

IMPACT OF A NATURAL GREEN STRUCTURE, WATERED WITH TREATED WASTEWATER, ON INDOOR AIR QUALITY

INTERNATIONAL CONFERENCE OF FEE ECOCAMPUS

Maria Inês Boaventura, Ana Maria Barreiros, Maria Idália Gomes
and

Alexandra S. Rodrigues
(ISEL Eco-Campus Coordinator)

SUPORTED BY:



From Eco-School to Eco-Campus

ISEL, is an Eco-school since 2020 and has been promoting a series of initiatives that aim to raise awareness about environmental impacts, circular economy, and climate change.

ISEL was distinguished in October 2022 with the Eco-Campus award, being part of the first 10 higher education institutions, in Portugal, distinguished with this award.



From Eco-School to Eco-Campus

The program allows us to understand the challenges that need to be overcome and some paths to follow.



What about Air Quality?

Air pollution is responsible for around 7 million deaths annually.

But air pollution is not just restricted to outdoor air, as the indoor air quality (IAQ) in buildings have a very significant influence on the health of the occupants, both from a physical and psychological point of view.

Poor indoor air quality can cause discomfort or health problems, such as respiratory problems and negative impacts on the cognitive abilities and productivity of occupants of these spaces.



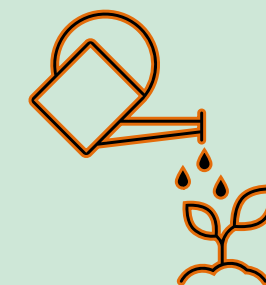
From Eco-School to Eco-Campus



The application of natural green structures inside buildings can benefit IAQ, increasing also thermal comfort and provide psychological well-being.

However, plants, like all living things, require water for survival.

Using treated wastewater (TWW) to water plants, instead of drinking water (DW), helps to improve buildings and cities water efficiency.

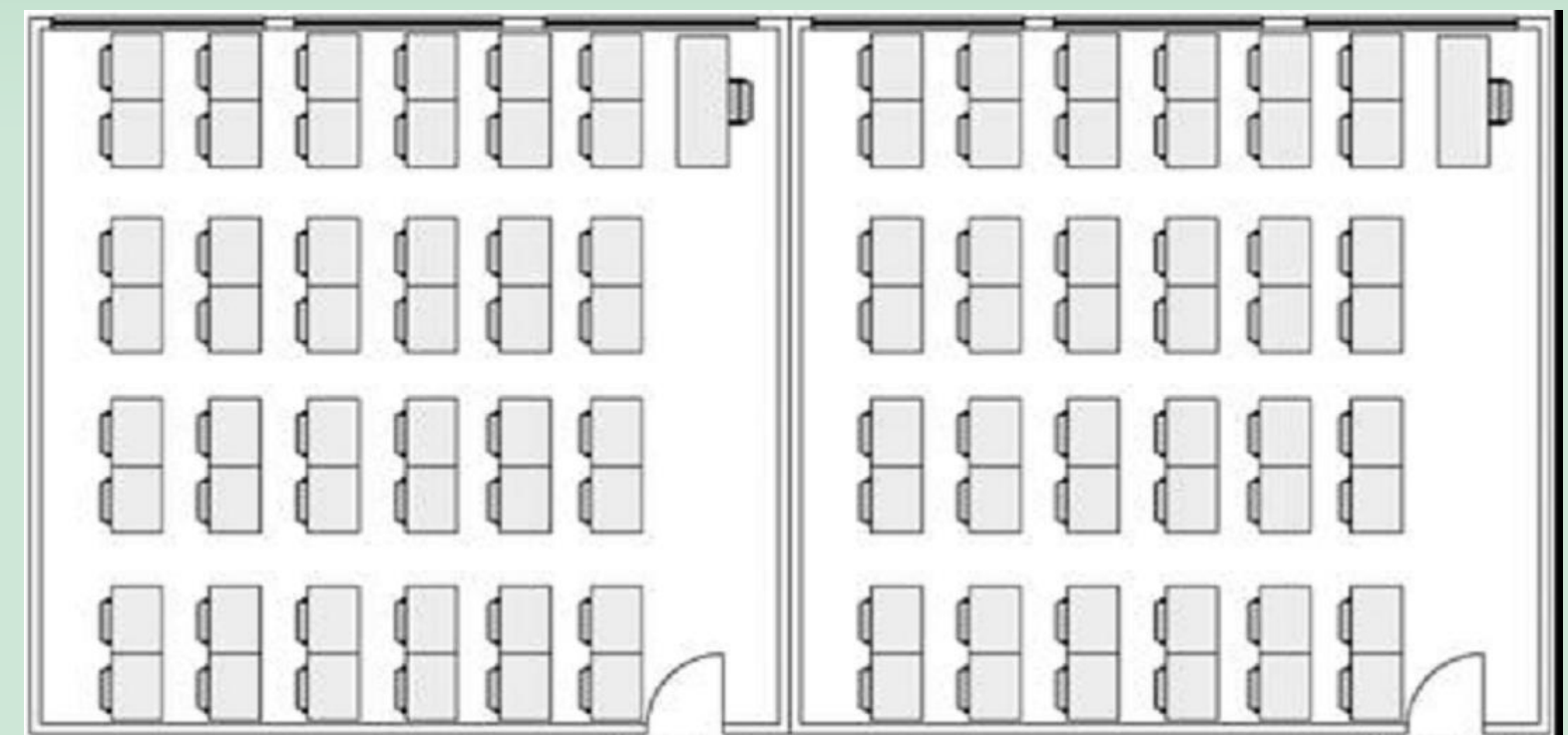


ISEL IAQ case study

The present study aimed to evaluate IAQ, through monitoring several air quality parameters in an Eco-Campus classroom where a natural green structure was installed.

Two rooms with the same conditions, were selected, and designated as: Neutral Room (NR) and Green Room (GR).

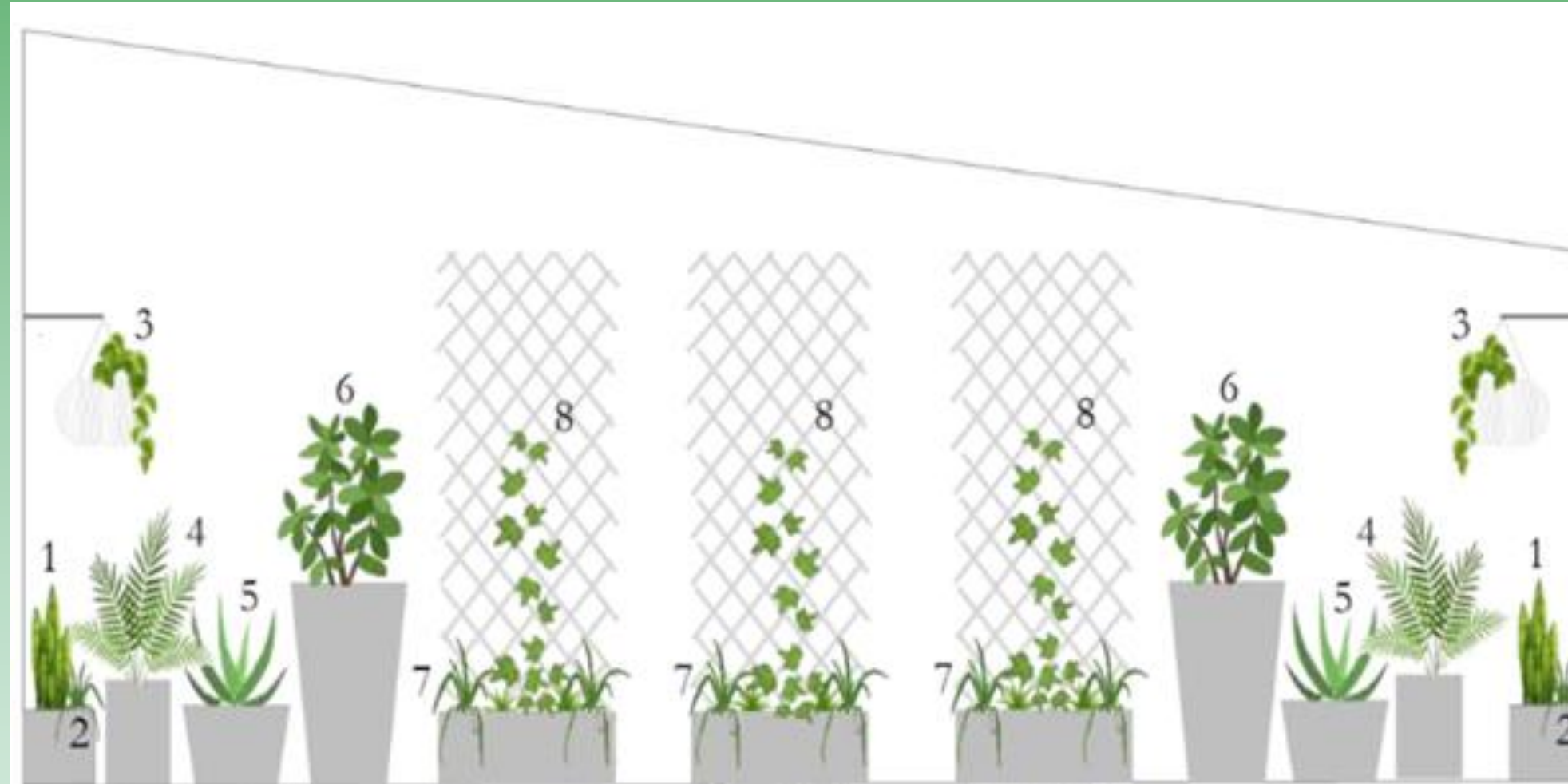
In the GR half of the plants have been watered with TWW and another half with DW, with plant growth being monitored through image analysis.



Neutral Room - NR

Green Room - GR

ISEL IAQ case study - Natural green structure



Dracaena trifasciata, side walls (1)

Chlorophytum comosum, side (2) and back wall (7)

Scindapsus aureus, side (3) and back wall (8)

Dypsis lutescens, corners (4)

Aloe vera, back wall (5)

Ficus benjamina, back wall (6)



Dracaena trifasciata



Aloe vera



Dypsis lutescens



Scindapsus aureus



Chlorophytum comosum

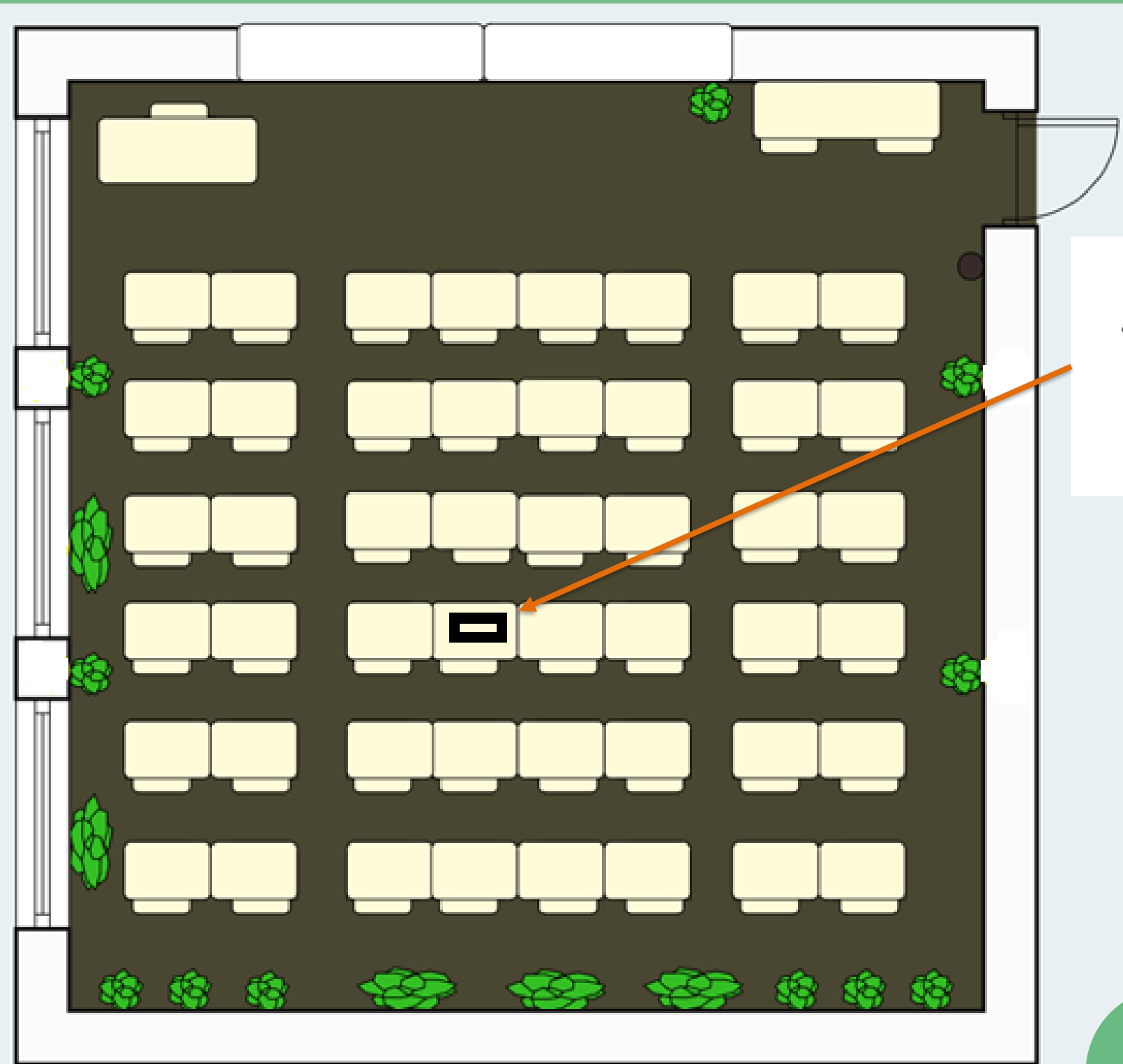


Ficus benjamina

ISEL IAQ case study - Natural green structure



ISEL IAQ case study - Parameters evaluated



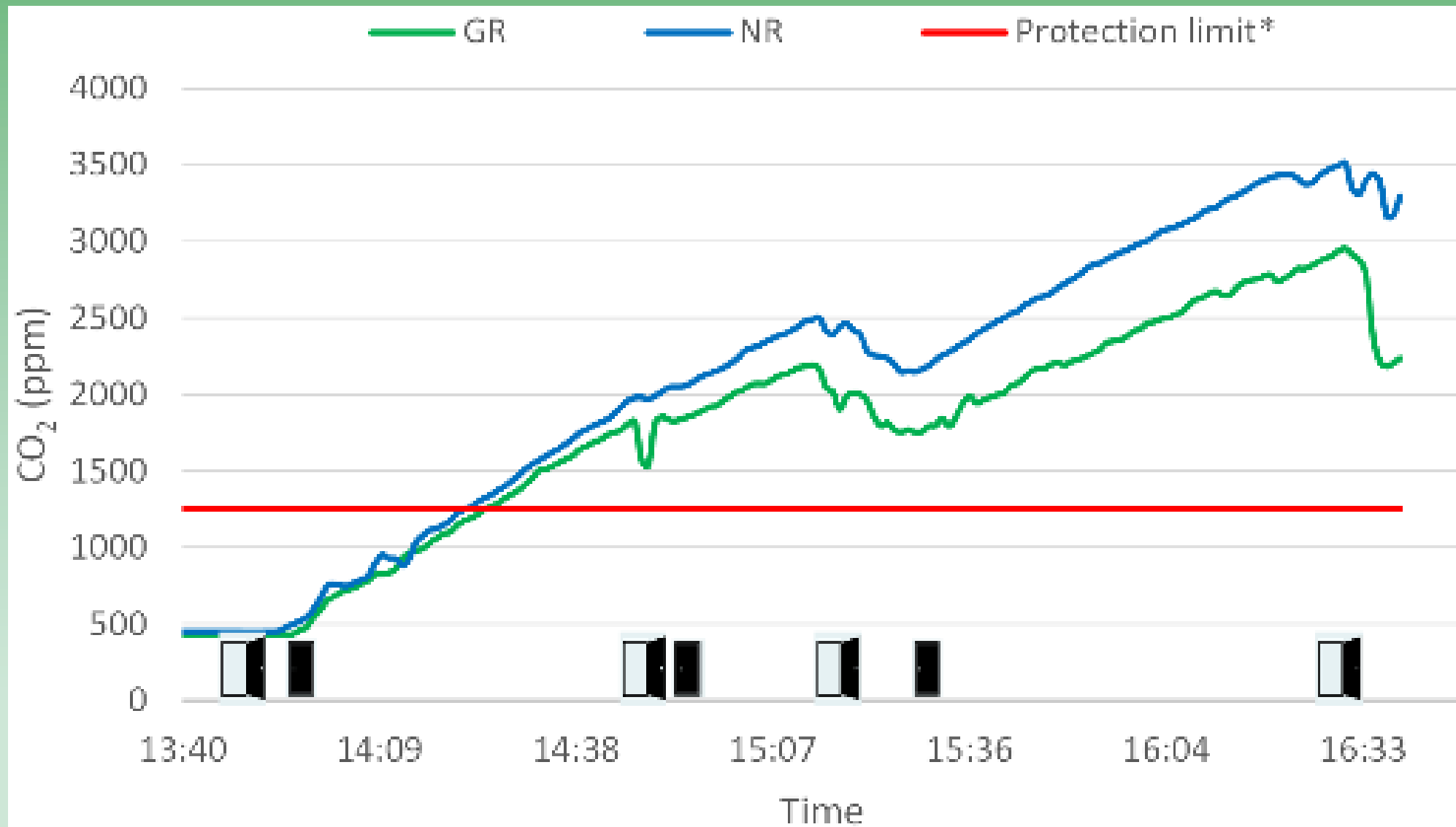
The following parameters were monitored: CO₂, VOCs, PM_{2.5}, PM₁₀, Temperature and Relative Humidity.

During IAQ monitoring, the windows were closed, and the doors were opened and closed simultaneously in both classrooms.



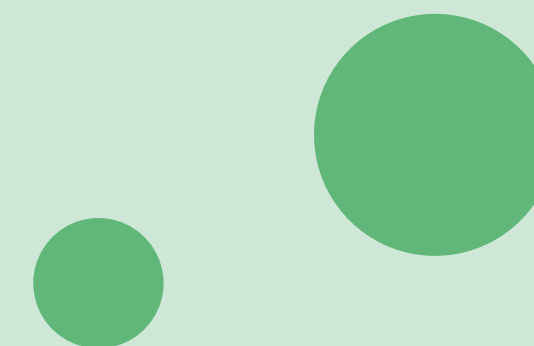
Plant growth is being monitored using photographic capture and image analysis

ISEL IAQ case study - Results

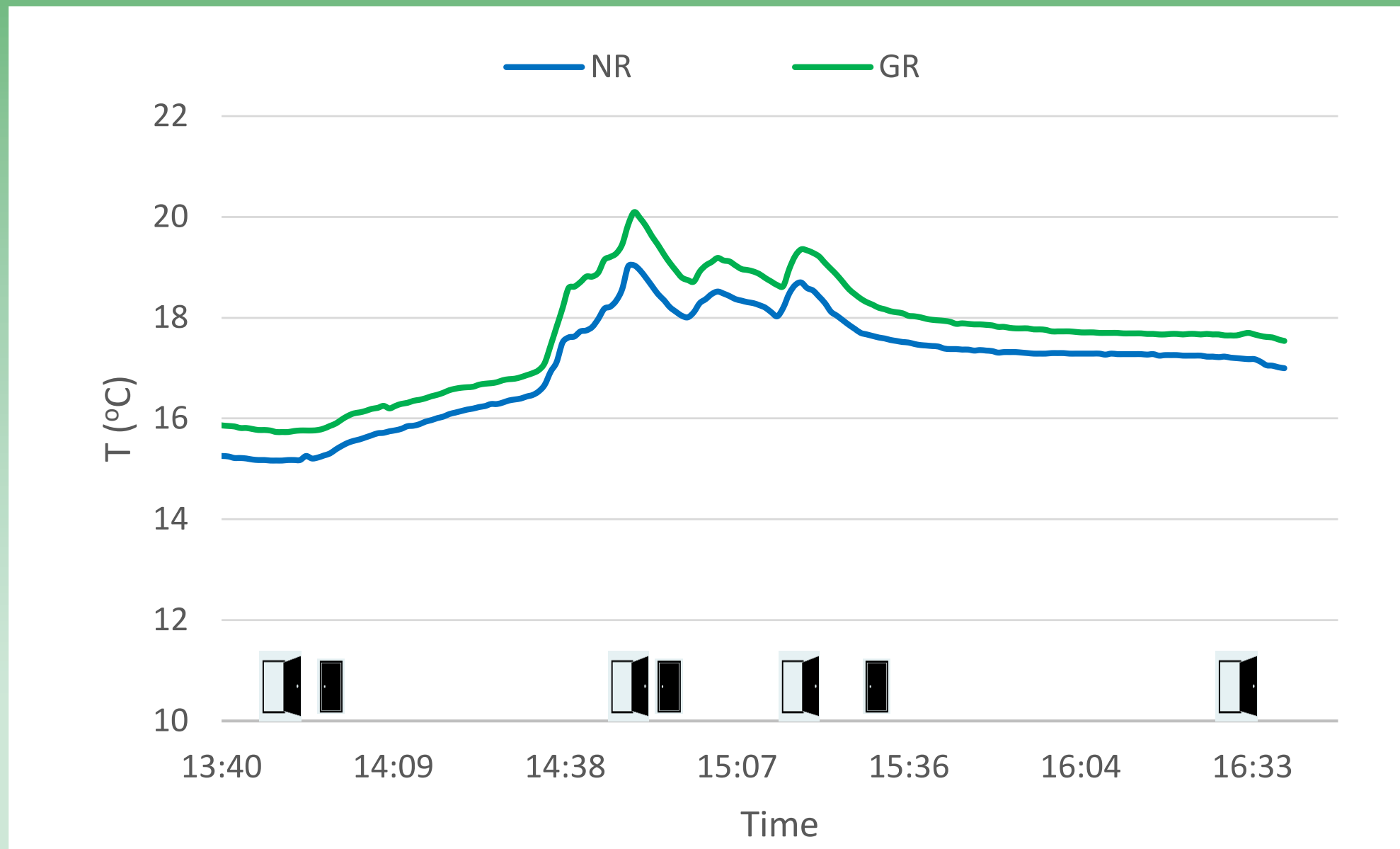
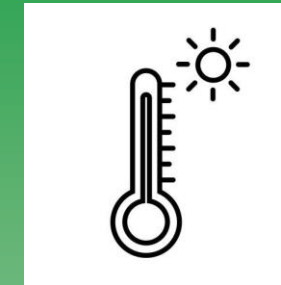


- ✓ CO₂ concentration significantly increased;
- ✓ CO₂ concentration quickly exceeded the protection limit imposed by Portuguese legislation;
- ✓ CO₂ concentration was lower in GR;
- ✓ The importance of natural ventilation was observed.

Comparison of CO₂ concentration between Green Room (GR) and Neutral Room (NR). *Ordinance nº 138-G/2021

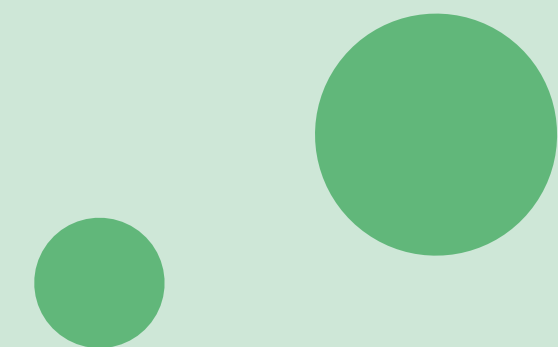


ISEL IAQ case study - Results



- ✓ The GR exhibited a slightly more pleasant higher temperature, which can be explained by the presence of plants;
- ✓ Some temperature fluctuations were observed simultaneous in the two rooms, due to variations of sun exposure.

Comparison of Temperature between Green Room (GR) and Neutral Room (NR).



ISEL IAQ case study - Conclusions

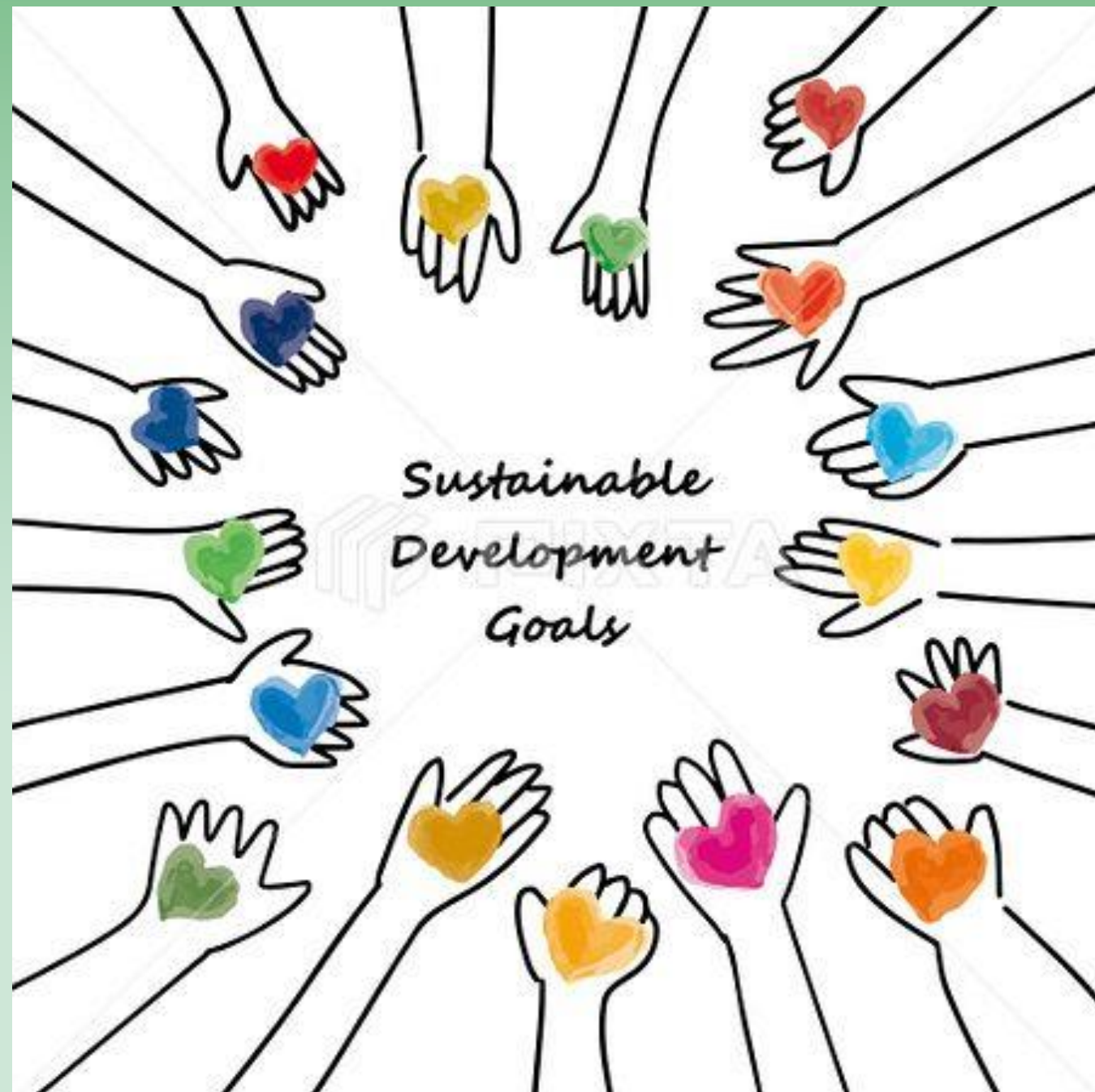
Do plants improve indoor air quality?

- Myth
- Reality

- ✓ It was observed the advantages of using indoor plants, regarding CO_2 , VOC_T and temperature;
- ✓ Evidence becomes more advantageous for the VOC_T ;
- ✓ It was observed the importance of natural ventilation;
- ✓ It was observed a normal plant growth using TWW, showing that TWW constitutes a good alternative to irrigation with DW, contributing to the Campus water and energy efficiency.



Contribution to the Sustainable Development Goals



The current study aims to contribute to several SDG once it intends:

- to improve the scholar population's health and well-being (SDG 3);
- to improve buildings IAQ (SDG 11 and 12);
- To increase water efficiency (SDG 6) due to the use of TWW for water plants.

Contribution to the Sustainable Development Goals



The current study aims to contribute to several SDG once it intends:

- to improve the scholar population's health and well-being (SDG 3);
- to improve buildings IAQ (SDG 11 and 12);
- To increase water efficiency (SDG 6) due to the use of TWW for water plants.

Acknowledgement



Inês Boaventura



Alexandra Rodrigues



Ana Maria Barreiros



Maria Idália Gomes

Authors would like to thank to ISEL and to the Polytechnic University of Lisbon (part of the work was supported by the project IPL/2021/RESpira_ISEL).

THANK YOU

ISEL
eco
campus

SUPORTED BY:

