Role of wetlands and wetland vegetation in regional water cycling

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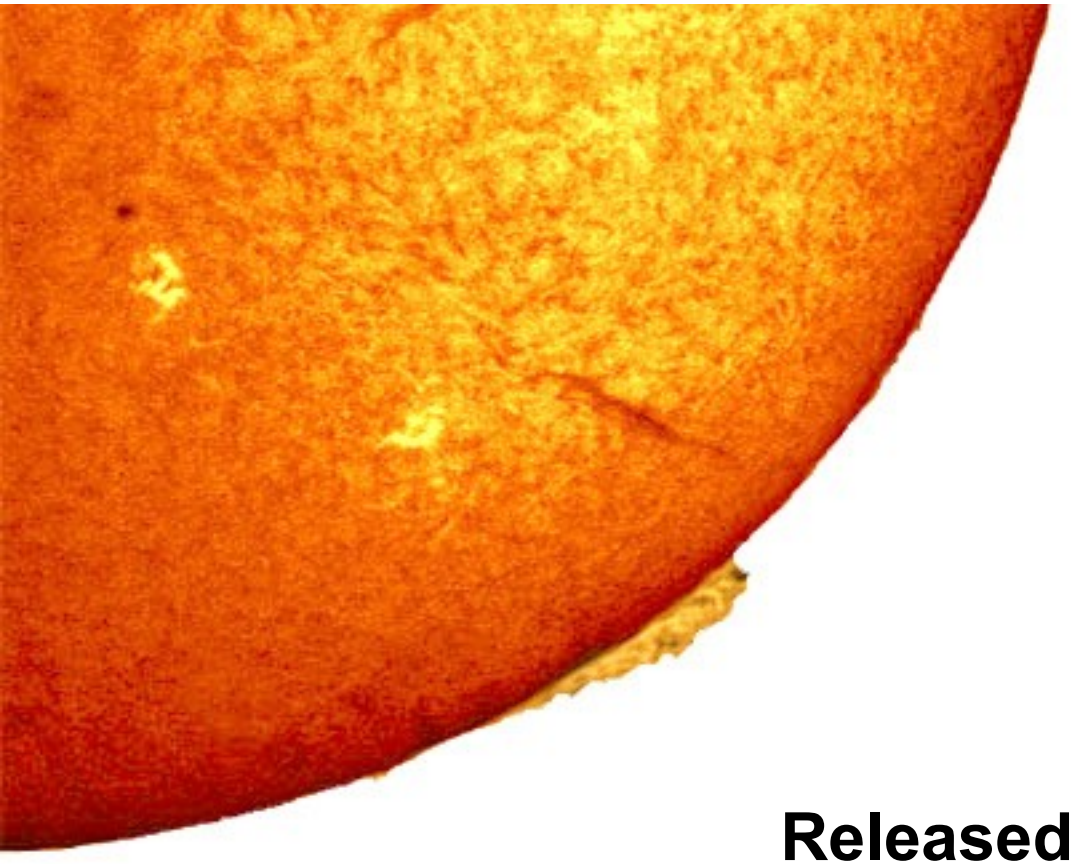
Landscape – open system
Income of solar energy
Distribution of solar energy in landscape
Role of water and vegetation in dissipation of solar energy

Closed and open systems

- Closed systems (classical thermodynamics): dissipation of energy in heat transfer, friction etc. is associated with waste
- Open systems (nonlinear thermodynamics): dissipative structures (living organisms) receive their energy from outside. They are far from equilibrium. Self-organization.

Solar Energy



SUN

Exists 5 billion years

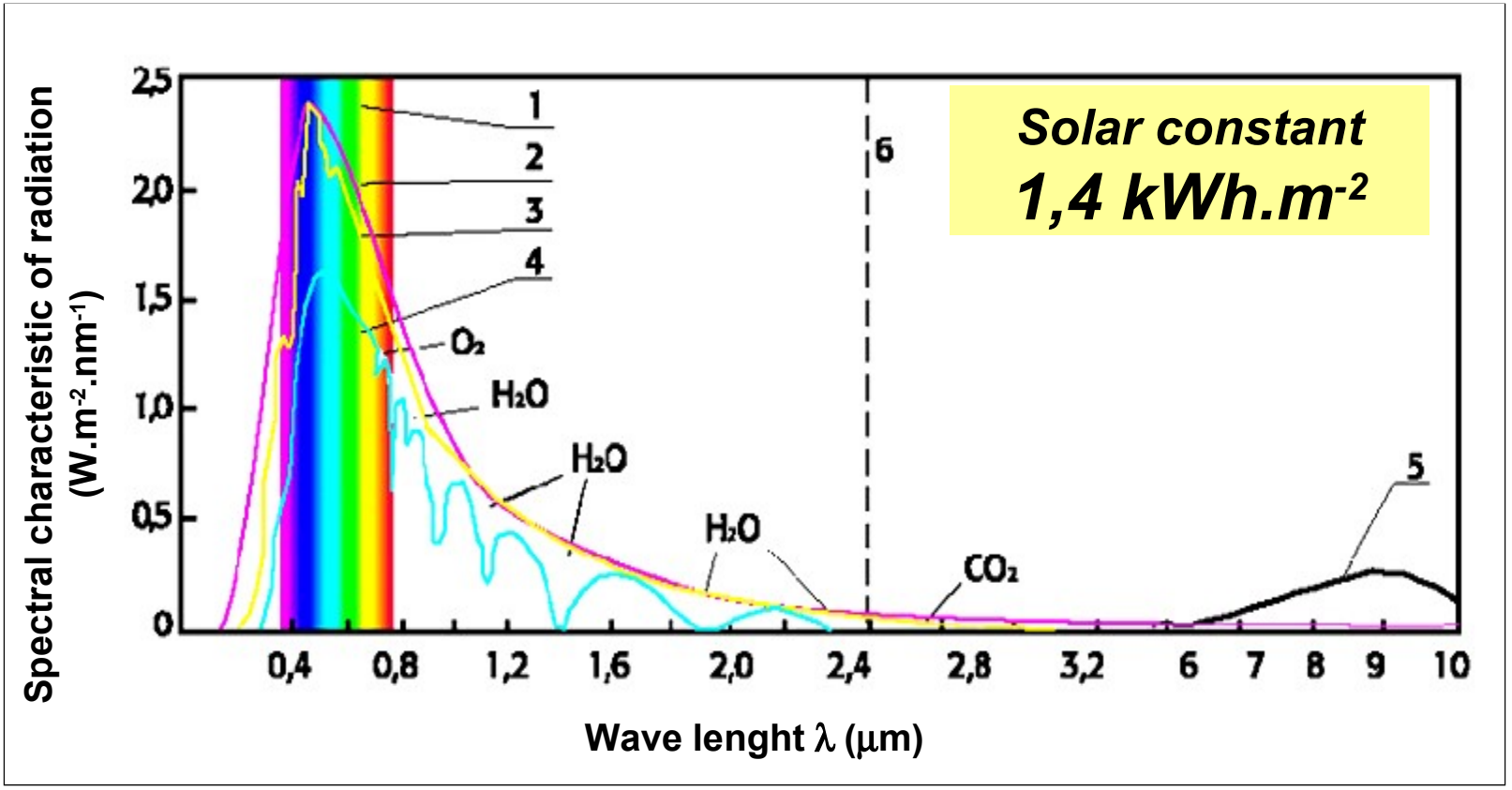
Released energy – 3,8 x 10^{26} J/sec

Earth get 180 000 TW, we use only 10 TW

Solar constant – 1400 W/m^2

Up to 1000 W/m^2 land surface

Solar Energy Flux Through Atmosphere



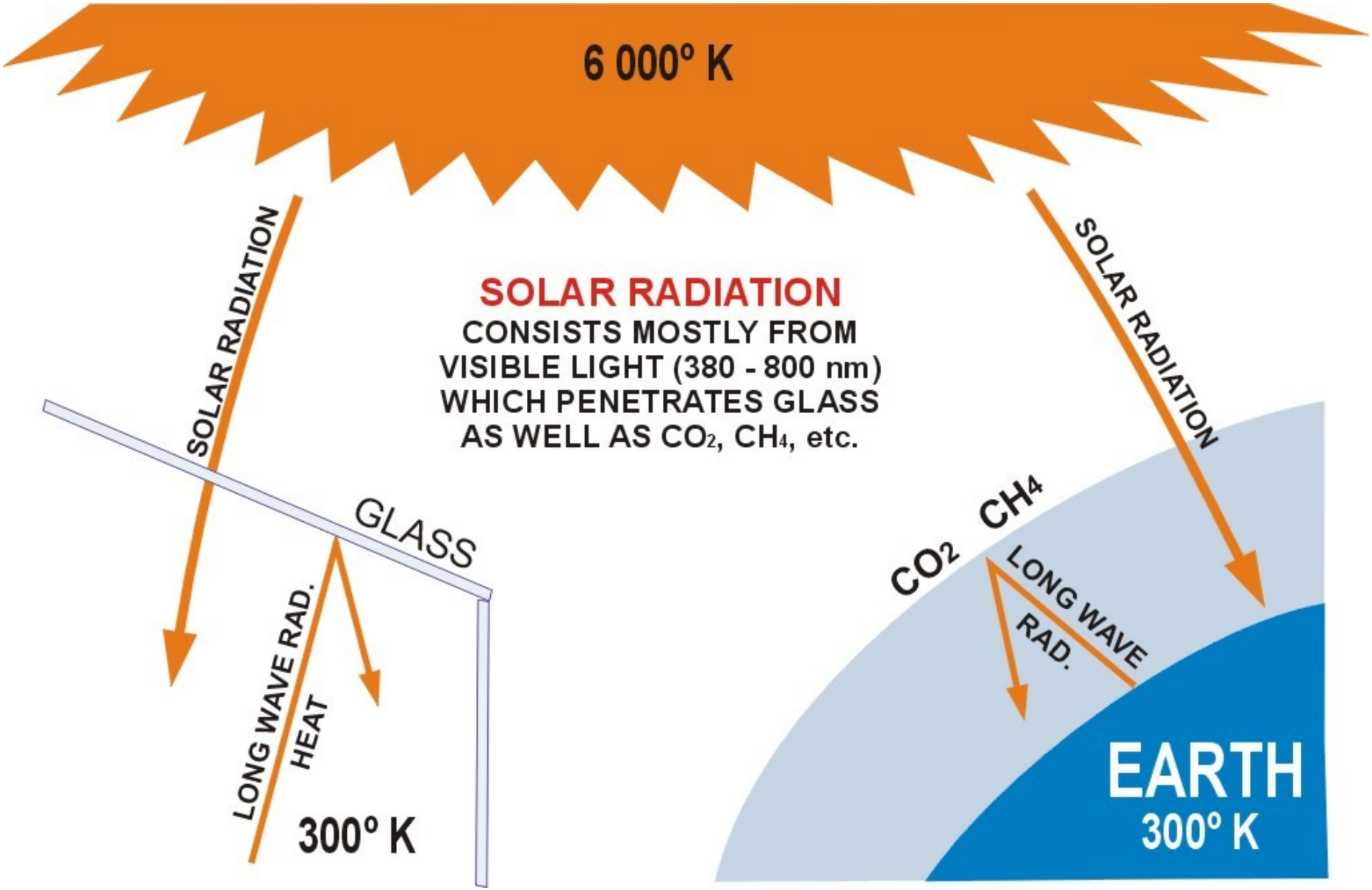
Stefan – Boltzmann law

$$R = \tau T^4$$

Wien´s law

$$\lambda_{max} = 2897 / T$$

GREEN HOUSE EFFECT



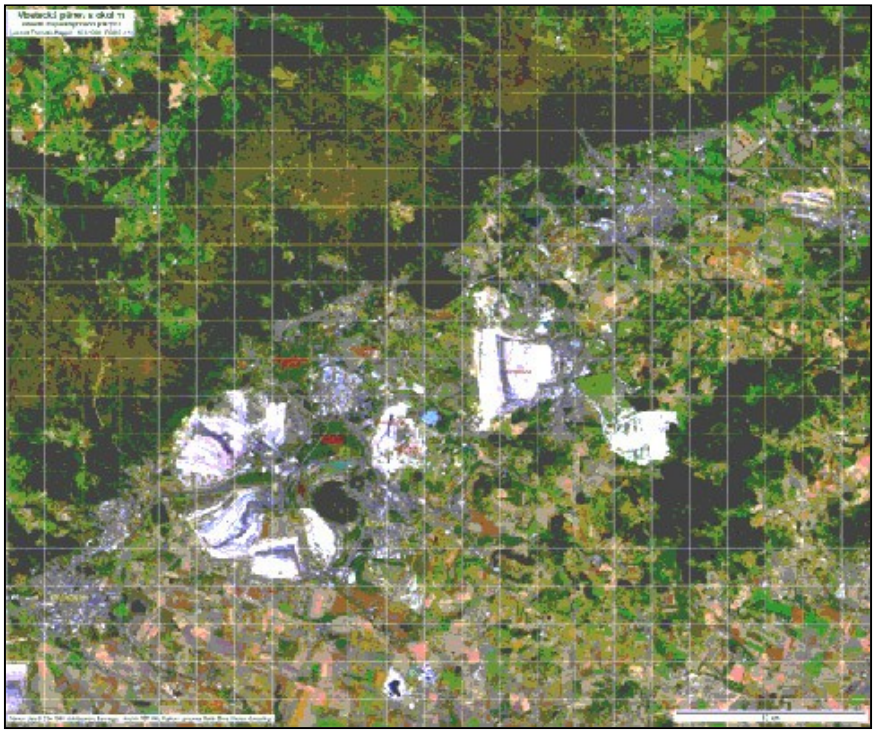
Greenhouse effect

- How much solar energy is radiated back to Earth from the atmosphere by additional green house gases?
- How much is the radiation enforcement ?

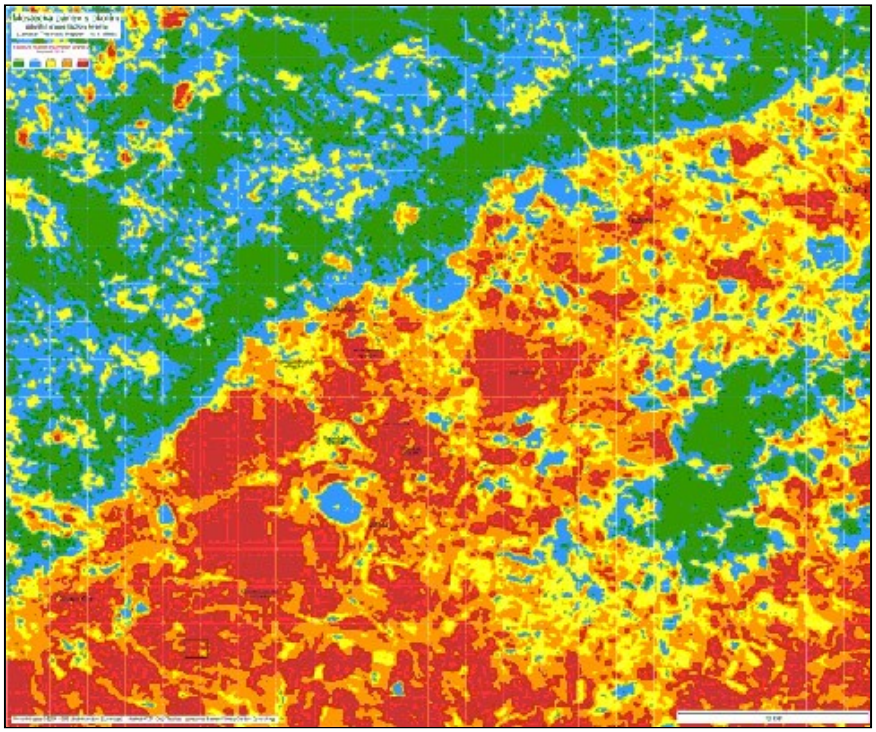
Most open cast basin

Black Triangle, Northern Bohemia

Most open cast basin



RGB



Infrared

AIR-CON TENDER

BIG GLOBAL CORPORATION CALLS FOR:

- Air-con system,
- Fully automatic, sun driven, outdoor use, quiet,
- Fully recyclable material only,
- Continuous self regulation,
- Minimum maintenance,
- Output power in tens of kW,
- Highly durable (decades).

Send your offer to: bigglobalcorporation@big.com

AIR–CON OFFER

New natural air-con on market!

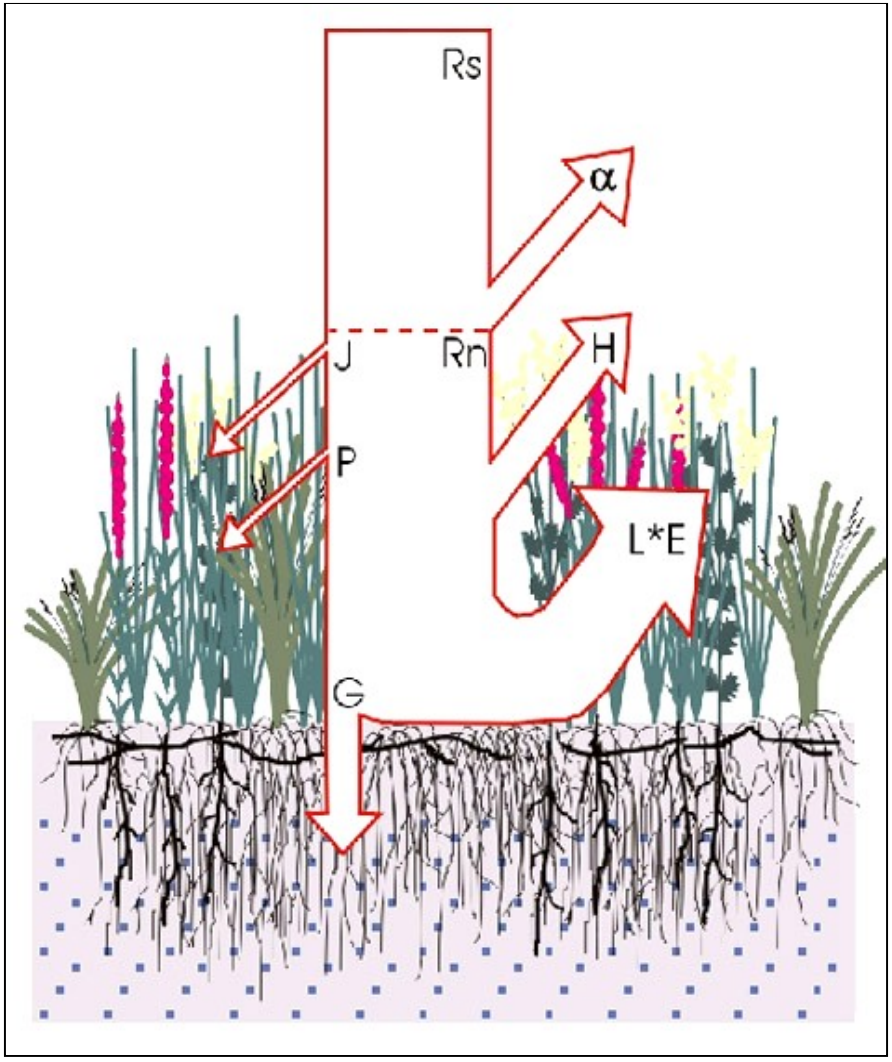
NATURE Ltd. presents highly efficient **TREE** air-com system. Standard model is able to **transpire 400 l** per day.

The latent heat would be 278 kWh, with cooling efficiency **23 kW** over 24 hours.

Regulation system consists from several billions of stomata **recycled** every year.

Warm places are cooled fully **automatically** according their demand.

Main Solar Energy Fluxes

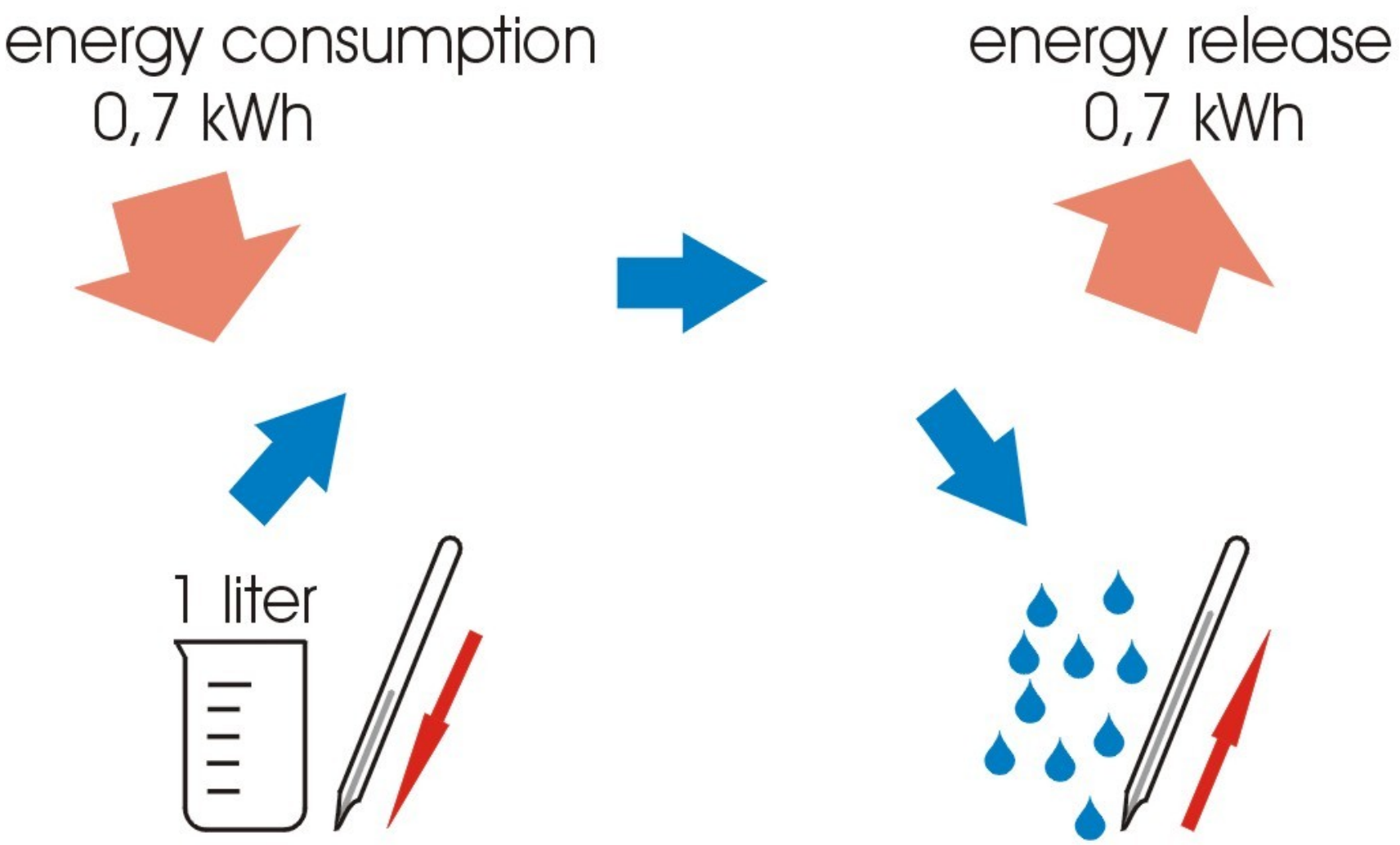


$$Rn = P + J + G + H + L^*E$$

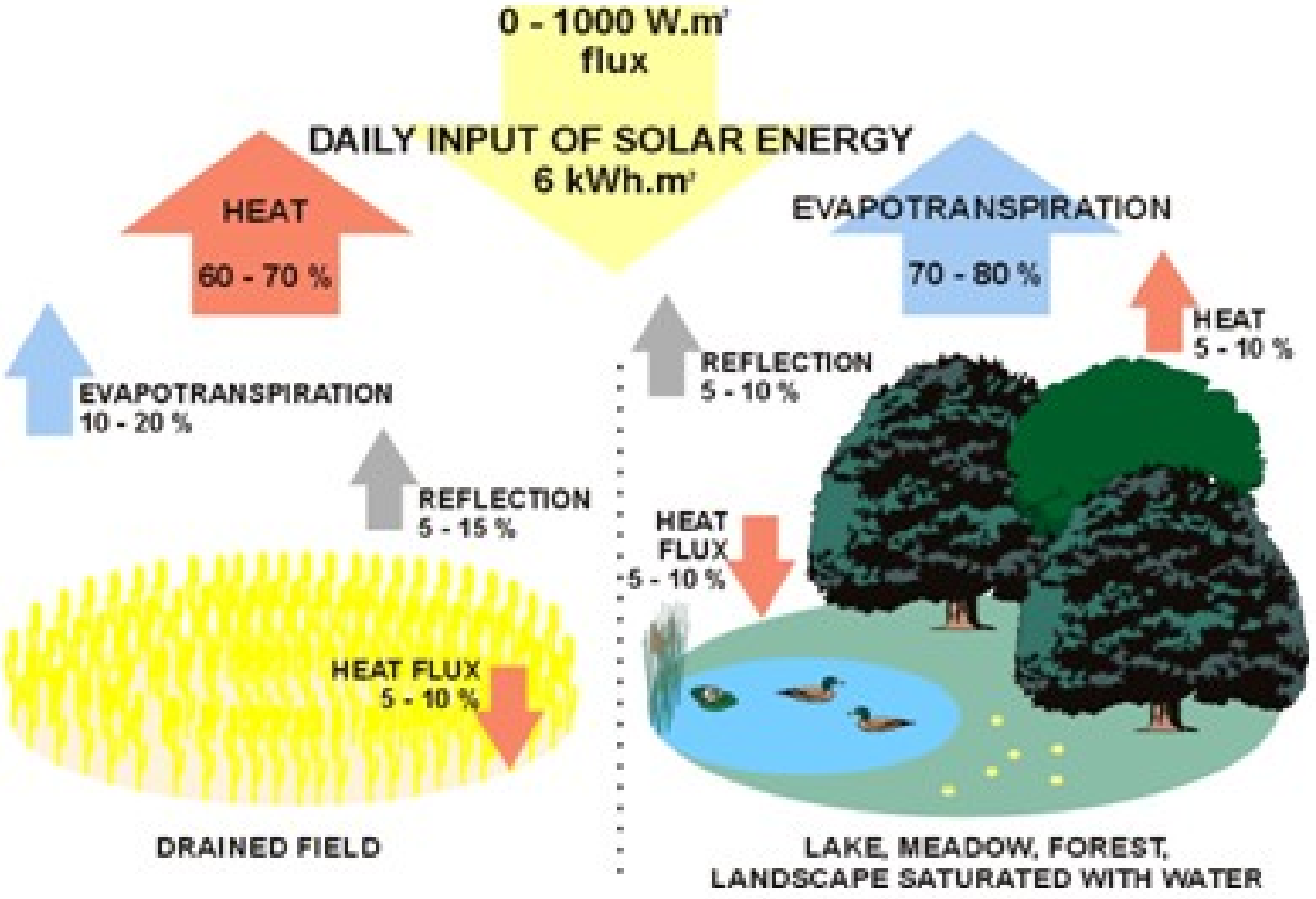
$$[\ Wm^{-2}\ ]$$

R_S - global radiation
R_n - net radiation
α - albedo
H - sensible heat flux
L x E - latent heat x evapotransp.
G - ground heat flux
J - accumulation of heat in biomass
P - photosynthesis

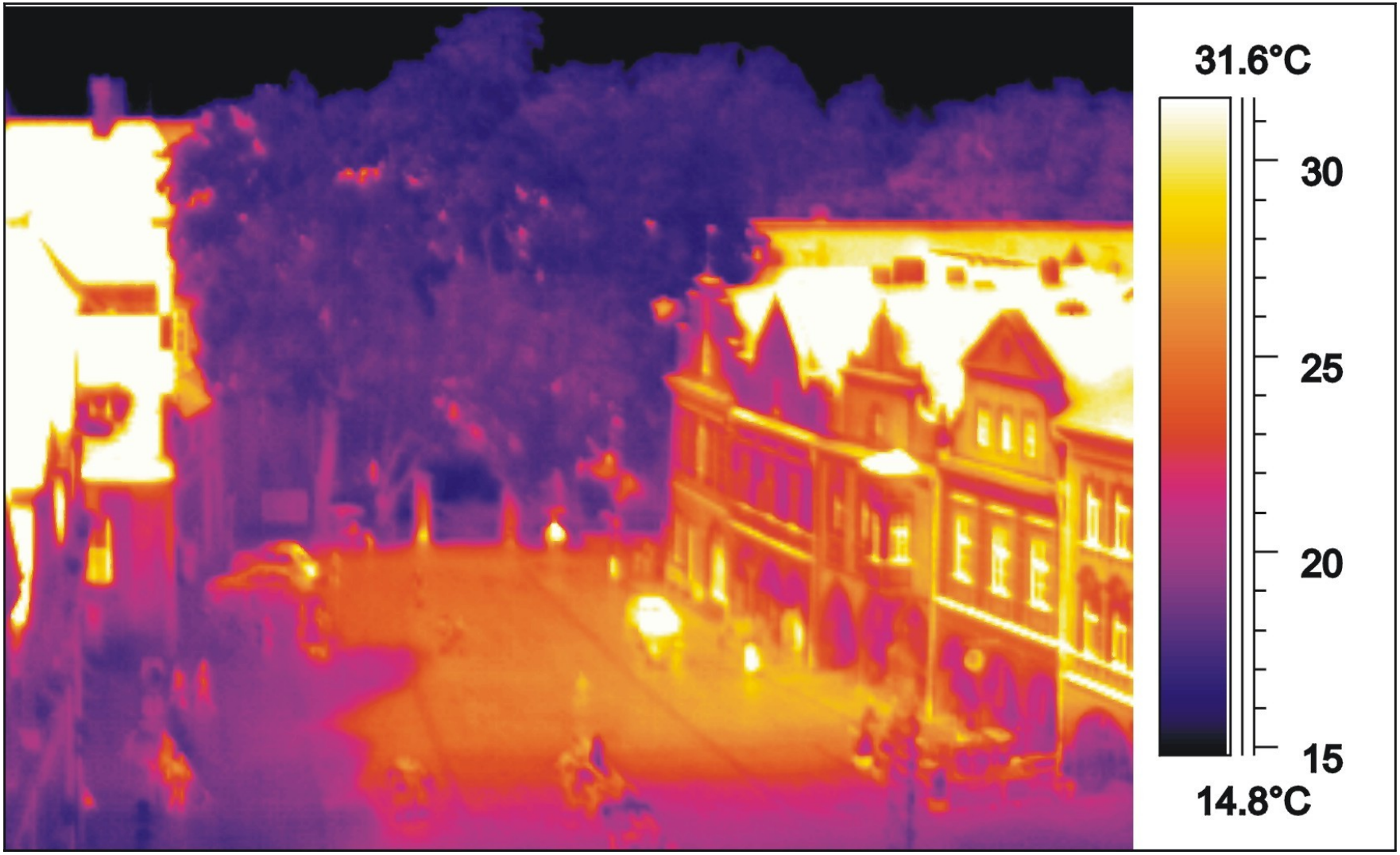
Latent Heat



EVAPOTRANSPIRATION



IR picture of Třeboň square



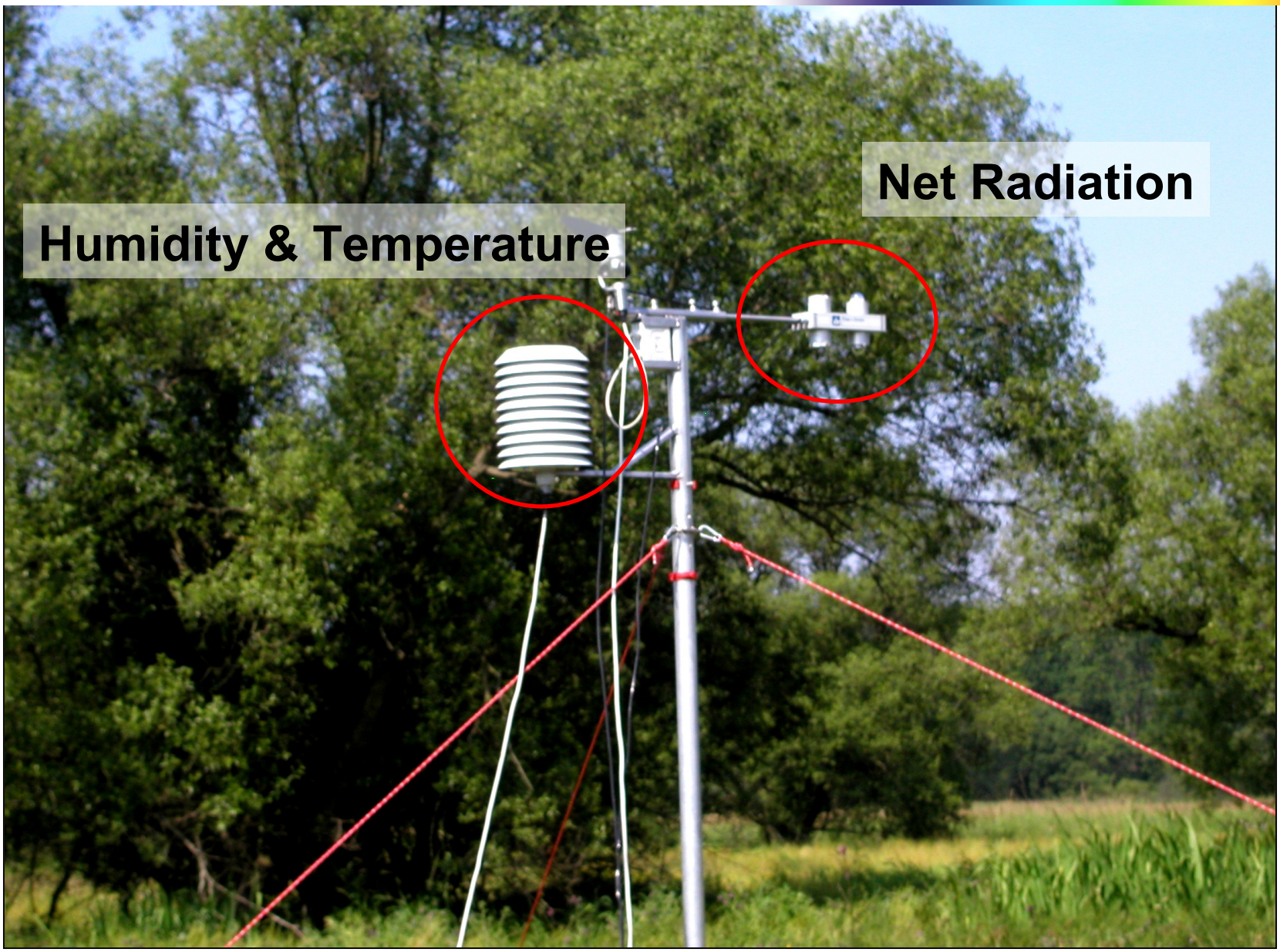
Evapotranspiration

Evapotranspiration of **terrestrial** plants ~ 2 – 5 l/m^2

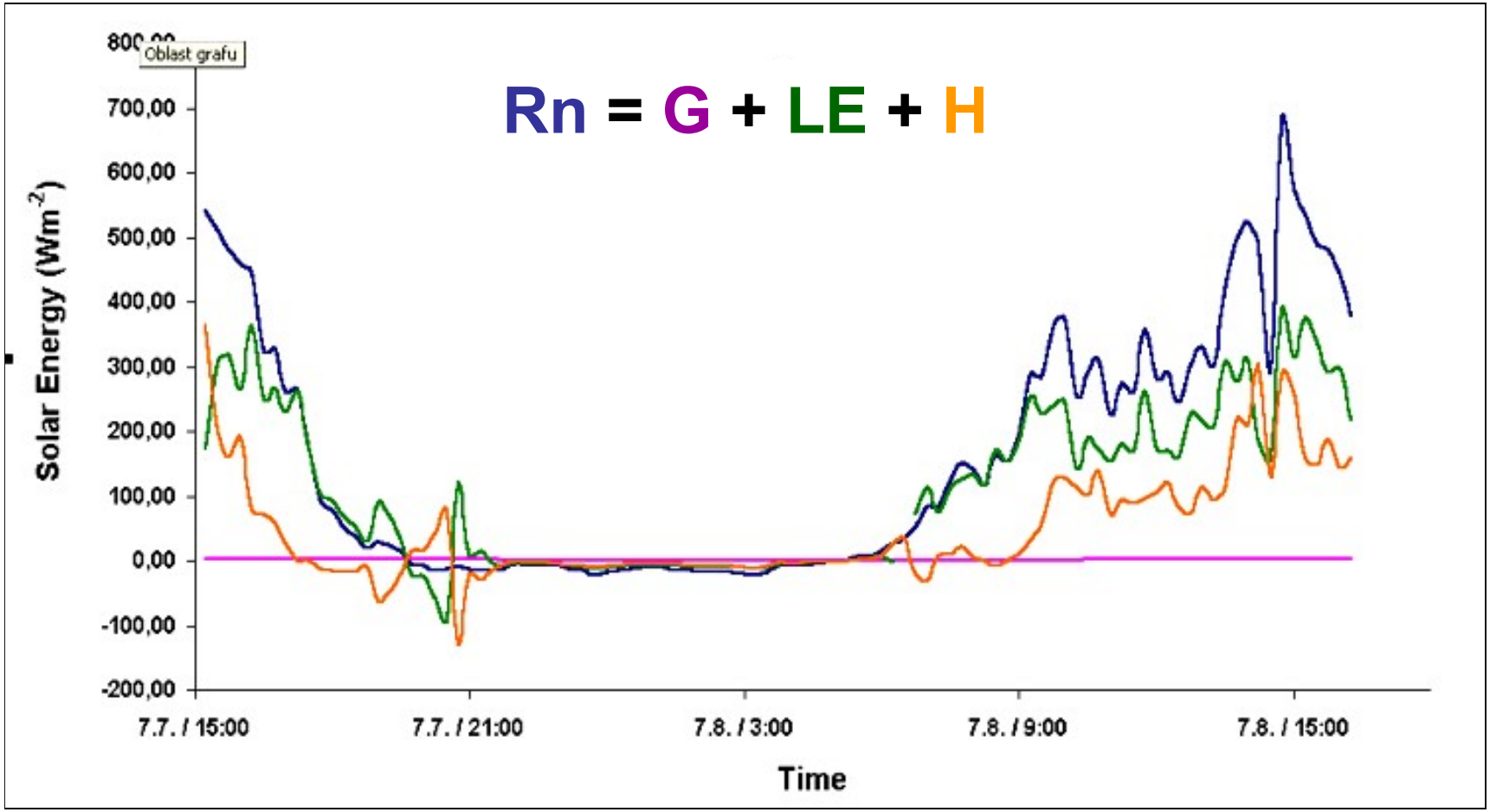
Evapotranspiration of **wetland** plants **- HIGHER**

Samples of extreme values

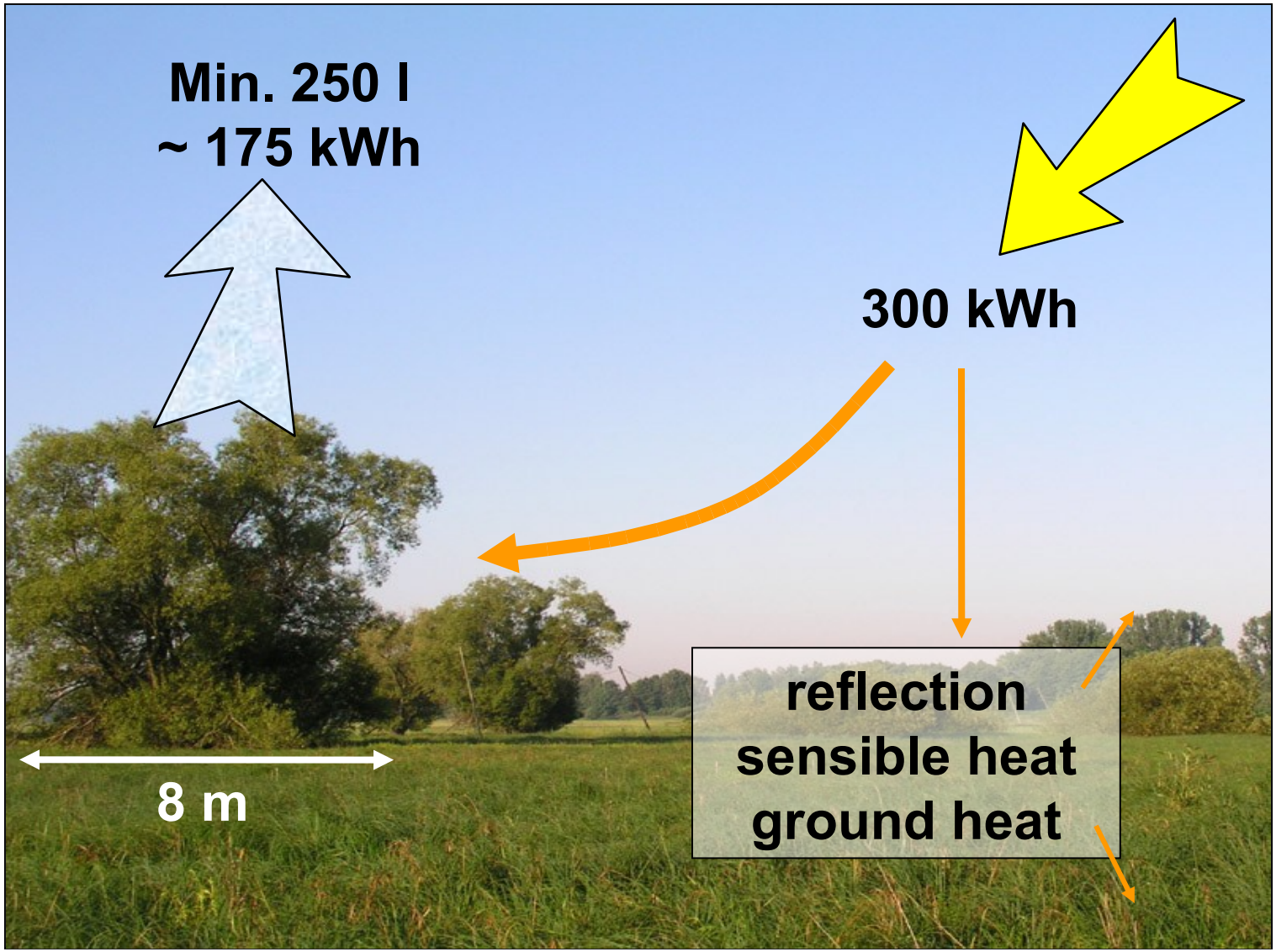
Salix cinerea	**16 – 27 l/m^2**
Alnus glutinosa	**13 – 21 l/m^2**
Populus tremula	**9,7 – 14,9 l/m^2**
Prunus padus	**5,6 - 9 l/m^2**
Fraxinus excelsior	**5,8 – 8,4 l/m^2**
Pinus rotundata	**2 – 4 l/m^2**
Sand	**1,7 – 3,7 l/m^2**


Humidity & Temperature
Net Radiation

Solar energy distribution in Wet Meadows



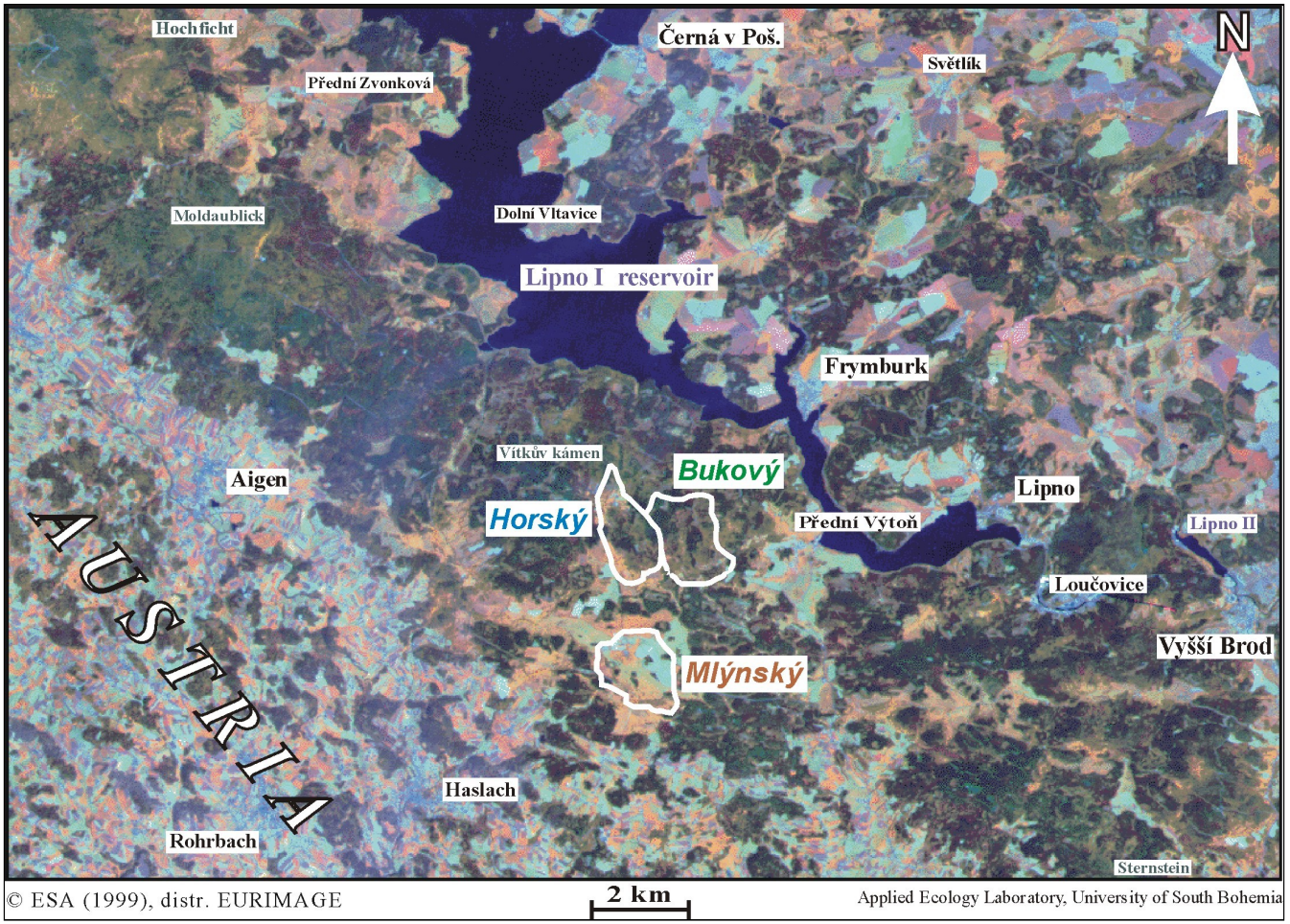
Daily energy budget in wetland



Different landscape management

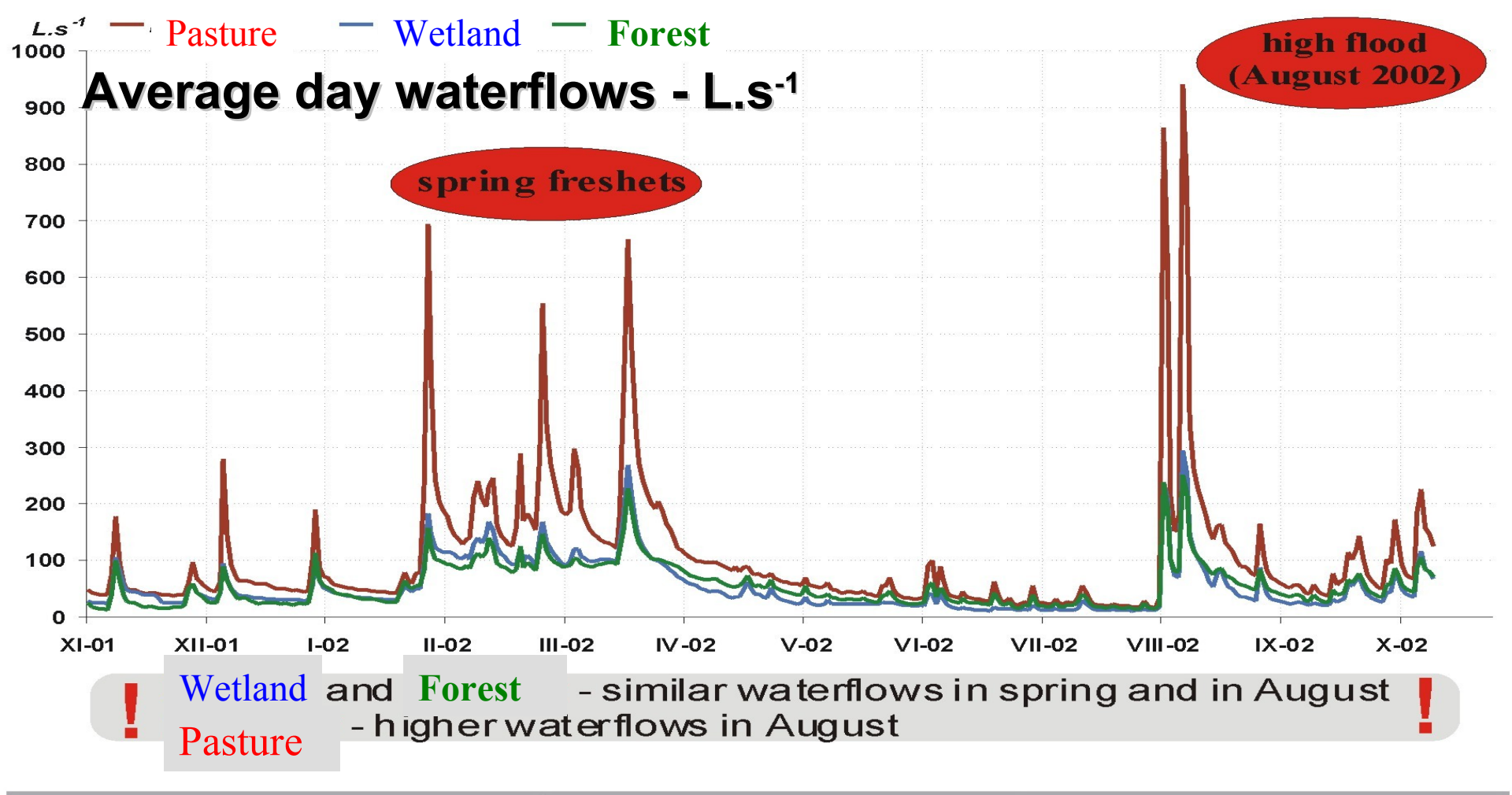
Different landscape management

Šumava National Park, Southern Bohemia

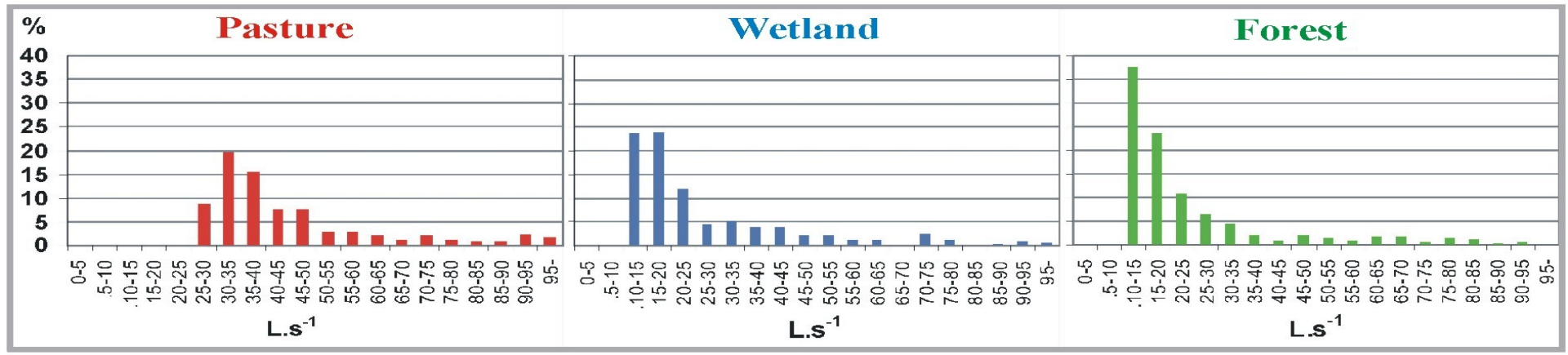


Basic characteristics

	Mlýnský	Horský	Bukový
Catchment area (ha)	214,1	201,7	264,4
Altitude (m asl)	784 – 884	826 – 1026	809 – 1026
Main Exposition	SW, NE	SW, NE	E, SW
Forested:Non forested	1:10	1:0,36	1:0,05



! Wetland and Forest - similar waterflows in spring and in August
Pasture - higher waterflows in August !

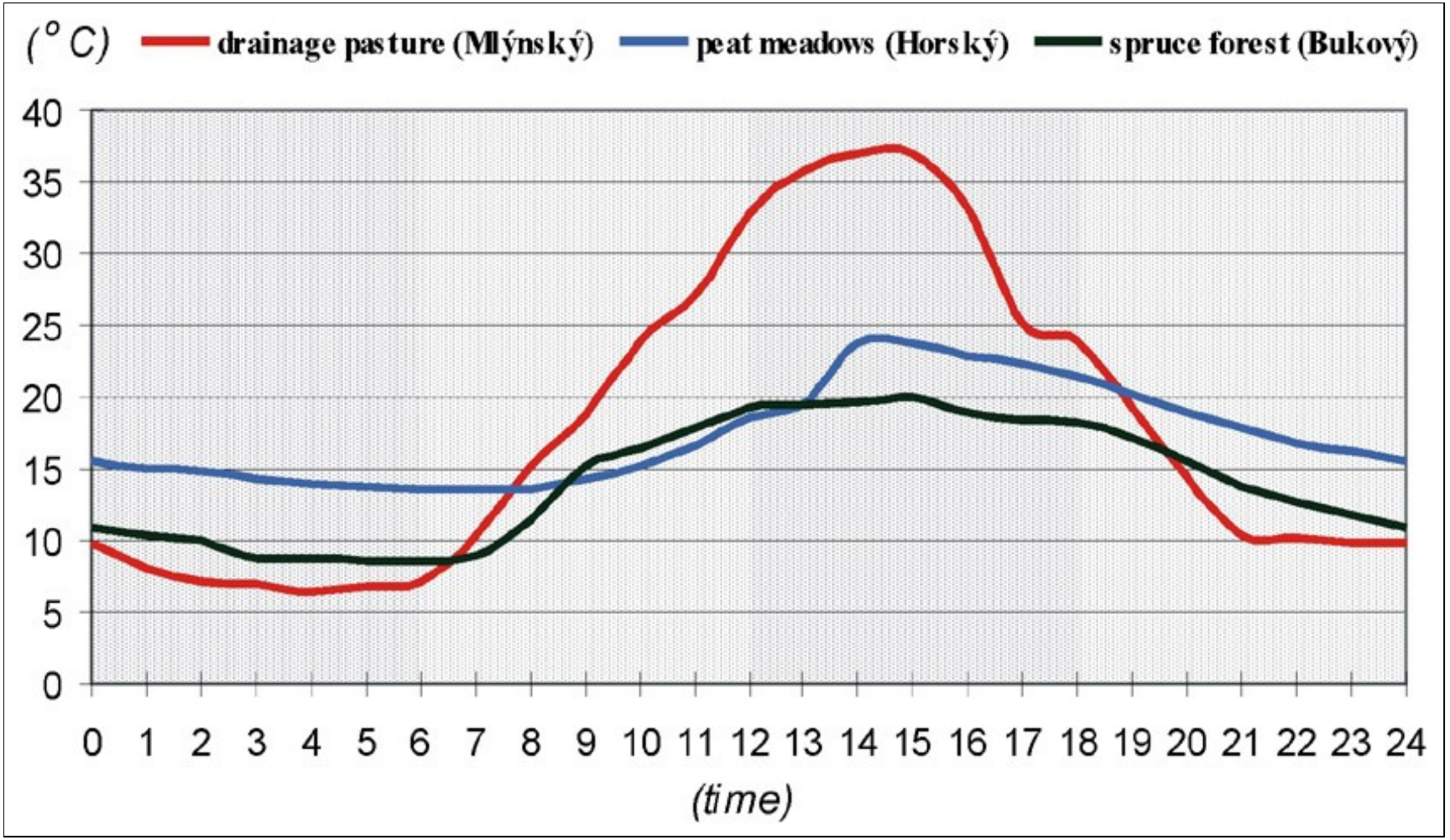


Water budgets in catchments during the period of 2000 – 2004

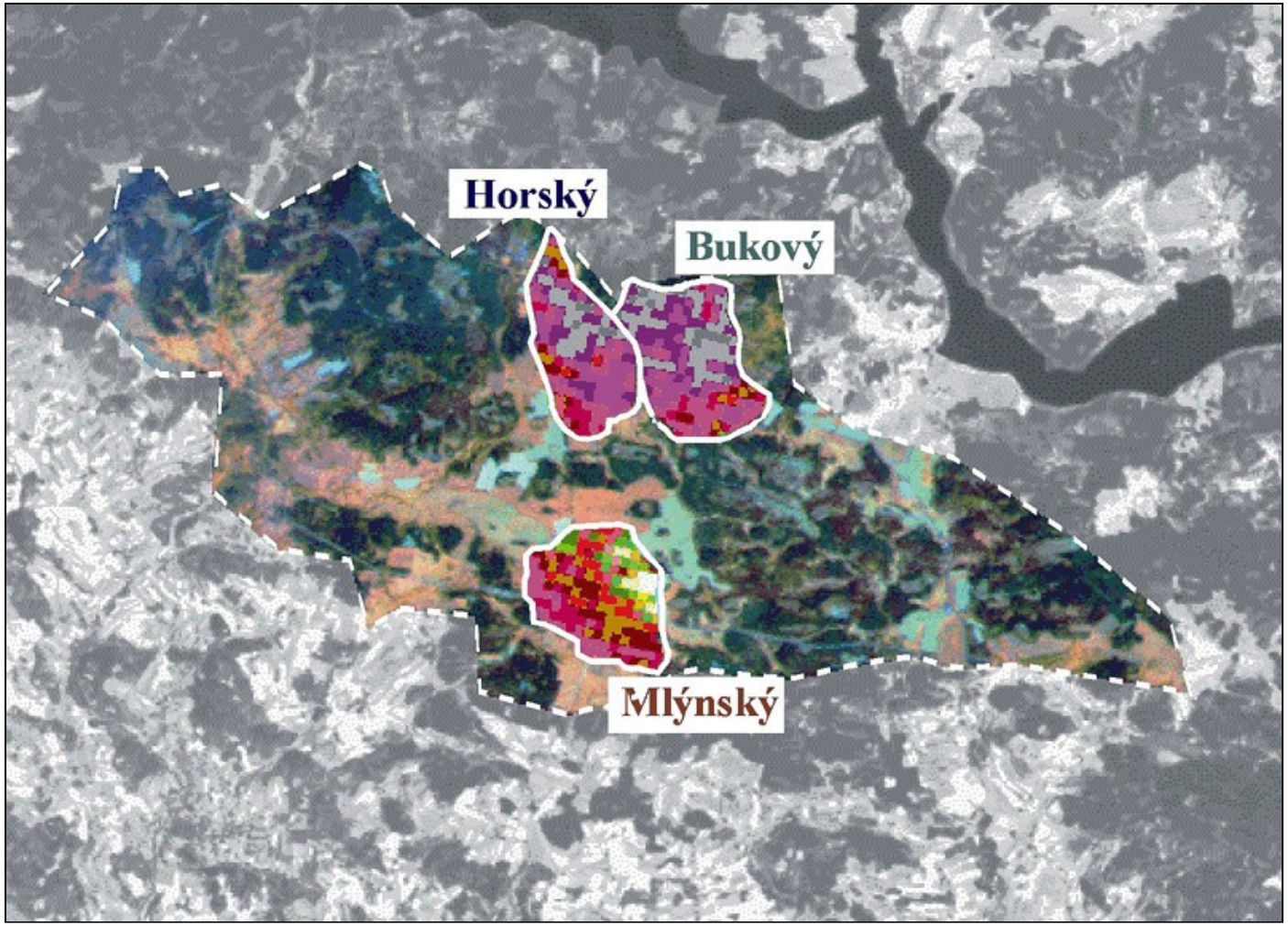
($m^3.ha^{-1}.year^{-1}$ and % of retained water in catchments)

		2000	2001	2002	2003	2004	average	%
Mlýnský	input	11 019	9 339	12 851	8 968	9 350	10 305	
	output	10 934	7 339	12 438	7 751	8 105	9 313	10
Horský	input	11 935	10 065	15 107	9 494	9 934	11 307	
	output	6 558	5 382	8 394	6 448	6 747	6 706	41
Bukový	input	11 935	10 065	15 107	9 494	9 934	11 307	
	output	4 623	4 778	6 451	4 862	5 495	5 242	54

Daily course of temperature



Relative temperature of land cover



MOST BASIN (N. Bohemia)

TŘEBOŇ BASIN (S. Bohemia)

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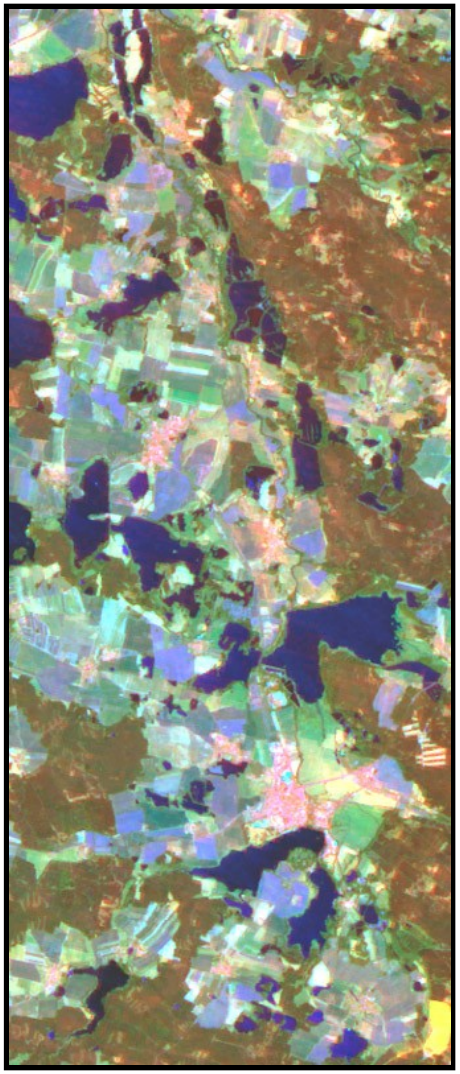

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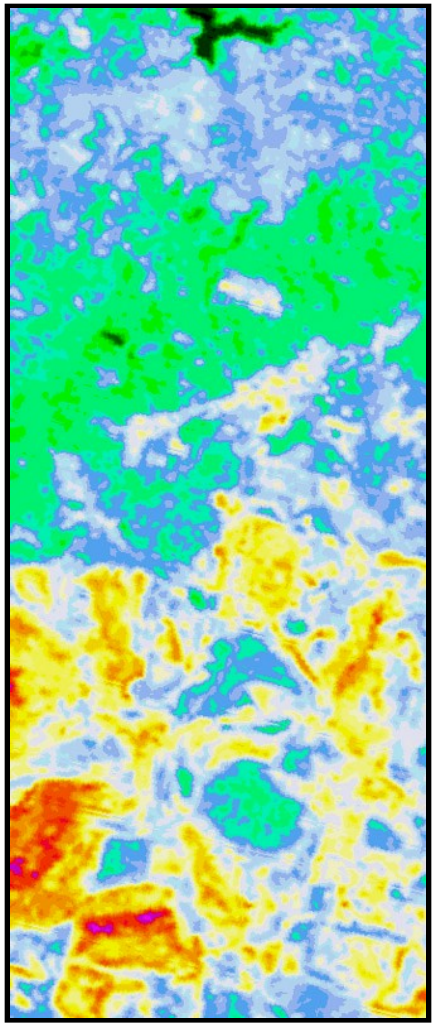
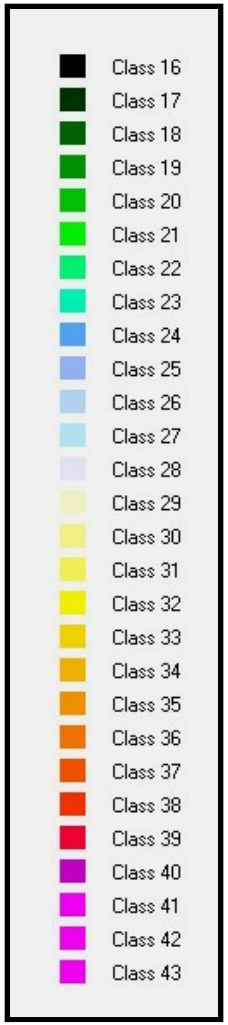
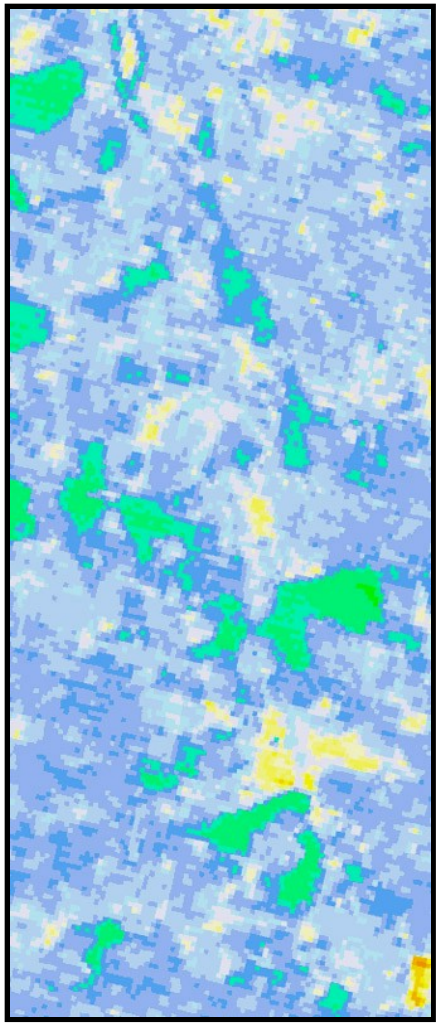
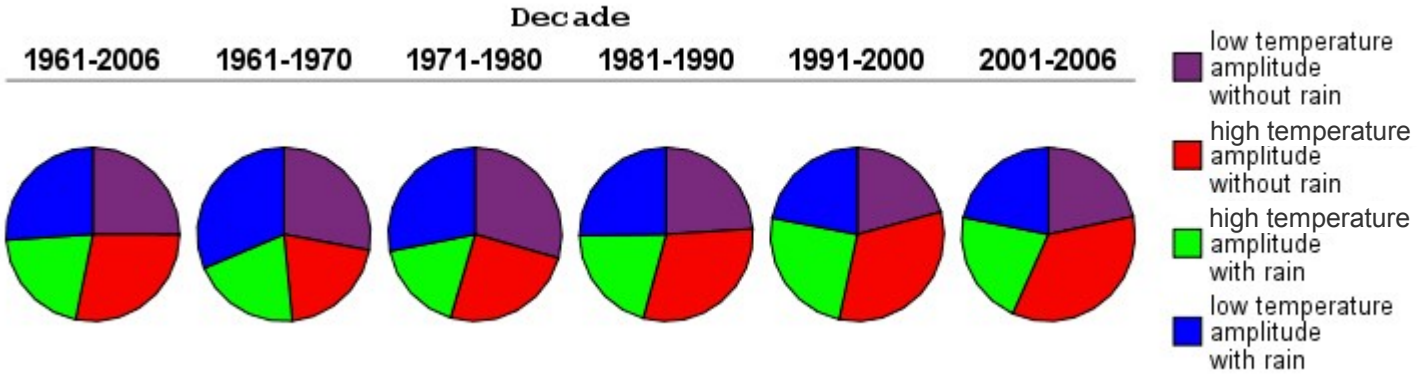
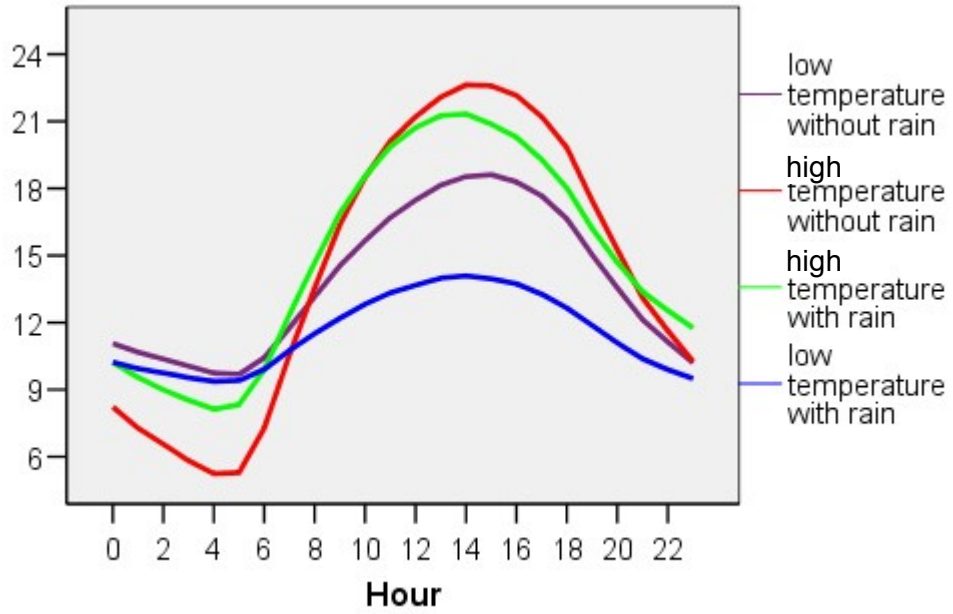




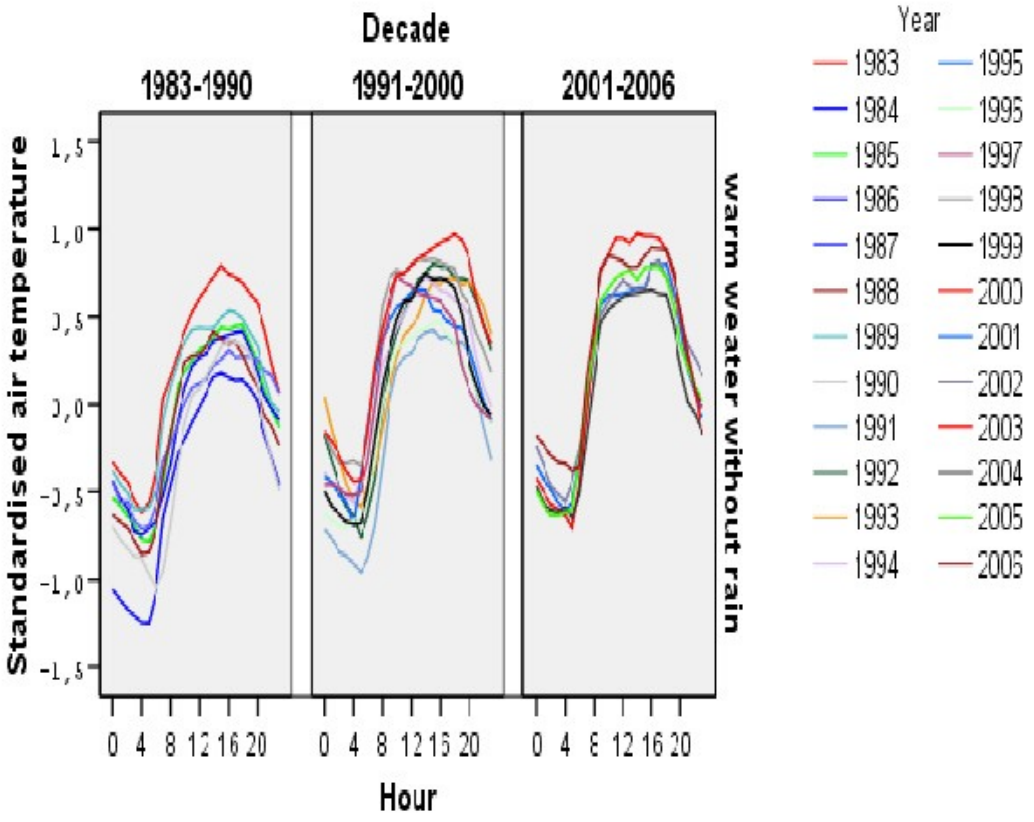


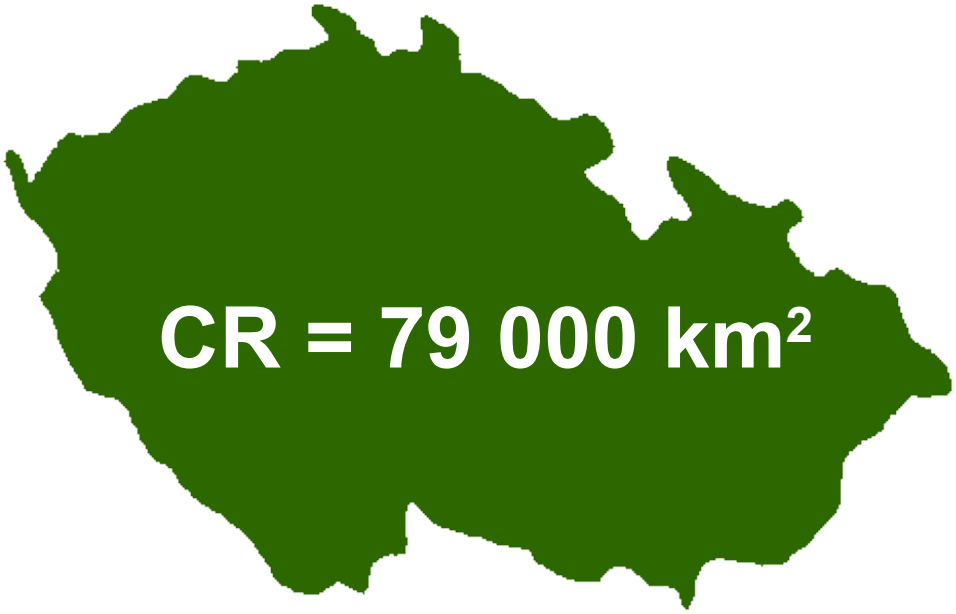
Types of days in Hobart





Deviations from average daily course of temperatures





Evapotranspiration decrease of 1 mm a day

↓

Sensible heat release of cca 56 000 GWh
(An. production of all PP in CR)

Sensible heat flux from 20 km² of drained land

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Energy production of all PP in CR (12 000 MW)

Ancient civilizations are burried under sand. Sumer,Mesopotamia, (Euphrates, Tigris)

Dranage systems

Soil degradation, Hypersalinity

Man made landscape

Třeboň Biospehere Reserve

WATER & PLANTS

The perfect airconditioning of the Earth

Learn from ecosystems - RECYCLING