




Role of wetlands and wetland vegetation in regional water cycling

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International Course UNESCO MaB

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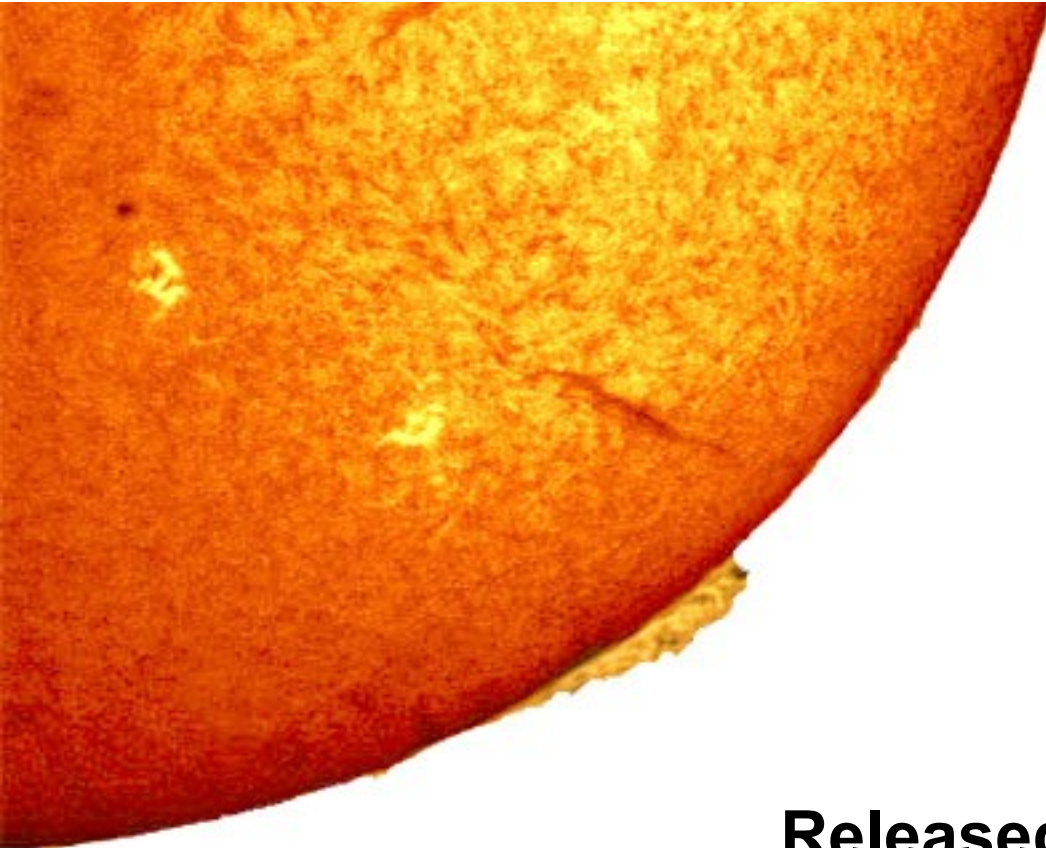
Landscape – open system
Income of solar energy
Distribution of solar energy in
landscape
Role of water and vegetation in
dissipation of solar energy



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



S U N

Exists 5 billion years

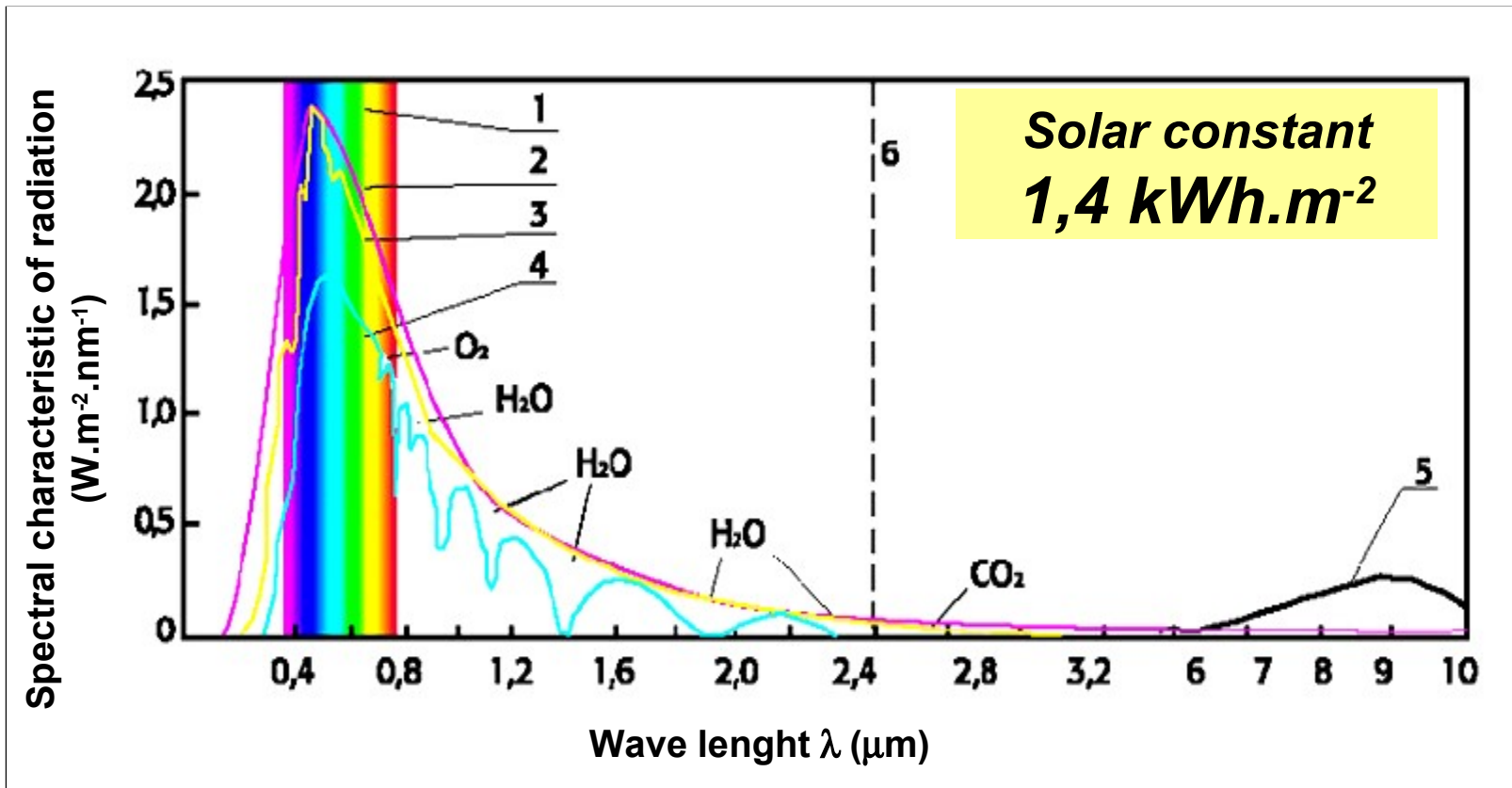
Released energy – $3,8 \times 10^{26}$ J/sec

Earth get 180 000 TW, we use only 10 TW

Solar constant – 1400 W/m^2

Up to 1000 W/m^2 land surface

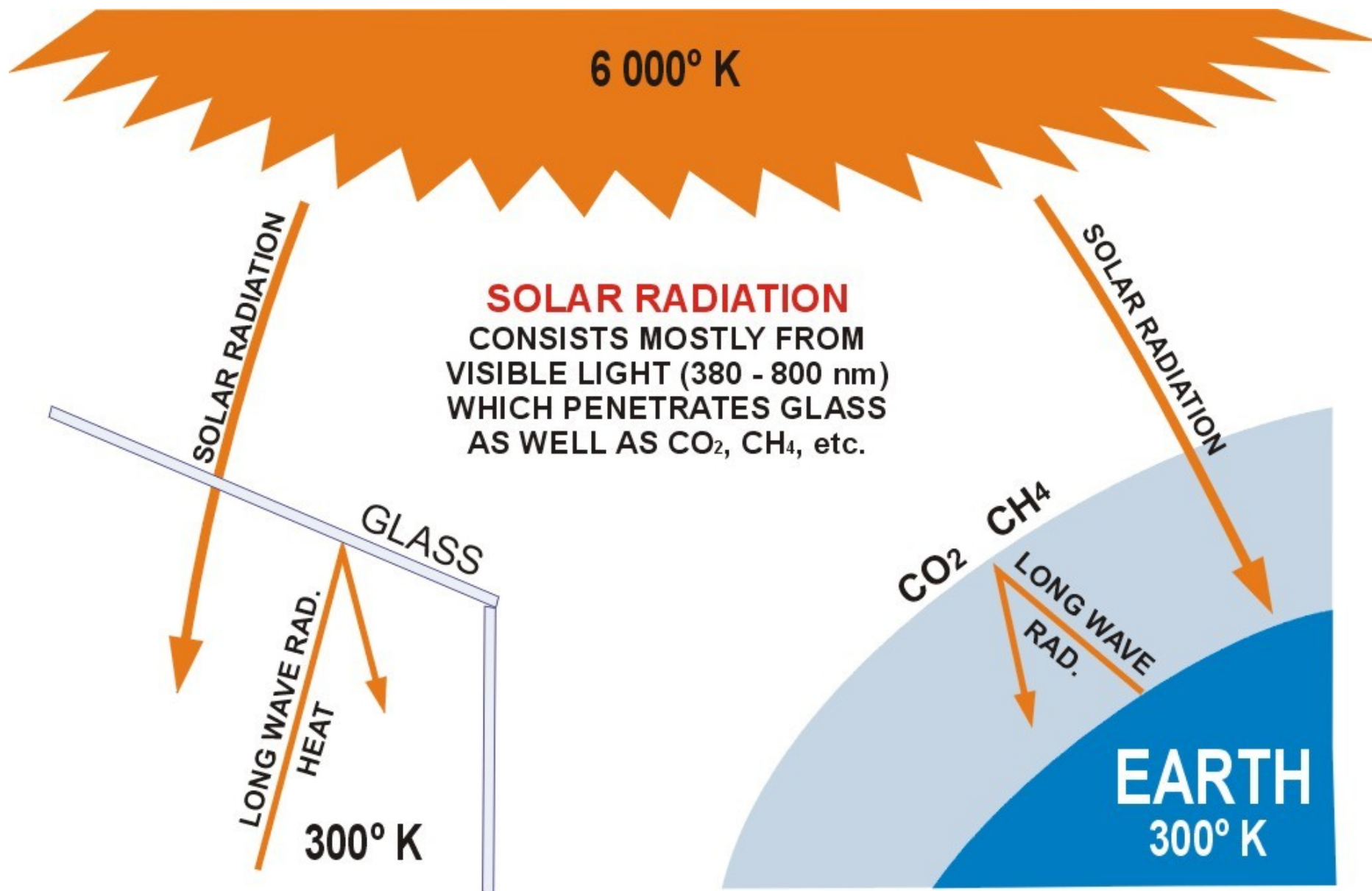
SOLAR ENERGY FLUX THROUGH ATMOSPHERE



Stefan – Boltzmann law
 $R = \tau T^4$

Wien's law
 $\lambda_{max} = 2897 / T$

GREEN HOUSE EFFECT





Greenhouse effect

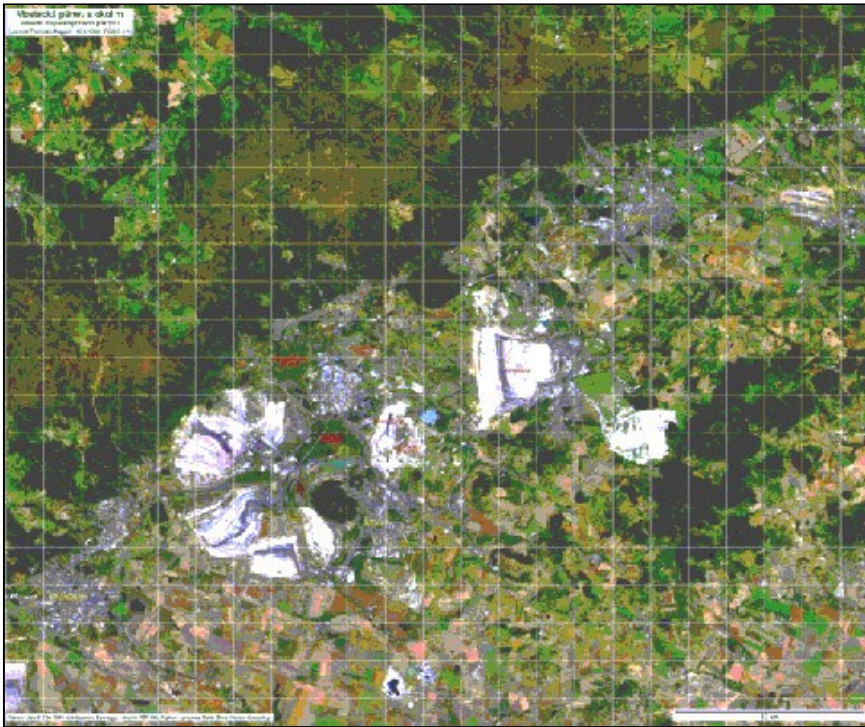
- How much solar energy is radiated back to Earth from the atmosphere by additional green house gases?
- How much is the radiation enforcement ?

Most open cast basin

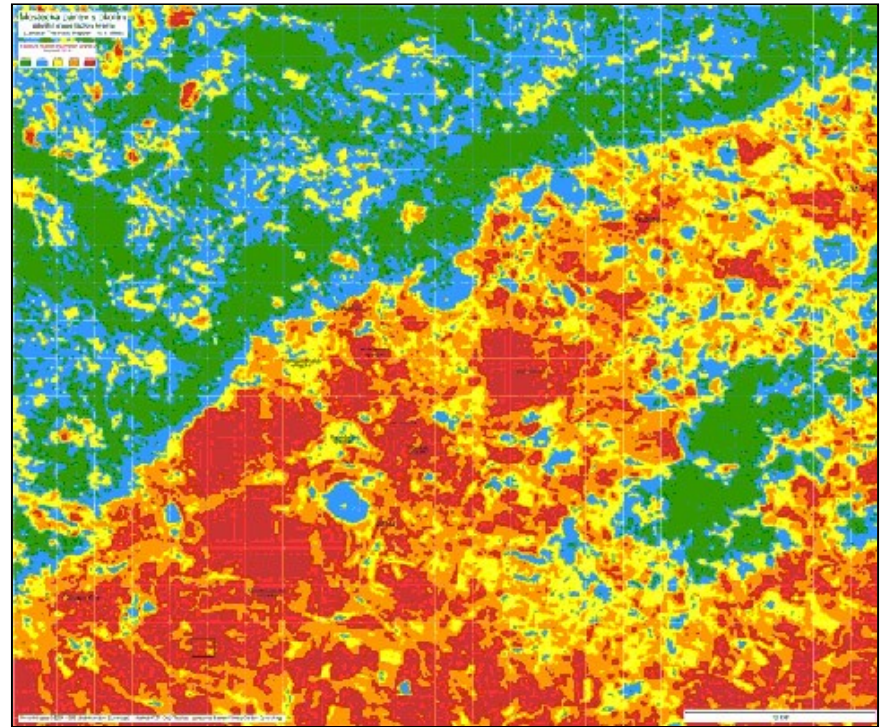
Black Triangle, Northern Bohemia



Most open cast basin



RGB



Infrared





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.

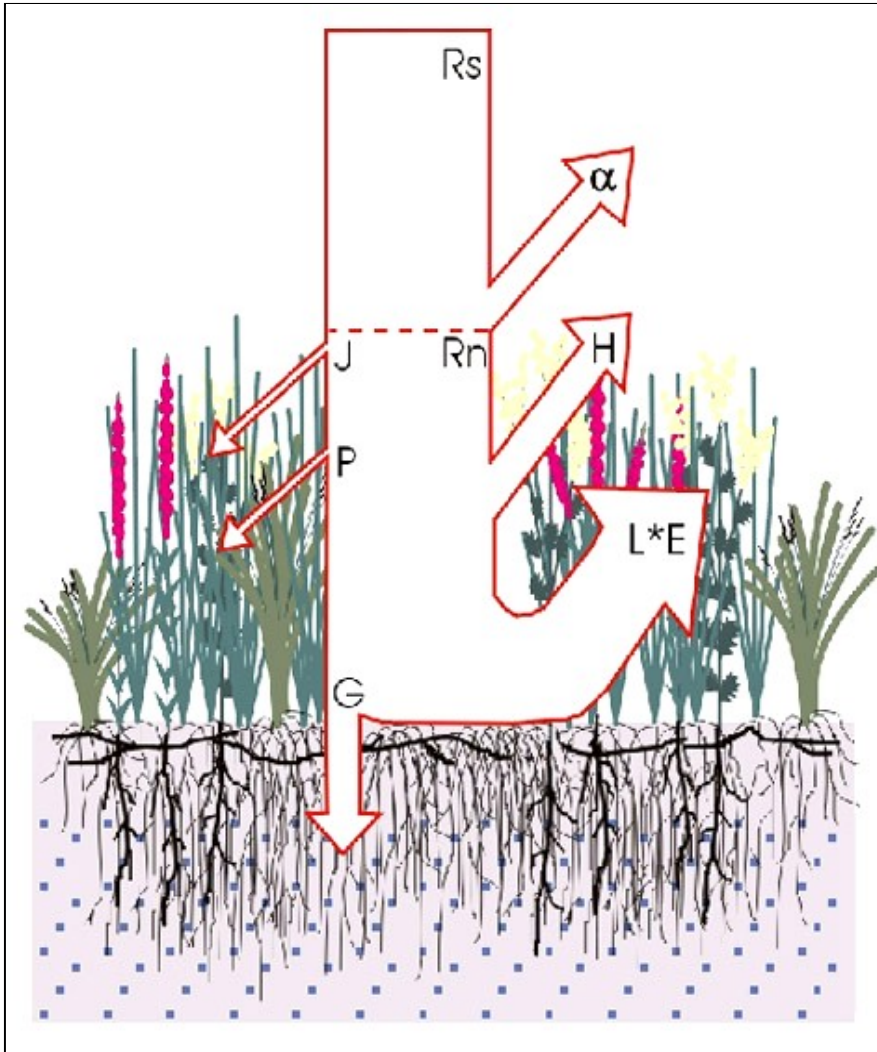
The latent heat would be 278 kWh, with cooling efficiency **23 kW** over 24 hours.

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

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



MAIN SOLAR ENERGY FLUXES



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

[Wm^{-2}]

R_s - global radiation

R_n - net radiation

α - albedo

H - sensible heat flux

$L \times E$ - latent heat x evapotransp.

G - ground heat flux

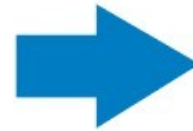
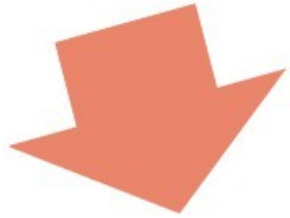
J - accumulation of heat in biomass

P - photosynthesis

LATENT HEAT



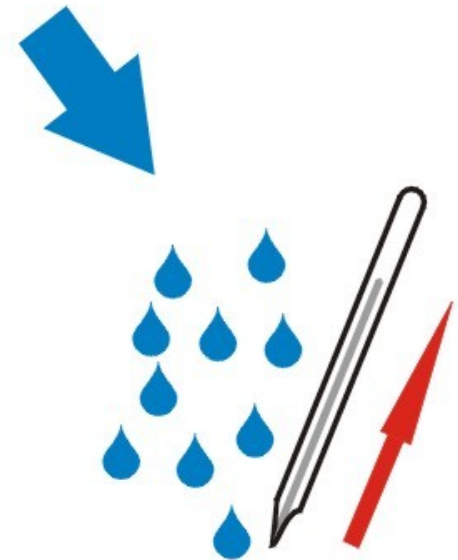
energy consumption
0,7 kWh



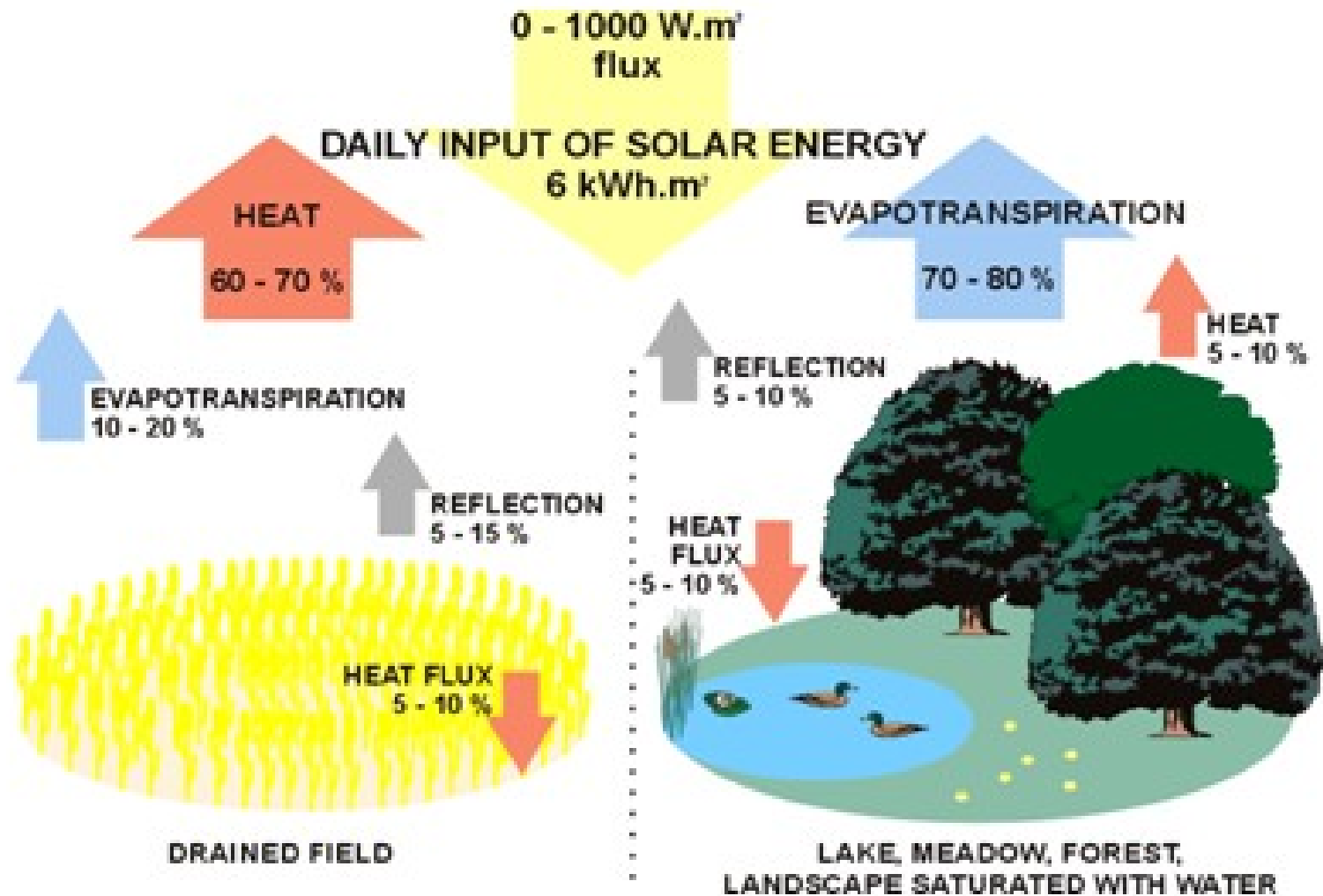
energy release
0,7 kWh



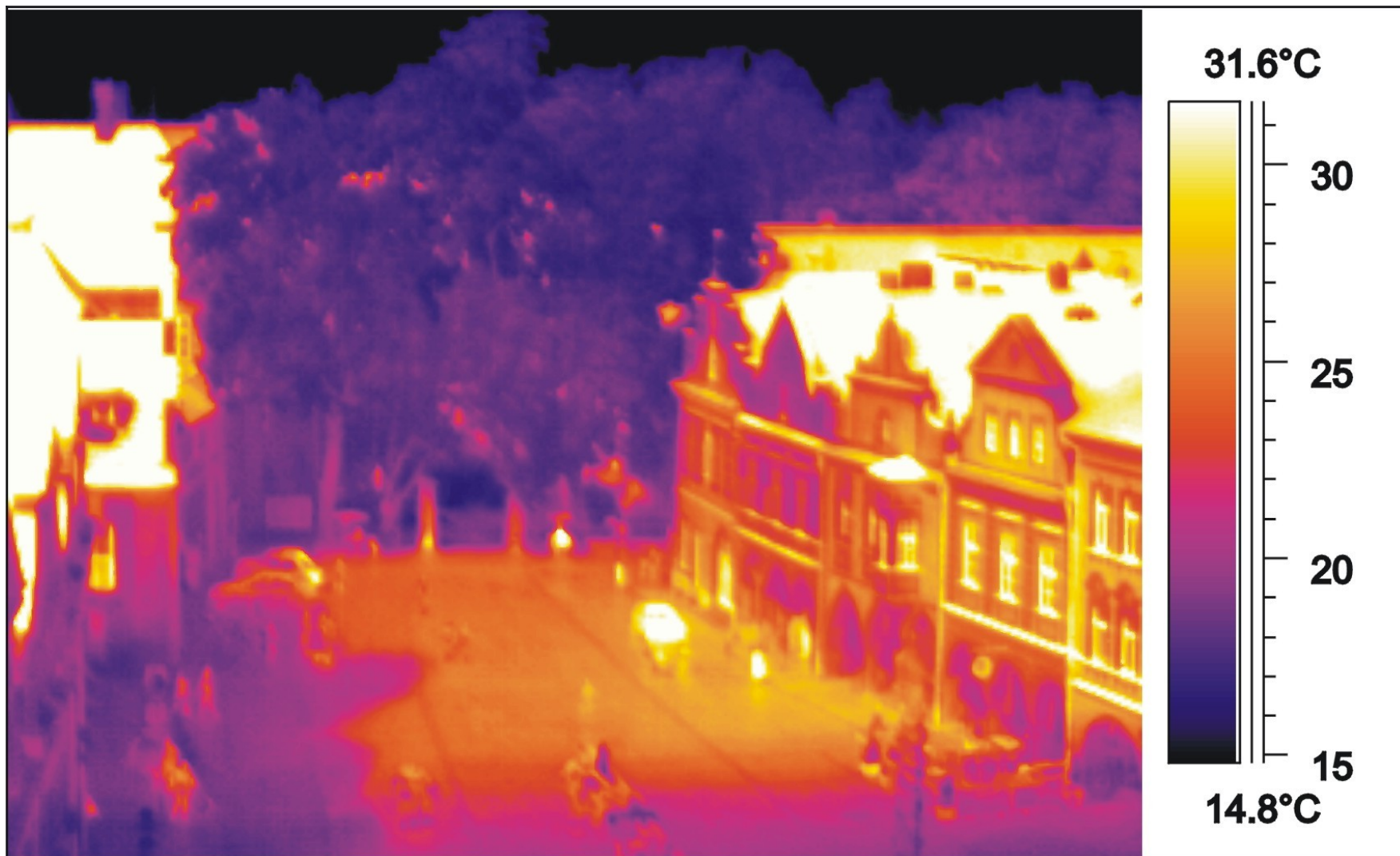
1 liter



EVAPOTRANSPIRATION



IR picture of Třeboň square



Evapotranspiration

Evapotranspiration of **terrestrial** plants ~ 2 – 5 l/m²

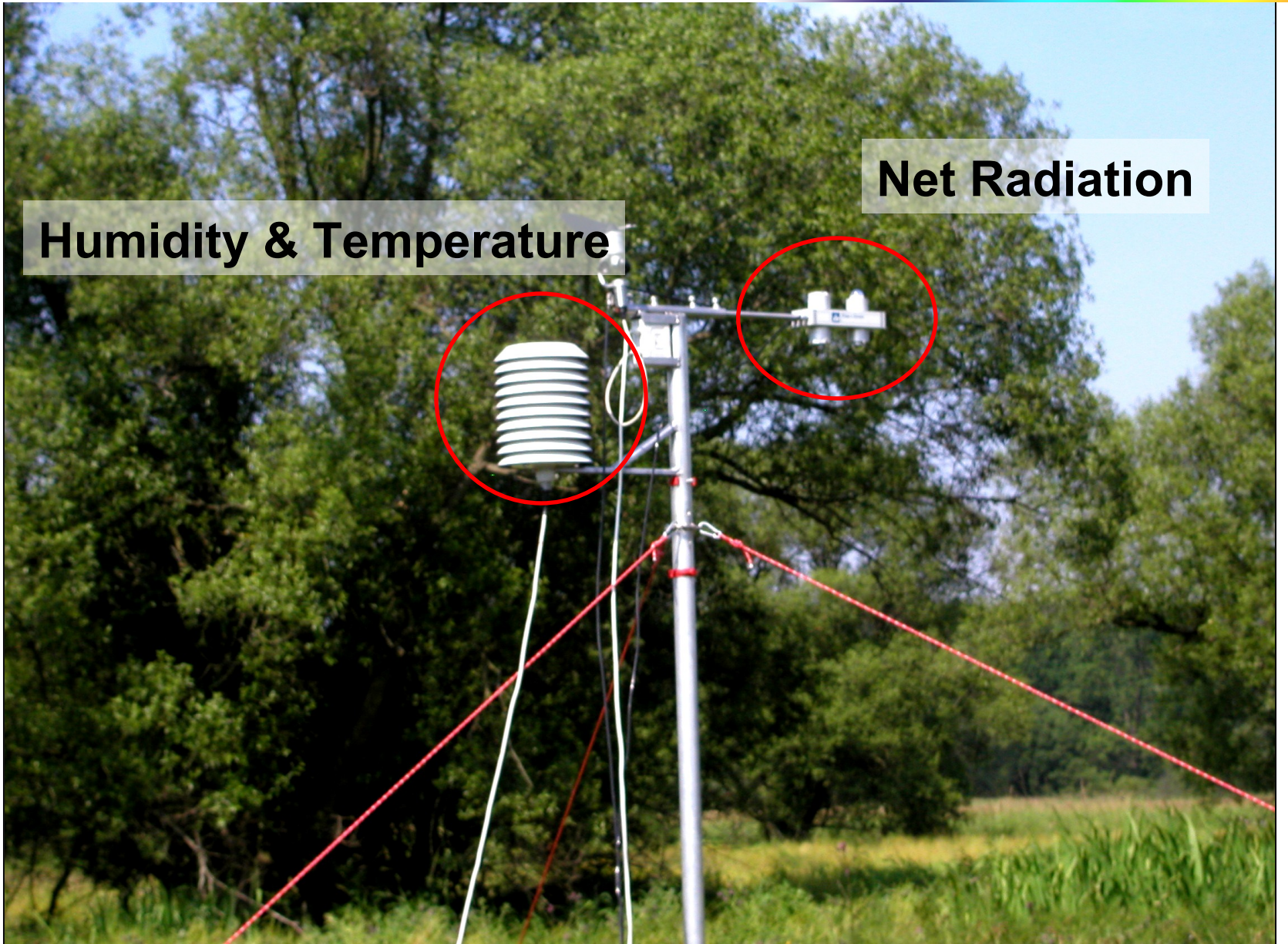
Evapotranspiration of **wetland** plants - **HIGHER**

Samples of extreme values

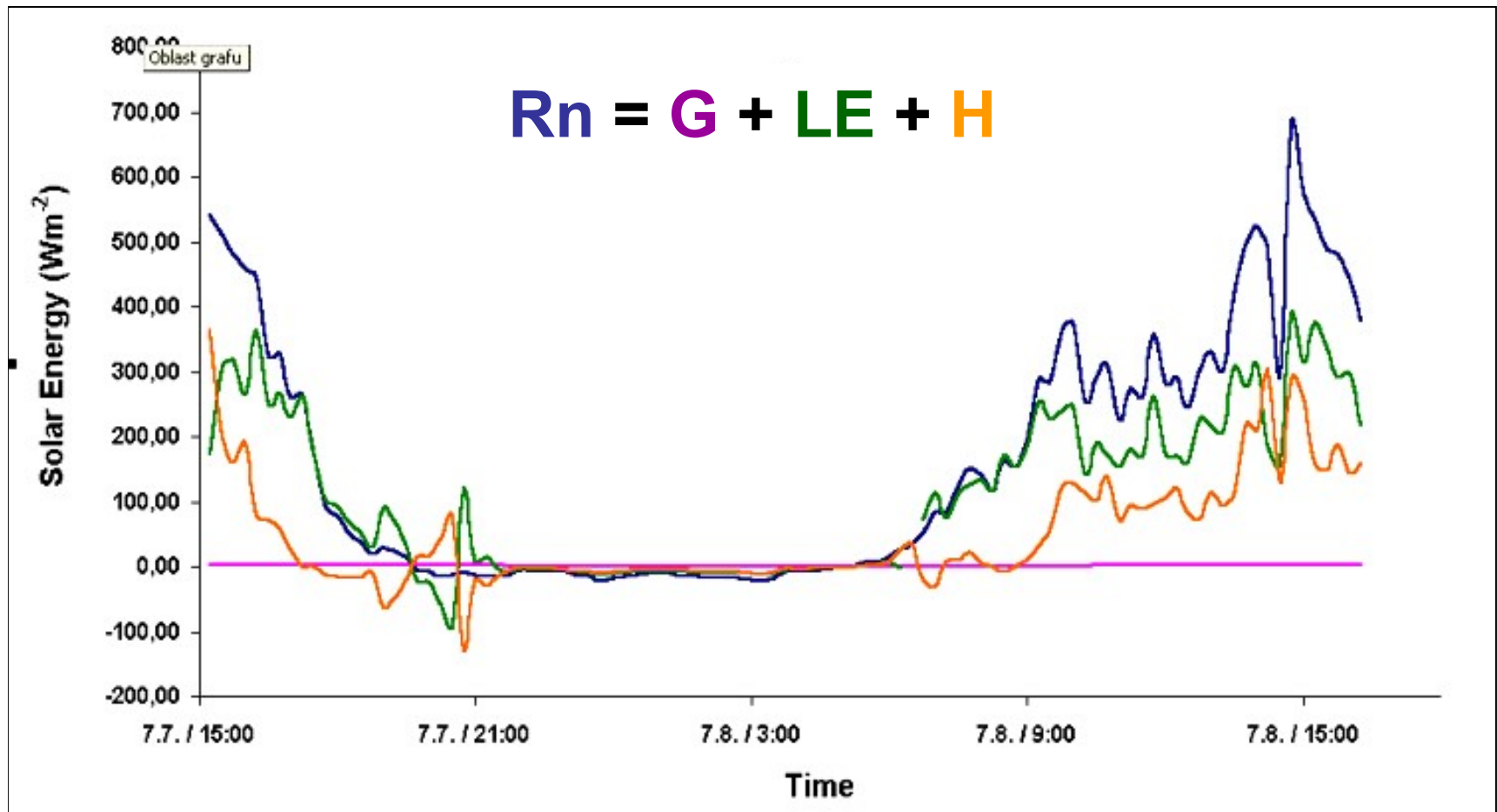
<i>Salix cinerea</i>	16 – 27 l/m ²
<i>Alnus glutinosa</i>	13 – 21 l/m ²
<i>Populus tremula</i>	9,7 – 14,9 l/m ²
<i>Prunus padus</i>	5,6 - 9 l/m ²
<i>Fraxinus excelsior</i>	5,8 – 8,4 l/m ²
<i>Pinus rotundata</i>	2 – 4 l/m ²
Sand	1,7 – 3,7 l/m ²

Humidity & Temperature

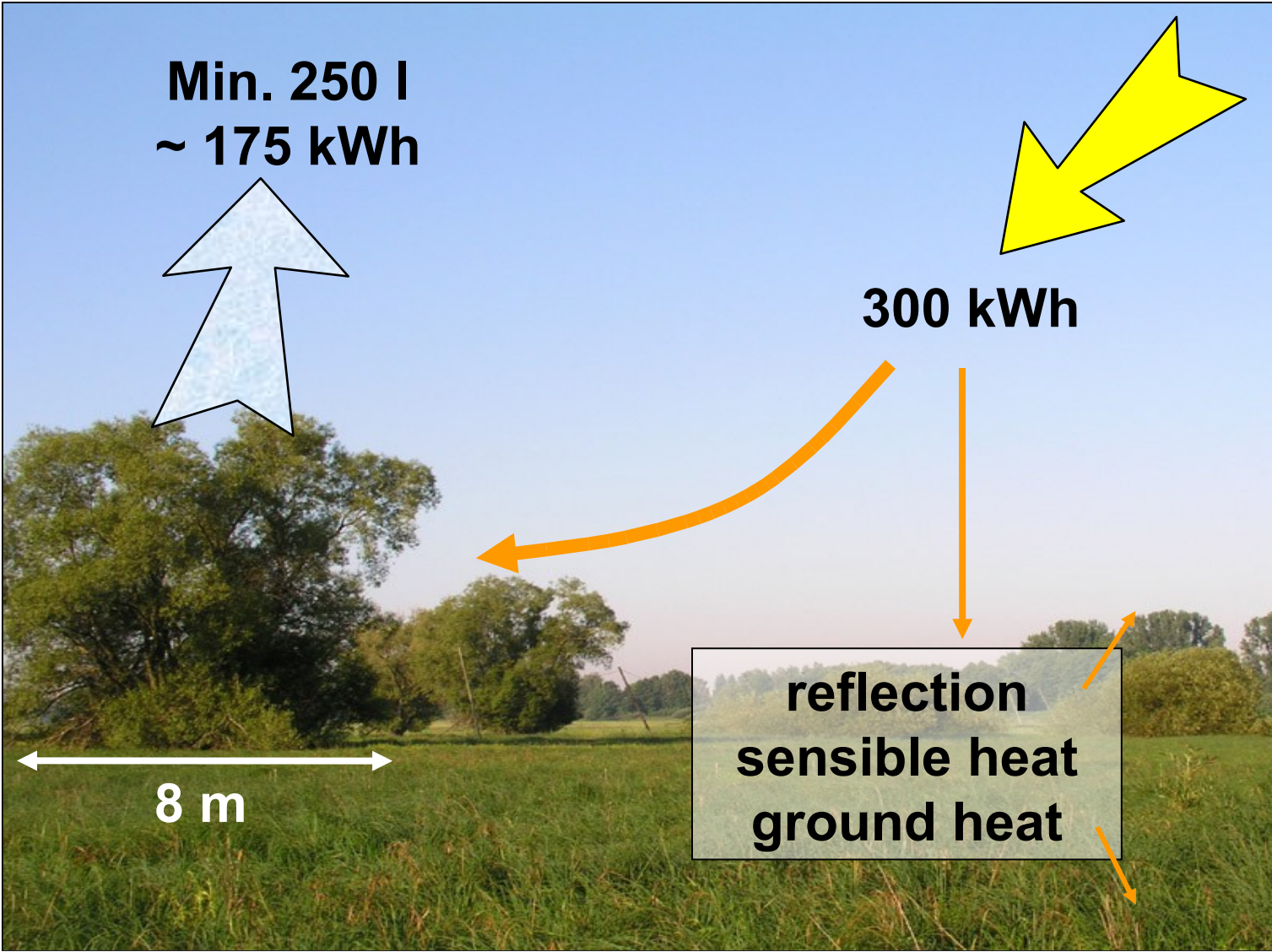
Net Radiation



Solar energy distribution in Wet Meadows



Daily energy budget in wetland

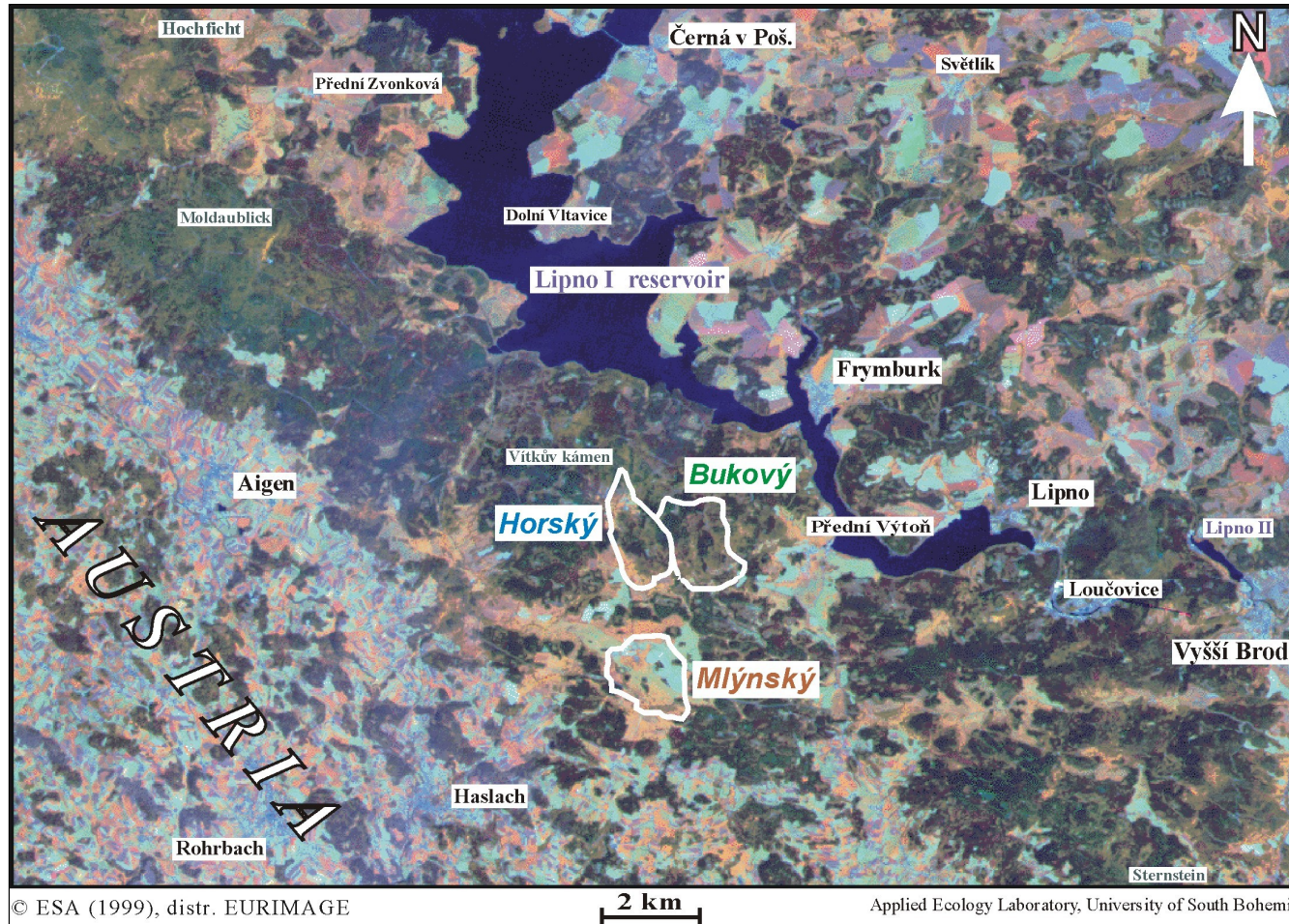


Different landscape management



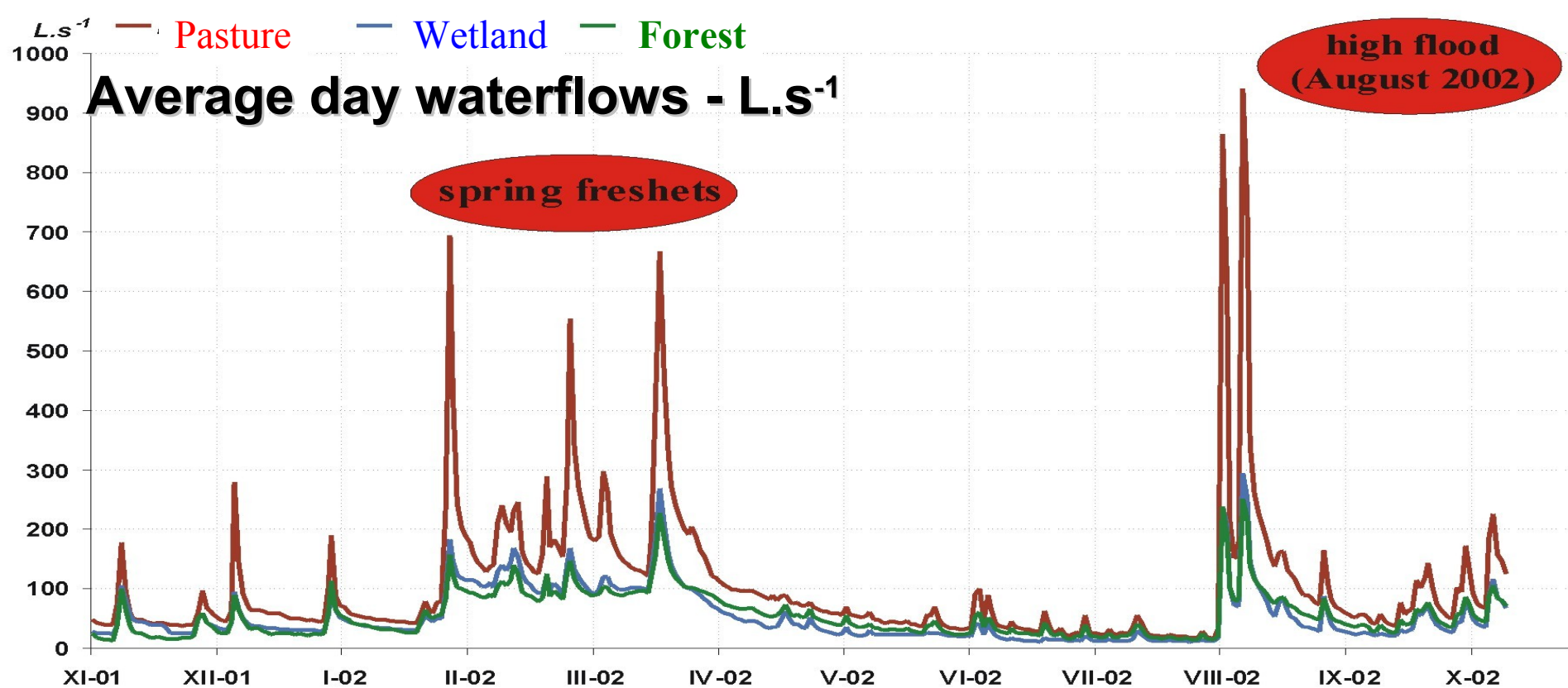
Different landscape management

Šumava National Park, Southern Bohemia

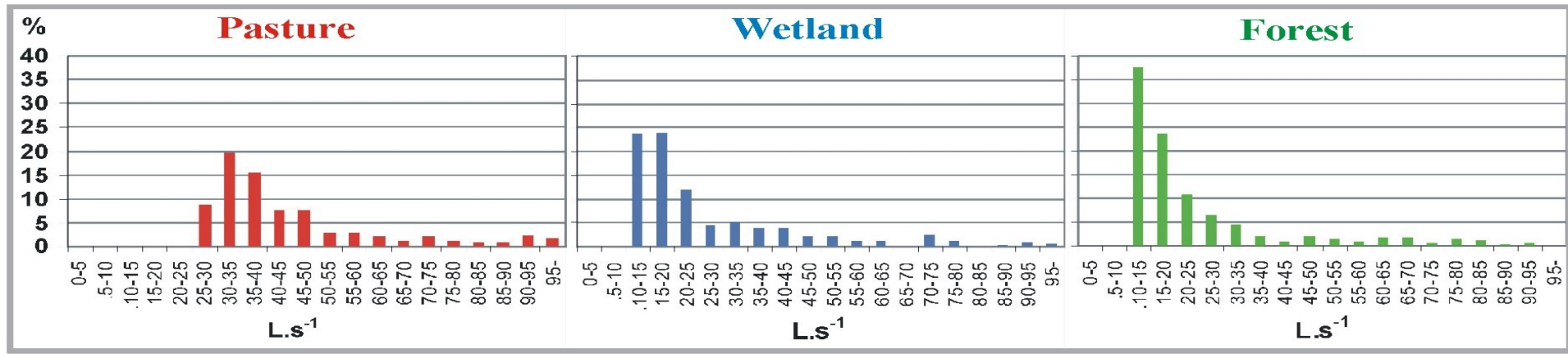


Basic characteristics

	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 **!**

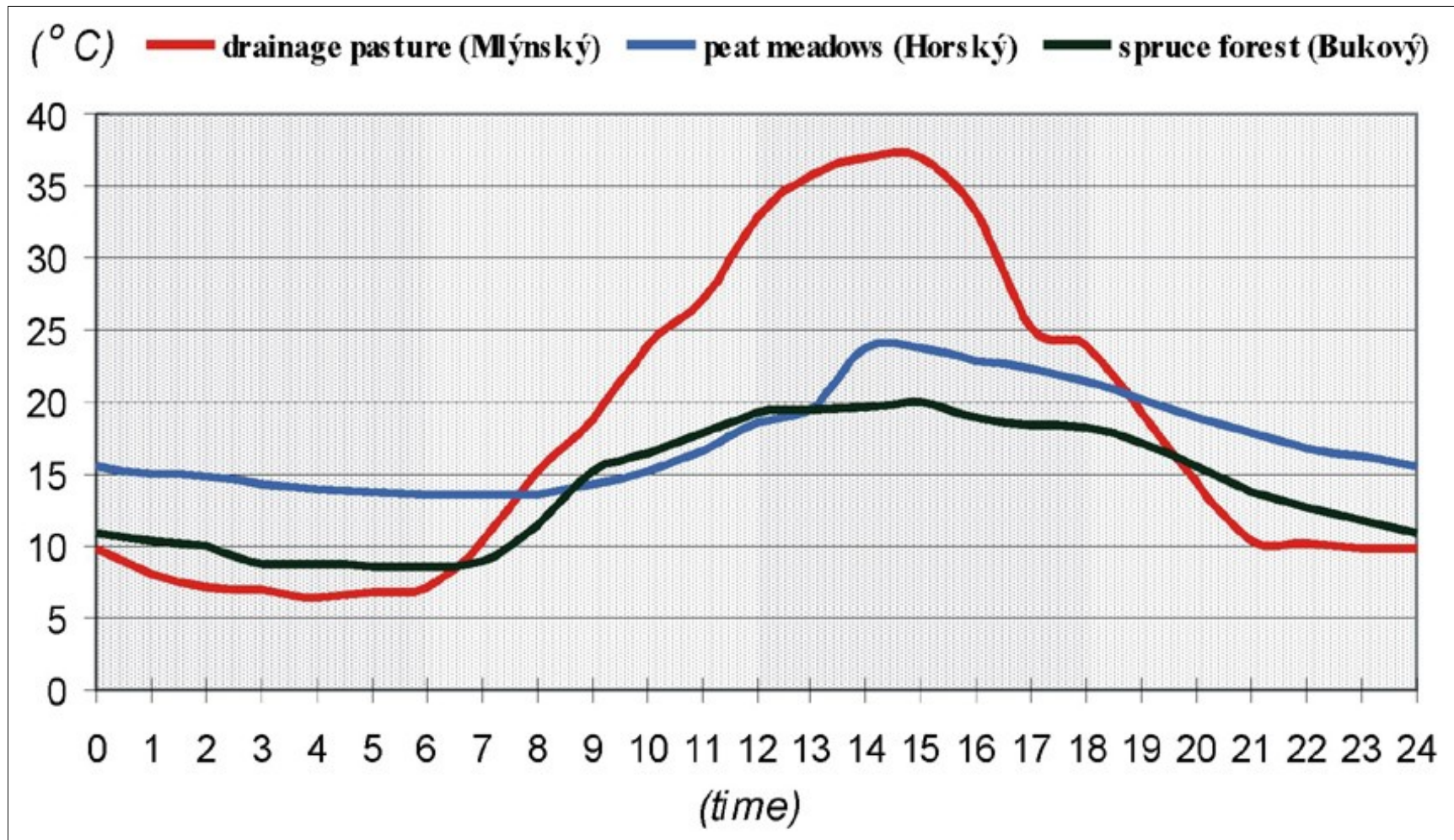


Water budgets in catchments during the period of 2000 –
2004

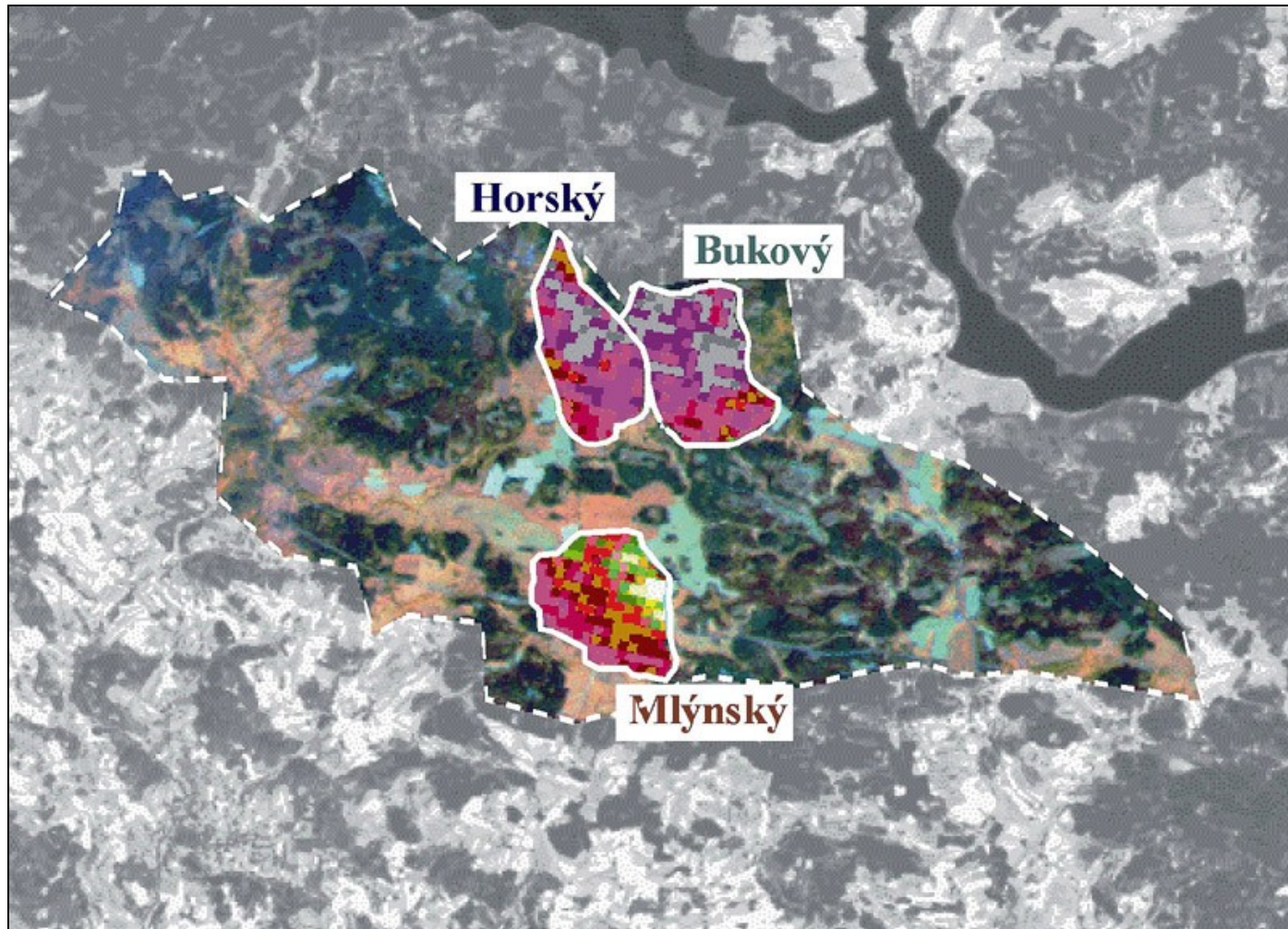
(m³.ha⁻¹.year⁻¹ and % of retained water in catchments)

		<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>average</i>	<i>%</i>
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)



MOUNTAINS

TOWN

TOWN

OPEN
CAST
MINES

TŘEBOŇ BASIN (S. Bohemia)

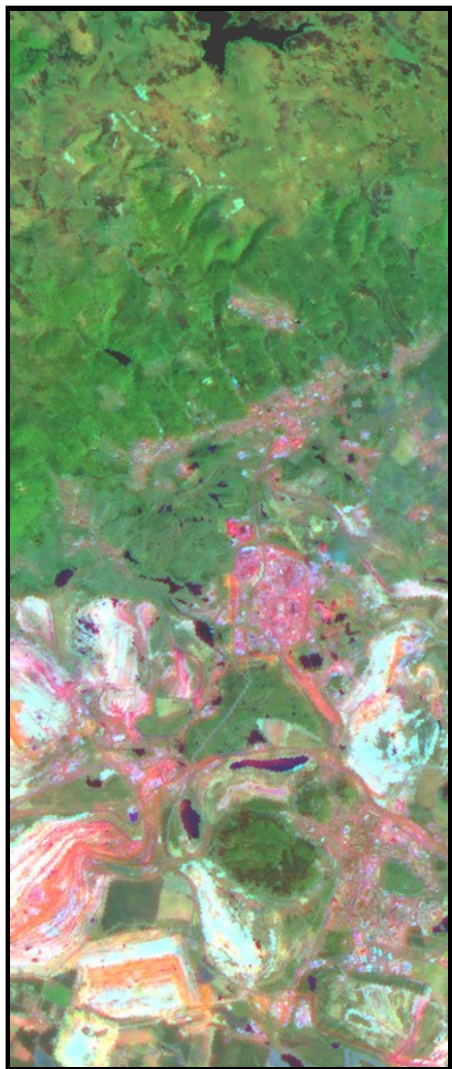


LAKE (400ha)

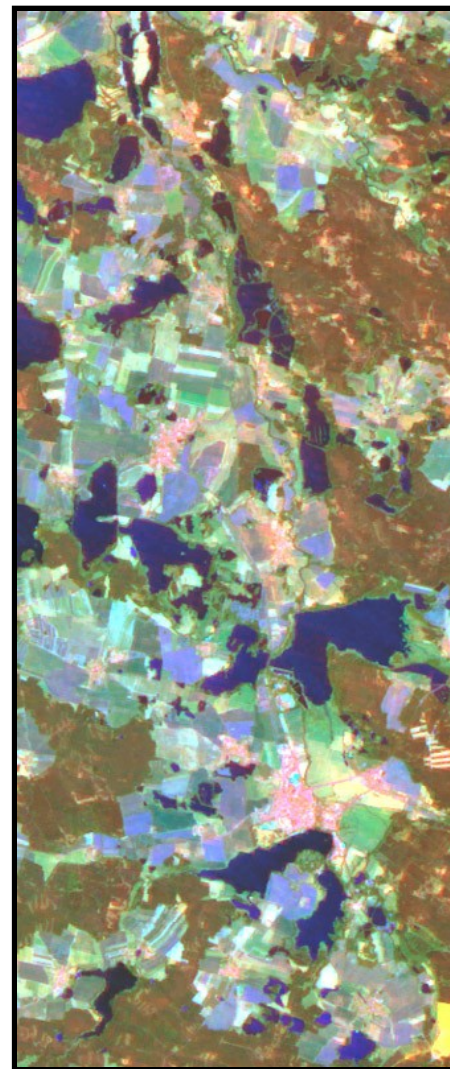
TOWN



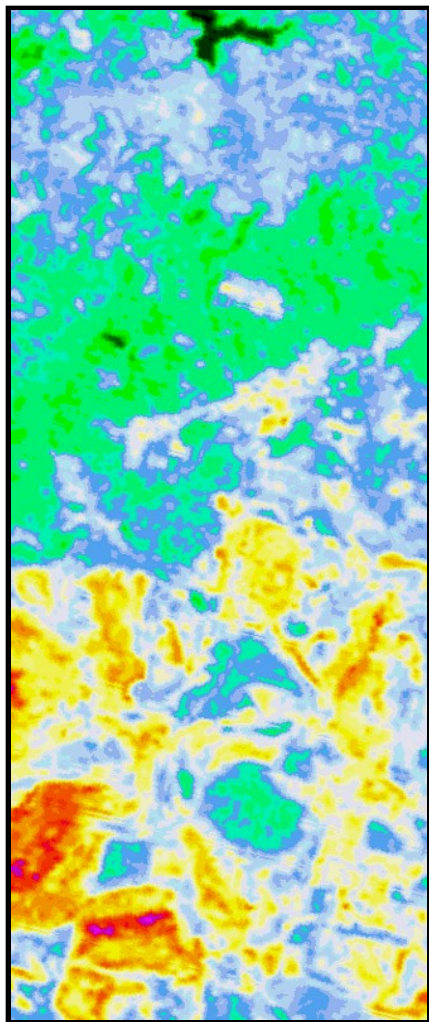
MOST BASIN (N. Bohemia)



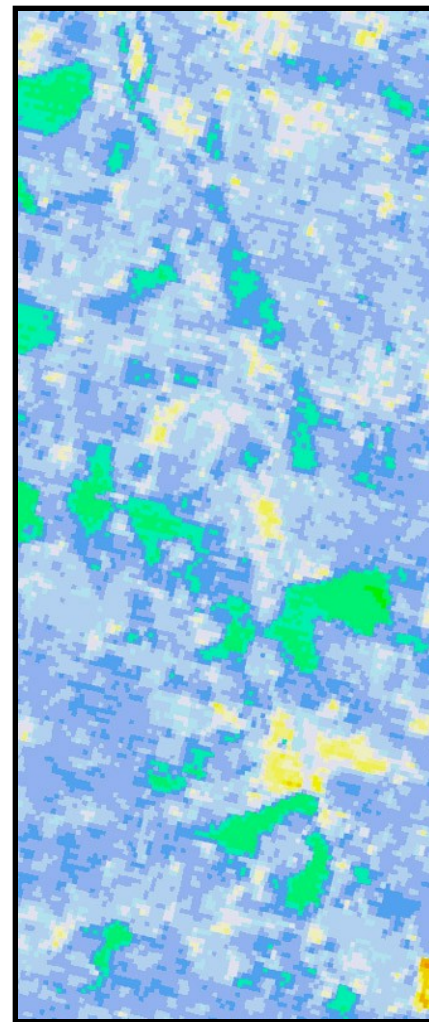
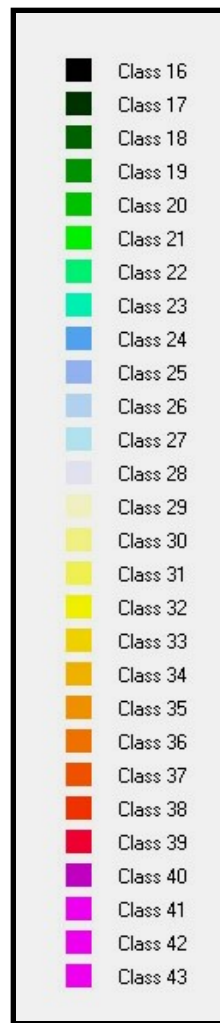
TŘEBOŇ BASIN (S. Bohemia)



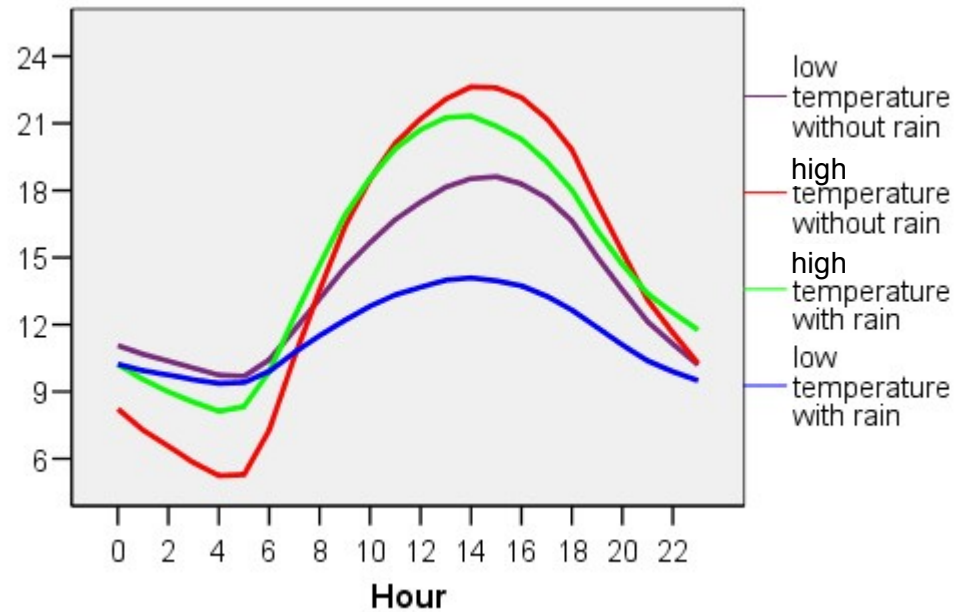
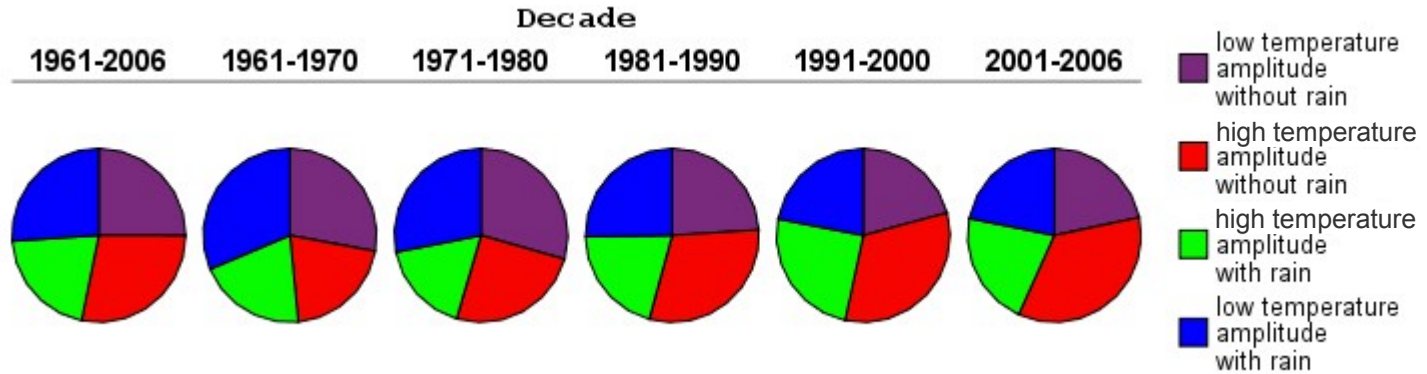
MOST BASIN (N. Bohemia)



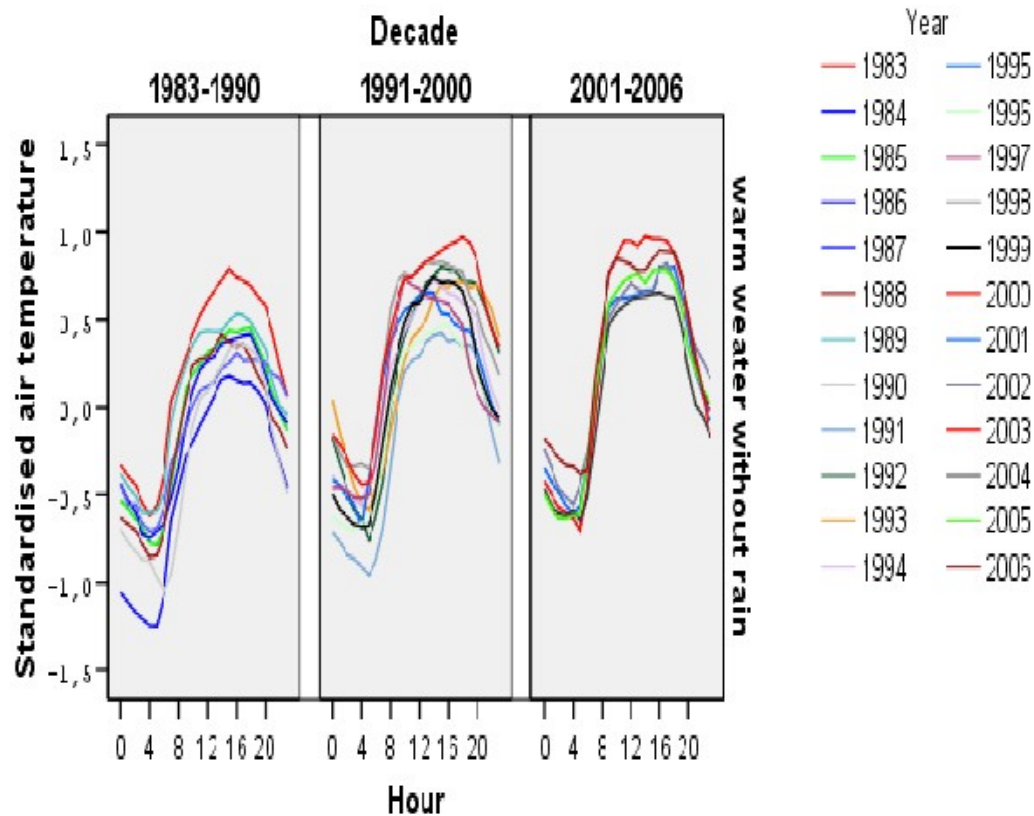
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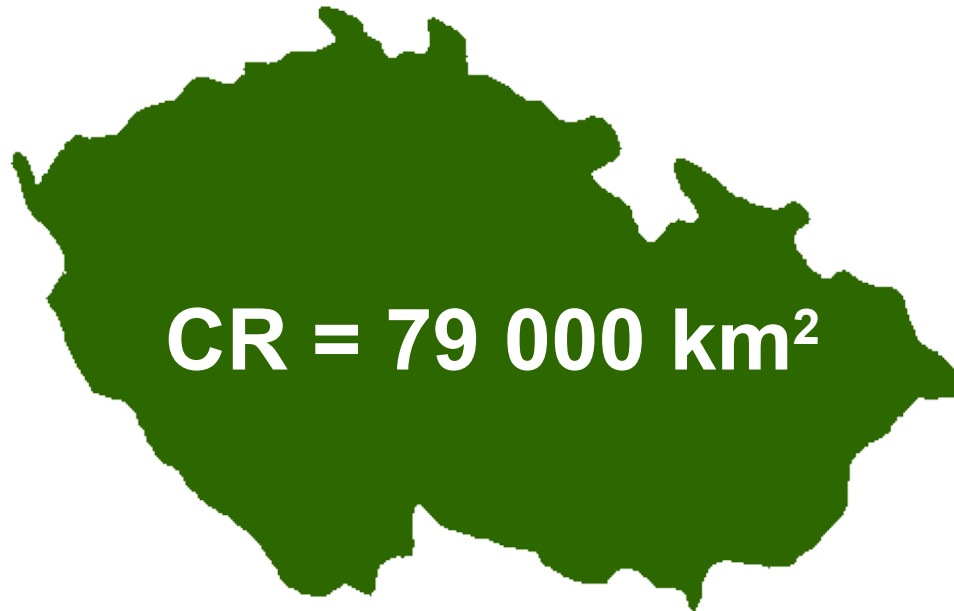


Types of days in Hobart



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

~

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





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

Drainage systems

**Soil degradation,
Hypersalinity**



Man made landscape

Třeboň Biosphere Reserve



WATER & PLANTS

The perfect airconditioning of the Earth

Learn from ecosystems - RECYCLING

