universität wien

International Research Symposium

Methodologies for Investigating and Fostering Plant Awareness

Workshop 2

Methodologies for investigating the awareness about the role of plants in sustainable development

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UNIVERSITY OF WESTERN MACEDONIA

Aims – core questions of the workshop:

1st part:

- Which are the ideal quantitative and qualitative research approaches for determining the link between Plants-Sustainable Development Goals and Limited Plant Awareness-Sustainable Development?
- Which are the key competencies in Education for Sustainable Development that can be used for fostering plant awareness?

2nd part:

- How to assess the comprehension of plant's role in human environment in frame of any tool for plant awareness assessment?
- In what way can the understanding of plant importance via sustainable education affect students' attitudes towards plants?

Plants supporting life phenomenon and human welfare

«plants are still neglected in the broader biodiversity and sustainability debate»
(Sharrock & Jackson, 2017, 292)

- 98% of planet's biomass and main energy input to the earth through photosynthesis
- Humans' diet depends 100% on plants (directly or indirectly)
- Contribute essentially to the pharmaceutical industry
- Offering a context for spiritual uplift, recreation and education
- Plants cleaning up soil, air, and water contaminated with hazardous contaminants («Phytoremediation»)

Humans' Connectedness to Plants

Plant Blindness (Wandersee & Schussler, 2001)

(a) failing to see, take notice of, or focus attention on the plants in one's daily life
(b) thinking that plants are merely the backdrop for animal life
(c) misunderstanding what kinds of matter and energy plants require to stay alive
(d) overlooking the importance of plants to one's daily affairs
(e) failing to distinguish between the differing time scales of plant and animal activity
(f) Lacking hands-on experiences in growing, observing, and identifying plants in one's own geographic region;
(g) failing to explain the basic plant science
(h) lacking awareness that plants are central to a key biogeochemical cycle
(i) being insensitive to the aesthetic qualities of plants

Lack of Plant Awareness or Plant Awareness Disparity (Pany et al., 2022; Parsley, 2020)

ATTENTION (People do not pay attention to plants in their everyday lives, limited visual perception)

RELATIVE INTEREST (People are not as interested in plants as they are in animals)

ATTITUDE (People expressing disinterest in talking, learning or spending time with plants)

KNOWLEDGE / MISCONCEPTIONS (Lack of knowledge, alternative ideas & flawed mental models)

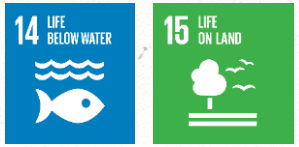
Plants & SDGs

Plants & SDGs

*Farming First is a multi-stakeholder organization that advocates for the centrality of agriculture in sustainable development. The organization was founded in 2002 by a group of farmers, scientists, and development practitioners who were concerned about the increasing focus on industrial agriculture and the neglect of traditional farming practices.

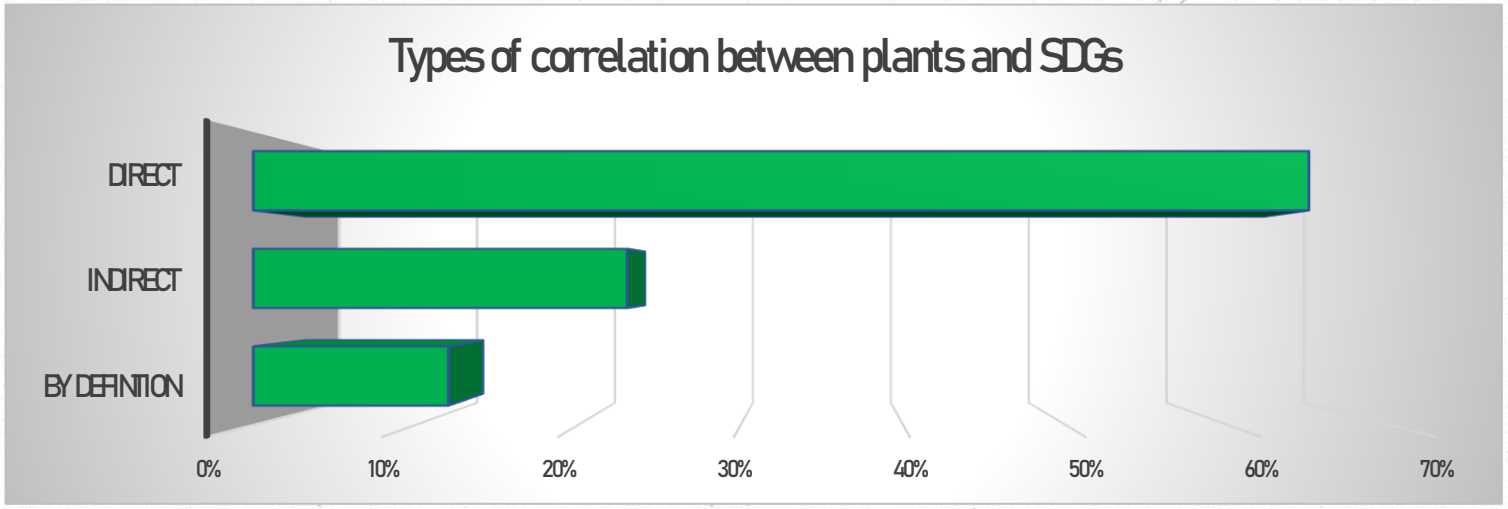
SDGs & Plants

Correlation by definition (2)



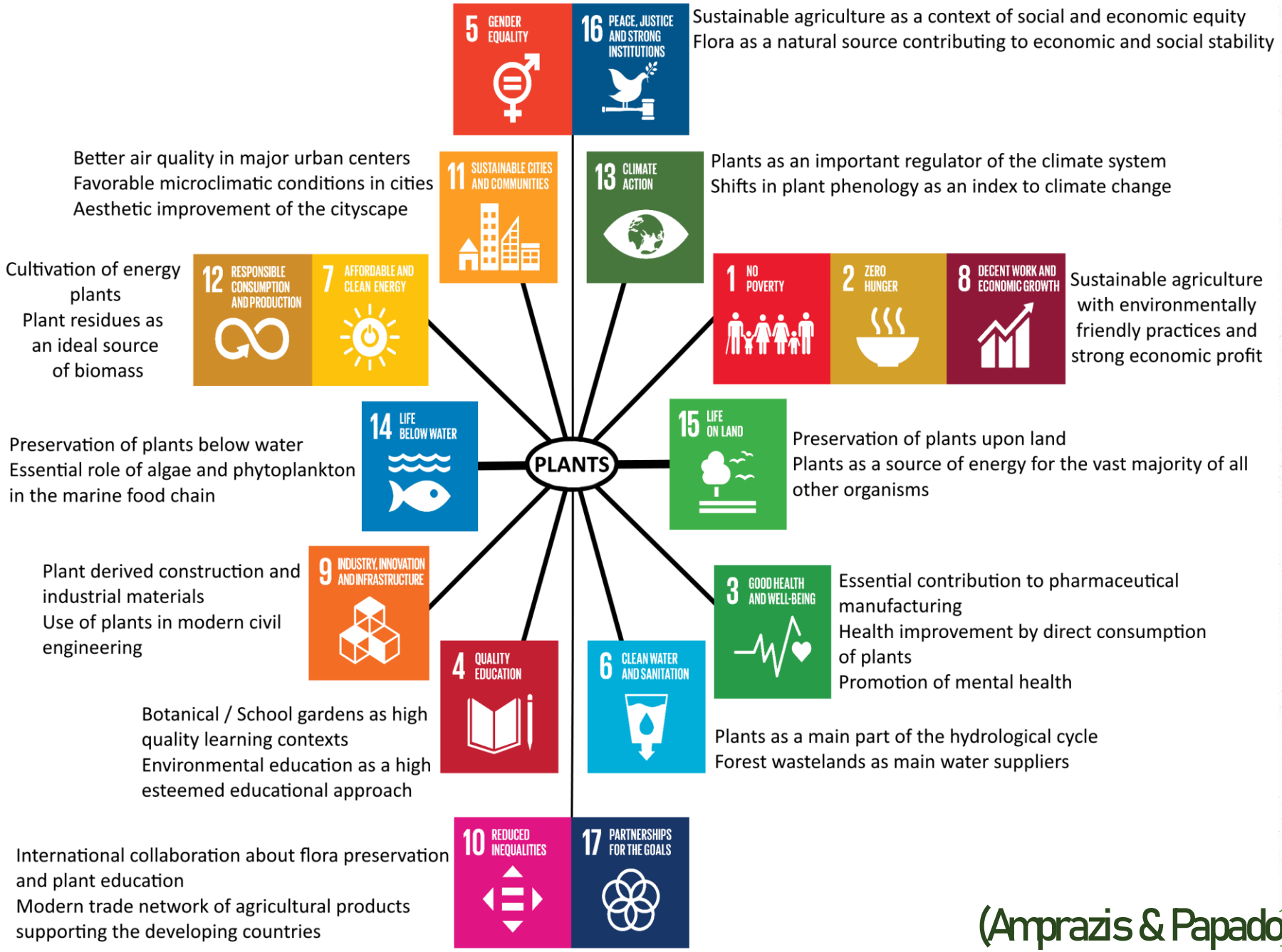
Indirect correlation (4)

Direct correlation (11)



(Amprazis & Papadopoulou, 2021)

SDGs & Plants



Sustainable agriculture as a context of social and economic equity
Flora as a natural source contributing to economic and social stability

Better air quality in major urban centers
Favorable microclimatic conditions in cities
Aesthetic improvement of the cityscape

Plants as an important regulator of the climate system
Shifts in plant phenology as an index to climate change

Cultivation of energy plants
Plant residues as an ideal source of biomass

Sustainable agriculture with environmentally friendly practices and strong economic profit

Preservation of plants below water
Essential role of algae and phytoplankton in the marine food chain

Preservation of plants upon land
Plants as a source of energy for the vast majority of all other organisms

Plant derived construction and industrial materials
Use of plants in modern civil engineering

Essential contribution to pharmaceutical manufacturing
Health improvement by direct consumption of plants
Promotion of mental health

Botanical / School gardens as high quality learning contexts
Environmental education as a high esteemed educational approach

Plants as a main part of the hydrological cycle
Forest wastelands as main water suppliers

International collaboration about flora preservation and plant education
Modern trade network of agricultural products supporting the developing countries

(Amprazis & Papadopoulou, 2021)

SDGs & Plant Blindness Symptoms

1. Thinking that plants are merely the backdrop for animal life

STOP

2. Misunderstanding what kinds of matter and energy plants require to stay alive

STOP

3. Overlooking the importance of plants to human's daily affairs

STOP

4. Failing to distinguish between the differing time scales of plant and animal activity

STOP

5. Being insensitive to the aesthetic qualities of plants and their structures – especially with respect to their adaptations, coevolution, colors, dispersal, diversity, growth habits, scents, sizes, sounds, spacing, strength, symmetry, tactility, tastes, and textures

STOP

SDGs & Plant Blindness Symptoms

6 Lacking hands-on experiences in growing, observing, and identifying plants in one's own geographic region

STOP →

7 Failing to explain the basic plant science underlying nearby plant communities – including plant growth, nutrition, reproduction, and relevant ecological considerations

STOP →

8 Lacking awareness that plants are central to a key biogeochemical cycle – the carbon cycle

STOP →

9 Failing to see, take notice of, or focus attention on the plants in one's daily life

STOP → Potentially all SDGs

Which are the ideal quantitative and qualitative research approaches for determining the link between Plants-Sustainable Development Goals and Limited Plant Awareness-Sustainable Development?

Quantitative research approaches for determining the link between Plant Awareness - Sustainable Development

SURVEYS

Surveys among various groups of people to assess their level of plant awareness and attitudes towards sustainability. Surveys can use Likert scales or other rating systems to quantify responses.

EXPERIMENTAL STUDIES

Controlled experiments to investigate the impact of interventions aimed at raising plant awareness and observe their effects on sustainable practices.

DATA ANALYSIS

Data analysis of existing datasets related to plant conservation, ecological health, or sustainable development indicators to identify potential correlations with plant awareness levels.

LITERATURE REVIEW

Quantitative systematic reviews that use numerical data to answer their research questions.

Qualitative research approaches for determining the link between Plant Awareness - Sustainable Development

INTERVIEWS

In-depth interviews with individuals or groups to understand their beliefs, values, and experiences related to plants and sustainable practices.

CASE STUDIES

Investigation of specific communities or regions where sustainable practices are prominent and exploration of the role of plant awareness in fostering these practices.

FOCUS GROUPS

Focus group discussions with participants to explore their plant awareness levels, their awareness of sustainable development, and the potential connections between the two.

LITERATURE REVIEW

Qualitative systematic reviews that use non-numerical data to answer their research questions (with a probable specific focus on ethnobotany or ethnobiology studies)

RESEARCH SCENARIO

By working in groups please describe a quantitative or a qualitative research scenario based on the following questions. Provide details regarding participants, research instrument, data collection and data analysis.

QUANTITATIVE Research Question: *Does the level of plant awareness have an impact on individuals' engagement in sustainable development practices?*

QUALITATIVE Research Question: *How does individuals' level of plant awareness influence their attitudes and behaviors towards sustainable development?*

DURATION 7 minutes

Which are the key competencies in Education for Sustainable Development that can be used for fostering plant awareness?

KEY COMPETENCIES IN EDUCATION FOR SUSTAINABLE DEVELOPMENT 1/2

United Nations
Educational, Scientific and
Cultural Organization

SYSTEMS THINKING COMPETENCY

The ability to recognize and understand relationships, to analyze complex systems, to perceive the ways in which systems are embedded within different domains and different scales.

NORMATIVE COMPETENCY

The ability to understand and reflect on the norms and values that underlie one's actions and to negotiate sustainability values, principles, goals and targets, in a context of conflicts of interests.

ANTICIPATORY COMPETENCY

The ability to understand and evaluate multiple futures – possible, probable and desirable – and to create one's own visions for the future.

STRATEGIC COMPETENCY

The ability to collectively develop and implement innovative actions that further sustainability at the local level and further afield.

KEY COMPETENCIES IN EDUCATION FOR SUSTAINABLE DEVELOPMENT 2/2

United Nations
Educational, Scientific and
Cultural Organization

COLLABORATION COMPETENCY

The ability to learn from others, understand and respect the needs, perspectives and actions of others, and to deal with conflicts in a group.

SELF-AWARENESS COMPETENCY

The ability to reflect on one's own role in the local community and (global) society, continually evaluate and further motivate one's actions, and deal with one's feelings and desires.

CRITICAL THINKING COMPETENCY

The ability to question norms, practices and opinions; reflect on own one's values, perceptions and actions and take a position in the sustainability discourse.

INTEGRATED PROBLEM-SOLVING COMPETENCY

The overarching ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive and equitable solution that promote sustainable development.

Quantitative research approaches for determining the ESD key competencies that can be used for fostering plant awareness

SURVEYS

Conducting surveys with a structured questionnaire to assess the level of plant awareness and ESD competencies among students, teachers, or the general public.

PRE-TESTS AND POST-TESTS

Implementing pre- and post-tests that can measure changes in participants' level of plant awareness after exposure to specific educational interventions that foster ESD competencies.

DATA ANALYSIS

Data analysis of existing datasets in order to identify trends, correlations, and patterns related to plant awareness and ESD competencies.

LITERATURE REVIEW

Quantitative systematic reviews that use numerical data to answer their research questions.

Qualitative research approaches for determining the ESD key competencies that can be used for fostering plant awareness

INTERVIEWS

Semi-structured interviews with students, educators, or experts in ESD that can provide in-depth insights into their experiences, beliefs, and perceptions concerning plant awareness and the effectiveness of ESD competencies.

CASE STUDIES

Case studies in schools or communities with successful ESD programs that can provide valuable qualitative data on their potential to raise plant awareness effectively.

FOCUS GROUPS

Organizing focus groups to explore shared opinions, attitudes, and barriers related to plant awareness and ESD competencies.

LITERATURE REVIEW

Qualitative systematic reviews that use non-numerical data to answer their research questions.

RESEARCH SCENARIO

By working in groups please describe a quantitative or a qualitative research scenario based on the following questions. Provide details regarding participants, research instrument, data collection and data analysis.

QUANTITATIVE Research Question: *To what extent do key competencies in Education for Sustainable Development (ESD) contribute to fostering plant awareness among university students of pedagogical departments?*

QUALITATIVE Research Question: *What are the perceptions and experiences of educators regarding the use of ESD key competencies for fostering plant awareness in their classrooms??*

DURATION 7 minutes

Q & A
CONCLUSIONS REGARDING THE FIRST PART OF THE WORKSHOP

How to assess the comprehension of plant's role in human environment in frame of any tool for plant awareness assessment?

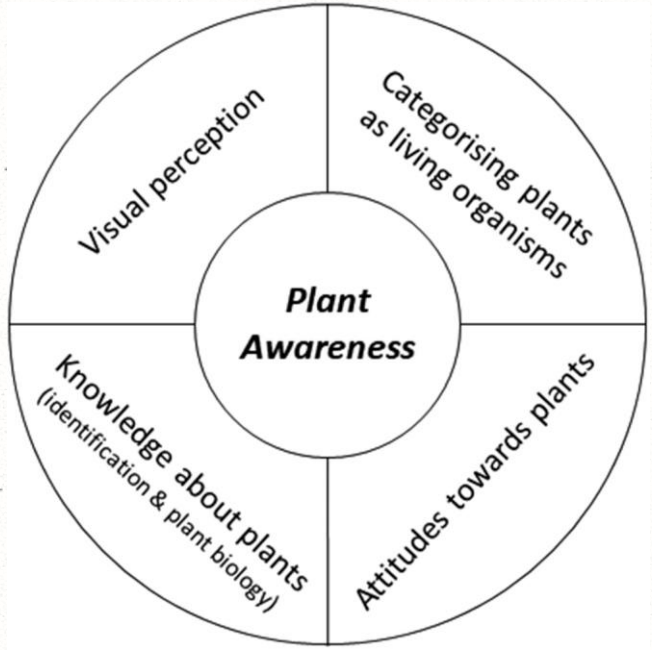
Parsley, 2020:

- ATTENTION
- RELATIVE INTEREST
- ATTITUDE
- KNOWLEDGE

knowledge

attitudes

Pany et al., 2022:



Several ways of assessing knowledge (tests, questionnaires, concept maps, essays…)

What kind of knowledge should be included in any instrument for assessment of plant awareness? Which roles of plants in human environment are crucial to reach SDG?

Activity 1

Write down 3 different roles of plants, which are according to your opinion the most important for sustainable development

DURATION 1 minute

2016 Research done in CZ among 426 students of lower secondary schools at the age of 13 – 16 years.

(Testing of IBSE activity to enhance plant awareness (pre-test/post-test):

Questions:

1. Do you prefer plants or animals?

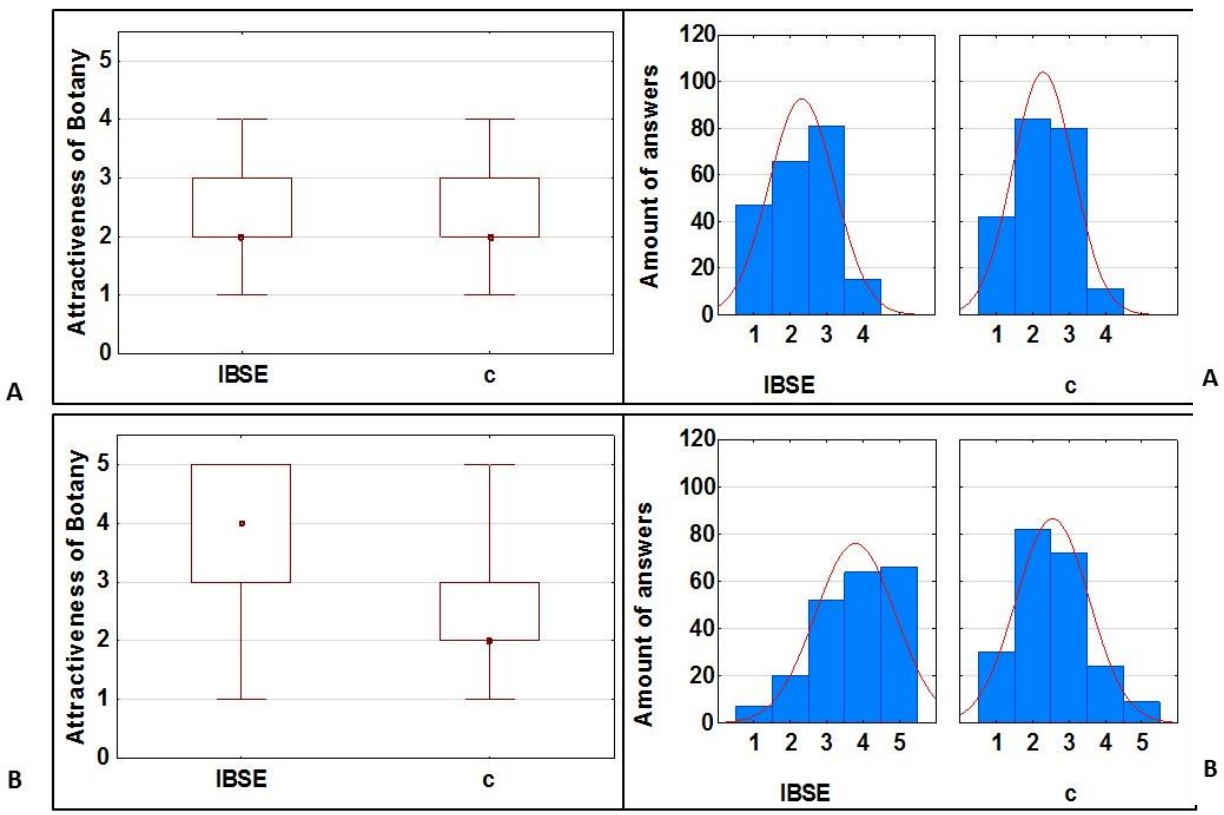
2. How attractive is for you to learn about plants? (Likert-type scale question, grade 1= boring, grade 5= amazing)

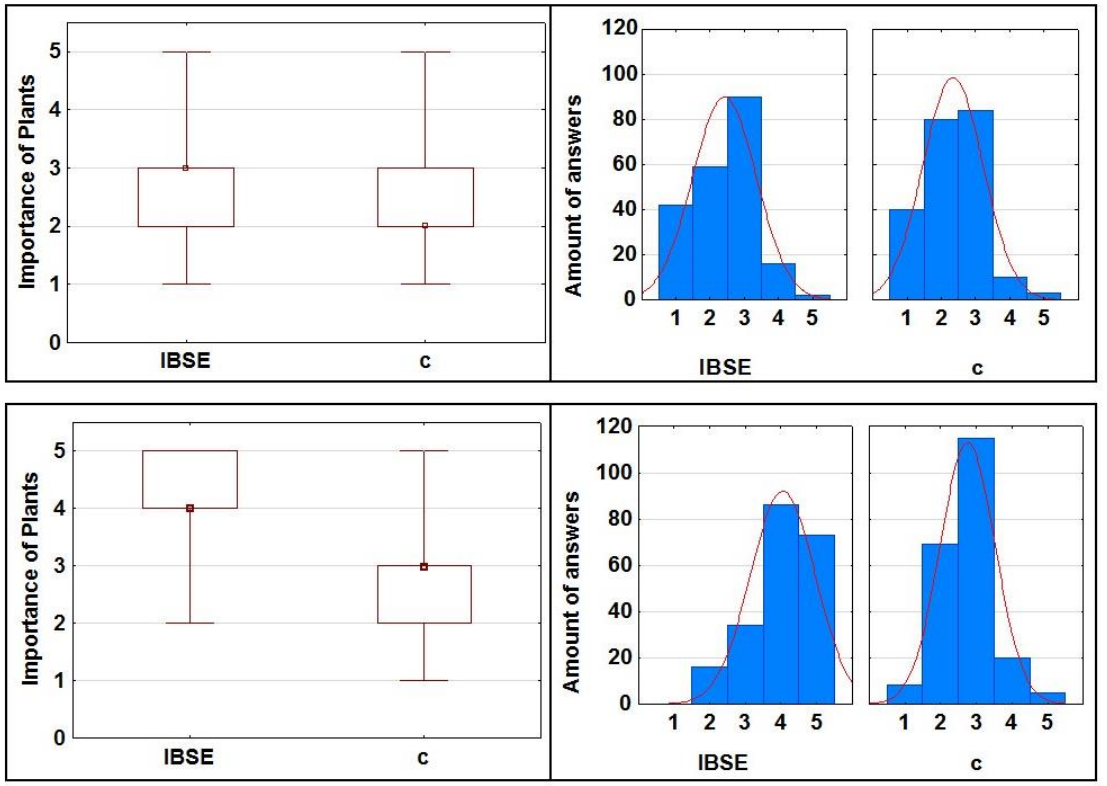
3. How much are, according to your opinion, the plants important for human environment? (Likert-type scale question, grade 1= unimportant, grade 5= very important

4. Name exactly, how are plants useful for human environment: (open type question)

How are plants useful for human environment:

production of oxygen	91%
source of food	31%
home for other living organisms	3%
removing dust	2%





Pre-test: 88 % of the respondents prefer animals

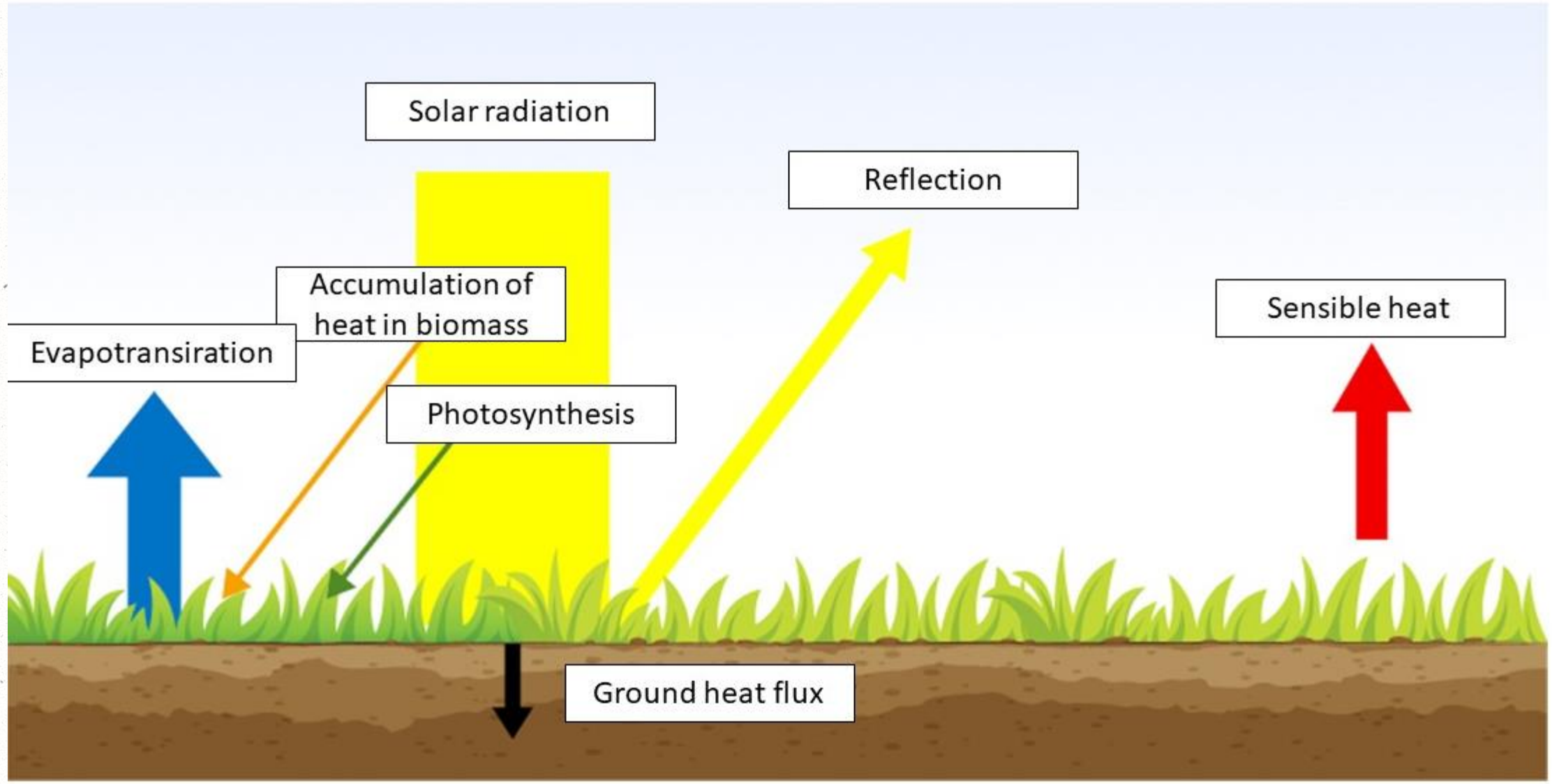
Post-test: 88 % of the respondents prefer animals

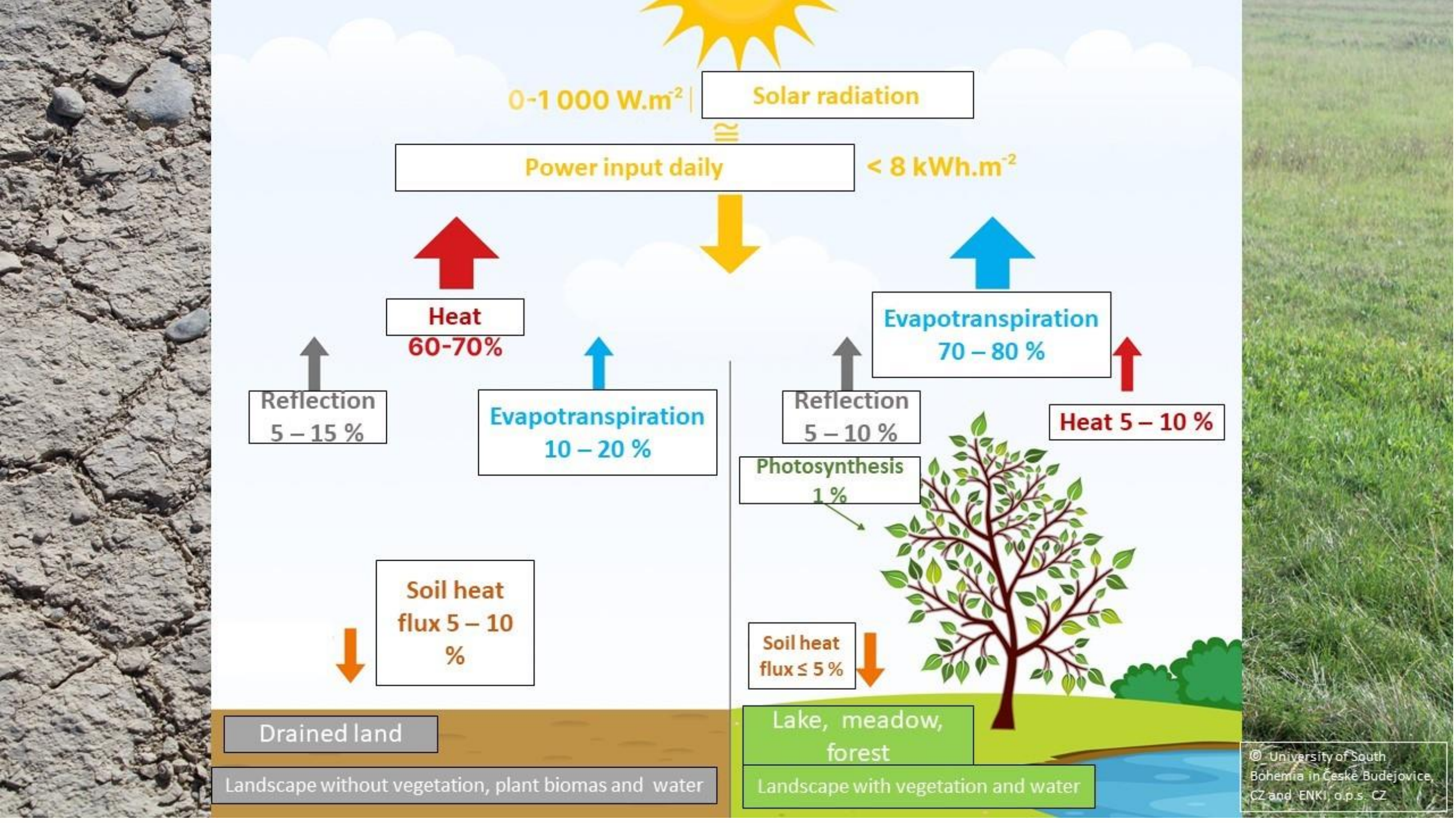
Roots of plant blindness in school education

„Plant Blindness“ vs. „Plant Awareness“

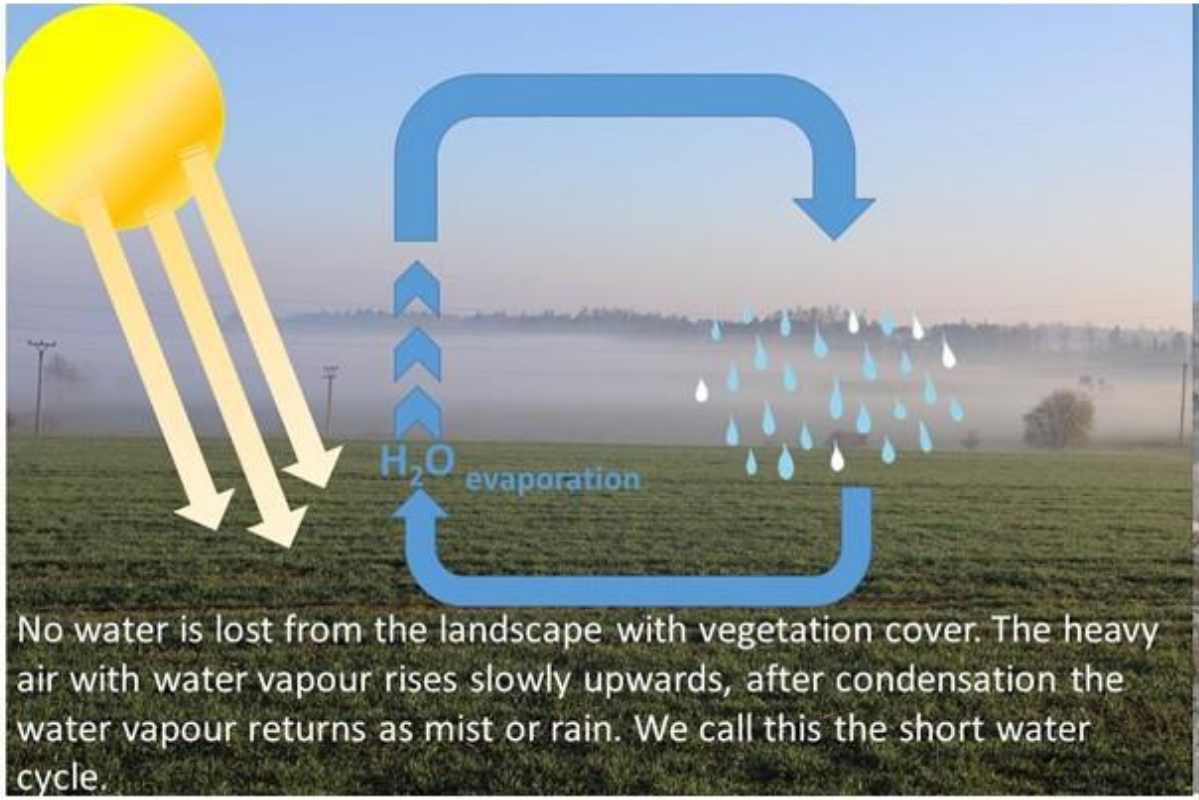
- Learning botany is boring
- „Plants are not doing anything“
- To much terminology
- To less physiology - but PHOTOSYNTHESIS! (critical point)
- Missing topics in science education –CLIMATIC FUNCTION of VEGETATION!
  ROLE OF PLANTS IN SHORT WATER CYCLE!

Climatic function of vegetation as omitted topic in science education

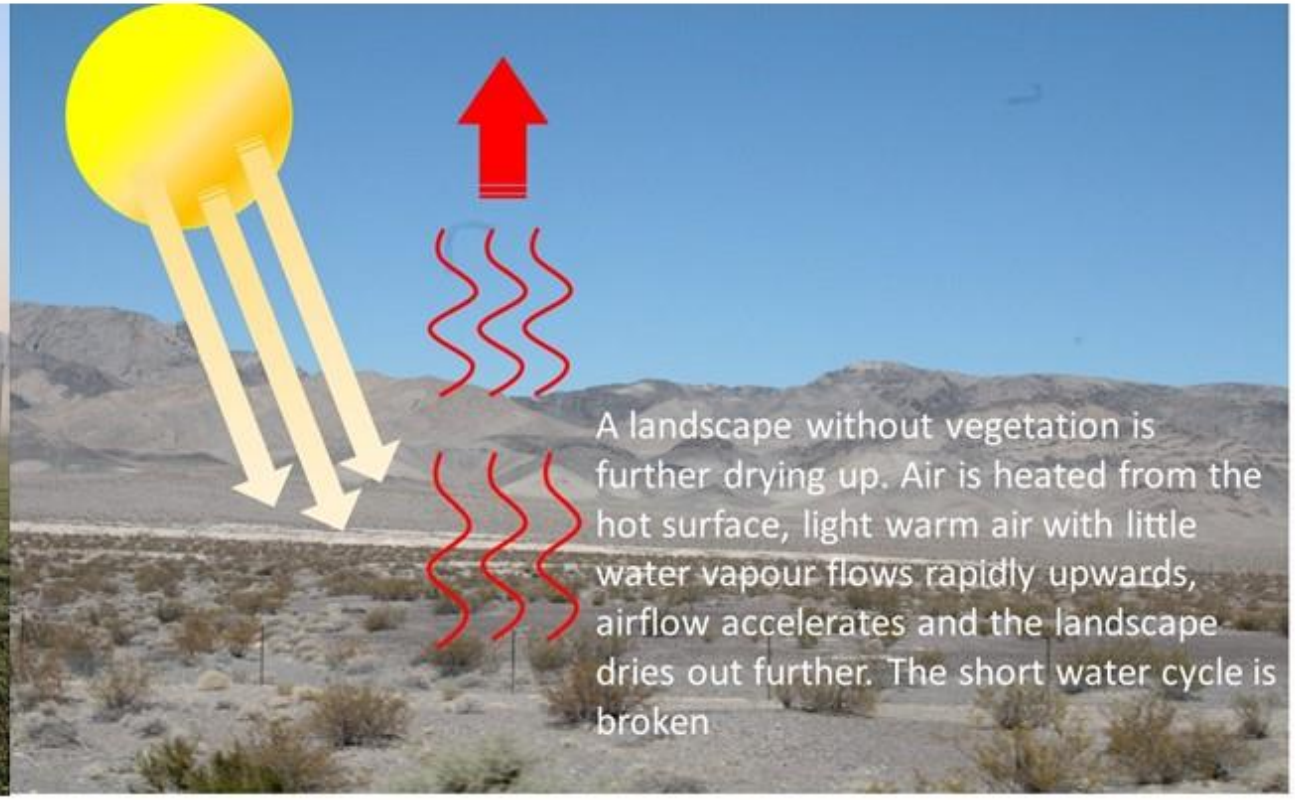



0-1 000 W.m-2
Solar radiation
≅
Power input daily
< 8 kWh.m-2
Heat
60-70%
Reflection
5 – 15 %
Evapotranspiration
10 – 20 %
Soil heat
flux 5 – 10
%
Drained land
Landscape without vegetation, plant biomas and water
Evapotranspiration
70 – 80 %
Reflection
5 – 10 %
Heat 5 – 10 %
Photosynthesis
1 %
Soil heat
flux ≤ 5 %
Lake, meadow,
forest
Landscape with vegetation and water
© University of South
Bohemia in České Budejovice,
CZ and ENKI, o.p.s. CZ

How plants retain water in the landscape?



No water is lost from the landscape with vegetation cover. The heavy air with water vapour rises slowly upwards, after condensation the water vapour returns as mist or rain. We call this the short water cycle.



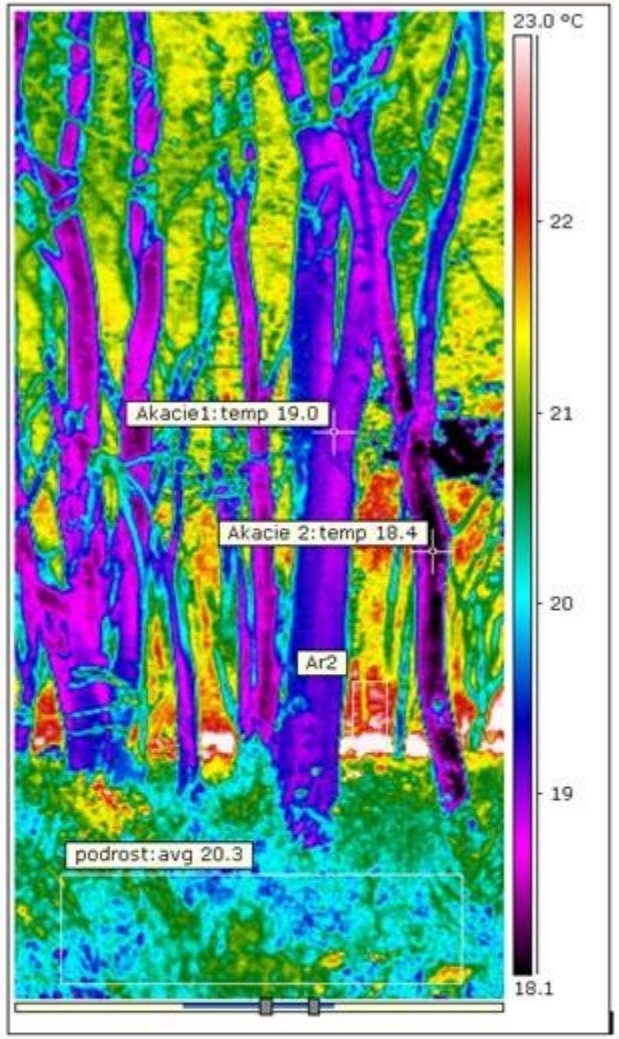
A landscape without vegetation is further drying up. Air is heated from the hot surface, light warm air with little water vapour flows rapidly upwards, airflow accelerates and the landscape dries out further. The short water cycle is broken

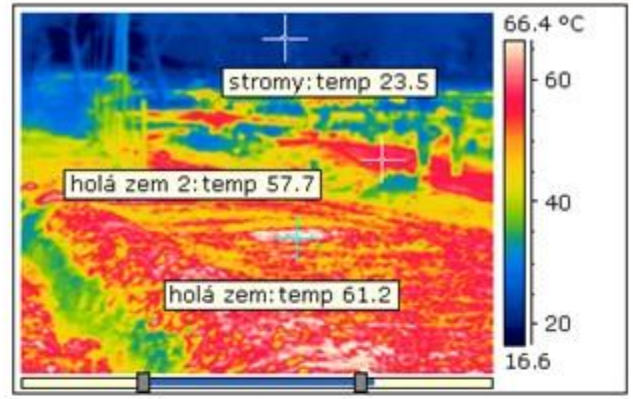
Air condition output 3.4 kW…

Tree: transpiration (Sap flow 20 litres/hour – output roughly 14 kW

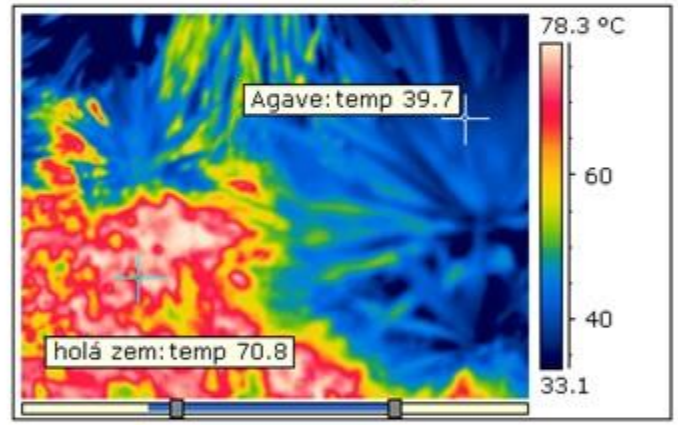
Sensible heat released on a sunny day from several km^{-2} of dry land withouth vegetation is higher than power production of the nuclear power plant.

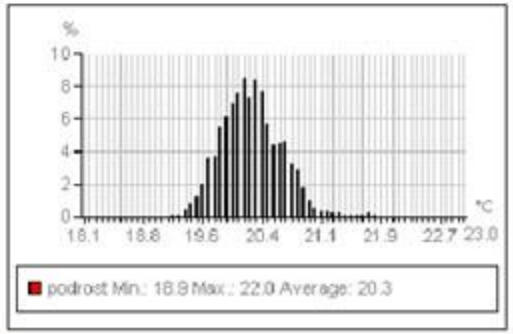

Nuclear power plant 2000 MW
(6600 MW incl. heat production)
Solar energy coming on 2 km-2 on a sunny day (2000 MW) is equal to power production of this nuclear power plant.

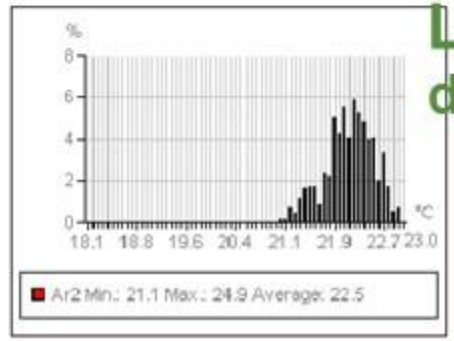




Sand has high reflection but highest temperature!





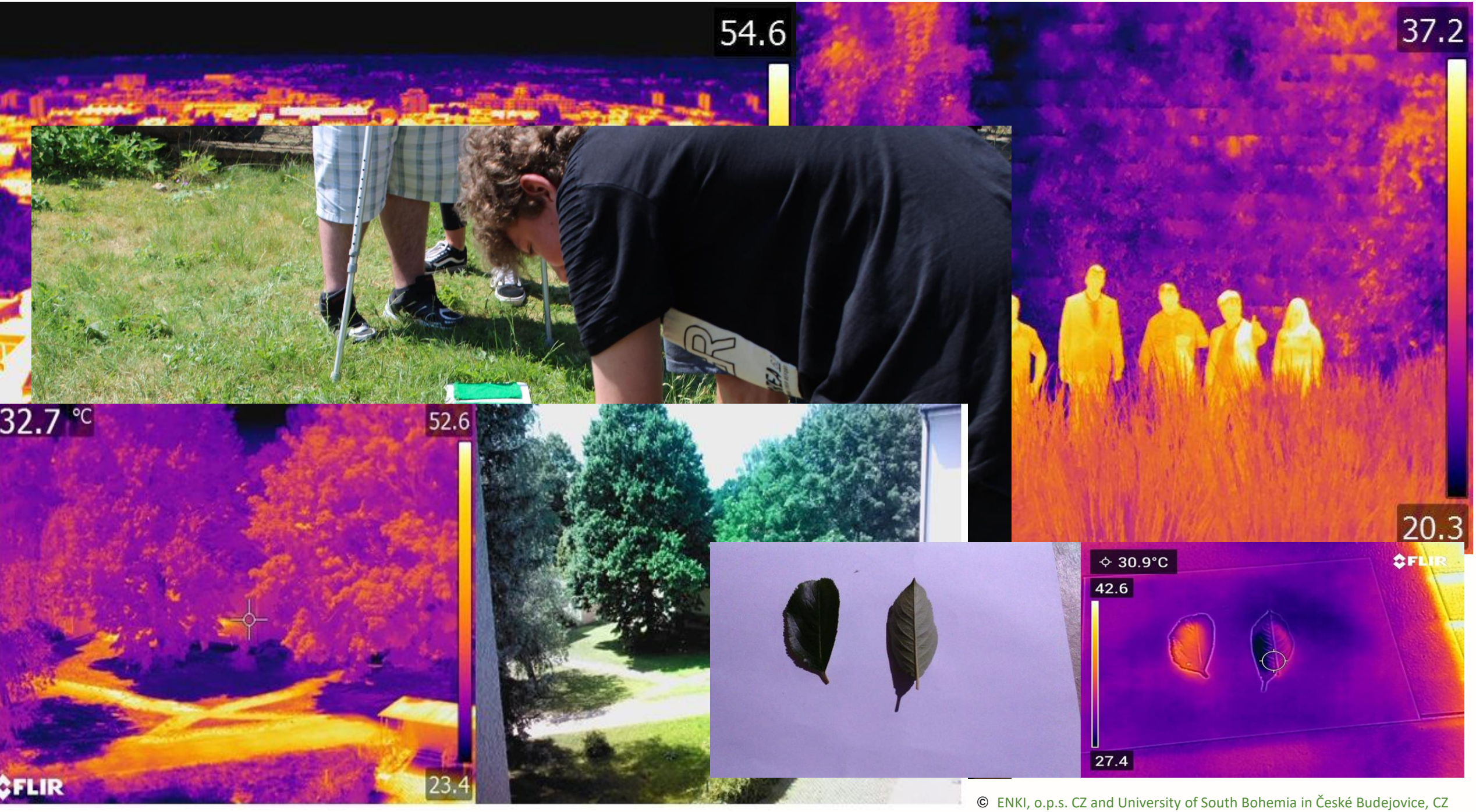


Lake Naivasha, Kenya, sunny day

Accacia forest about 20 °C
bare land up to 70 °C

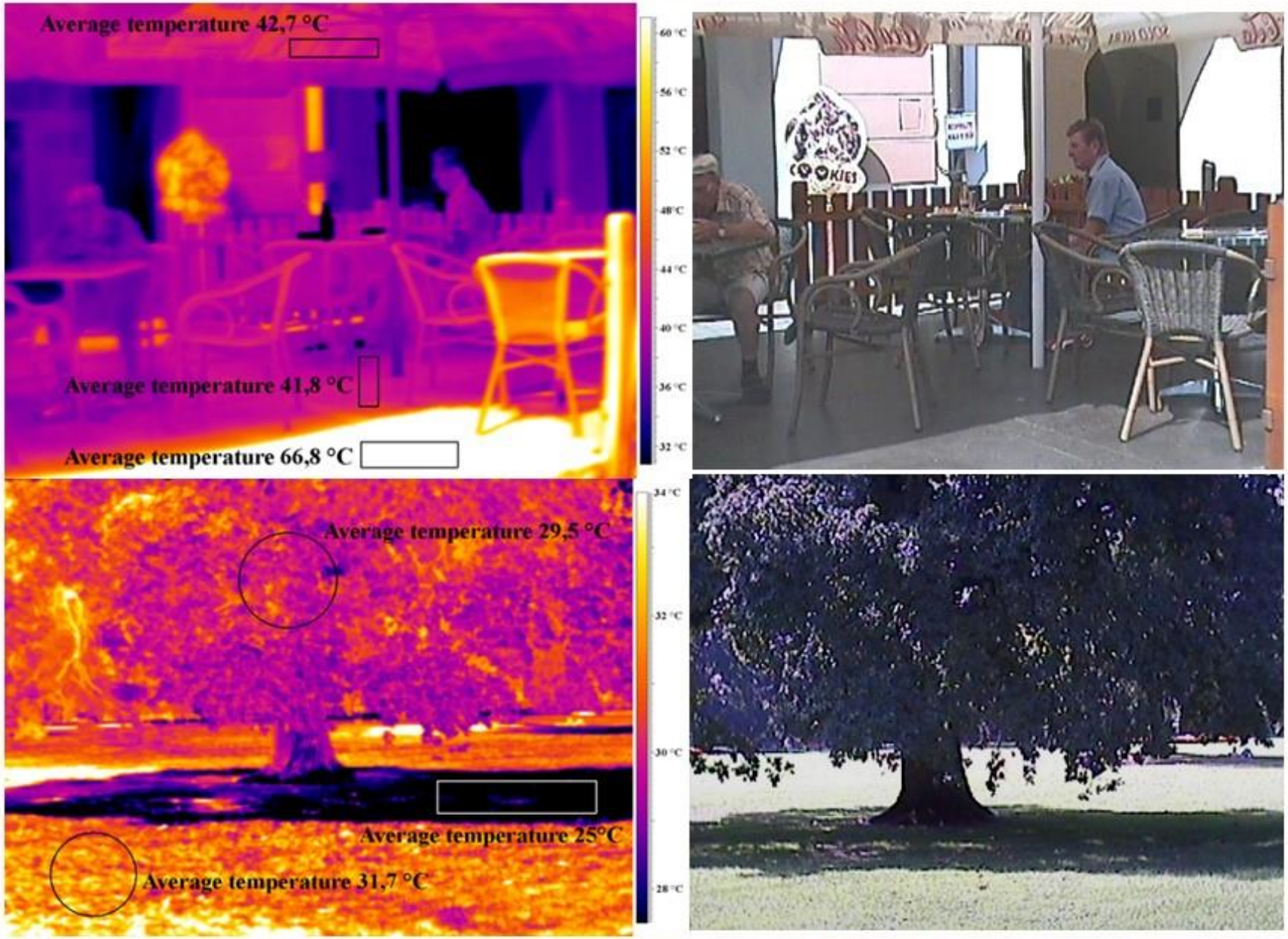
The topic of cooling function of vegetation is important for SD and attractive for students at schools

- Experience from everyday life
- Simple cheap and user friendly measuring devices for hands-on activities
- STEM topic, lot of posibilities to develop modern teaching activities
- Very good feedback from students



What means ,,cooling efect of vegetation“

?



Eiseltová, M., Pokorný, J., Hesslerová, P., Ripl, W. (2012): Evapotranspiration – A Driving Force in Landscape Sustainablility. *In.* Irmak A. (ed.) *Evapotranspiration - Remote Sensing and Modeling.* InTech, pp. 305 – 328.
Available from: http://www.intechopen.com/articles/show/title/evapotranspiration-a-driving-force-in-landscape-sustainability

People are living in different areas. Should they possess different knowledge of plant role in their environment or is there any crucial knowledge identical for all? Is there any relation among the attitudes to plants and level of comprehension of role of plants in our environment?

Activity 2

Imagine, you are preparing a questionnaire to assess plant awareness of respondents living in different areas. By working in groups please create 5 items which should be included in your questionnaire for assessment of plant awareness. Provide details regarding the age of participants and/or level of education. Can there be any relation among the attitudes to plants of respondents from your area and their knowledge ?

group 1

Respondents living in the city – urban landscape

group 2

Respondents living in the rural landscape

group 3

Respondents living in the costal (maritime) areas or wetlands

DURATION: 10 minutes

TEAMWORK

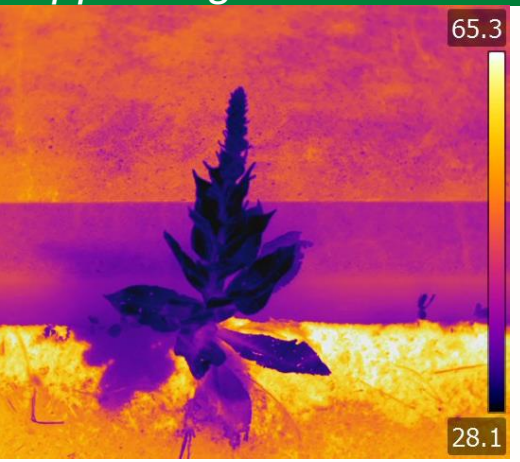
Co-funded by the Erasmus+ Programme of the European Union

Erasmus+ Project No. 2021-1-CZ01-KA220-HED-0000302

Education for Plant Literacy

https://planteducation.eu/

6 project partners 5 EU countries 4 online publications with teaching materials on plant role in our environment appearing in 2024



OUR MISSION is to improve plant literacy of general public by more efficient and attractive botany teaching at all school levels which has to be reached via education of educators, i.e. innovative teachers‘ training.

Would you like to know...?

How can a tree cool our environment by the capacity higher than common air –conditioning system?
How can the forests pump the water from the see into the continents?
Why is the shadow under a tree cooler than the shadow under an umbrella?
Why is the atmosphere above the forest smelling?
How to measure these principles at schools?
How to make botany teaching more attractive for students?
…and much more?

Jihočeská univerzita v Českých Budějovicích
University of South Bohemia in České Budějovice

ENKI o.p.s.

HOCHSCHULE FÜR Agrar- und Umweltpädagogik
Eigene Rechtspersönlichkeit

LAPIN YLIOPISTO
UNIVERSITY OF LAPLAND

in Dialogue leadership and organisational development

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