Tropical Agriculture and Sustainable Development (EEEB G4136)
Guest lecture: Livestock systems – Ruminants (01)

Why are ruminants so important?

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Number of known and classified species of plants and animals

Vertebrates	
Mammals	4 500
Birds	10 000
Amphibians and Reptiles	12 000
Fish	22 000
Invertebrates	
Insects	960 000
Others	400 000
Bacteria	4 000
Viruses	5 000
Higher plants	270 000
Fungi	70 000

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Estimated number of species in different groups and number of domestic species recruited from those

Species Group	total	domestic
Mammals	4 500	35
Birds	10 000	8
Amphibians & Reptiles	12 000	-
Fish	22 000	(2)
Insects	960 000	2
Others	400 000	2

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Allocation of domestic livestock species to different feeding types

Herbivores (35)*	**Bovidae**	***21 Ruminants**
	Tylopodae	
	Cervidae	
	Equidae	**Horse, Donkey**
	Proboscidae	**Elephant**
	Lagomorpha	**Rabbit**
	Rodentia	**Guinea Pig, Great Cane Rat, Capybara**
	Insecta	**Honey Bee, Silkworm**
	Mollusca	**Escargot Snail, Giant African Snail**
	Aves	**Dove, Ostrich, Canary, Budgerigar**
Omnivores (7)	**Suidae**	**Pig**
	Aves	**Chicken, Duck, Goose, Turkey**
	Rodentia	**Laboratory Mouse, Laboratory Rat**
Carnivores (5)	**Canidae**	**Dog, Silver Fox**
	Felidae	**Cat**
	Mustelidae	**Ferret, Mink**

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Example: Grass eaters

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Example: Grass eaters

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Numbers and biomass of domestic animals and humans

Species	Numbers (million)	Biomass (million t)
Cattle & Buffalo	1 480	740
Sheep	1 065	40
Goats	780	27
Camelids	24	8.5
Equines	118	42
Pigs	936	122
Poultry	14 711	15
Total		994.5
Humans	6 800	374

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Ruminants

(134 species in total, 21 domestic species)

Are not competitive to humans

Convert low nutrient density organic materials
into food for humans

By anaerobic microbial fermentation of fibrous plants
and plant residues in the rumen

Provide services and assist in recycling soil nutrients

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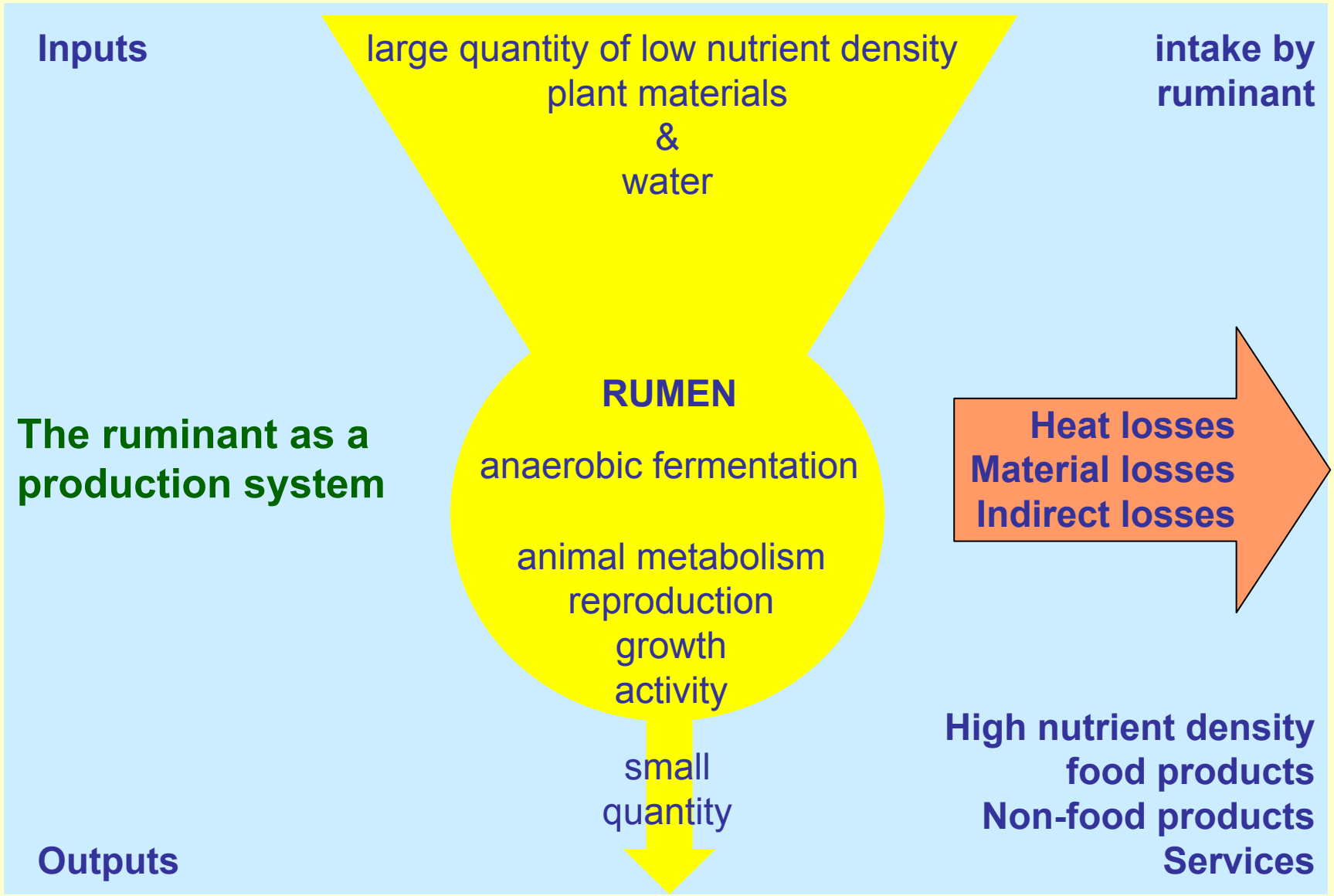

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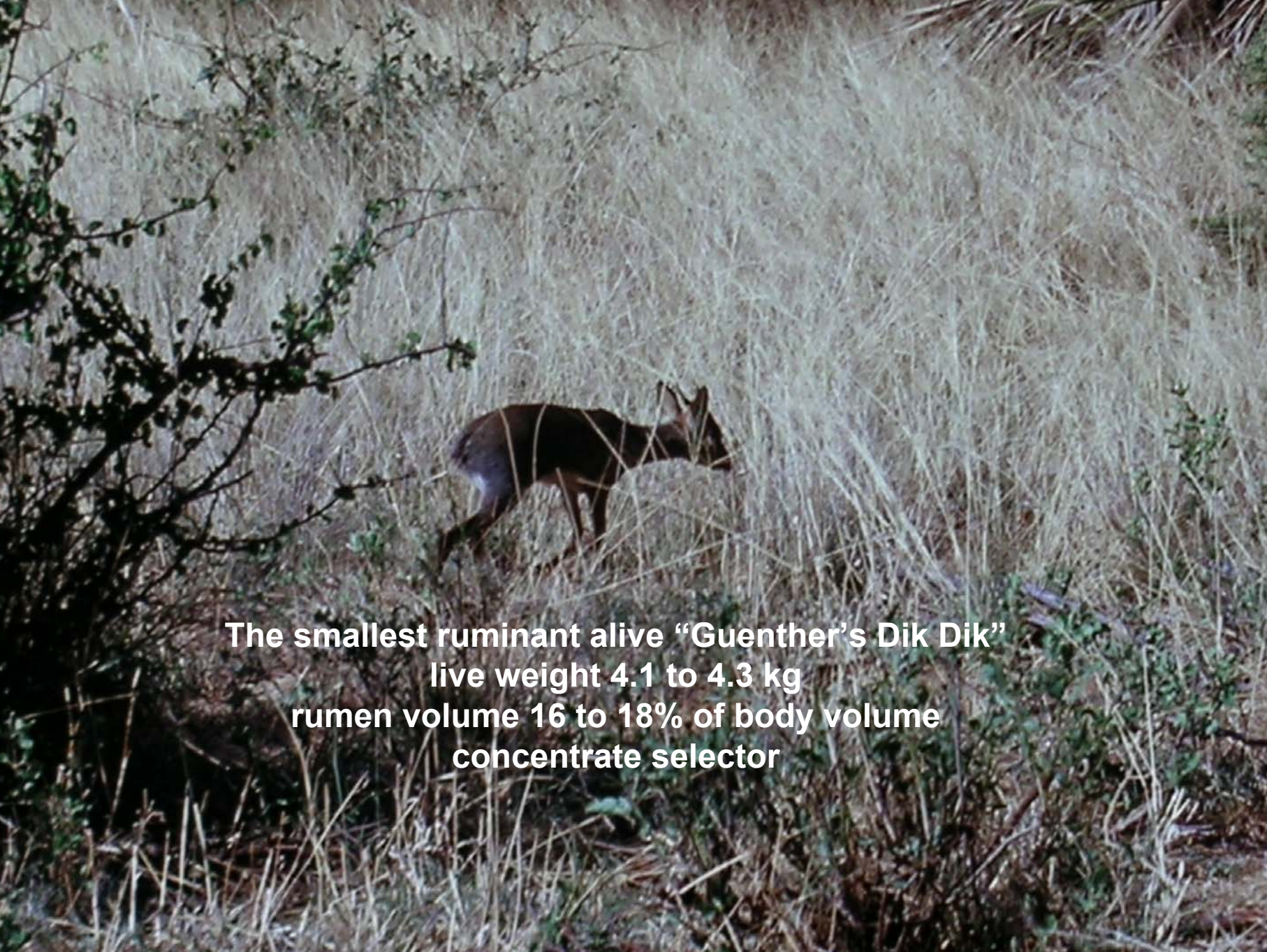
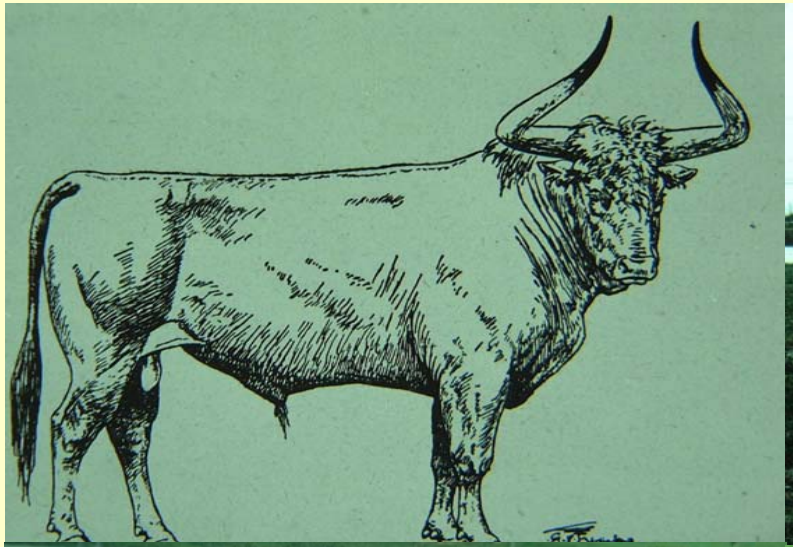

The smallest ruminant alive “Guenther’s Dik Dik”
live weight 4.1 to 4.3 kg
rumen volume 16 to 18% of body volume
concentrate selector


The second largest ruminant alive “ Cape Buffalo”
live weight 800 to 1200 kg
rumen volume 35 to 40 % of body volume
bulk and roughage feeder



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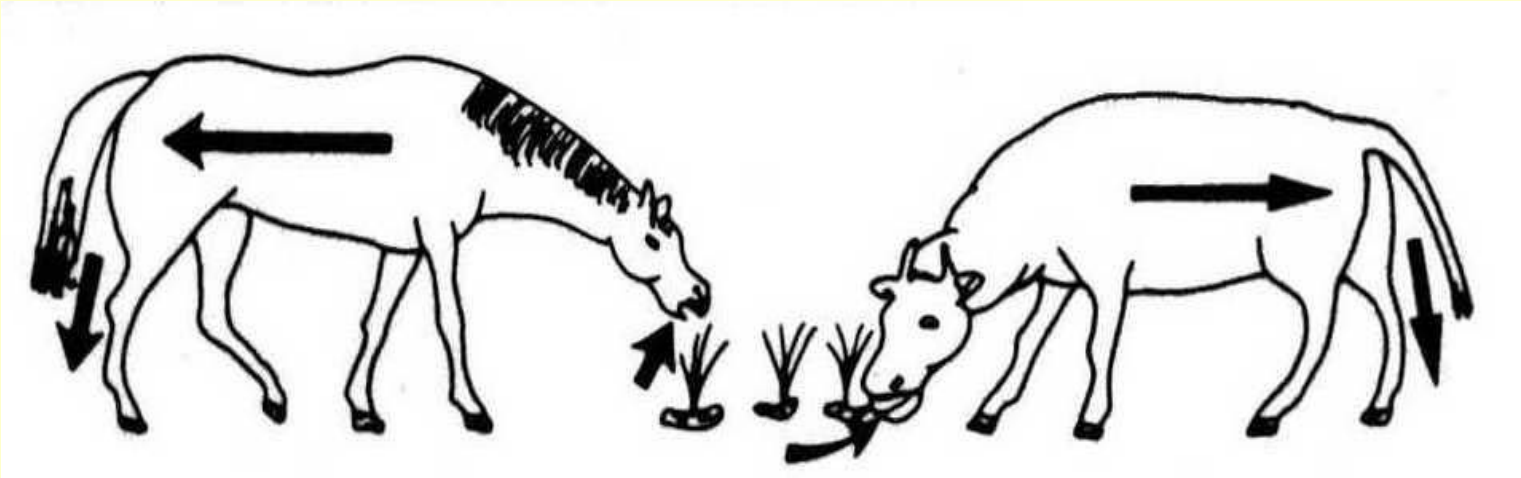
Differences between the food intake strategies of horses and cattle
A: food consists of young, short grass with low crude fibre content



Food intake	moderate	moderate
Feed passage rate	48 hours	80 hours
Cellulose digestibility	70 % that of cattle	30-55

After W. von Engelhardt

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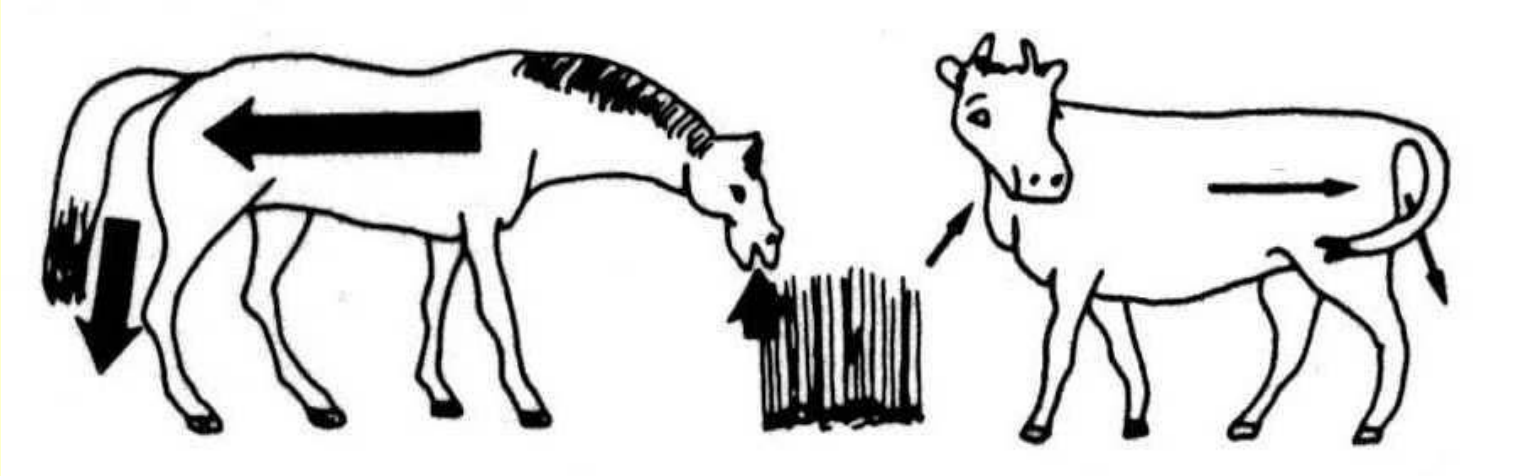
Differences between the feed intake strategies of horses and cattle
B: food consists of long grass with high fibre content



Feed intake	more	less
Feed passage rate	faster	slower
Cellulose digestibility	worse	same or worse
Absorption of nutrients	same	same or worse

After W. von Engelhardt

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Milk production on different pastures

Food basis	DM-digestibility [%]	Milk production [kg/cow]
Tropical pastures (young)	60 - 65	1800 - 2000
Tropical pastures (mature)	50 - 55	1000 – 1400
Temperate pastures	70 - 80	3300 – 3800
Concentrates	80 - 85	4400 - 4900

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Water and feed requirements of a zebu steer

- Mean body water turnover of a zebu steer is 140 ml * l^{-1}BWP * d^{-1}
- Body water pool is 65 to 70 % of body weight
- Life time drinking water use at 4 years of age weighing 400 kg is 28 000 kg
- 250 kg water evaporated per 1 kg DM grass produced
- 11 kg of grass eaten per 1 kg body weight gain
- 2.75 m^3 feed water per 1 kg of body weight
- Total water use at slaughter weight 1,128 m^3 or 2.82 m^3 per kg live weight

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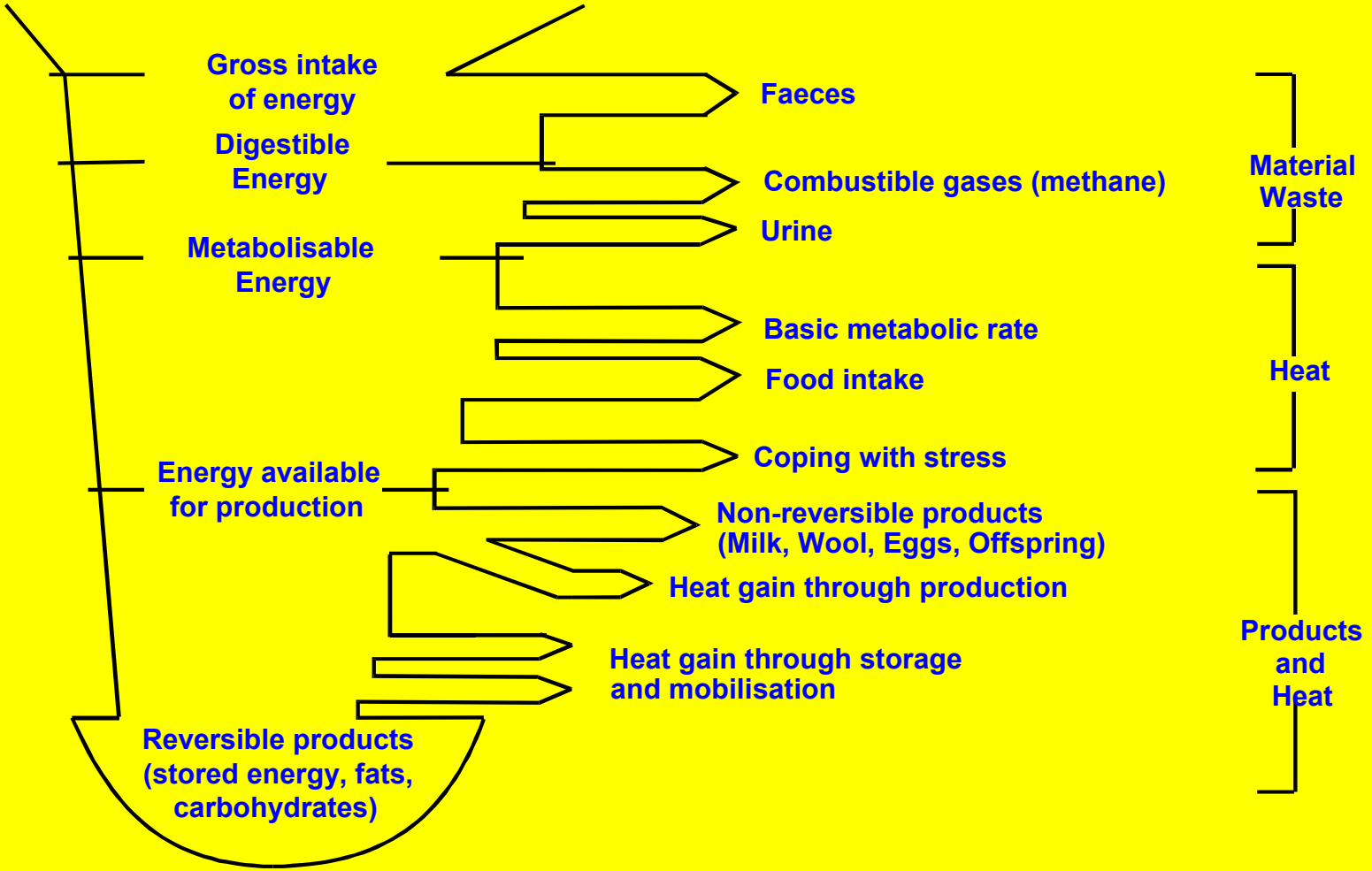
Conversion of food energy in the body of a ruminant



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Annual methane losses from a model livestock production system: dairy farming in S.W. England

(102 cows, 110 others, stall feeding of silage and concentrate)

type of loss	total emission kg CH_4 - C $year^{-1}$
losses from ruminants	6775
losses from stored wastes	2285
losses from silage effluent	2596
losses from dirty water	332
total losses	11988

Source: after Jarvis & Pain, 1994

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The compound value of the domestic ruminant

Meat
Milk
Fibres
Hides and skins
Work
Manure
Leisure value
Socio-cultural and religious value

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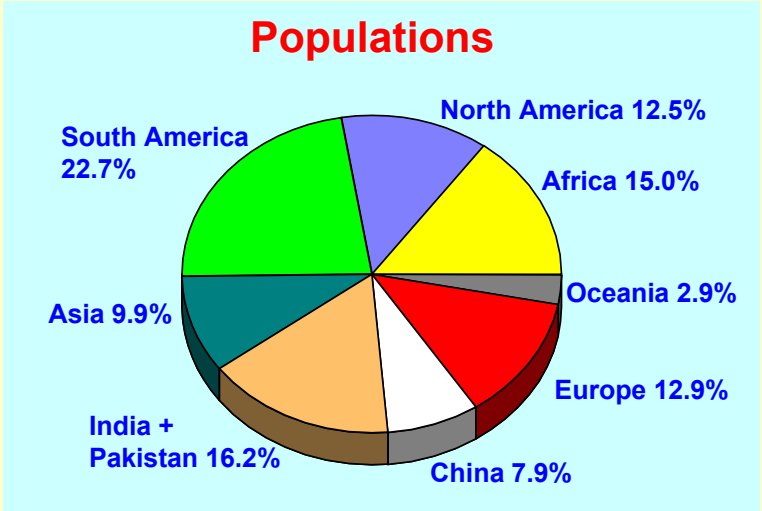
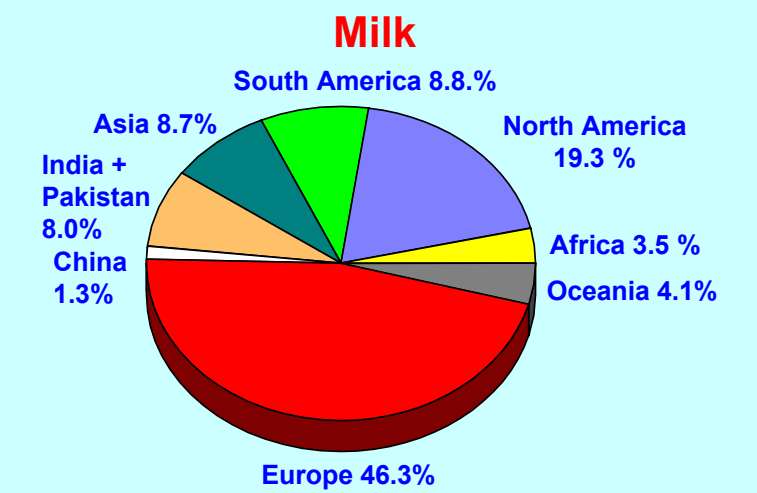
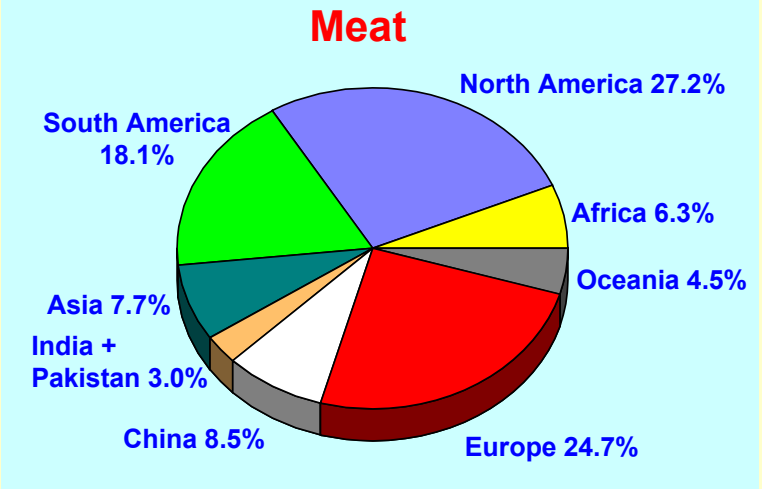
Regional distribution of CATTLE populations and proportion of regional production of meat and milk

Source: FAO Production Yearbook 2004







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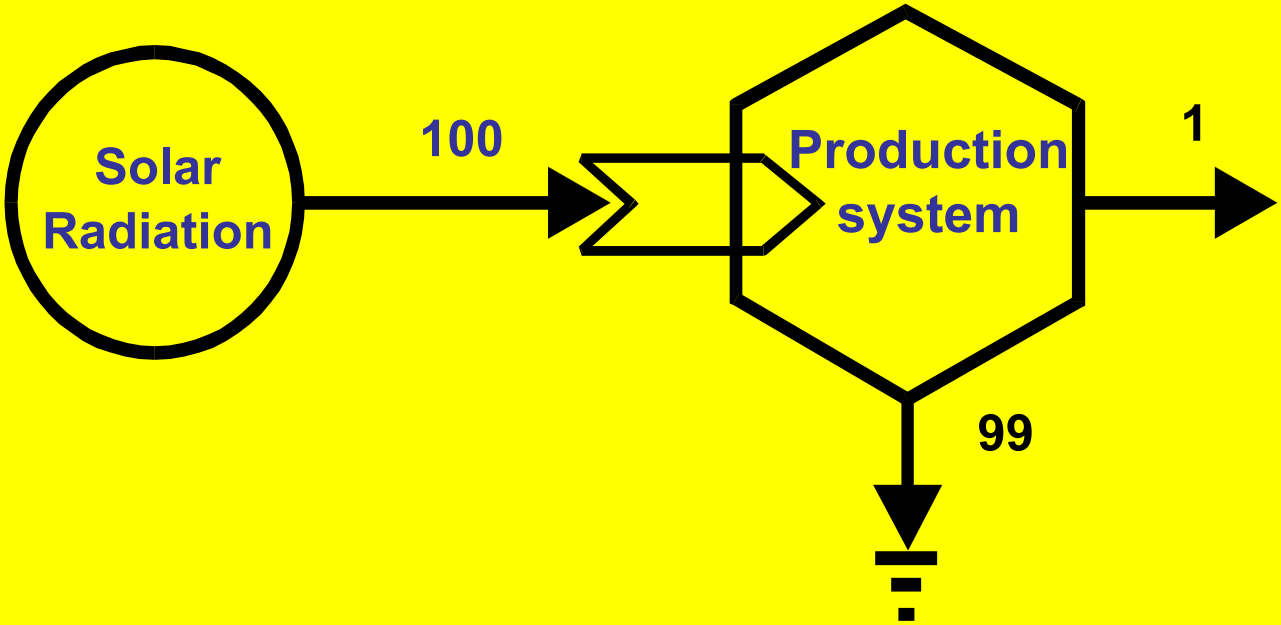
Schematic presentation of energy conversion in a near-natural livestock production system



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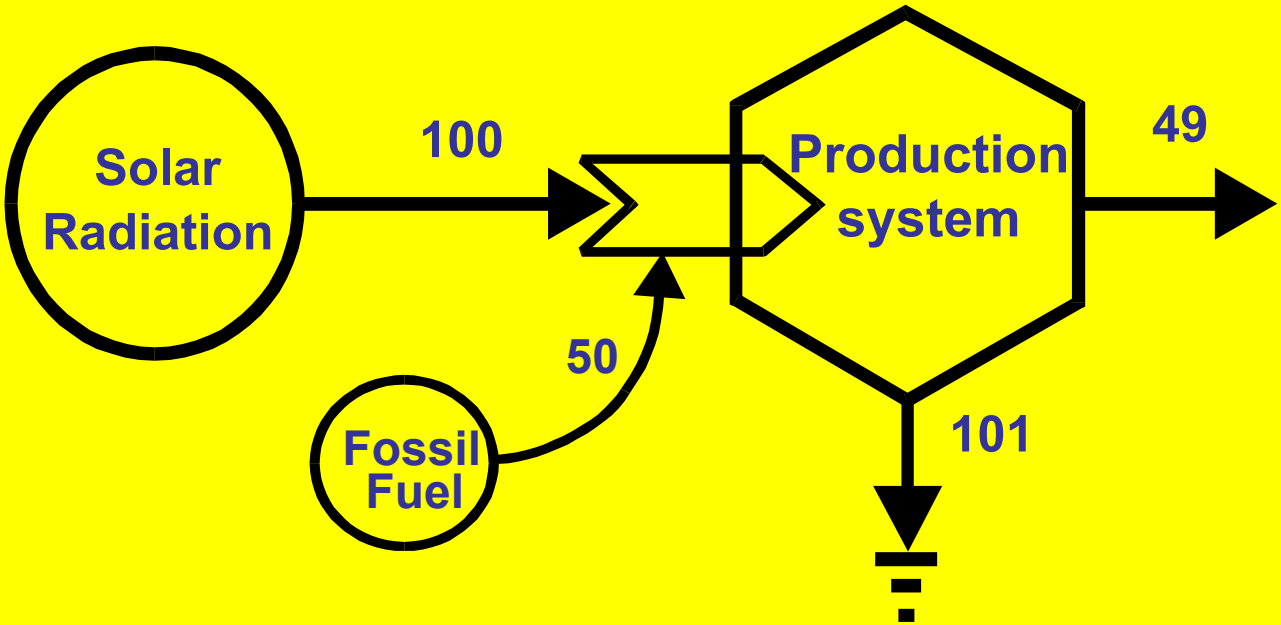
Schematic presentation of energy conversion in a livestock production system with fossil fuel input



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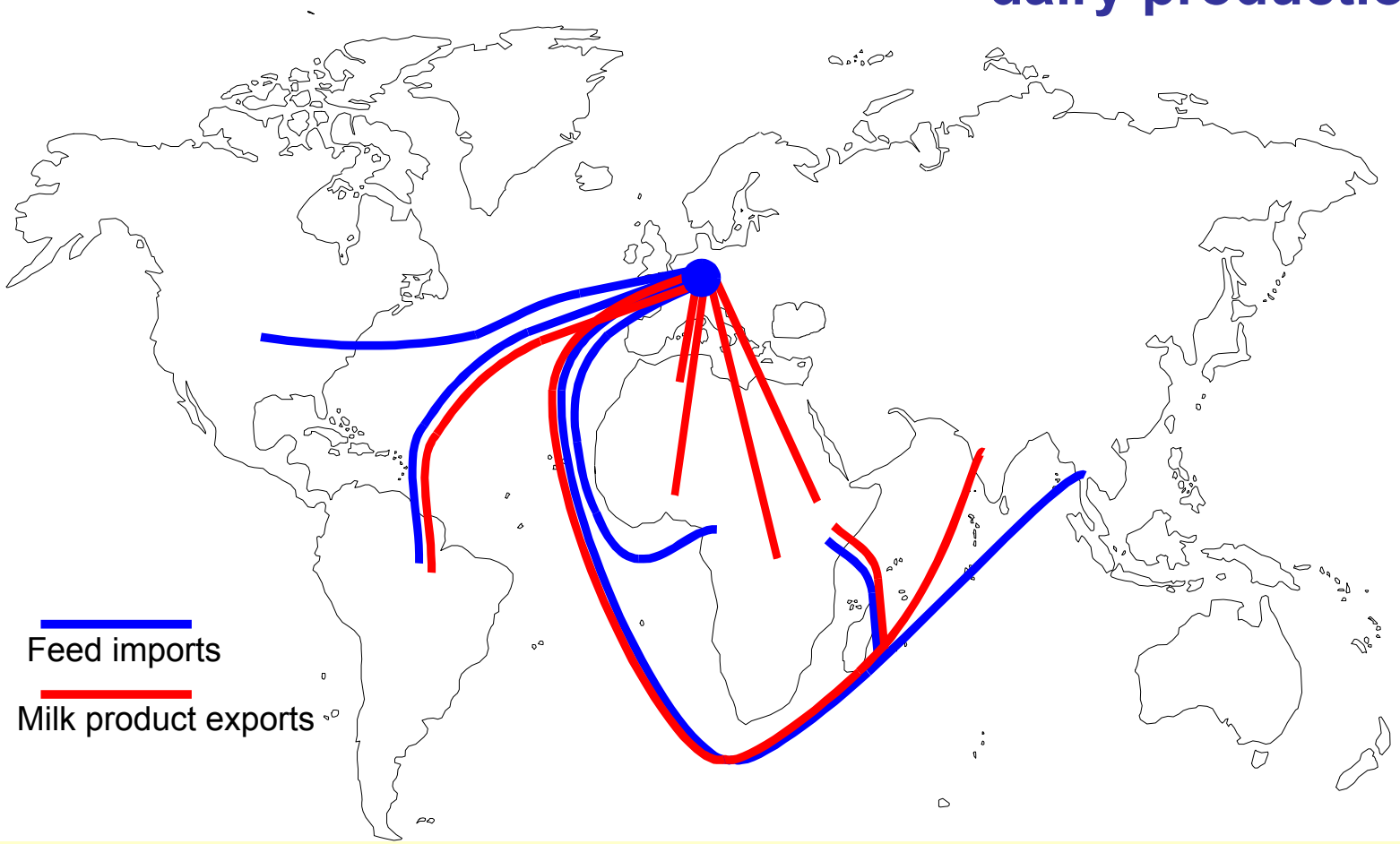
Transport routes of importance for Western European dairy production



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