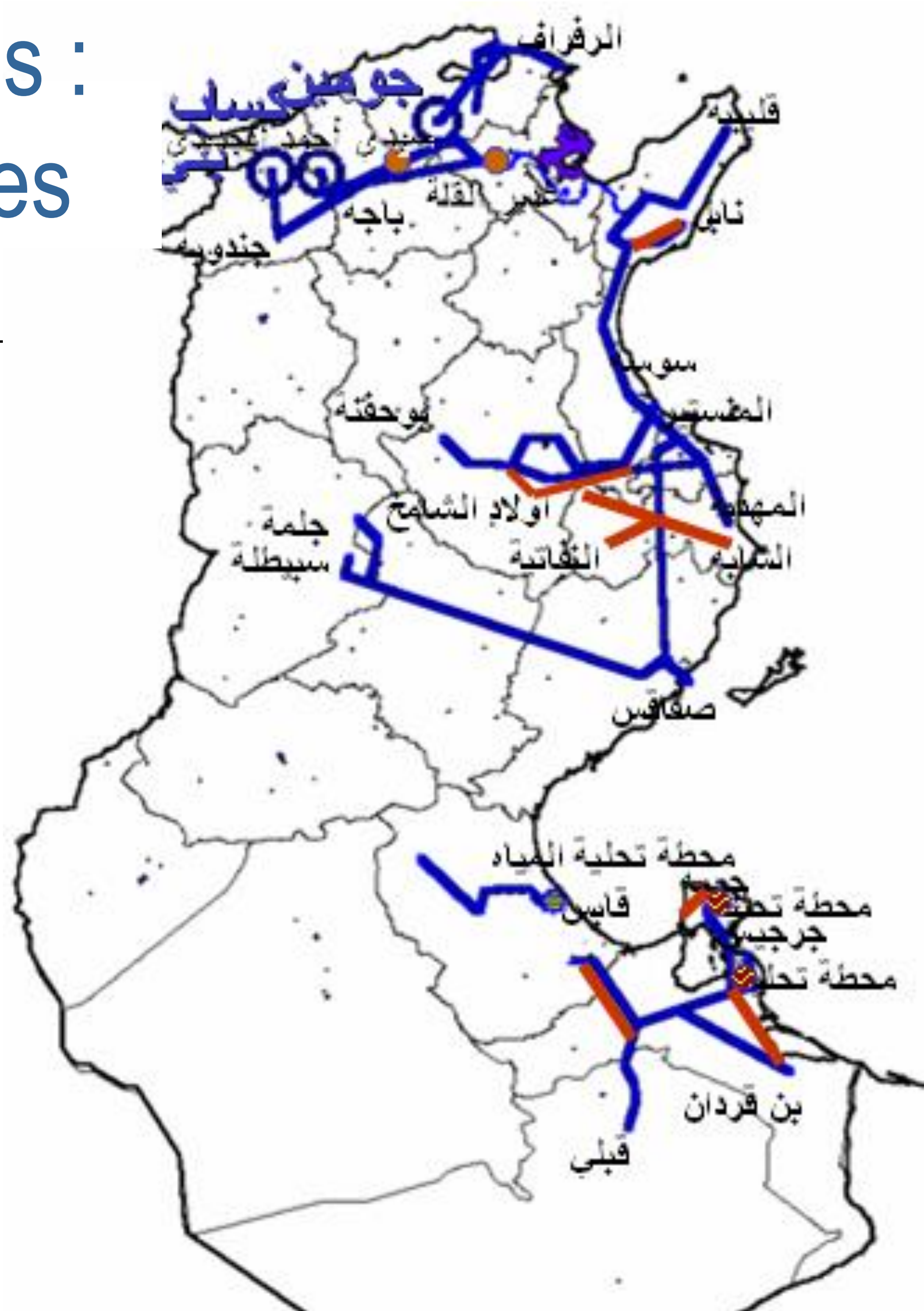
Water for Industry:
100 $Mm^3 \approx$ (10 m^3/Cap/year)

Water for Tourism:
50 $Mm^3 \approx$ (5 m^3/Cap/year)

Water for Agriculture :
2100 $Mm^3 \approx$ (210 m^3/Cap/year)

Rate of water withdrawal

Global ≈ 90 %
Surface water ≈ 85 %
Groundwater ≈ 95 %



Water resource development and management in Tunisia

- Water resources in Tunisia are scares, not uniformly distributed and highly withdrawn
- Water withdrawal has reached the water potential especially for groundwater
- The direct demand (drinking water, industry, tourism) is incompressible and increases with the population but still moderate
- An important part of «**Blue Water**» is used in agriculture : As water supply stabilizes agricultural water allocations will be reduced. *This is the key question that determines the water policy in Tunisia*

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Blue Water for Irrigation (BW)

Trends in agricultural water use, 1990–2006

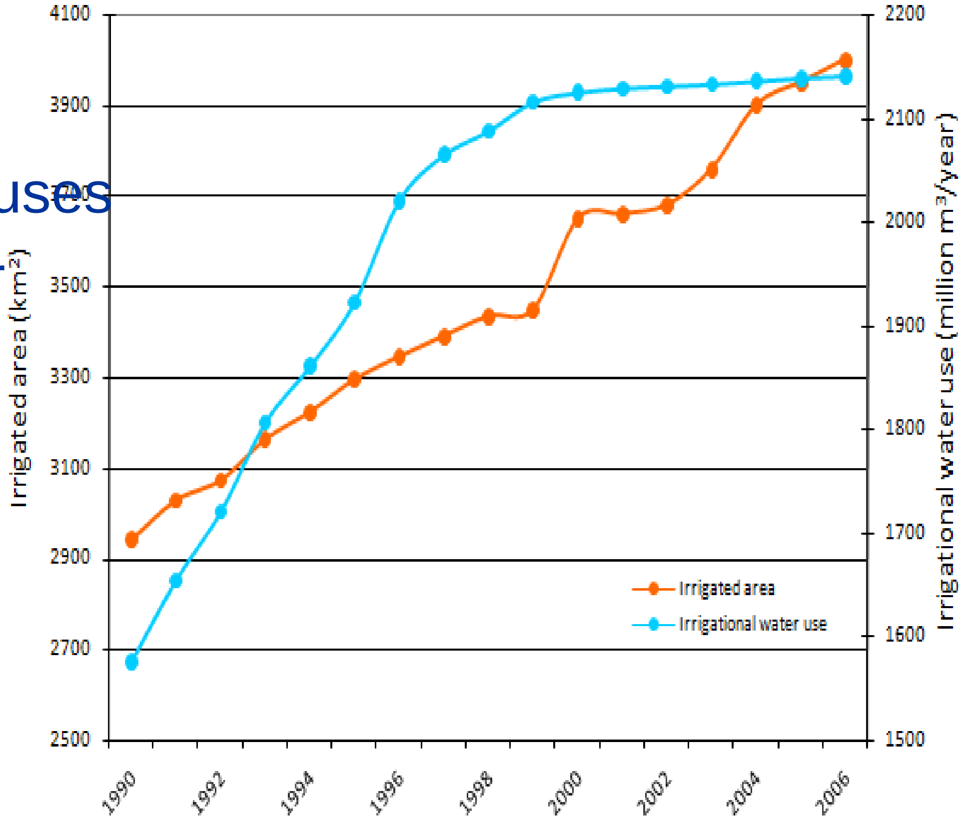
Direct water uses

(collectivities, tourism, industry)

- Represent around 20 % of water uses
- Benefit from a priority in the water allocation

Irrigated Agriculture

- Uses more than 80 % of water.
- Occupies 1/10 of cultivated areas
- Produces 1/3 of food production



Rainfed Agriculture

- Occupies 9/10 of cultivated areas
- Produces 2/3 of food production in value
- has not received as much attention as irrigated agriculture

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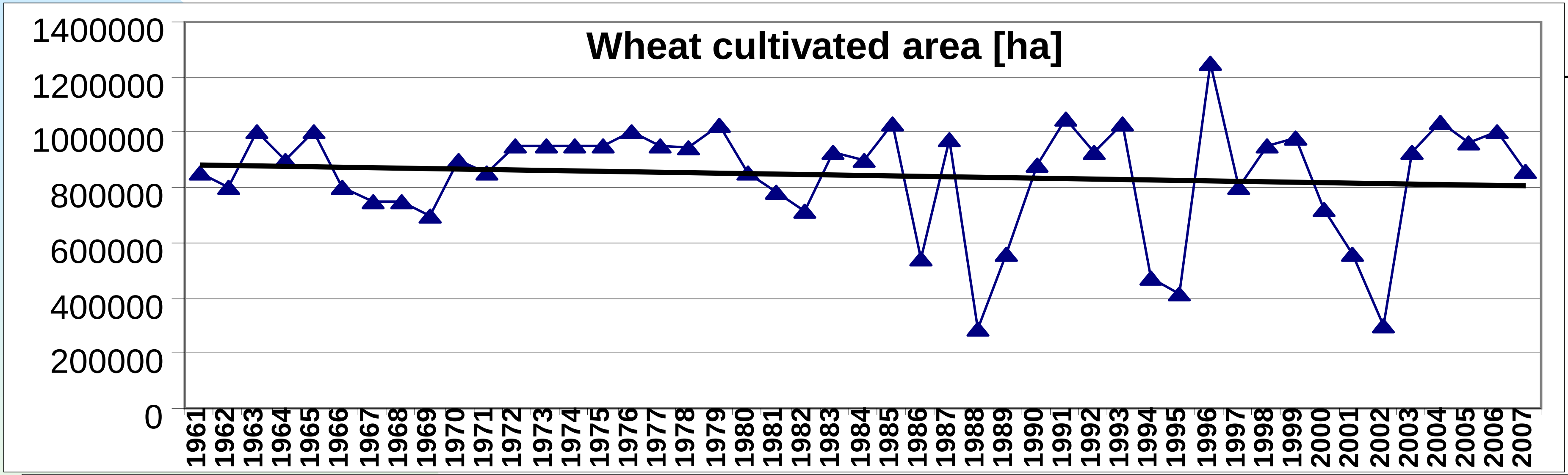
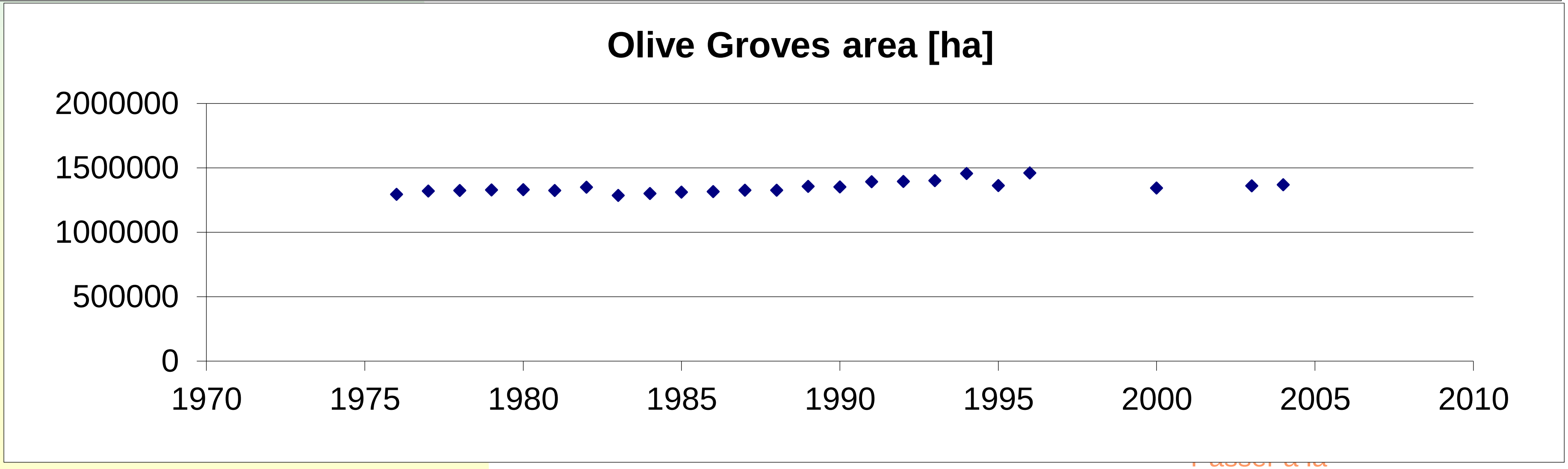
Green Water (GW)

Rainfed agriculture : Olive groves and wheat sown area





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Water and food security issues in Tunisia

- Irrigation has been the key of agriculture development. An important part of withdrawal water «***Blue Water***» is used in agriculture (more than 80%).
- Rainfed agriculture «***Green Water***» plays an important role in food security. It takes an important part in food trade balance. But rainfed agriculture has not received the same attention as irrigated agriculture and its contribution is not directly taken into account in the global balance of water resources
- Imports of cereals, edible oil and other basic foodstuffs «***Virtual Water***» is required to fill the deficit of the local production. The part of Virtual Water is already important and it is expected to increase significantly.

How improve Food Security ?

Should first improve the knowledge of the different contributions to the provision of food

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Green Water assessment

$$GW(i,n) = 1000\zeta(i)Y_G(i,n)S_G(i,n)$$

GW(i,n) : Green Water of rainfed production (region (i), year (n))

ζ : Specific Equivalent Water [m3/kg];

Y_G(i,n) : Yield of rainfed production [ton/hectare]

S_G(i,n) : Environmental Water demand

$$h_G(i,n) = h_W(i,n) - h_S(i) = 100\zeta(i)Y_G(i,n)$$

$$h_W(i,n) = \alpha h_p(i,n) + \beta h_p(i,n-1)$$

At the national level

$$\overline{\zeta} < \overline{Y_G} >= \frac{1}{100}(< \overline{h_w} > - \overline{h_S})$$

$$< \overline{Y_G} >=< \sum_i Y_G(i,n)s_G(i) >$$

$$s_G(i) =< \frac{S_G(i,n)}{\sum_i S_G(i,n)} >$$

$$< \overline{h_W} >=< \sum_i h_W(i,n)s_G(i) >$$

$$\overline{h_S} = \sum_i h_S(i)s_G(i)$$

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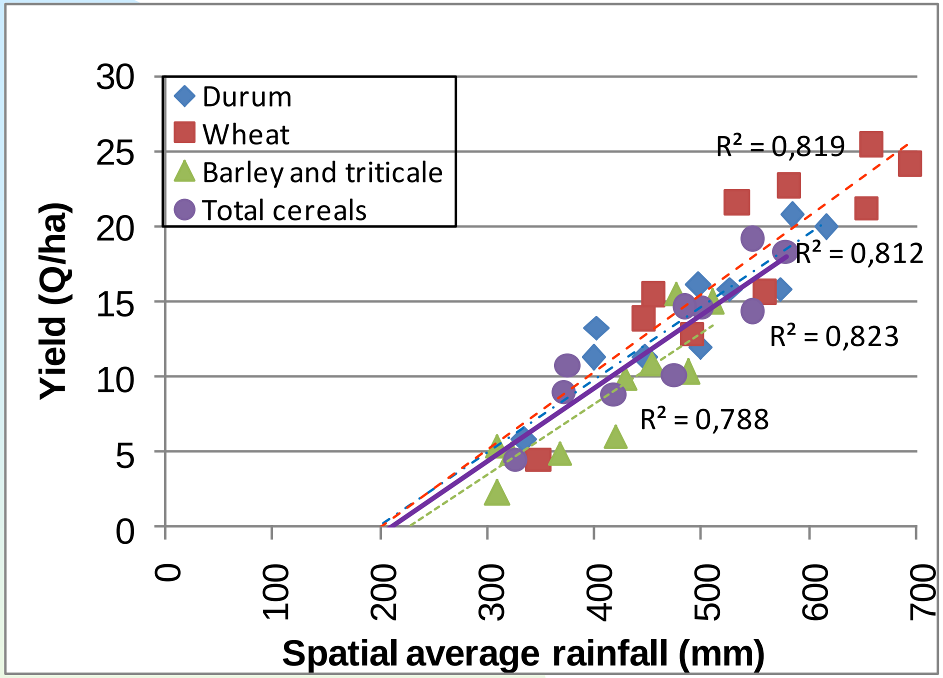
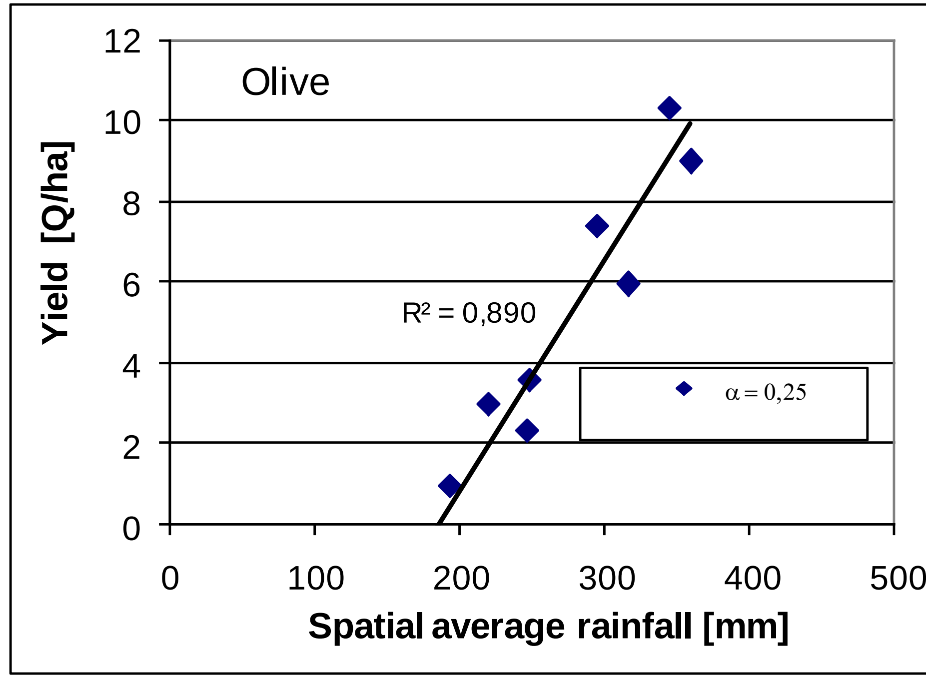
Green Water assessment (Cereals Olives)





Potential of "Green Virtual-Water" content of rain-fed agriculture in Tunisia.

	Weighted Rainfal $<\overline{h_w}>$ [mm]	Water threshold $<\overline{h_s}>$ [mm]	Green water height $<\overline{h_v}>$ [mm]	Maximun Rainfed Area [10^3 ha]	Green water Potential [km^3]
Cereals	462	210	252	2023	5,1
Olive trees plantations	294	186	108	1666	1,8
Other rainfed crops			187	834	1,6
Rainfed agriculture	Total			4523	8,5

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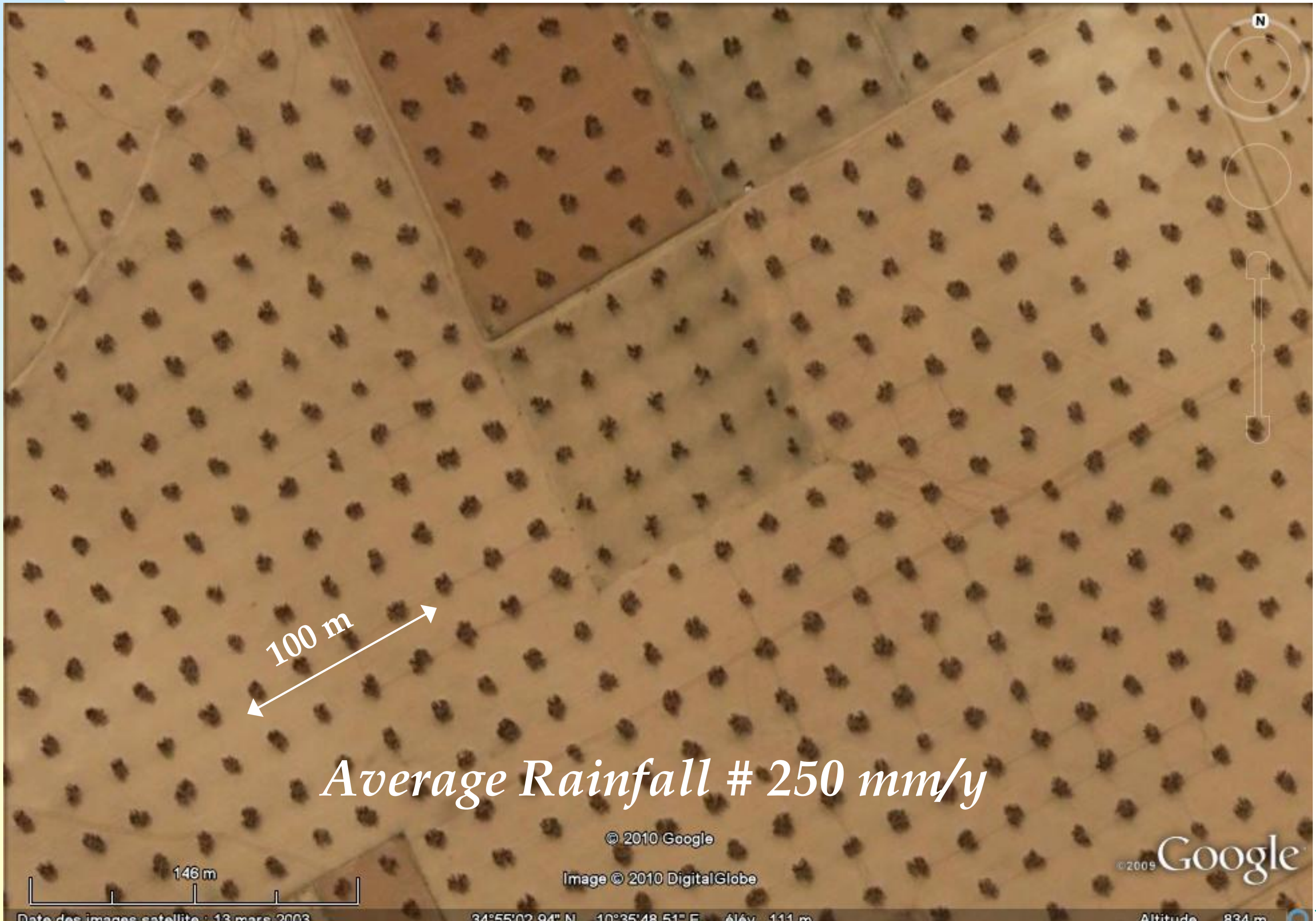
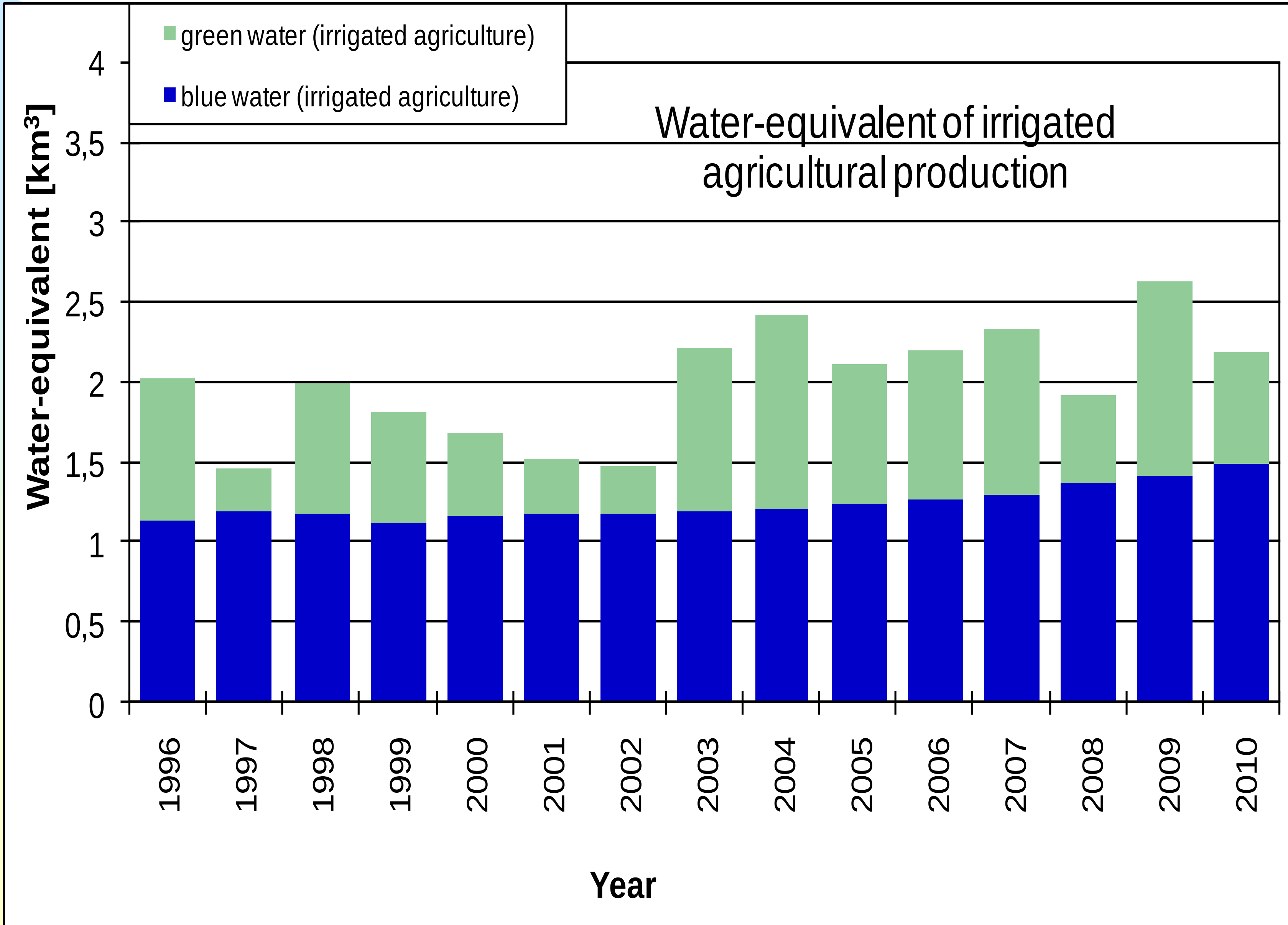
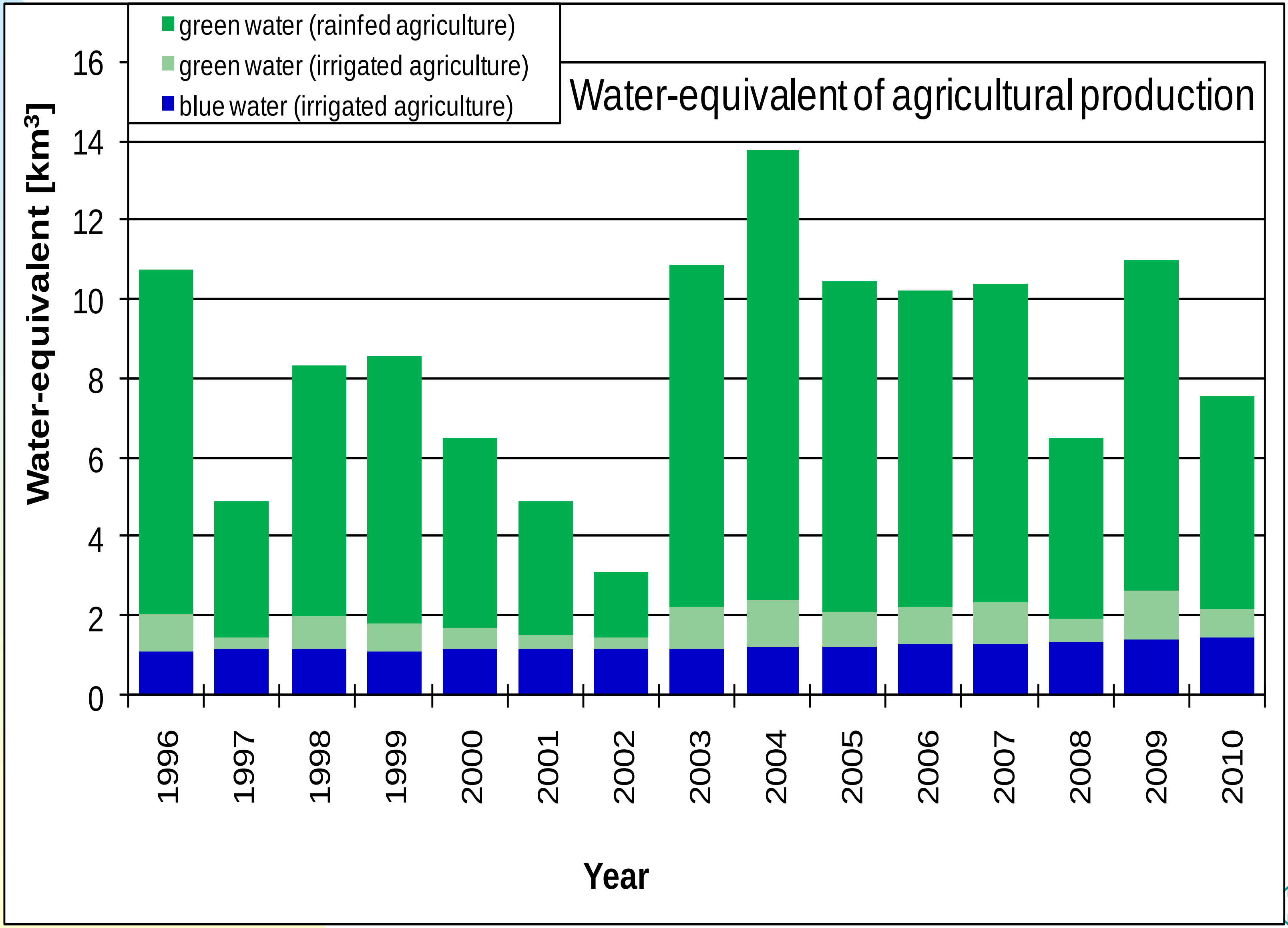
A field of olive trees, near Sfax, Tunisia



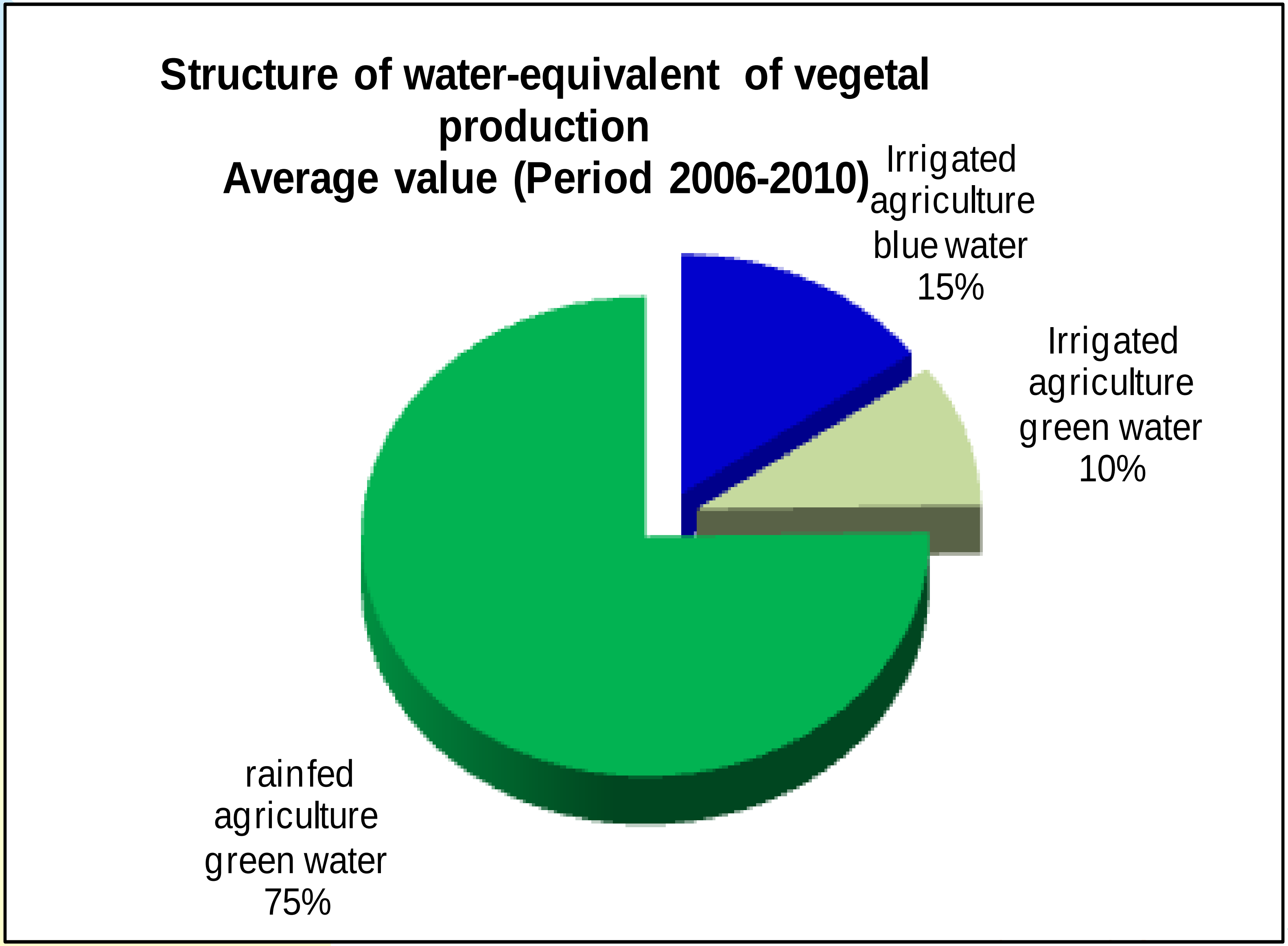
Water-equivalent of irrigated agriculture



Water-equivalent of vegetal production

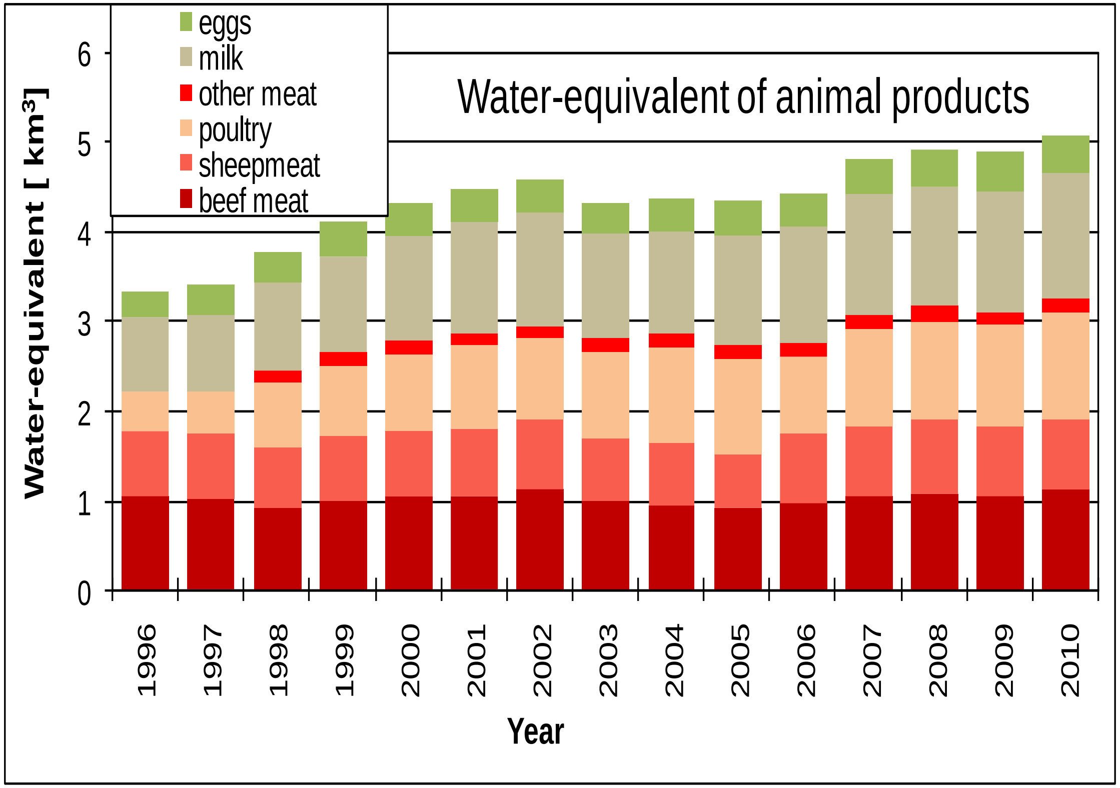


Water-equivalent of vegetal production



Water-equivalent of animal production

- Sustained policy for increasing animal production has led to a significant development of the sector
- Tunisia proudly displays a relative self-sufficiency in animal products since the early 2000s



and even there are signs of overproduction during the last period

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"….Déversement de lait sur la RN 17 !...

http://www.tunivisions.net/28299/152/149/instauration-du-blocage-des-routes-deversement-de-lait-sur-la-rn-17-ou-va-t-on-ij.html

Protests against the difficulties of milk marketing: producers discharge milk on the public way (Mars 2014)

But this abundance is not real : lets analyze the imports (in water-equivalent) of animal products and of fodder

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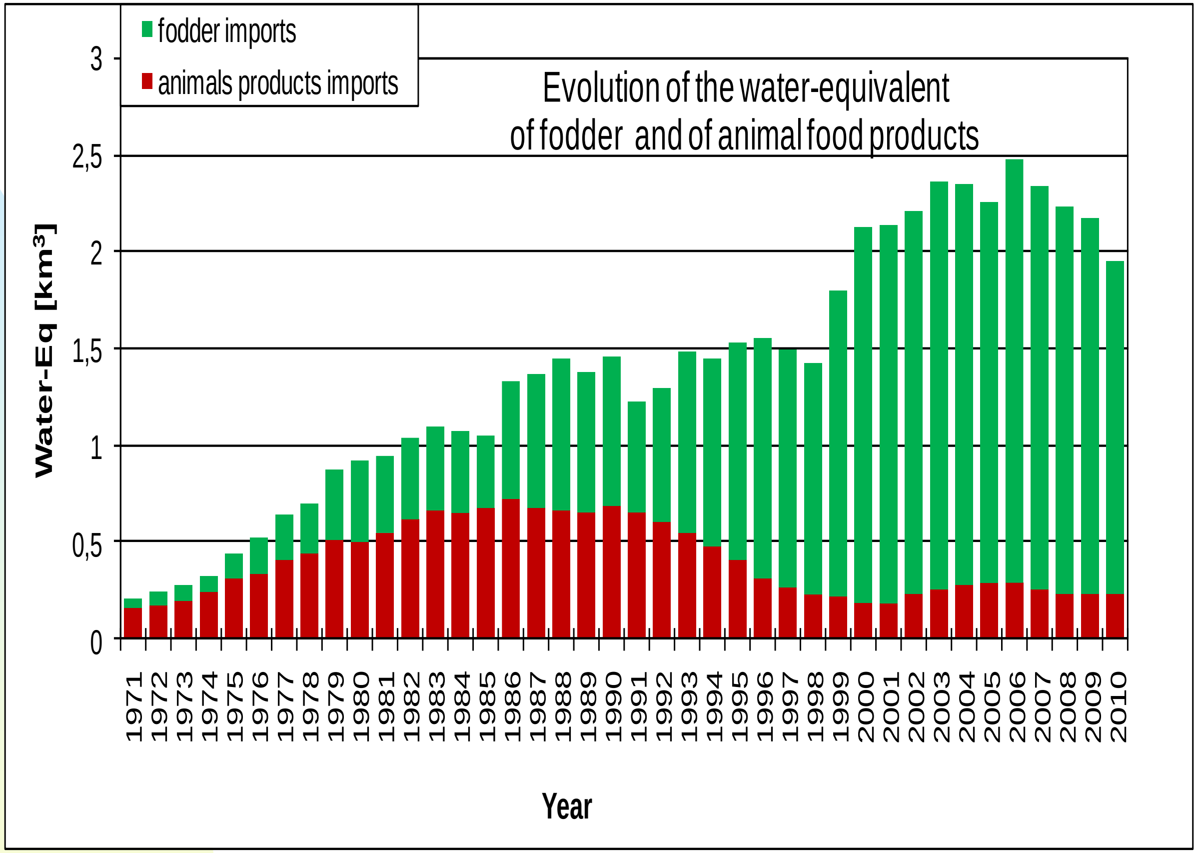
Imports in water-equivalent of animal products and of fodder



the decrease in imports of animal products that began in the late 1980s was accompanied by a significant amplification of animal feed imports in the early 1990s : so that the deficit in equivalent-water is significantly incresed

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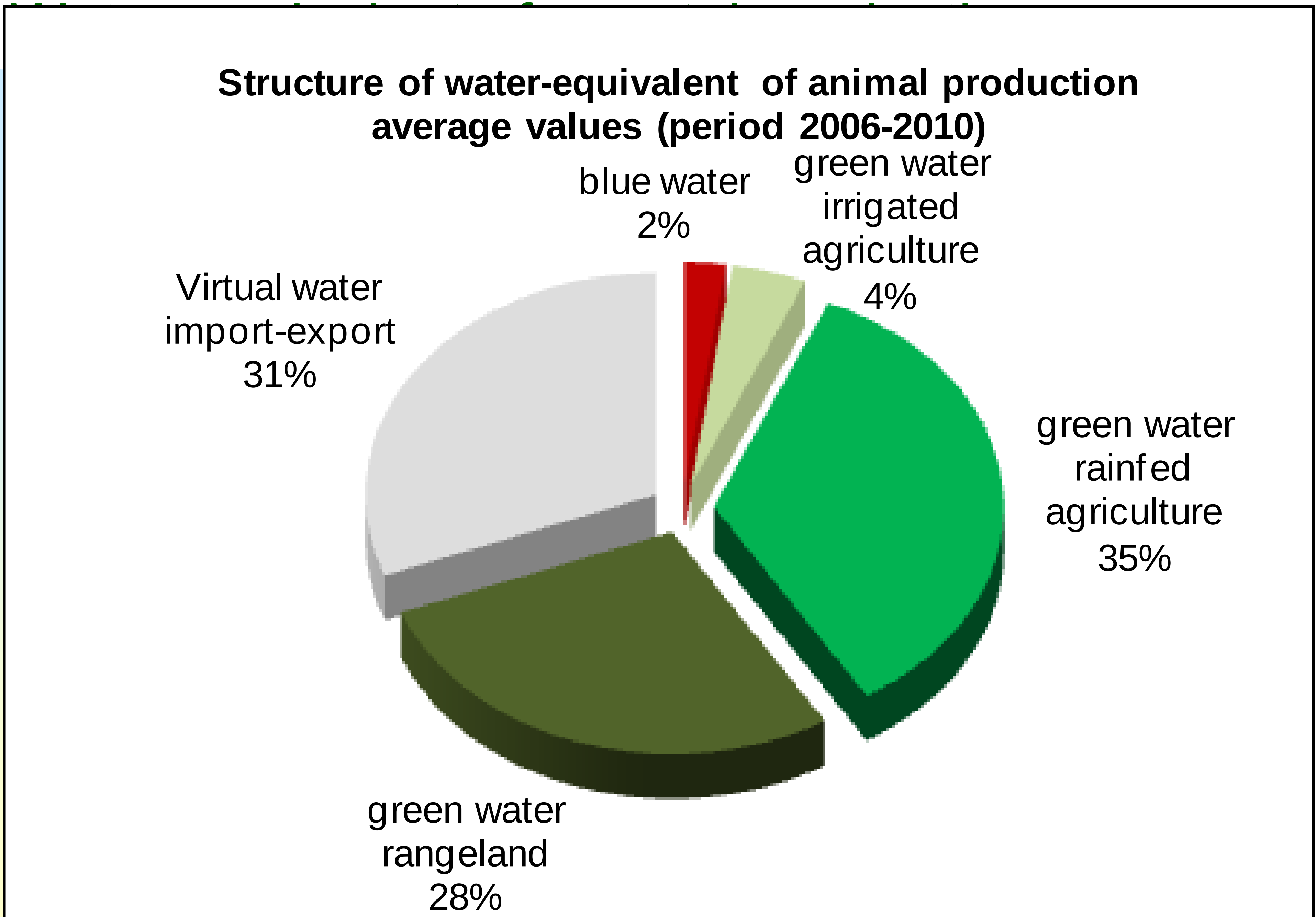
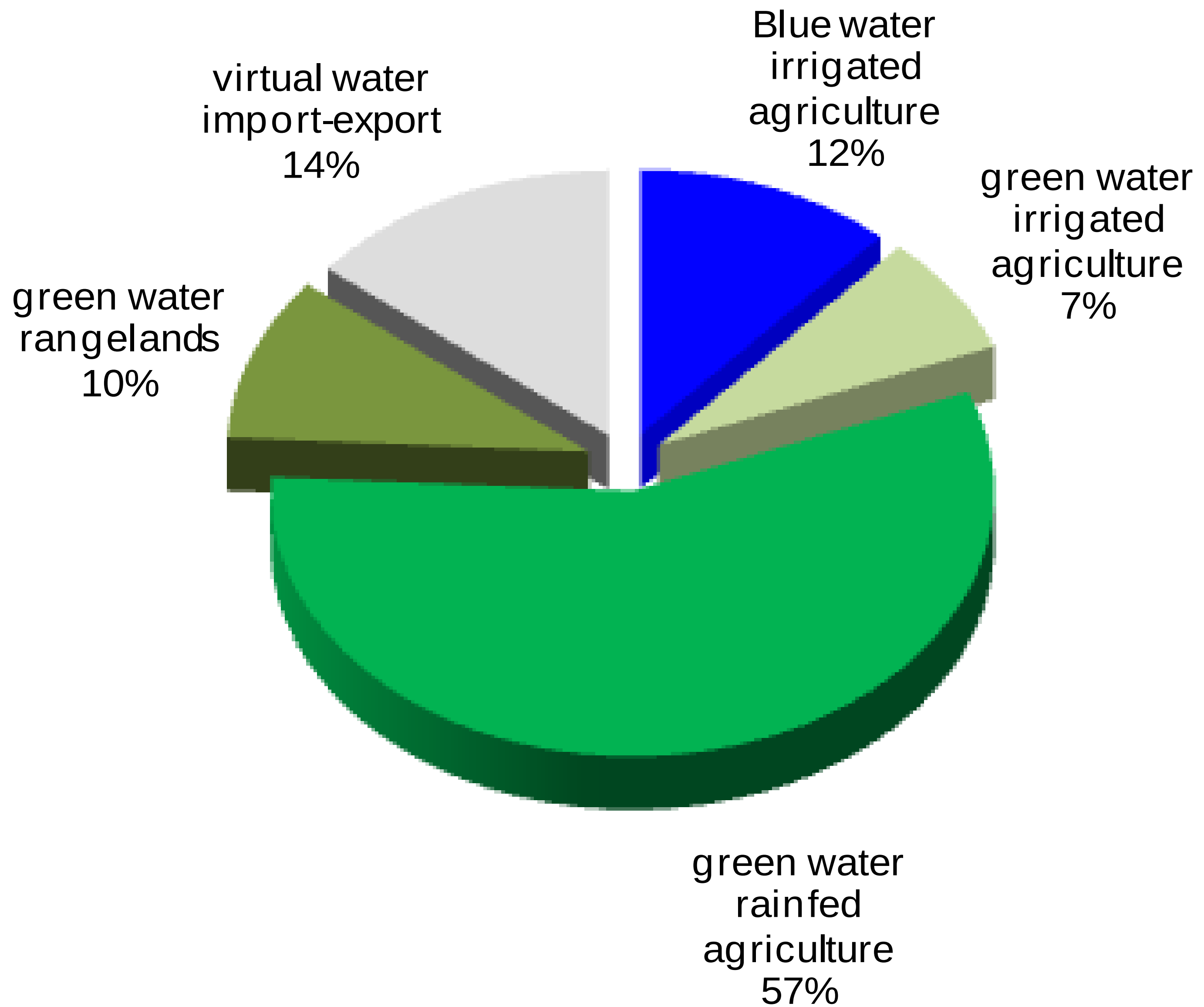
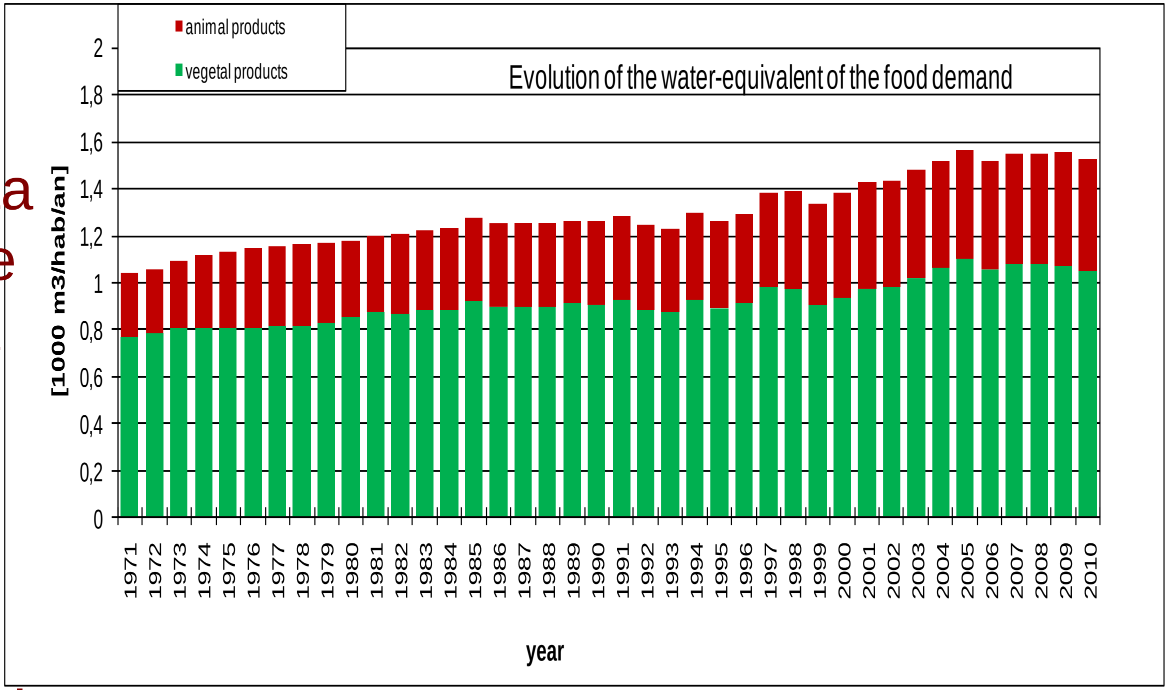

Structure of water-equivalent of animal production average values (period 2006-2010)
blue water 2%
green water irrigated agriculture 4%
Virtual water import-export 31%
green water rainfed agriculture 35%
green water rangeland 28%

Structure of water-equivalent of food productions



Evolution of the specific food demand (water-equivalent)

- Water requirements for food have increased from about 1000 m3/year/capita in the early 1970s to more than 1500 m3/year/capita in the last 2000s
- Diet has changed : the consumption of animal products increased more rapidly than that of vegetal products



Taking into account the relatively low level of the actual animal products consumption, we may expect in the coming years more change of the diet accompanied with an increase of the water requirement for food needs increasing the equivalent-water imports

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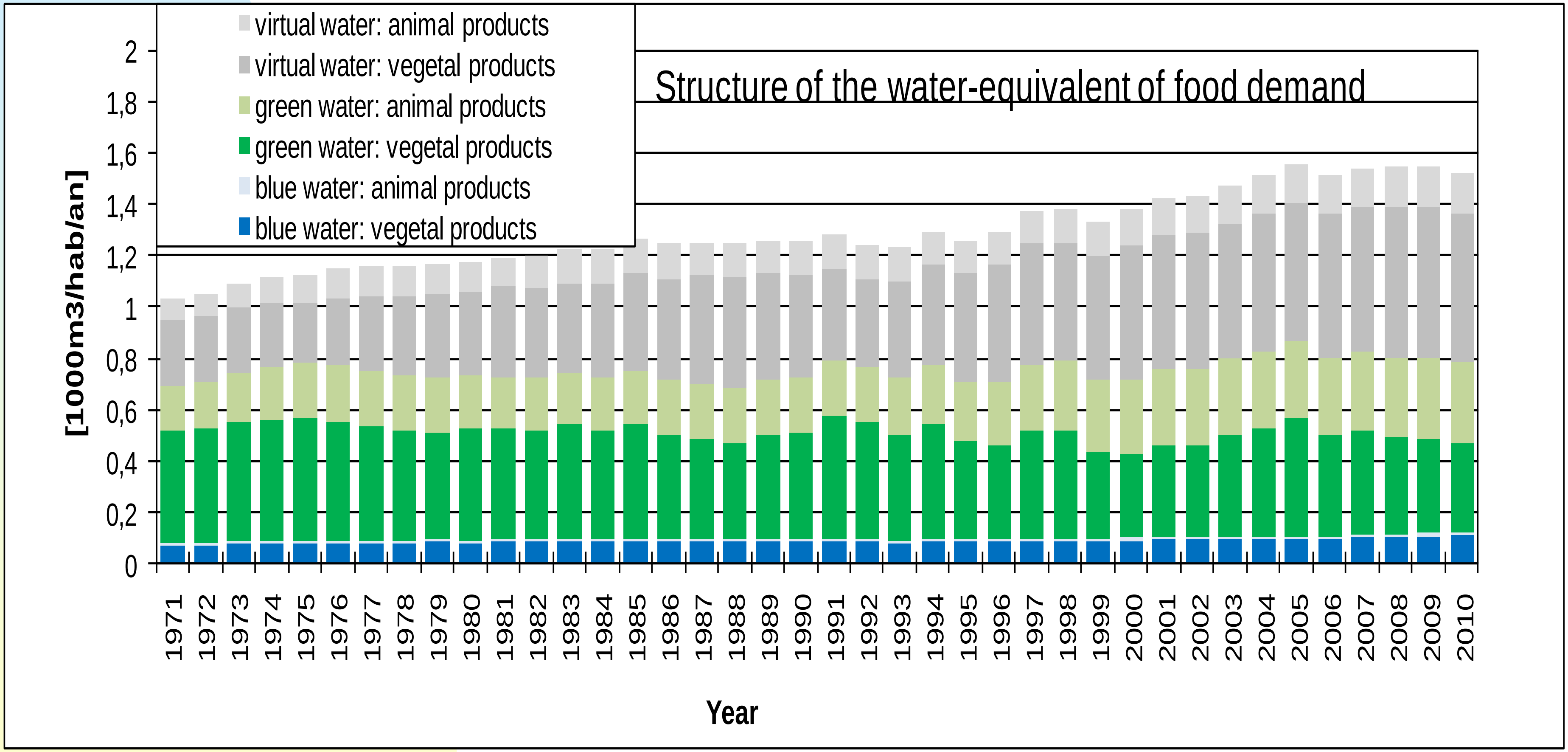
Structure of the specific food demand (water-equivalent)



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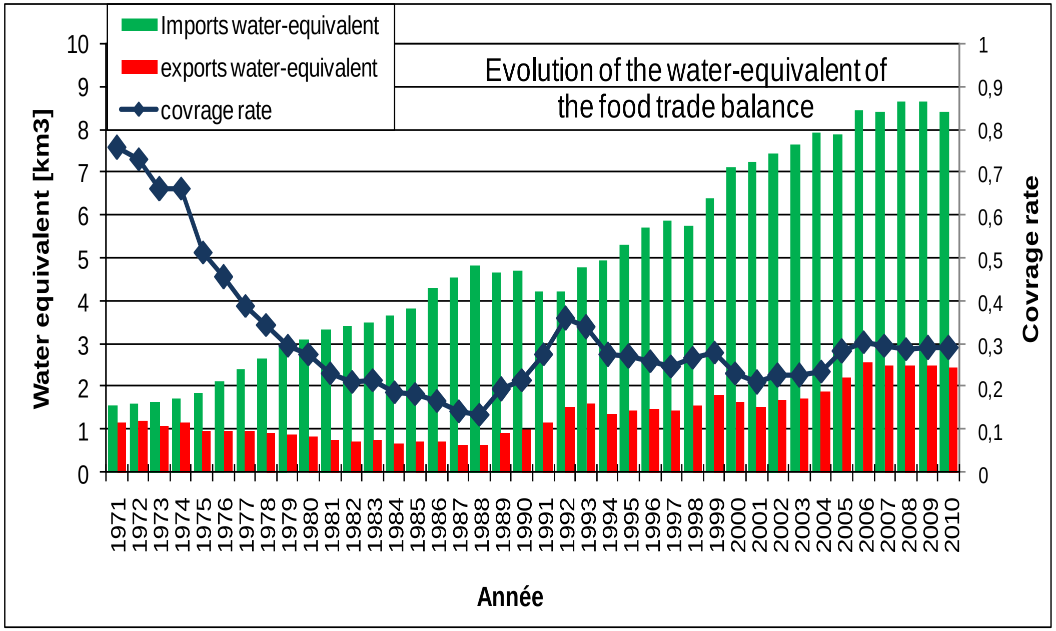
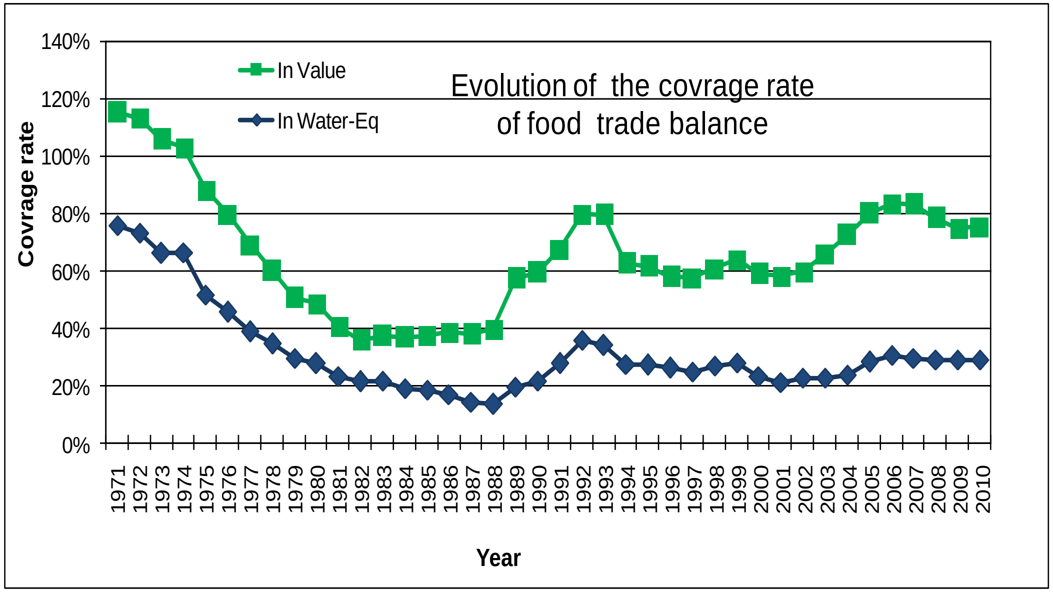
Evolution of the food trade balance (water-equivalent)

- The coverage rate of food imports gradually deteriorated in connection with the increase in imports of agro-alimentary products
- The water-equivalent of the food trade balance is very favourable to Tunisia: the coverage rate of the food trade balance, which reached in value around 80% in the late 2010s, represents less than 30% in water-equivalent





Average Global Water Balance

Blue Water	**3,3**
Irrigation	2,1
Urban [Cities, tourism]	0,4
Industry	0,1
Environment [conservation of humid areas]	0,1
Water Bank [Storage in dams for droughts]	0,6
Green Water	**12,1**
Rainfed agriculture	6,6
Forests and Rangelands	5,5
Net Virtual Water	**6,3**
Deficit of food balance[Imported Virtual Water]	6,3
Total Water Demand	**22,5**
Food Water Demand	15,8
Direct Water demand (Collectivities, Industry, Tourism)	0,5
Water Bank [Storage in dams for droughts]	0,6
Environmental Water demand	5,6

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Improvement of the global water balance

- **Enlargement** of the **Water Resource** notion to all kind of the contributions to the **Global Water Balance** : «**Blue Water**», «**Green Water**», «**Virtual Water**», «**Non-conventional Water**».
- **Enlargement** of the **Demand Management** notion to all kind of water uses including the water requirements for food demand
- **Optimization** of all water uses including the water involved in the rainfed agriculture production «**Green Water**», and in the international trade exchange «**Virtual Water**»,

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Conclusions

- The development of irrigation sector is limited by the availability of water: irrigated agriculture is increasing its efficiency and promoting better use of water.
- The potential of “Green Water” is large. Its development requires the implementation of a coherent strategy to promote the sector of rainfed agriculture, vulnerable to rainfall variability:

1. Development of technical tools for better assessment of the Green Water resource in order to make it more visible: identification, mapping, etc.
2. Establishment of regulatory and legislative measures: encourage soil water resources developments, promote foodstuffs storage, implementation of drought insurance mechanisms…
3. Analysis of the market conditions and prices for specific products (Edible oils, cereals ...)

But first, explain and convince …

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