



The VIIIth International Congress on Cactus Pear and Cochineal

Morocco, Agadir, 18-24 - October 2010

Session : animal feeding

Cactus, a Forage for Camel

Presented by:

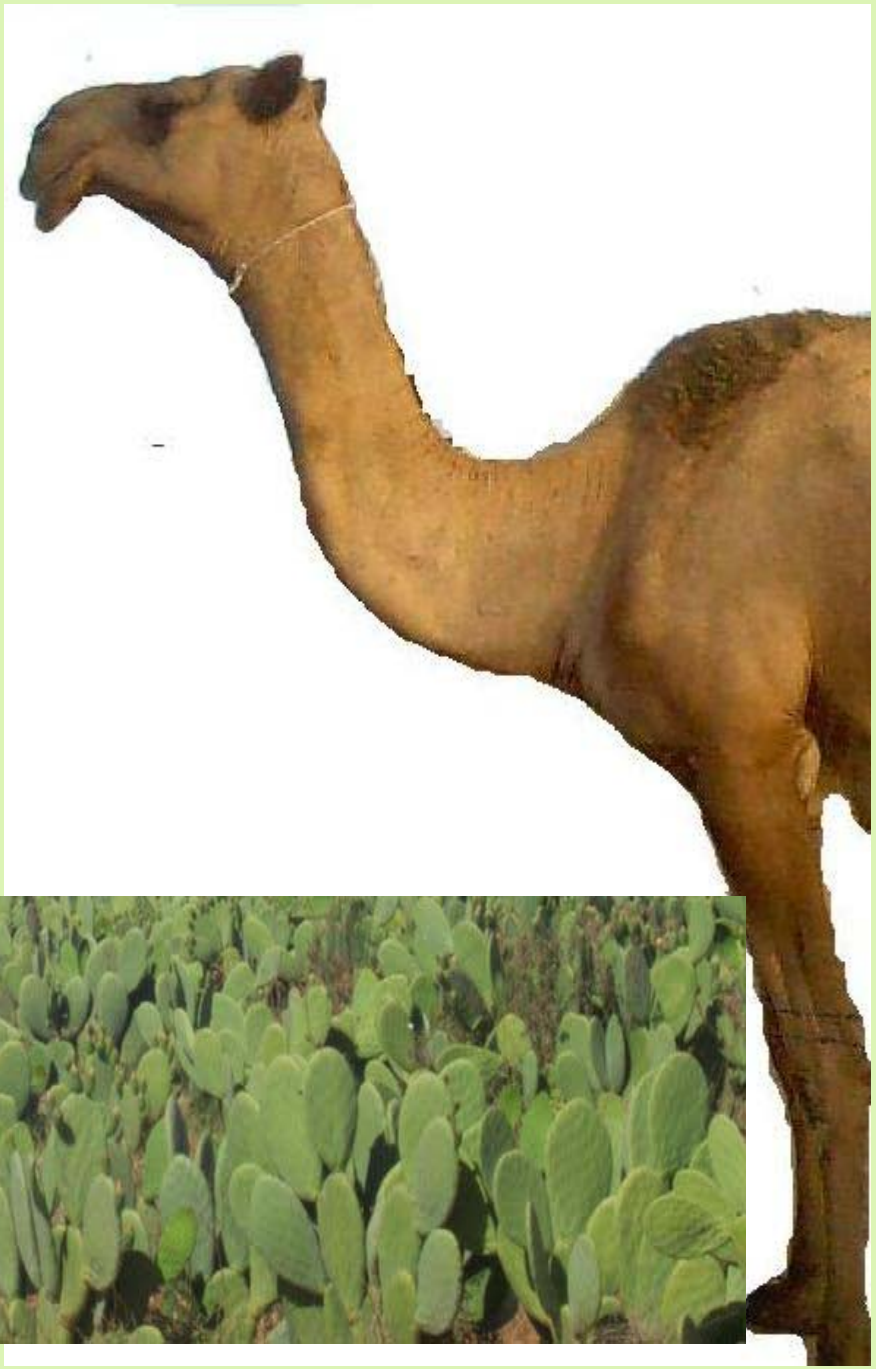
**Ing. Abderrahman AIT HAMOU
ANADEC / Cactus Premium sarl
Kelaâ Sraghna – Morocco**

aithamou@hotmail.com

+212 (0)64 17 346 71



*a bit of
a love
story*



Plan of the presentation

1. Introduction: Arid and semi arid areas

2. Prickly pear cactus

3. Dromedary

4. Case of Rehmana region

5. Conclusions (recommandations)

What is the problem ?



environmental problems of the world



Immigration and social tensions



Famine

decline of public health



ozone hole



carbon dioxide

Bad quality of life



Food scarcity



Soil degradation



Water



Climatic Change



Melting of glaciers



deforestation



Desertification



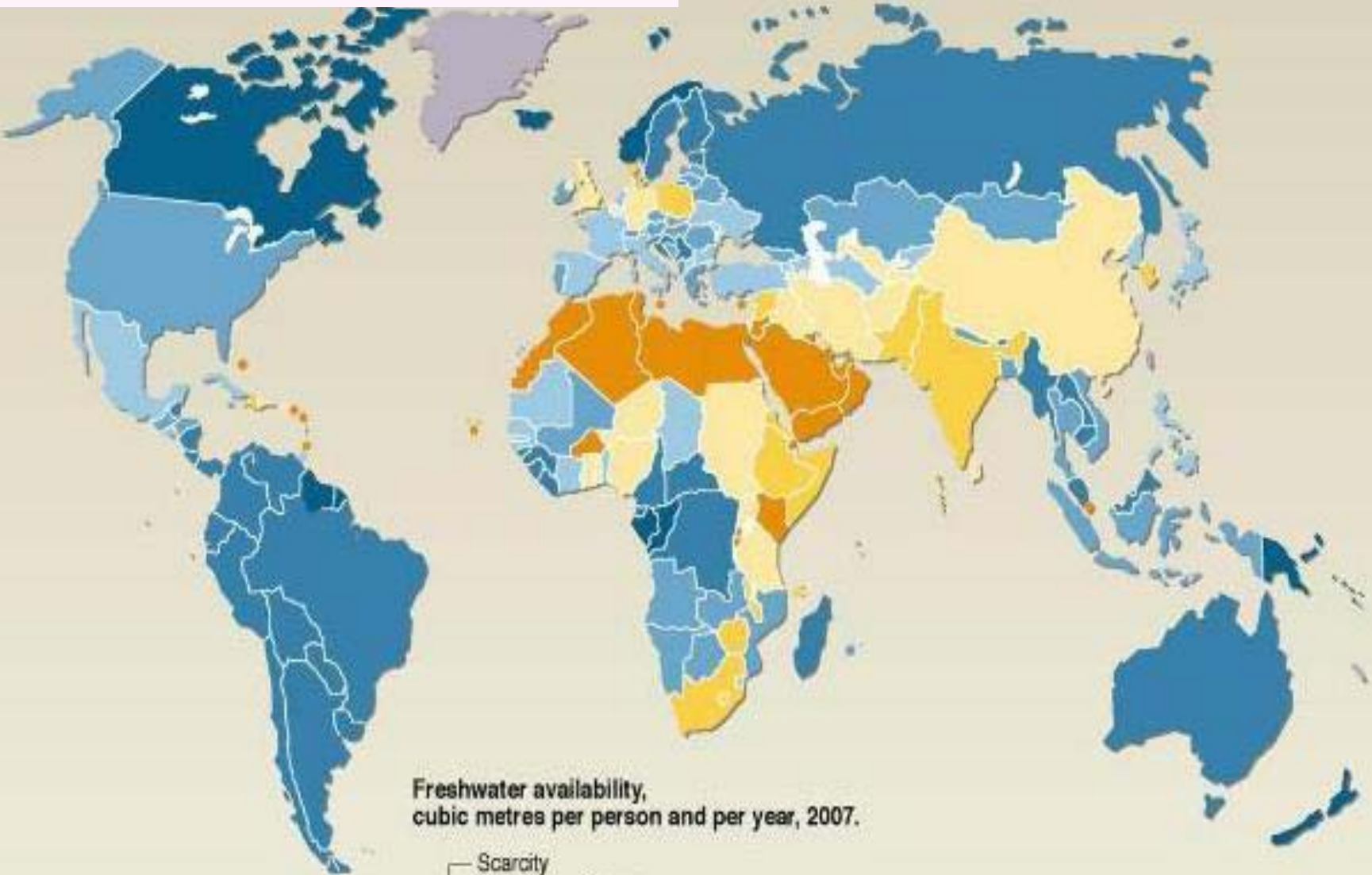
loss of biodiversity



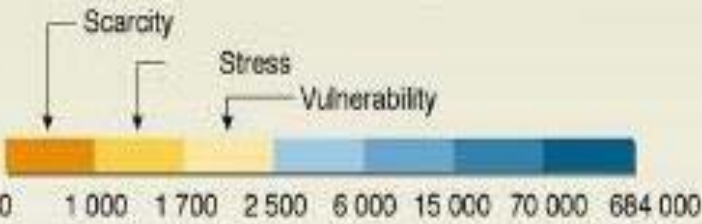
fire and floods



Freshwater availability



Freshwater availability, cubic metres per person and per year, 2007.

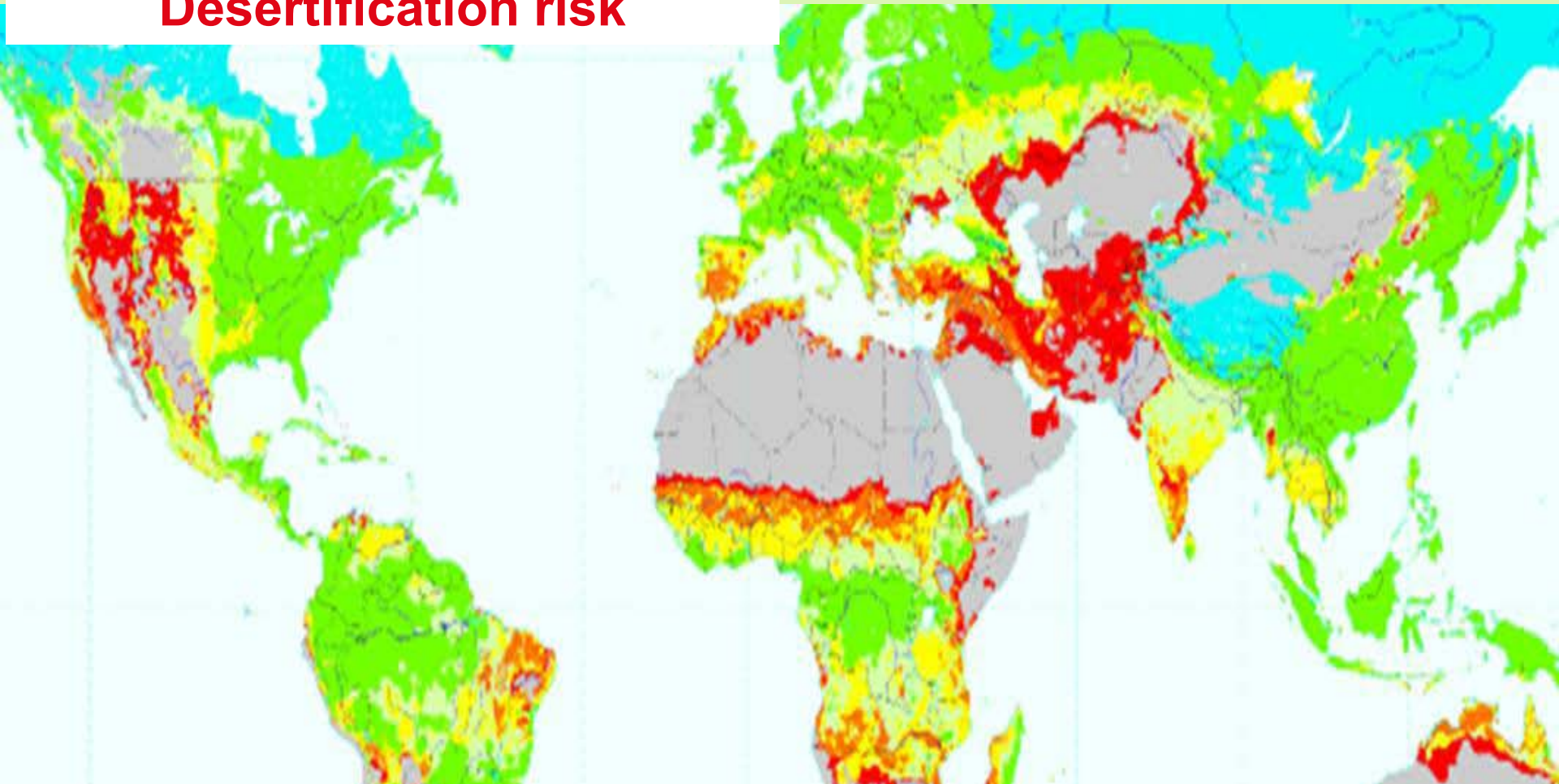


Data non available

Source: FAO, Nations unies, World Resources Institute (WRI).

PHILIPPE REYACEMICZ
FEBRUARY 2008

Desertification risk




Criteria	Arid	Semi arid	Desert
Rainfall (mm/year)	- 300	300 - 600	- 250
Evapotranspiration	++	+++	++++
Growing period (days)	- 7 5	75-119	-

Arid, semi arid and desert characteristics

Criteria	Arid	Semi arid	Desert
Rainfall (mm/year)	- 300	300 - 600	- 250
Evapotranspiration	++	+++	++++
Growing period (days)	- 75	75-119	-

**What is the
solution?**



A close-up photograph of a human hand holding a small, realistic-looking globe of the Earth. The hand is positioned in the foreground, with fingers gently cradling the globe. The globe shows blue oceans, white clouds, and green landmasses. The background is solid black, making the hand and globe stand out. A dark blue rectangular box with a white border is superimposed over the center of the image, containing white text.

**A sustainable
plant-livestock based
production system ?**

Witch crop ? for witch livestock ?



Low rainfall



High temperature



Strong sunlight



Warm wind



Evapotranspiration



Poor soil

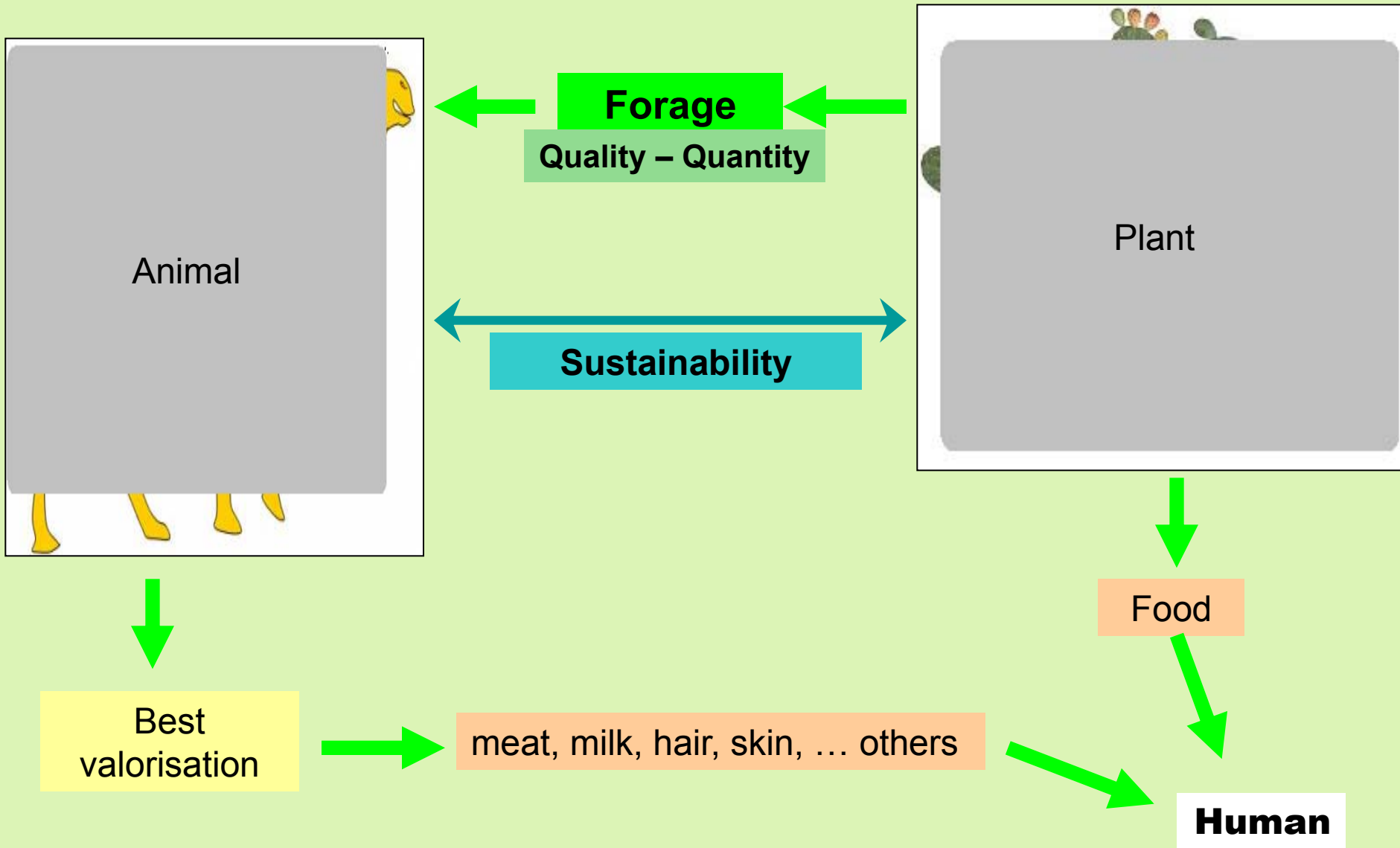


Water scarcity



Low-quality forage

Native candidates ?



Plantae – Angiosperms - Cactaceae – Opuntieae - *Opuntia*

Opuntia ficus indica

Prickly pear
Indian Fig
Barbary fig
Cactus



Dew



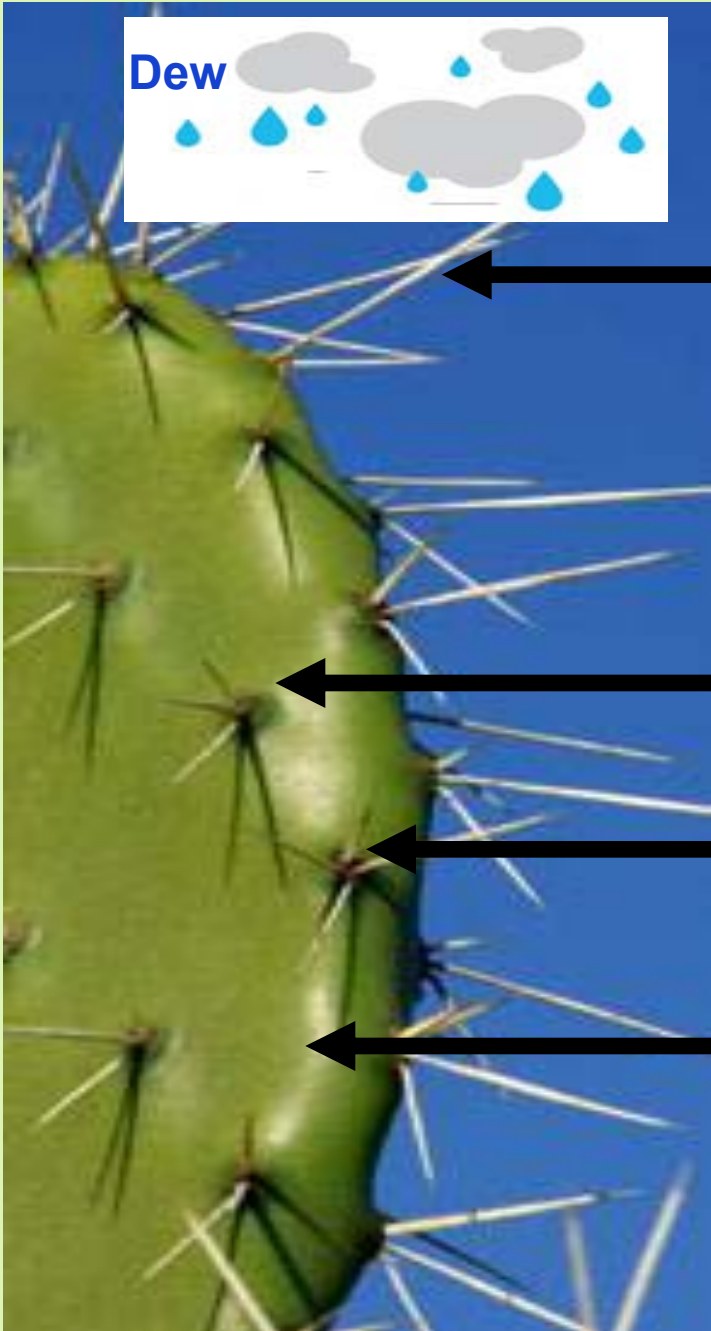
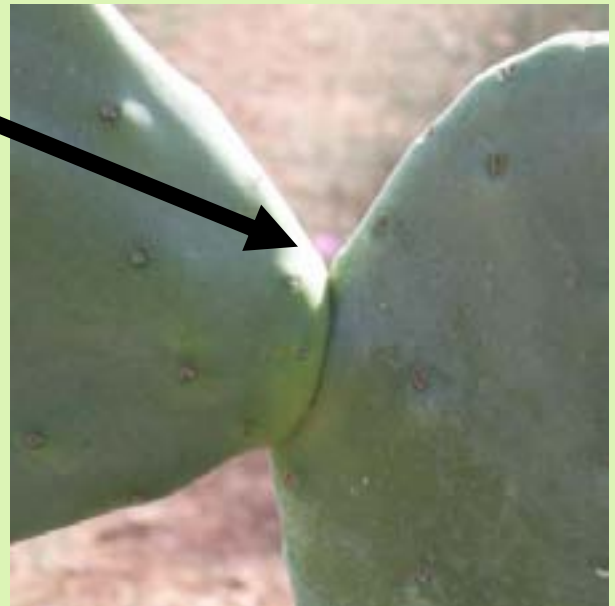
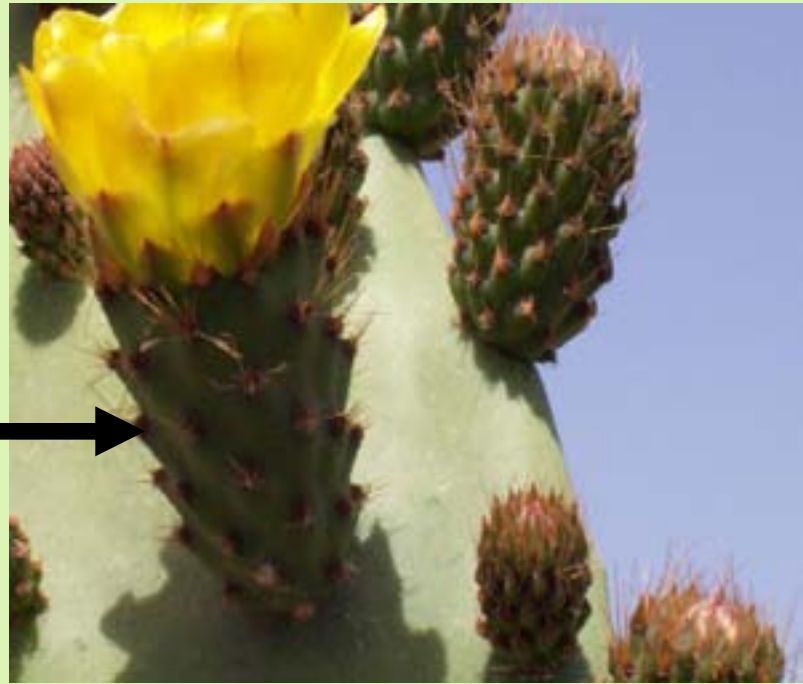
Spines

Glochids

Leaf

Areole

Wax coat





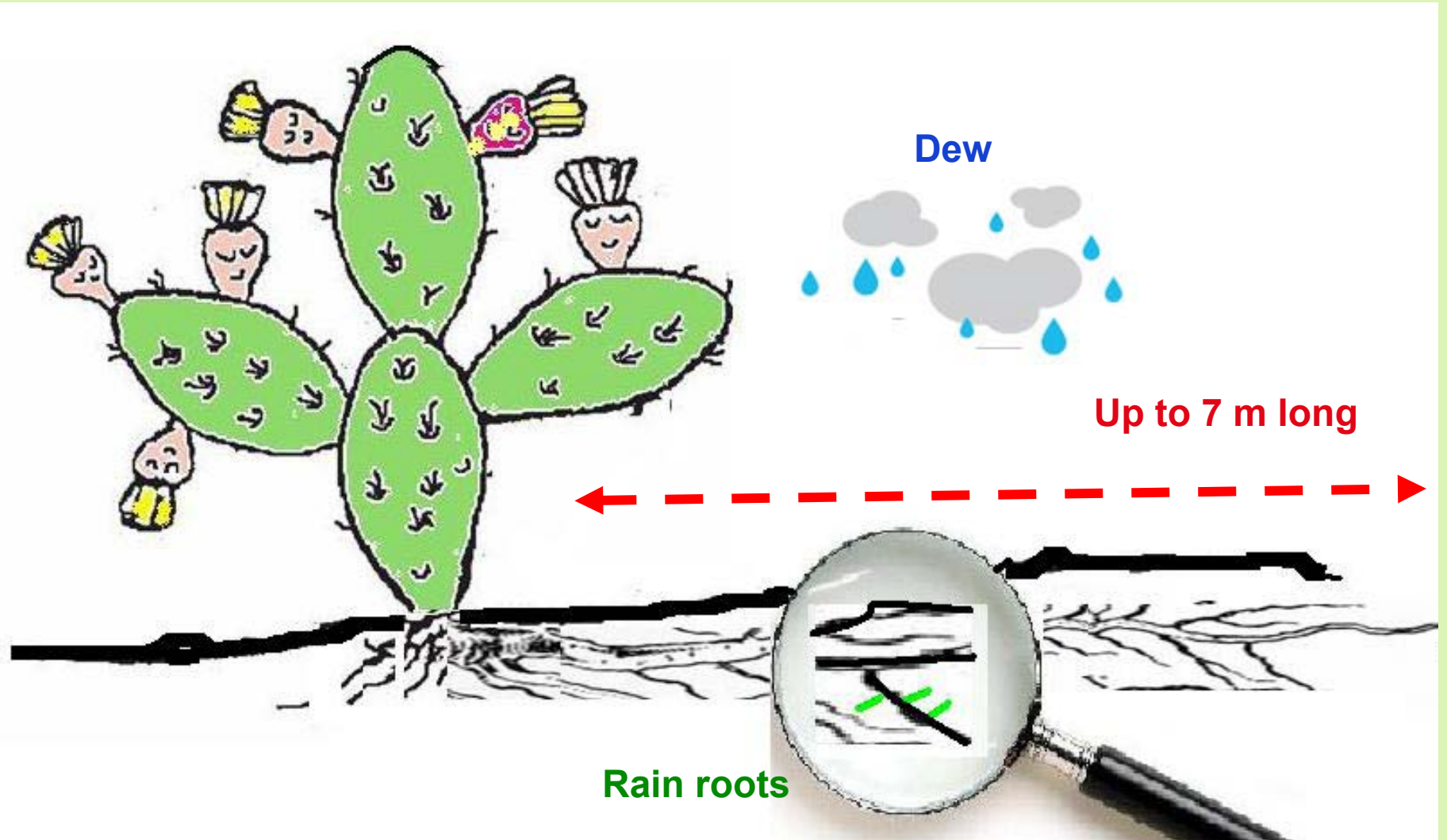
Destroyed



Saved



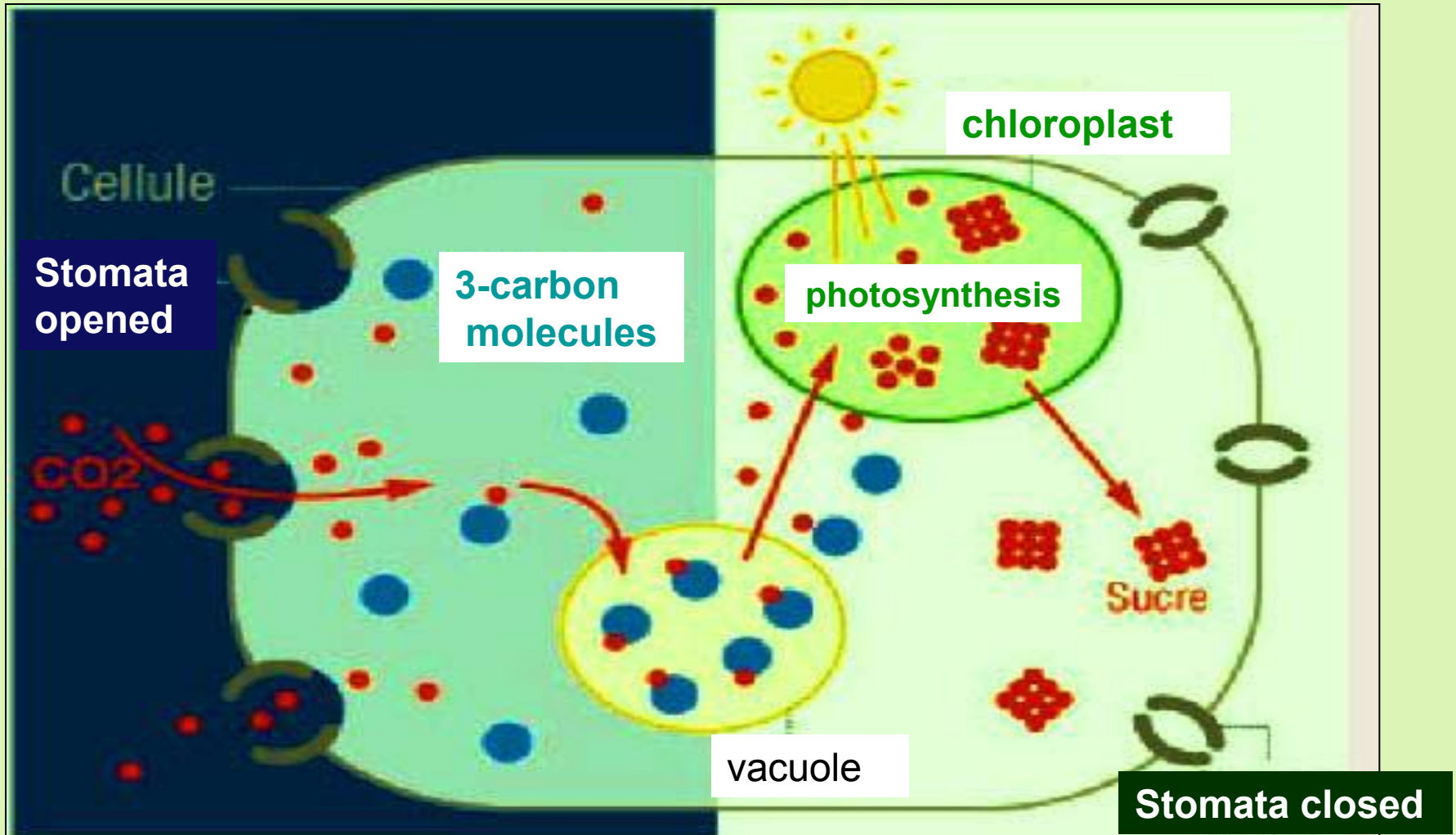
Root system



CAM: Crassulacean Acid Metabolism

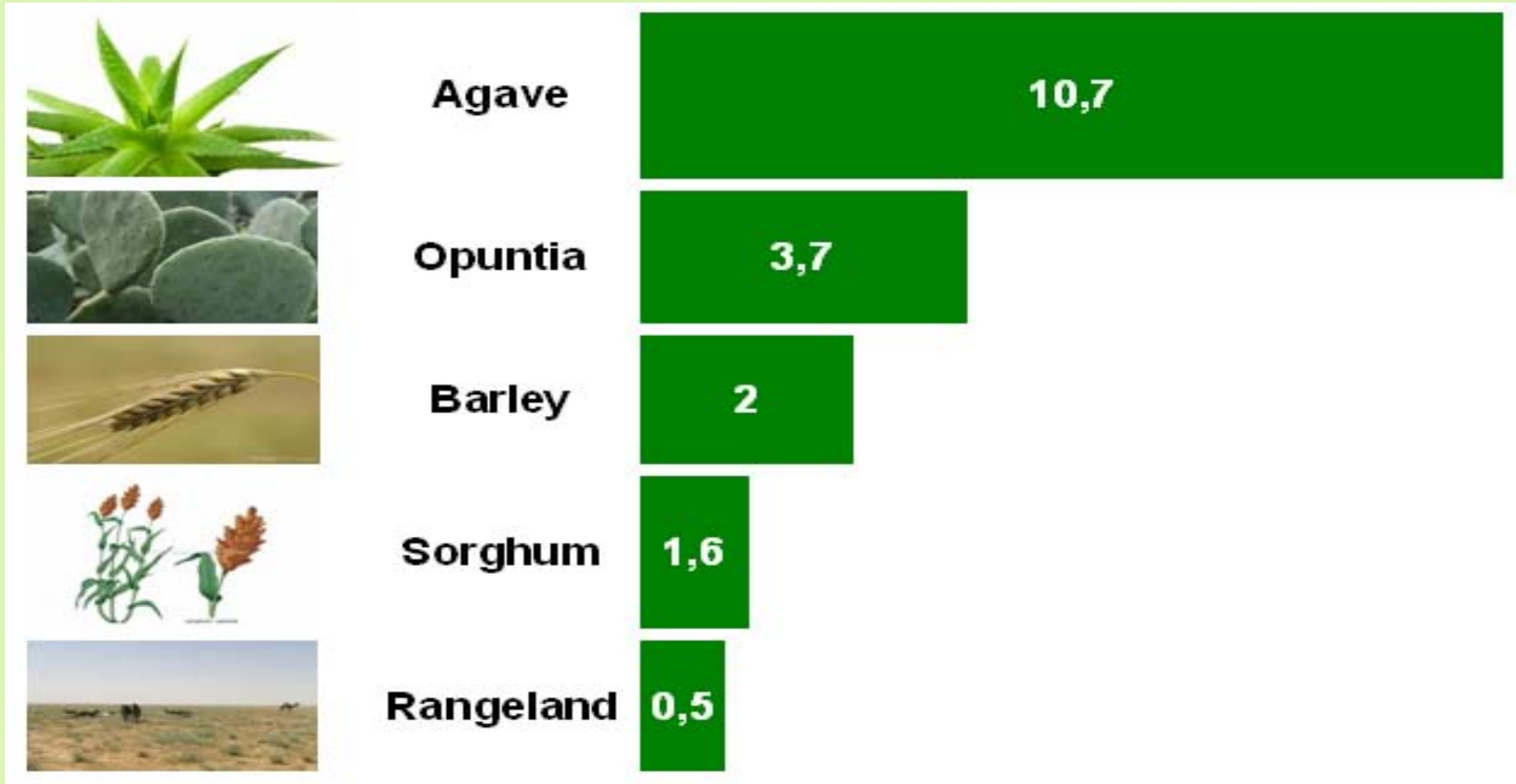
night

day



Water use efficiency (WUE)

mg DM/g H₂O



Cactus as forage



Chemical Composition of Different Prickly Pear Cactus Species (%).

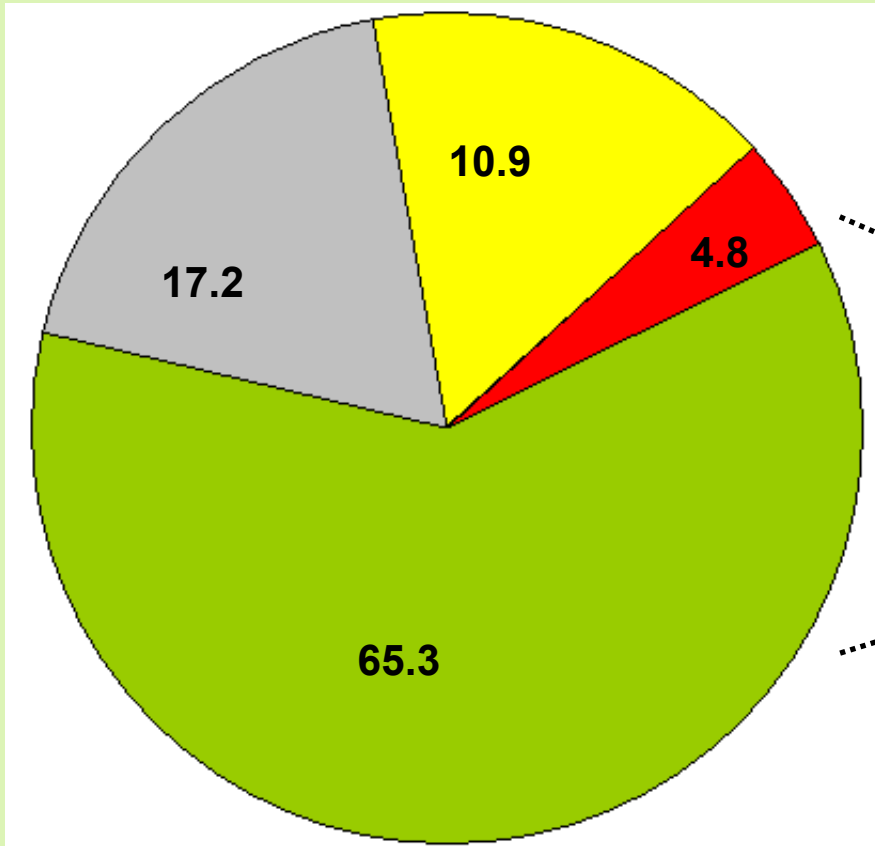
Specie	Dry Matter	Organic Matter	Crude Protein	Ether Extract	Crude Fiber	Ash	Nitrogen-Free Extract
<i>O. engelmannii</i>	15.1	68.4	3.3	1.2	3.6	31.6	60.3
<i>O. ficus-indica</i>	11.3	89.9	3.8	1.4	7.6	13.1	77.1
<i>O. lindheimeri</i>	11.6	74.5	4.1	1.0	3.0	25.5	66.3
<i>O. rastrera</i>	14.4	59.9	2.8	0.8	16.2	40.1	40.2
<i>O. robusta</i>	10.4	81.4	4.4	1.7	17.6	18.6	57.6
<i>Opuntia spp.</i>	17.0	-----	5.1	1.9	13.2	20.5	59.2

max

min

J. Fuentes-Rodriguez, 1997

Mean chemical composition of cactus cladodes

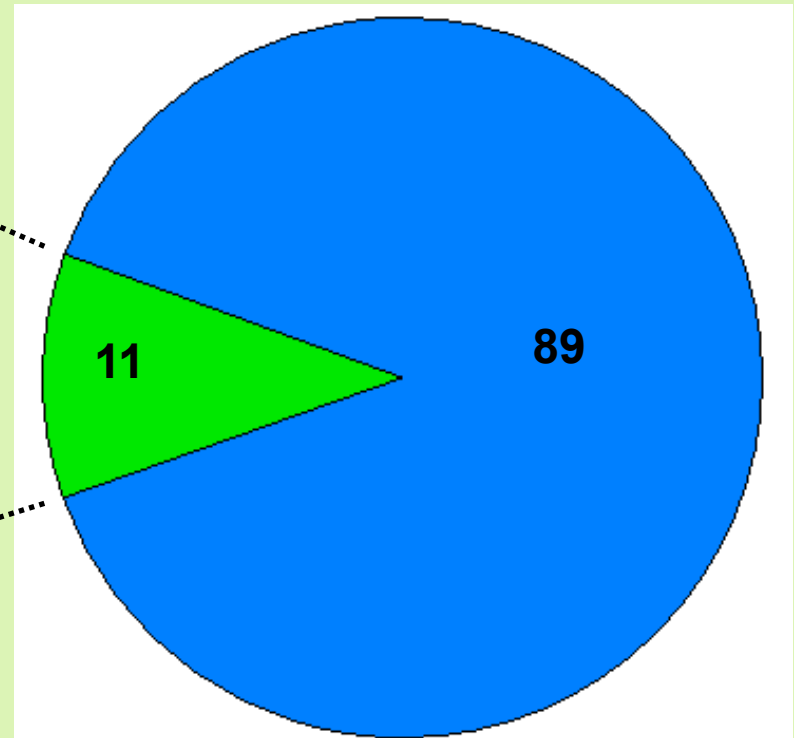


Energy: 2.6 Mcal/kg



DM

H₂O



% DM	
Phosphorus:	0.08-0.18
Calcium:	4.2
Potassium:	2.3
Magnesium:	1.4

Prickly pear is it really a forage for ruminants?



Human consumption : Fresh, dried

Artisan process

Non ruminants, poultry, ostrich

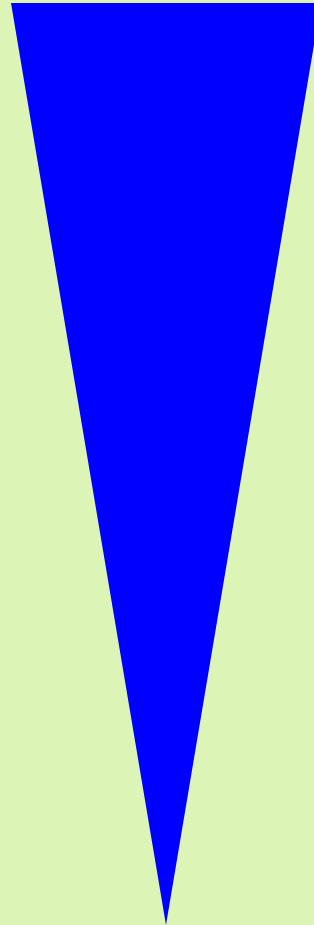
Wild animals: birds (biodiversity)

Camel

True ruminants

Environment vs economy

Interest



Mammalia Artiodactyla  Boveida

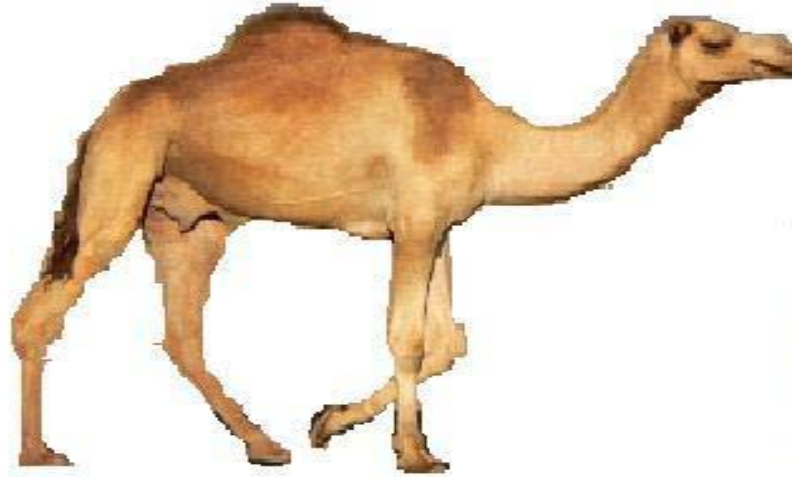
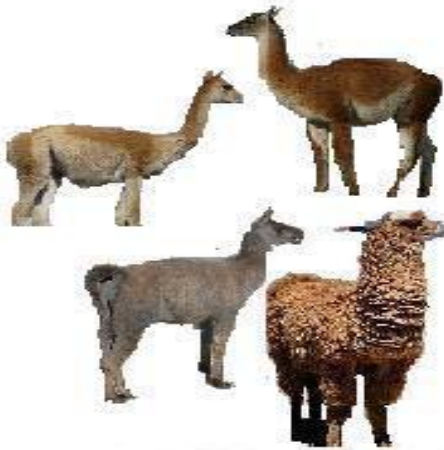


Camelidae

Vicugna

lama

Camelus



V : 0.1

L: 3.0

G: 0.5

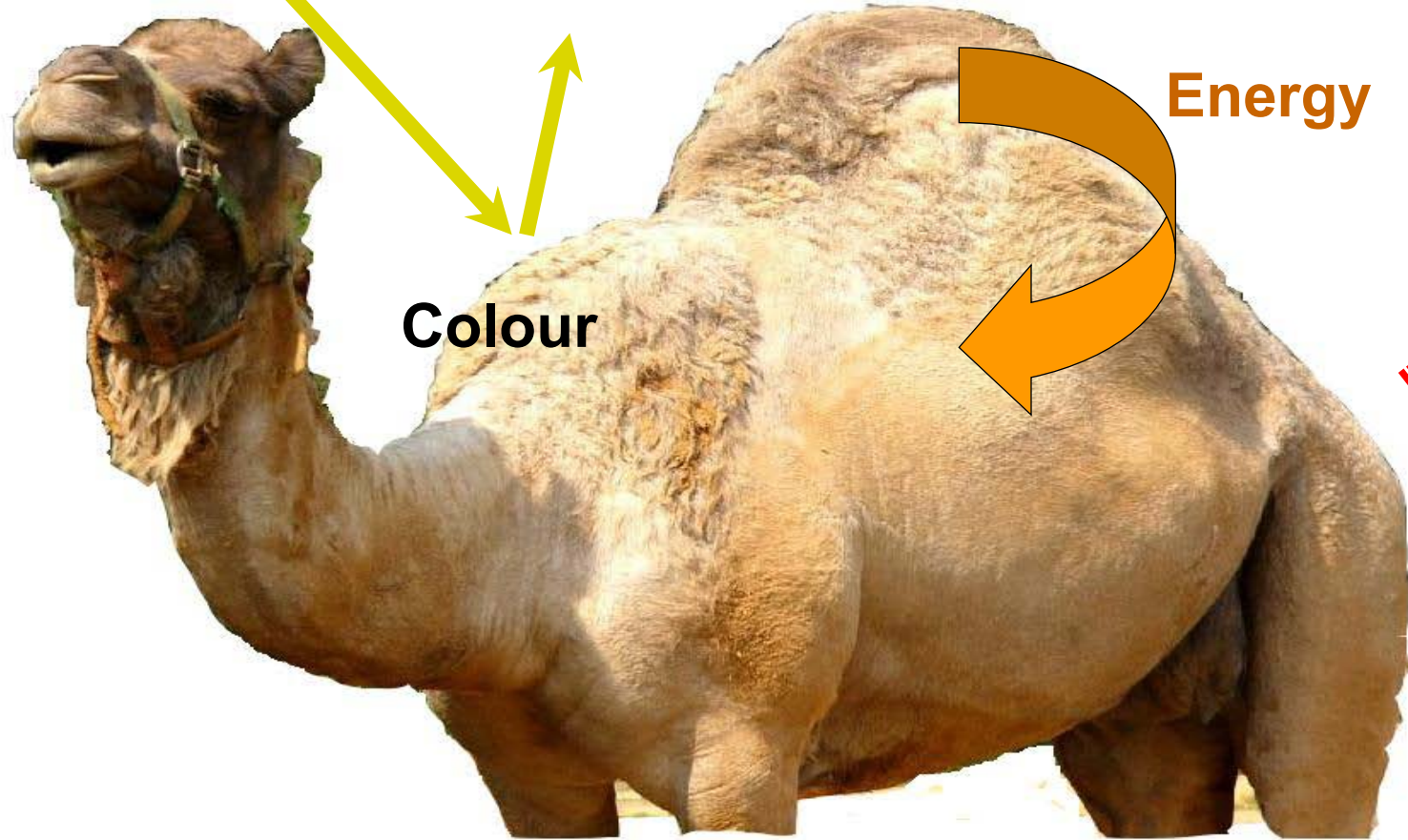
A: 3.5

Dromedary : 20

BC: 1.5



The hump, colour, hair



Hump : **fat** not water

Colour

Energy

Heat

Eyelashes + Eyebrows



Camel



Cow

Nostrils



Neck



Giraffe

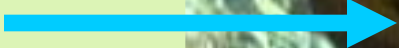


Camel



Bull

Sternum



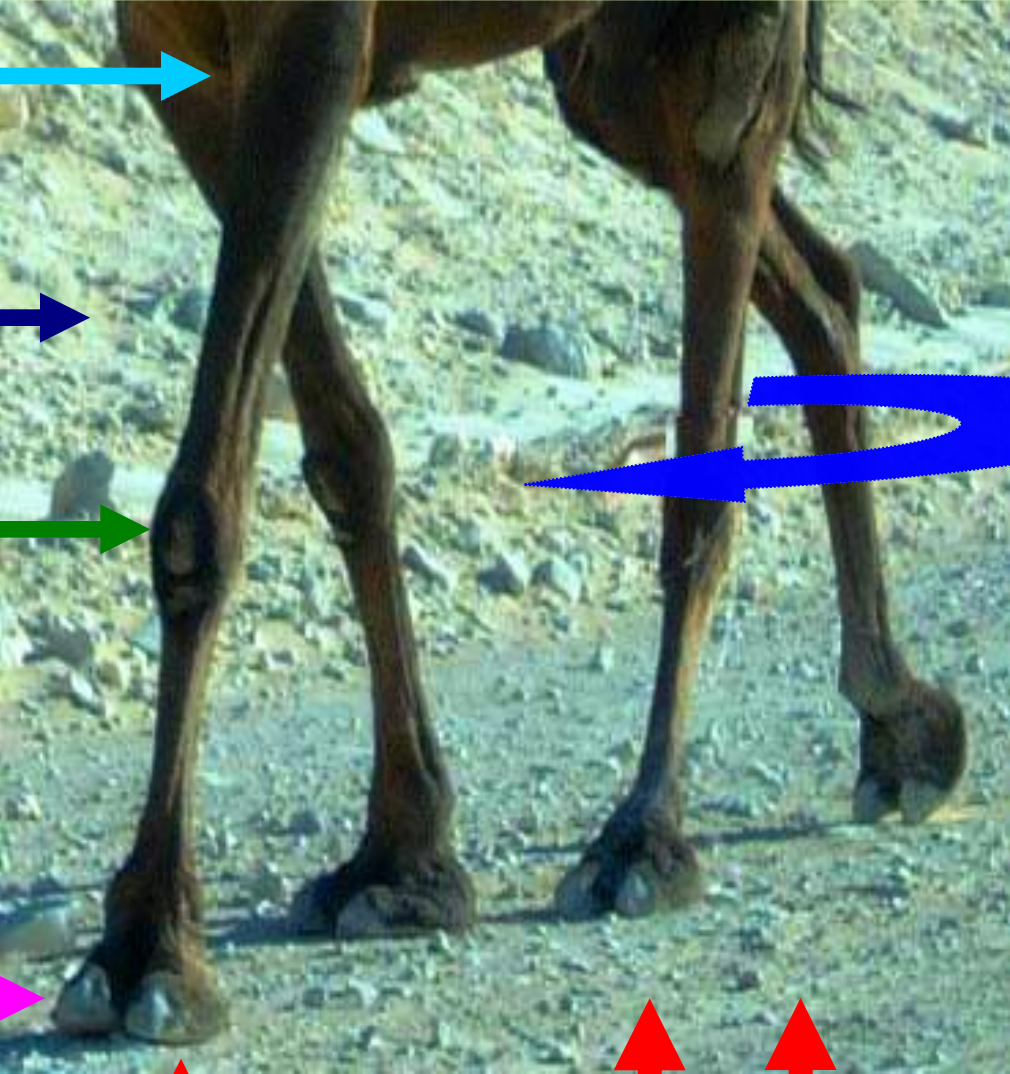
Legs



Knees



Hooves

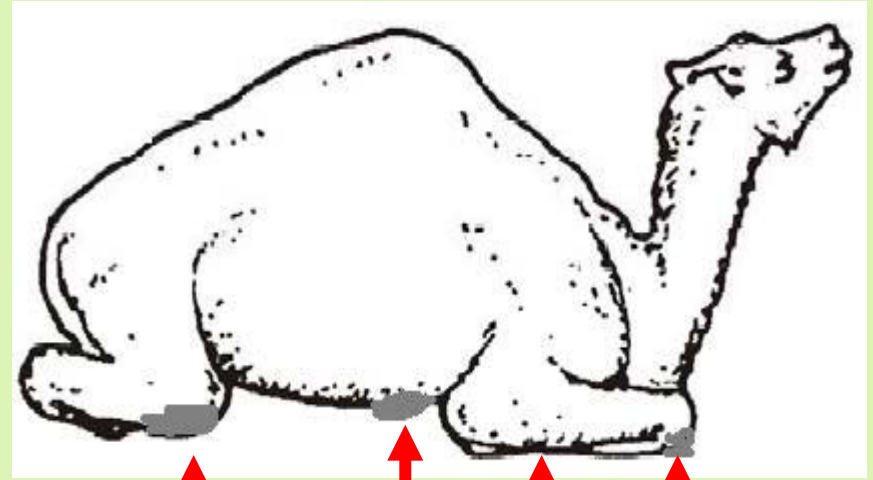
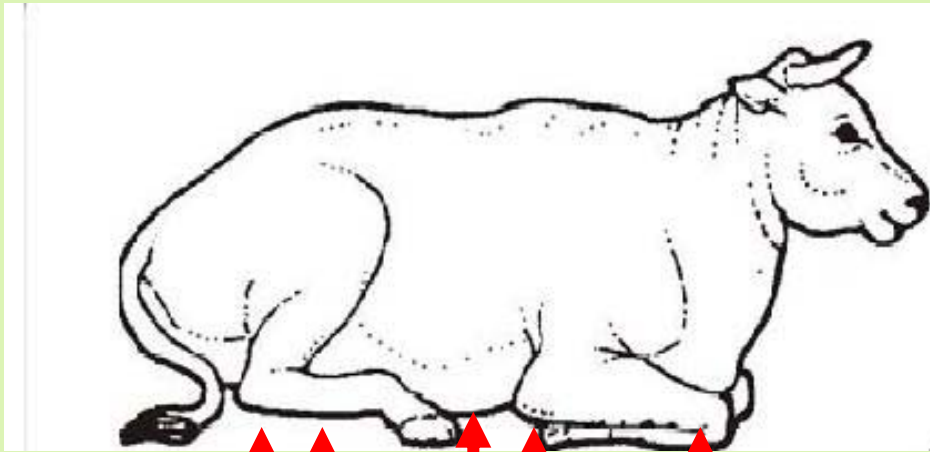


Fresh air



Heat

Lying and couching postures



Heat

Source: Wilson (1998)

Hard palate



Water use efficiency (WUE)

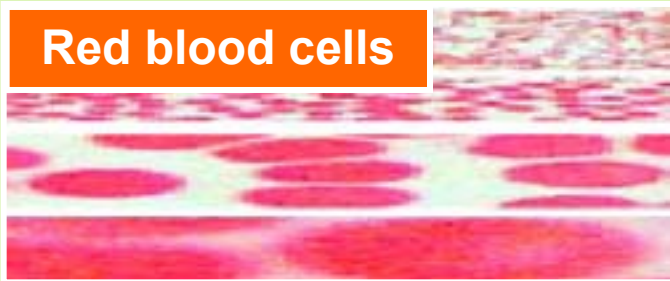
Water storage



+ 100 litres



Red blood cells



Thirst



- 40%



Human

- 12% : death.

- 5% : serious medical problems.

Water use efficiency (WUE)

Water preservation

1. Little urine

Small urinary bladder



3 - 4 litres per day



1 litre per day

2. Dry faeces : 43 %



Fuel

3. Nostrils

4. Nasal passages



- The camel does not pant
- hygroscopic characteristics

Water use efficiency (WUE)

Body temperature in °C

warm-blooded or homeothermic



38.5



38.2



39.0

38.0

39.5

34.5 - 41.0



2 advantages

avoid sweating

limit the temperature exchange by reducing gradient

Camel brain: nasal heat exchange mechanism.

Anatomy of the digestive tract

Prehensile and split upper lip

selectively grasping plant parts (leaves)

Salivary glands

Similar to those of other ruminating animals

Oesophagus

- long and of large capacity (1-2 m)
- Secreting glands : to **moisturize** the food.

Liver, pancreas and spleen

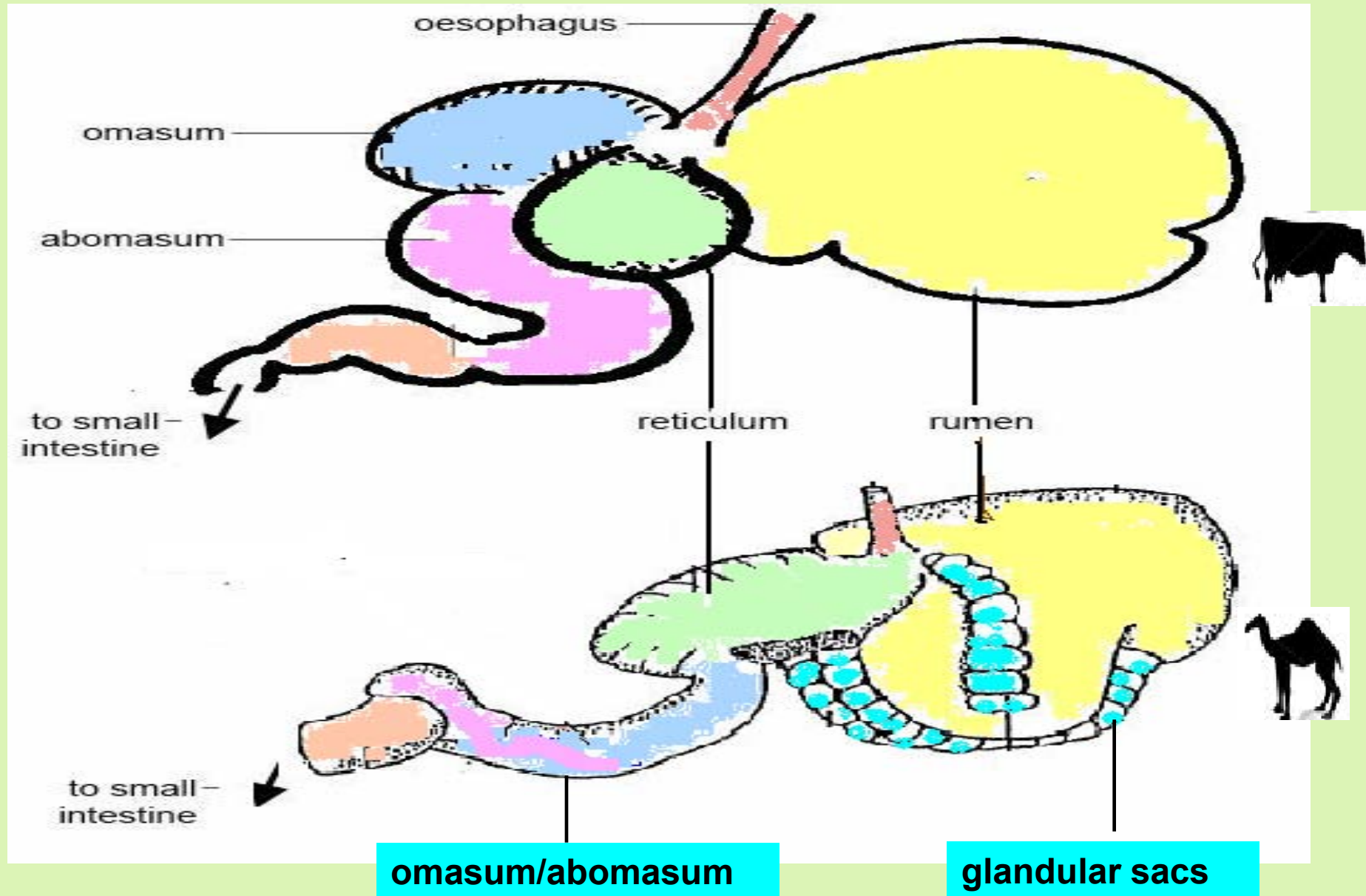
no gall bladder

Kidney

Renal pelvis : Great ability of to concentrate urine: **recycle urea**



Forestomachs of camel and cow



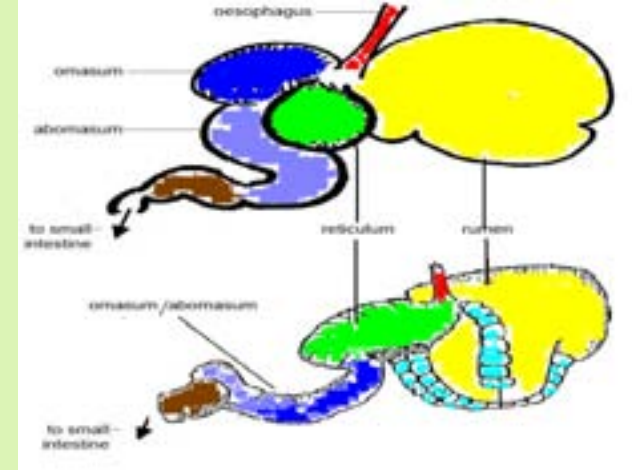
Digestion and metabolism

Great digestive capacity of cellulosis

Specific and differentiated motility

Very active microflora , better microbial digestion

Significant food mixing in pre-stomachs



Nitrogen metabolism

Camelids : can recycle up to 90 – 96 % of blood ureic nitrogen

True ruminants : 10 to 30 % only.

Dehydration

and / or

Lower proteins in diet

Dietary protein: **13.6 to 6.1 %**



urea recycling **47 to 86 %**

Ingestion and Feeding behaviour

AITHAMOU, 1993

Ingestion of Dry Matter :

2,32 – 2,33 g DM / Kg LBW
10,8 - 11,3 Kg DM / animal

Water ingestion

Wet season : -
Dry season : 75 l /animal / 2 days

Distance walked

Wet season : 15 km / day
Dry season : 13 km / day

Time spent on activities

Feeding : 438 mn
Resting : 118 mn
Rumination: 284 mn

Diet composition

Herbaceous : W : 44 % – D: 67 %

Protein content ? Moisture ?

Nutrient requirements of dromedary *camels*: *protein and energy*

Maintenance

(kg^{0.75} per day)

Energy

Requirements : **89.3** kcal ME
Recommended : **104** kcal ME

DN

Requirements: **349** mg
Recommended : **368** mg

Milk production

% of the maintenance requirement

Energy: **10**

Protein : **20**

(Mohamed F.A. Farid , 1995)

Productions

Meat

World production: 350.000 tonnes
(0,7 % of world meat production)

Milk

World production: 1,3 – 4,5 million tonnes
Individual production: 1000 - 2 700 litres/
lactation (can reach 7 -12 000 litres)



Importance

Valuable protein supplements in arid areas

Increase in world animal protein demand

Medicinal and cosmetic virtues

Camel urine: schistosomiasis : **bilharzia**
Camel milk : type 1 diabetics, autism



Sport

Camel racing

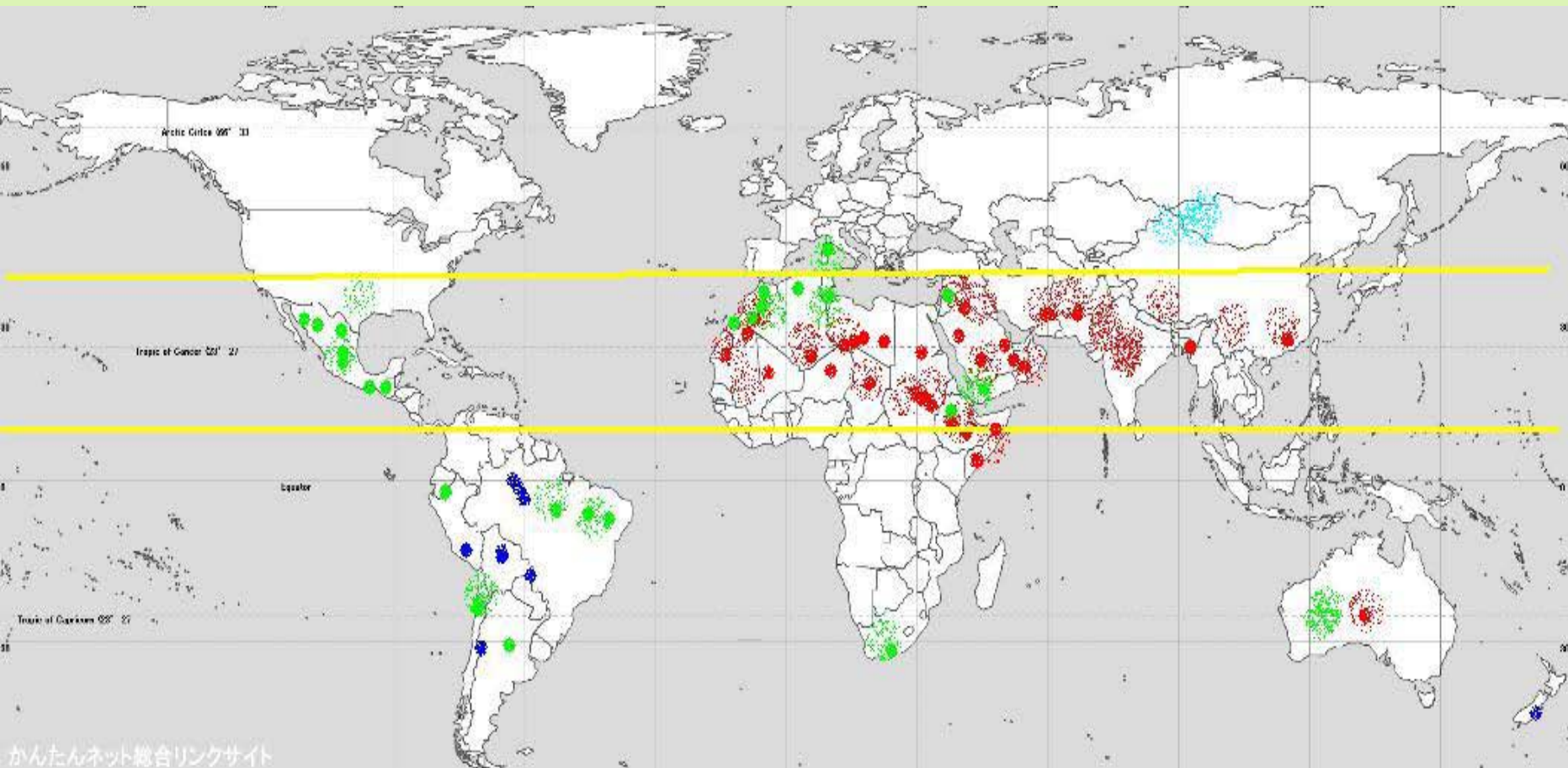


recreation



Ex : 3 she-camels sold at 6,3 million \$ US

What and how to do ?



Cactus

Dromedary

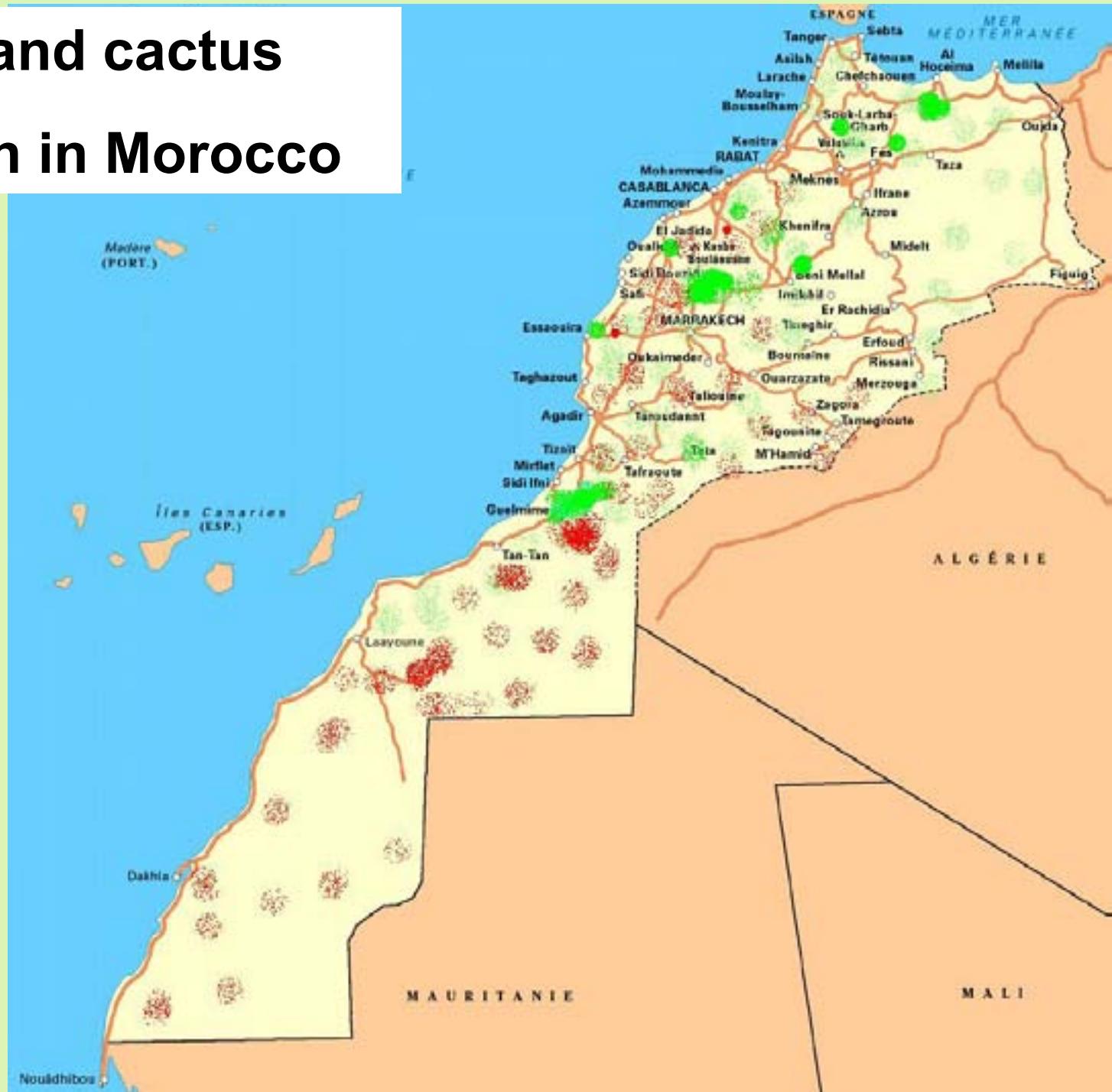
Llama

Bactrian camel

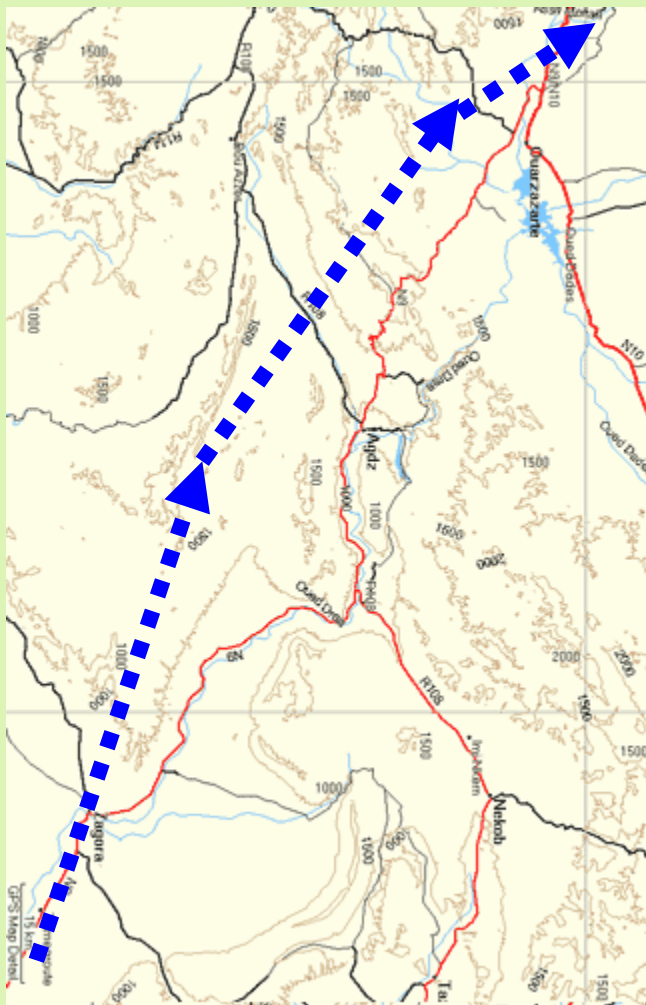
Camels and cactus distribution in Morocco

Cactus

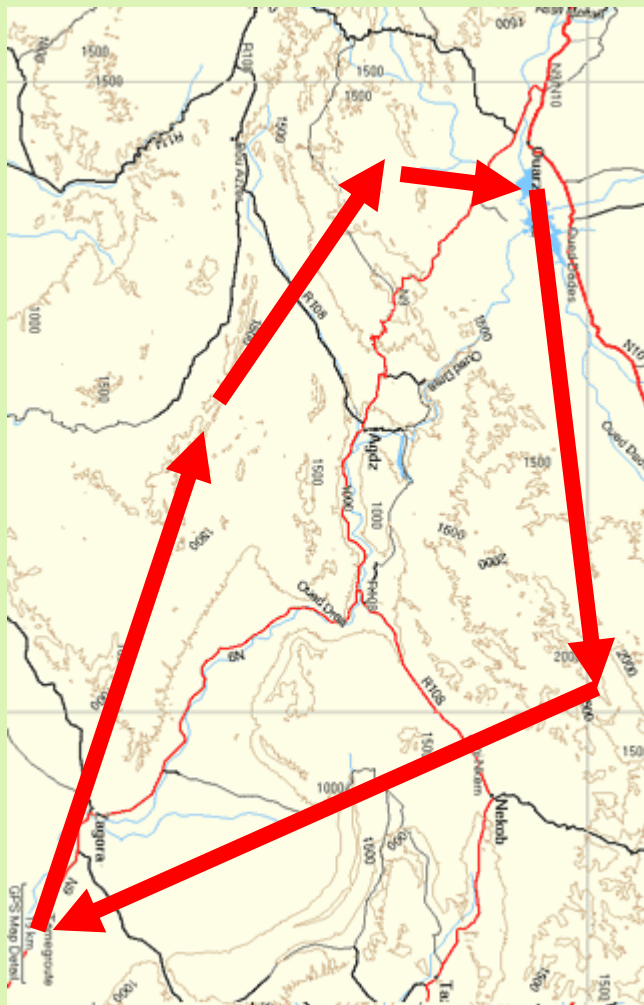
Camels



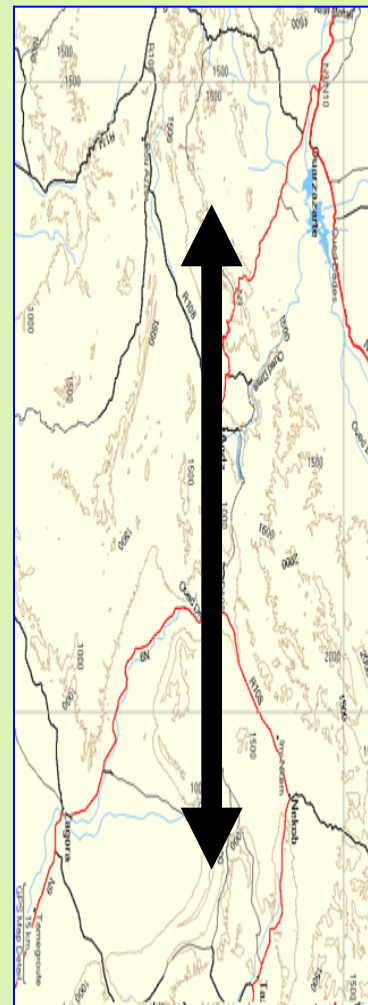
Nomadism



Semi nomadism



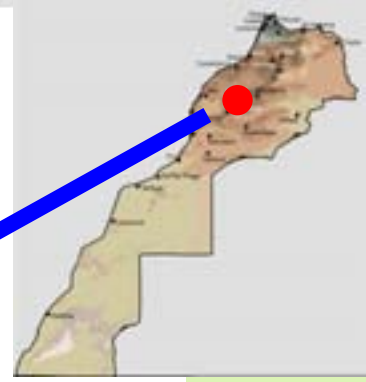
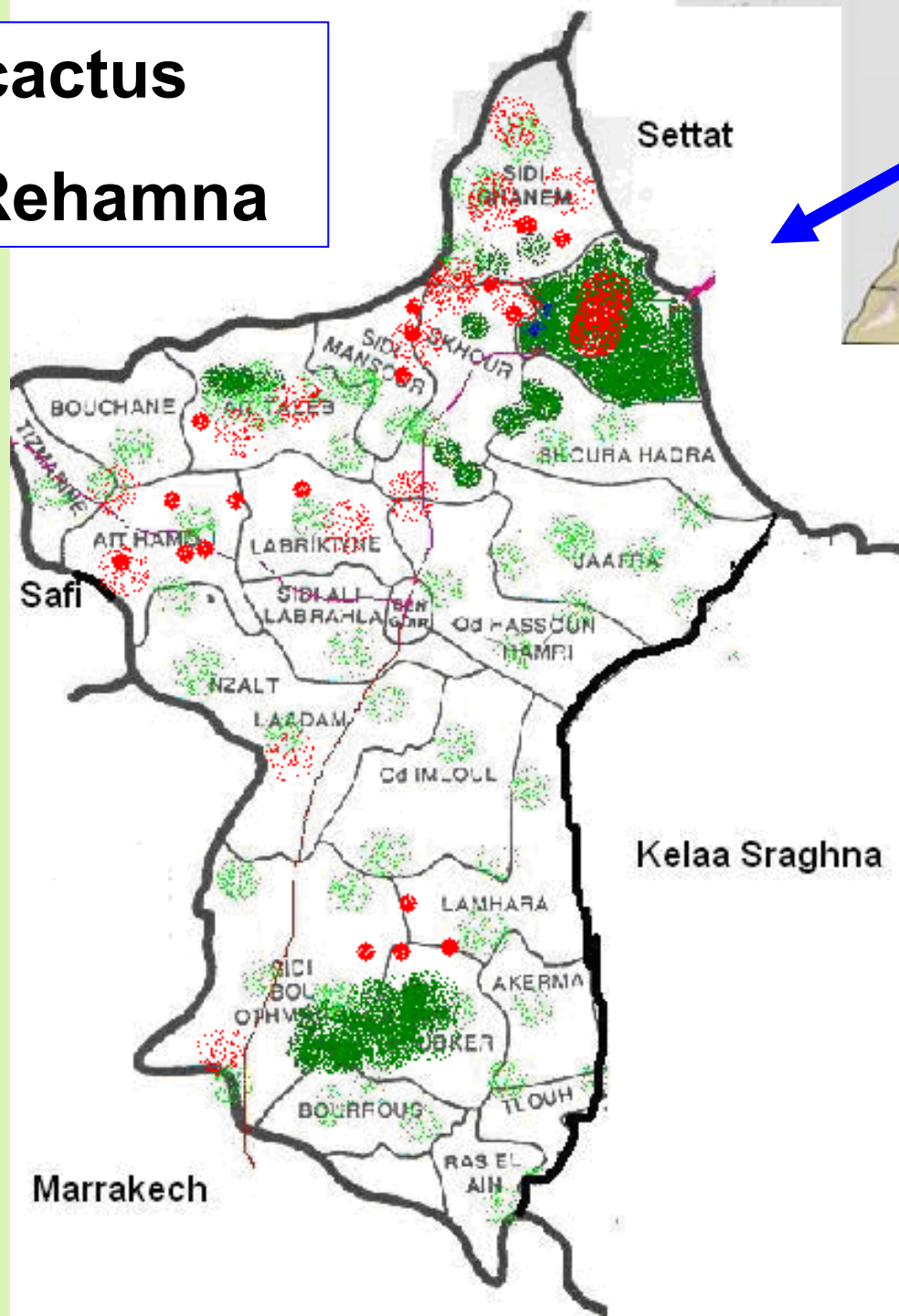
Transhumance



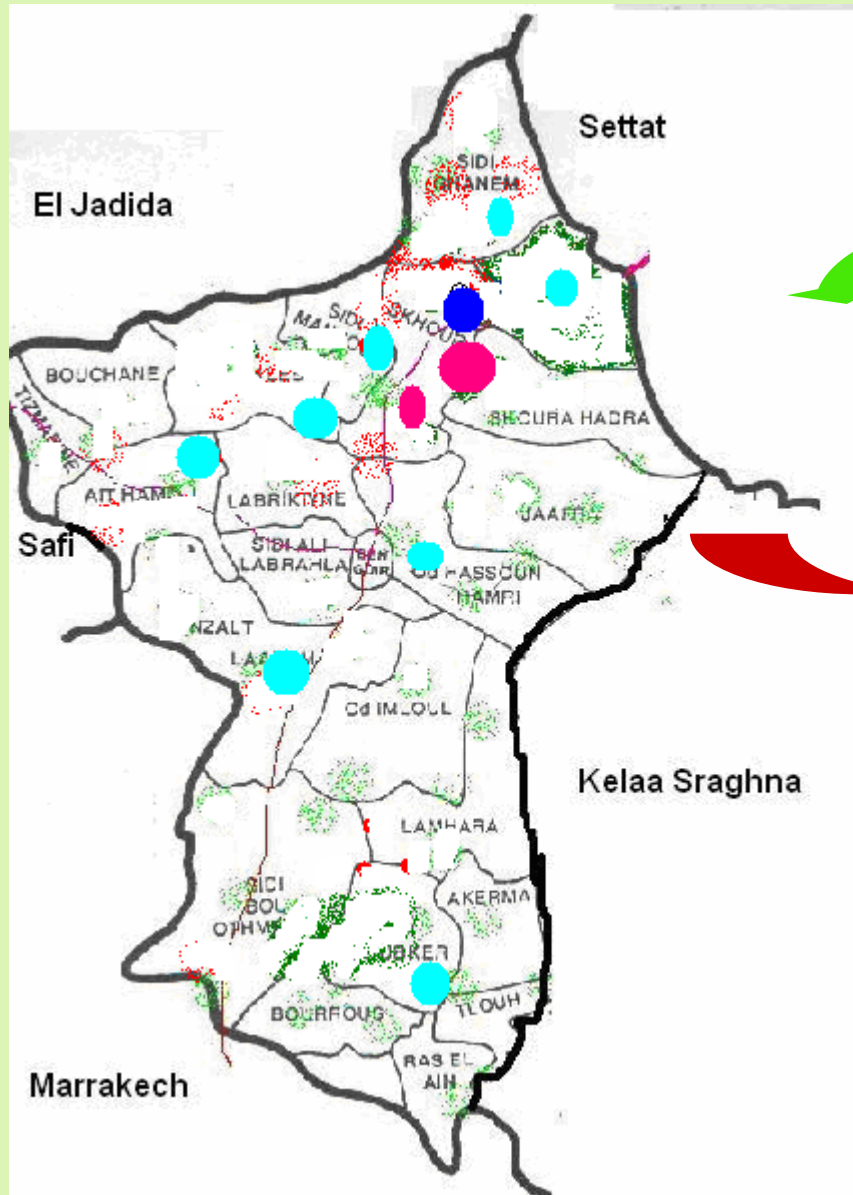
Camels and cactus distribution in Rehamna

Cactus

Camels



Rehamna cactus processing



Semi arid
230 mm / year

Plan Maroc Vert

35.000 ha in 5 years

Reticence

 Functional cooperative

 Future cooperative

 Societies:

Les confis du Maroc
Cactus Premium
Inovag

Cactus-atriplex forage



Sardi bred

Kelaa Sraghna



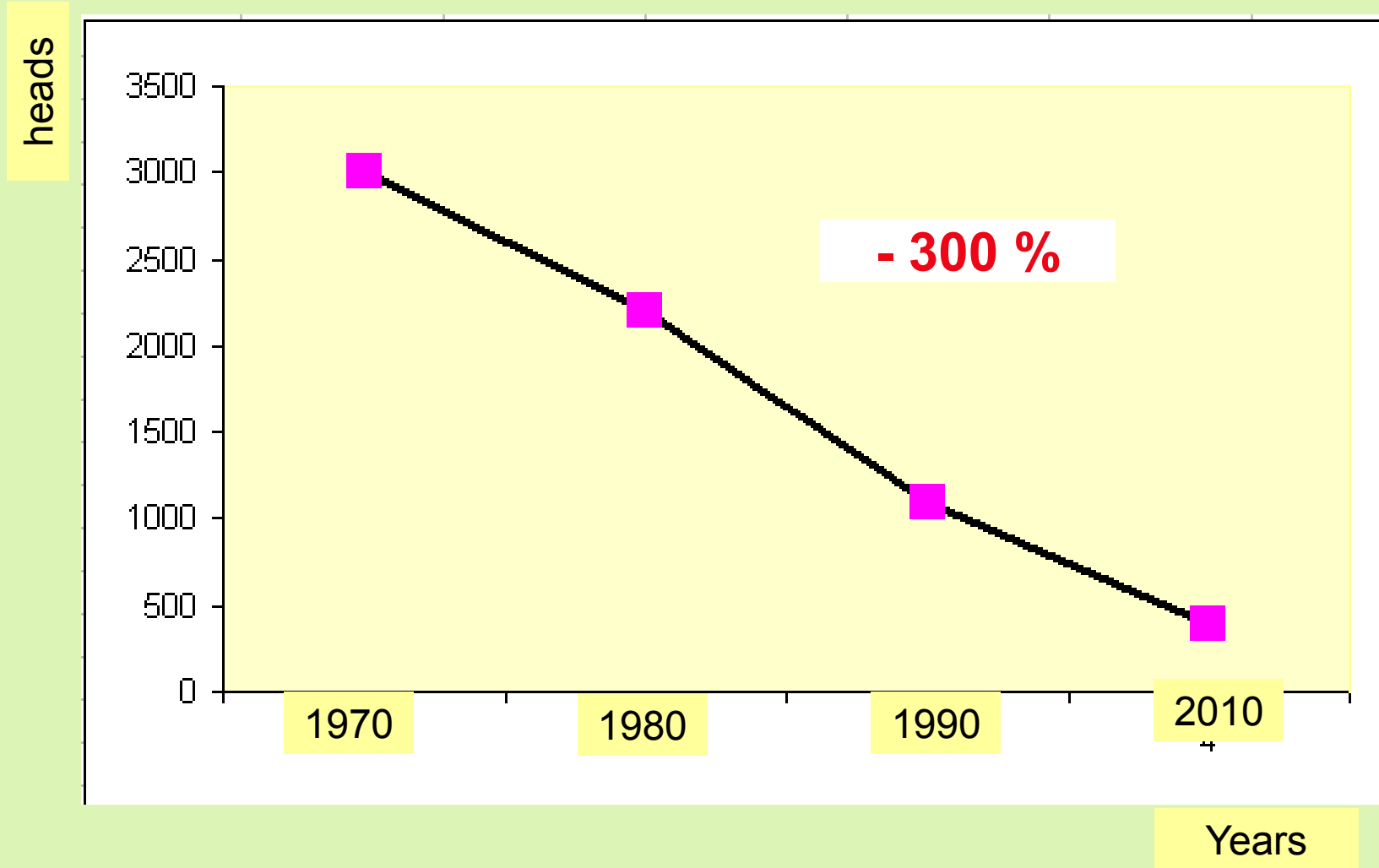
Rehamna



Essaouira



Regression of numbers of camels of Rehamna during recent decades



Opportunities for the reintroduction of camels in Rehamna region

- Rehmana is close to great urban centers
- The population has experience in farming
- Camel products (milk, meat) are becoming increasingly popular
- Cactis plantations are in a continuing extension

constraints to camel camel farming

- Finance: High cost of camels:
acquisition and risk
- Relatively slow productivity

Arid and semi arid areas

Native plants and animals

Art complementes sciences

Dromedary: animal of the future

Environment vs economy

**Cactus has no limit .. Our
creativity ?**



*Thank You
So Much!*



شكراً لكم

من الأعماق

