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**Urban forests in corporate spaces: AI as a tool to estimate their benefits as nature: based solutions**

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**PROIBIDO REPRODUÇÃO**



## URBAN FORESTS IN CORPORATE SPACES: AI AS A TOOL TO ESTIMATE THEIR BENEFITS AS NATURE-BASED SOLUTIONS



# CONTENT

## 1. IPT

Corporate Space Context

## 2. Case Study

Results of IPT Urban Forest Management

## 3. AI Exercise

Can it highlight the benefits of urban forests in corporate spaces, as NbS?



# IPT

One of Brazil's first R&D&I institutions  
126 years old

+ 1,000 employees

## Mission

- **Overcoming society's challenges** through science, technology, and innovation applied in public policies and productive sectors.

## Vision

- To be a global reference in innovation and value creation for society, **collaboratively developing technological solutions for a sustainable future.**

## Values

- Connections, diversity, ethics, excellence, impact, innovation, people, and **sustainability.**



# BUSINESS UNITS

## BIONANOMANUFACTURING

Processes, Chemistry, PPEs, Biotech, Nanotech, Microfabrication

## CITIES, INFRASTRUCTURE AND ENVIRONMENT

Territorial planning, Sustainability, Risks, Civil works

## ENERGY

Generation, Infrastructure, Efficiency, Clean energy

## TECHNOLOGICAL EDUCATION

Master's Degree, International MBA, Specialization

## BUILDING AND HOUSING

Confort, Performance, Safety, Materials, Sustainability

## ADVANCED MATERIALS

Metallic, Polymeric, Composite, Cellulosic, Corrosion

## DIGITAL TRANSFORMATION

IoT, Embedded Systems, Intelligent Transport Systems, AI, Analytics

## METROLOGICAL AND REGULATORY TECHNOLOGIES

Mechanics, Electrical, Flow Measurement, Aerodynamics, Chemistry





# IPT MAIN CAMPUS

São Paulo, Brazil



TOTAL AREA  
**217,000 m<sup>2</sup>**



BUILT AREA  
**53%**



BUILDINGS  
**67**



URBAN FOREST  
AREA  
**30%**



TREES  
**+3,000**





# URBAN FOREST ADOPTED CONCEPT

- predominantly **arboreal-shrubby vegetation**, natural or planted
- located in **public or private domain**
- decision-making processes **dominated by local urban actors**
- contributes to the provision of **physiological, sociological, economic and aesthetic benefits to society**



<sup>1</sup> For further details on the adopted concept, see Lima et al. (2023): " Perception about urban forest and its influence on well-being in workplaces".

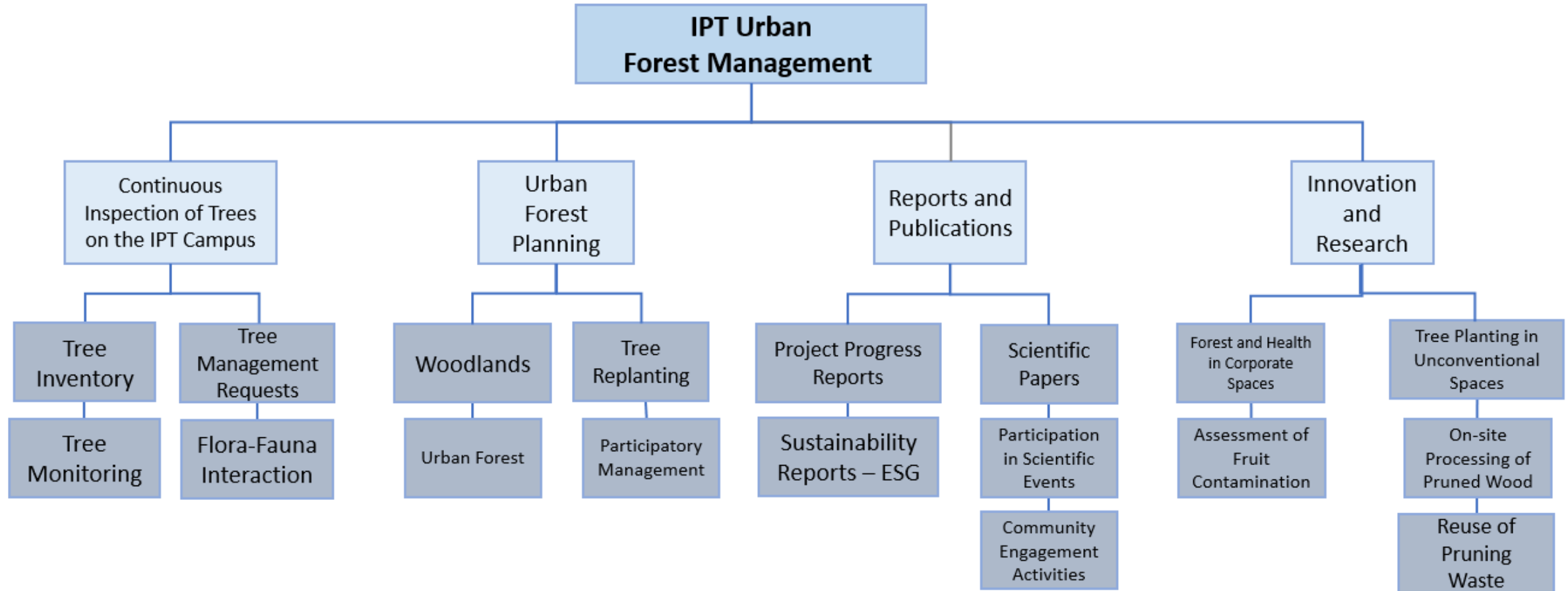




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# URBAN FOREST MANAGEMENT - IPT MAIN CAMPUS, SÃO PAULO





# DENDROMETRY and FLORA BIODIVERSITY



**2,466**

trees registered



Average DBH: 35 cm

Average height: 12 m



Species:

**160**



Native species:

**60%**



Shannon Index  
= 3.758

Pielou's evenness  
index = 0.7616





# WOODLANDS

## Woodland 1

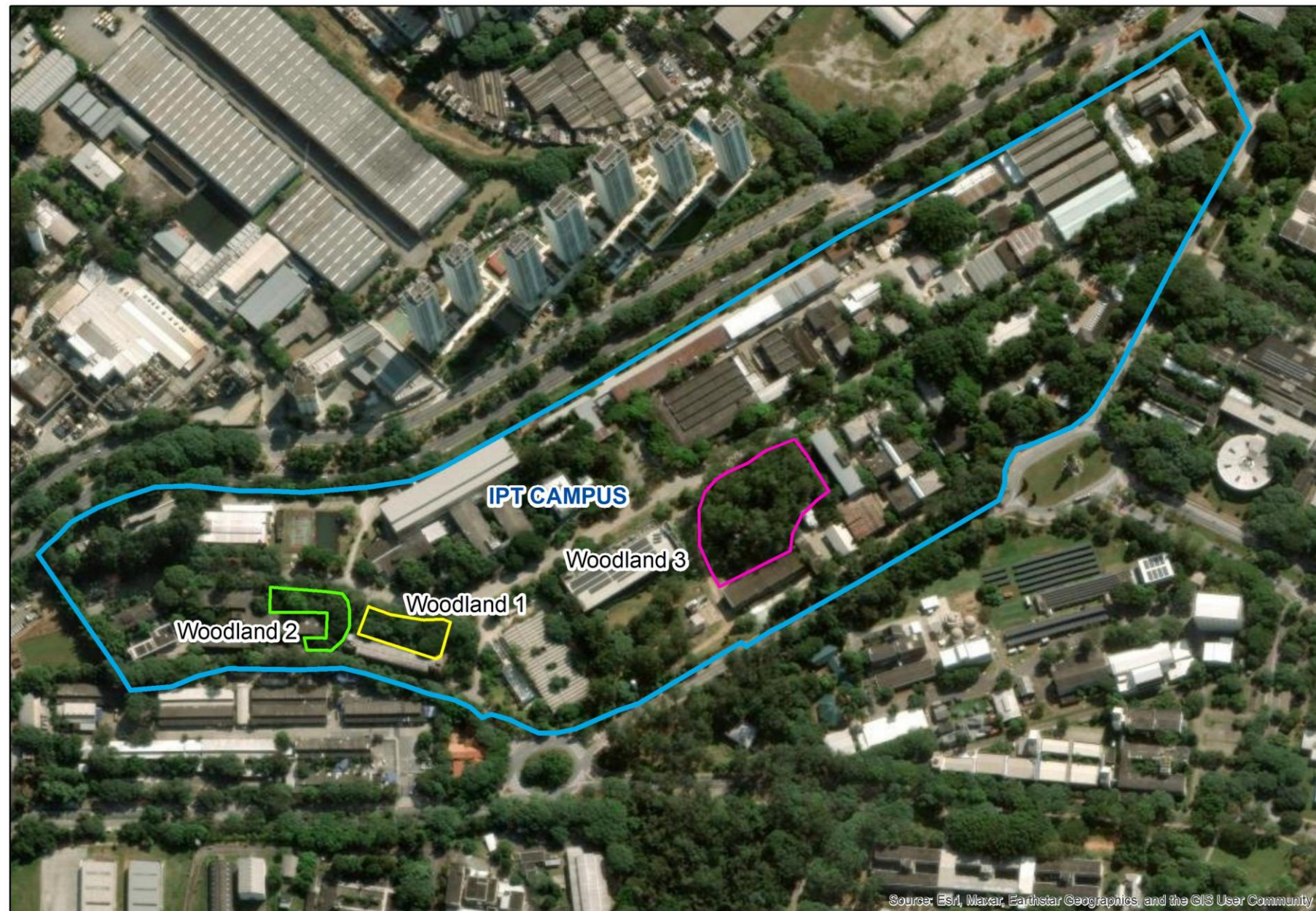
- 2,290 m<sup>2</sup>

## Woodland 2

- 2,240 m<sup>2</sup>

## Woodland 3

- 9,490 m<sup>2</sup>





# WOODLAND 1: NATIVE SPECIES PREDOMINANT WITHOUT UNDERSTORY





# WOODLAND 2: NATIVE SPECIES PREDOMINANT

40 years

20 years natural  
regeneration

**Initial stage of ecological  
succession**

Carbon stock

- $9.61 \text{ kg/m}^2$
- Total: 21.5 t





# WOODLAND 3: EUCALYPTUS SPECIES PREDOMINANT

Natural regeneration of the understory

**Pioneer stage of ecological succession**

Carbon stock

- 27.76 kg/m<sup>2</sup>
- Total: 263.4 t

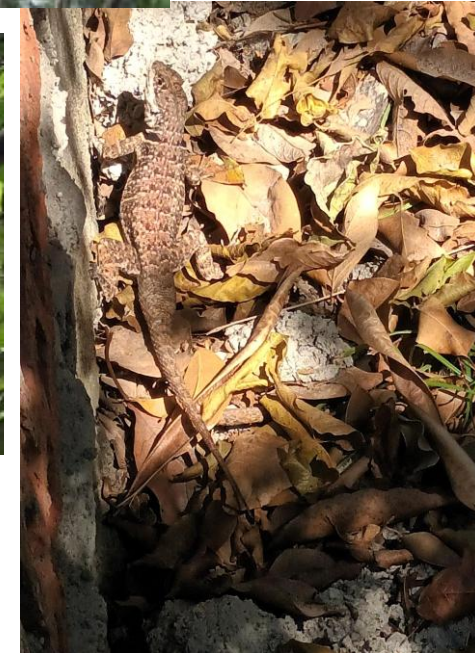
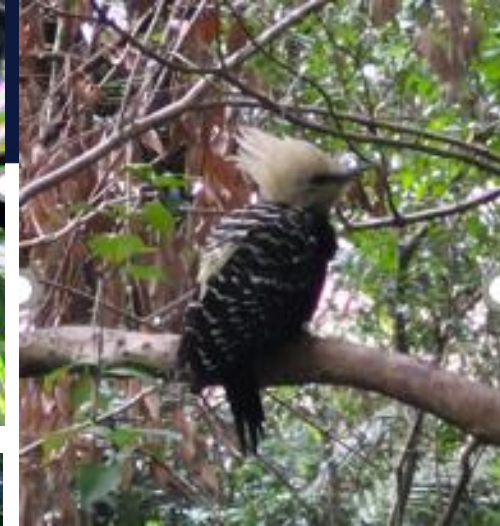
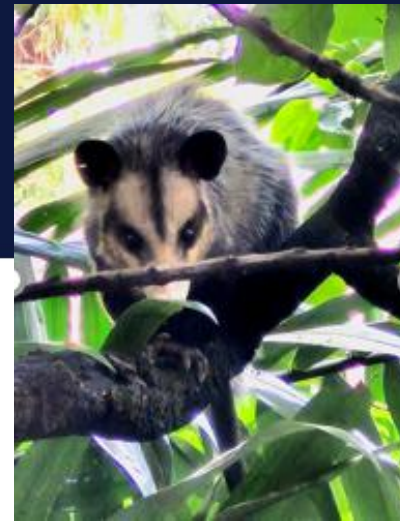




# FAUNA BIODIVERSITY

## 59 SPECIES

- **Birds:** 54 species
- **Mammals:** 4 species
- **Reptile:** 1 species.
  - 16 orders
  - 26 families.





# MAIN RECOMMENDATIONS FOR ENHANCING ENVIRONMENTAL MANAGEMENT AND BENEFITS



## Guidance for tree management:

- Emergency pruning
- Suppression
- Cleaning pruning
- Monitor biodeterioration



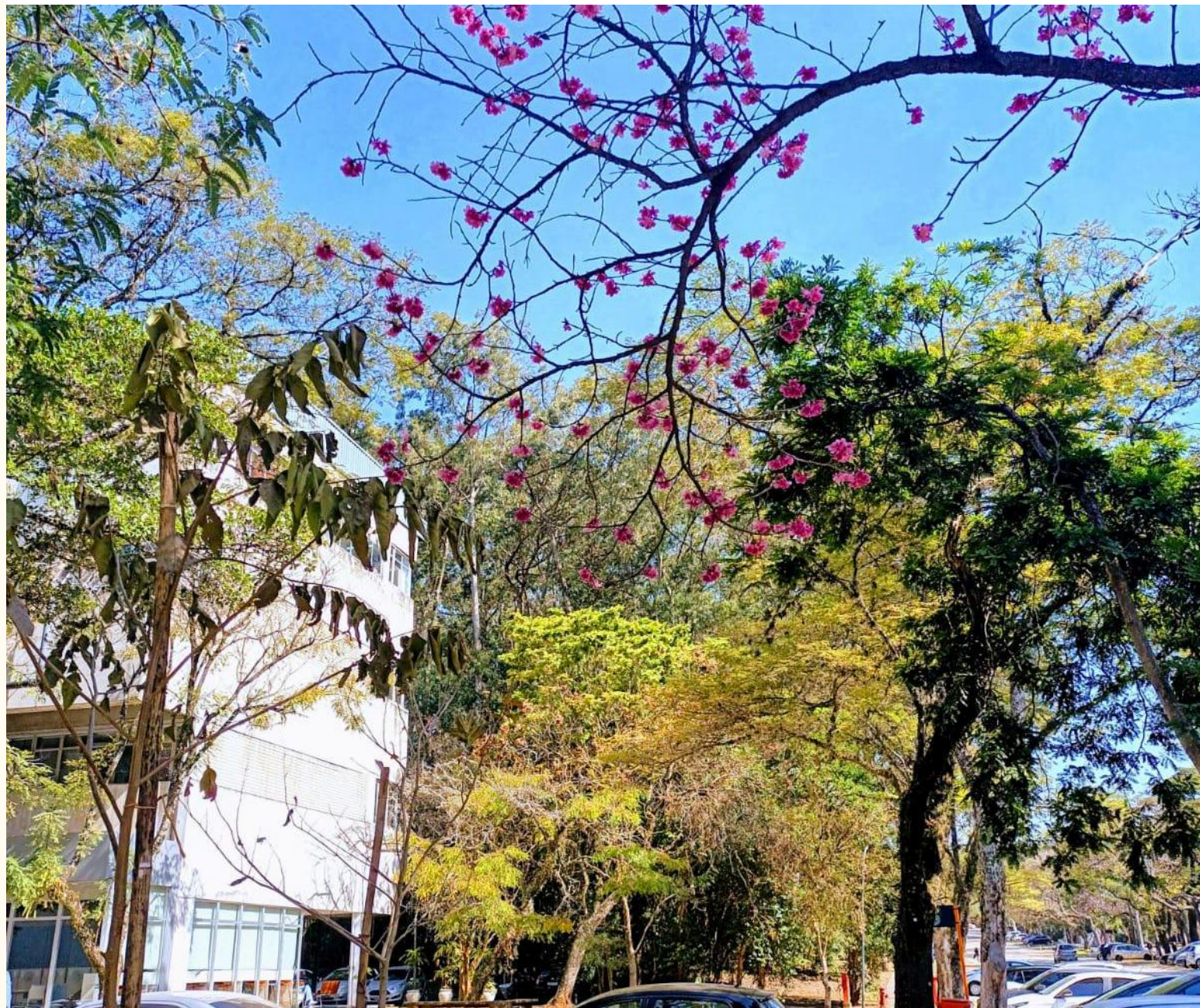
## New plantings:

- Species proposed to avoid repetition
- Native regional species



## Woodlands:

- Enrichment with native species
- Management of invasive exotic species
- Gradual replacement of eucalyptus and enrichment with native species





# PERCEPTION ABOUT THE URBAN FOREST AND ITS INFLUENCE ON WELL-BEING IN THE WORK ENVIRONMENT

## Survey: 20% of IPT Community:



99.5% have a positive perception  
of the presence of trees at IPT



+70% perceive and value the IPT  
urban forest



+40% indicated potential activities  
to perform in the IPT urban forest



+70% relate illnesses to the  
absence of trees

## Arborized environment contributes to well-being in the work environment



Practice physical activity



Rest



Environmental education



Social gathering spaces

Walking trails





# SURVEY HIGHLIGHTS

Results helps plan activities to leverage the potential of IPT's arborized environment to improve the well-being of the IPT community



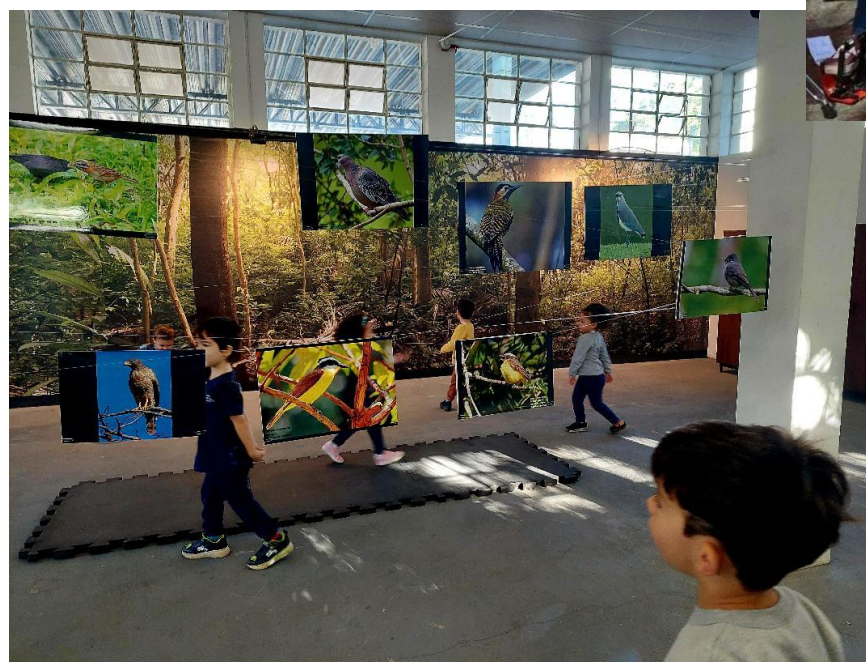
Exhibition: Fauna biodiversity observed at IPT – to celebrate IPT's 125th anniversary



Environmental education for the children of the IPT daycare



Promotion of events, such as musical activities at lunchtime





# ENVIRONMENTAL BENEFITS RELATED TO IPT'S URBAN FOREST



**HABITAT  
MAINTENANCE**



**MAINTENANCE  
OF GENETIC  
DIVERSITY (GENE FLOW)**



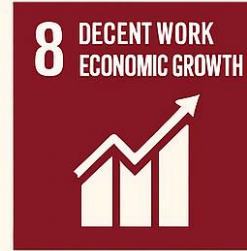
**MAINTENANCE  
OF ECOLOGICAL  
BALANCE**



**RECREATION,  
PHYSICAL AND  
MENTAL HEALTH**



**PROVISION OF FOOD,  
MEDICINAL RESOURCES,  
AND RAW MATERIAL**



**Corporate urban forests expand  
urban green areas, promoting  
environmental benefits and  
better living conditions.**

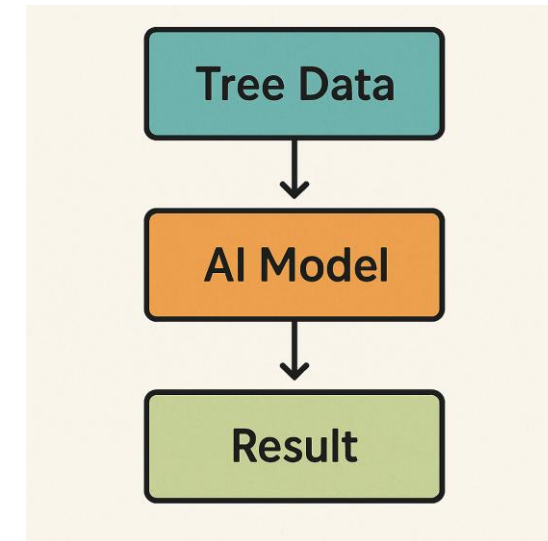
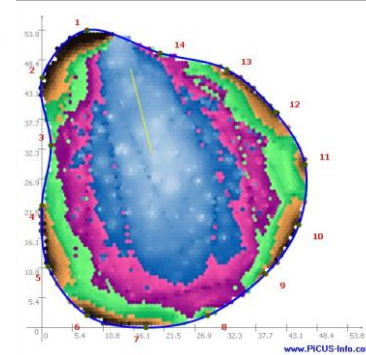
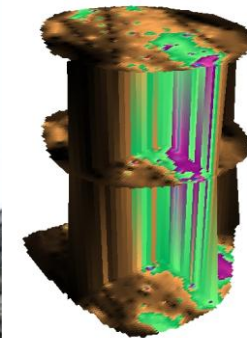


# POTENTIAL USES OF AI IN THE CONTEXT OF URBAN FORESTS



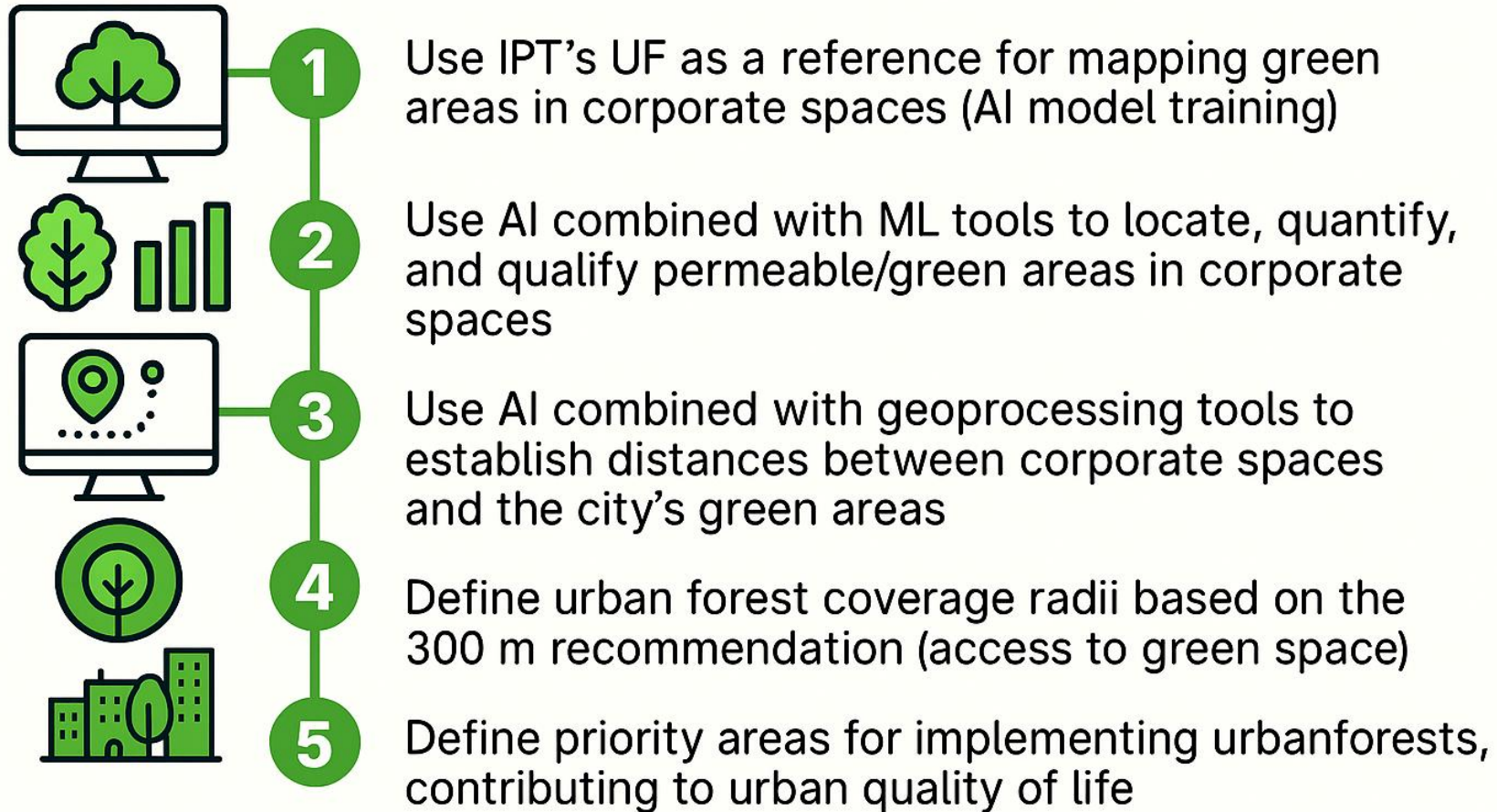
## Use of AI combined with Machine Learning

- Prediction of tree fall risk
- Prediction of trunk biodeterioration in trees
- Prediction of tree branch break risk
- Estimation of biomass and carbon stored in trees
- Prediction of generated environmental benefits
- Identification of corporate spaces with potential to implement urban forests





# METHODOLOGICAL ROADMAP: AI FOR IDENTIFYING CORPORATE SPACES WITH POTENTIAL TO IMPLEMENT UF



The World Health Organization recommends that all people reside within 300 meters of green spaces, citing broad benefits for both human health and biodiversity conservation (World Health Organization, 2017. Urban green spaces: a brief for action).



## CORPORATE REFORESTATION POTENTIAL

BEFORE: Existing Urban Landscape



AFTER: Urban Forest Integration



**NbS: "Actions that protect, sustainably manage, and restore natural or modified ecosystems to address societal challenges effectively and adaptively, while simultaneously providing benefits for biodiversity and human well-being."**  
— *IUCN & European Commission*





# AI & Corporate Urban Forests: Contributions for the SDGs



## Scalability of Environmental Benefits

Use AI to replicate urban Forest benefits across other corporate or urban sites



## Alignment with SDGs

Promote AI development focused on generating environmentally relevant insights



**AI Training for Environmental support** Equip AI models to address and support sustainability and ecological goals



**Support for Urban Forest management**



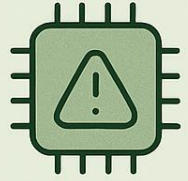
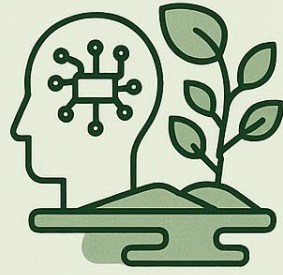
**Support for mitigating the effects of extreme weather events in cities**



**Corporate Urban Forest to mitigate the impacts of AI use in companies**



# AI & CORPORATE URBAN FORESTS: CHALLENGES FOR THE SDGs



## Model limitations

Accuracy in identifying corporate land areas



## Data availability

Feed AI models



## Costs

Data collection and AI model development



## Resource consumption

Water and energy required for AI model training



## Environmental impact

Electronic waste and carbon emissions from AI infrastructure





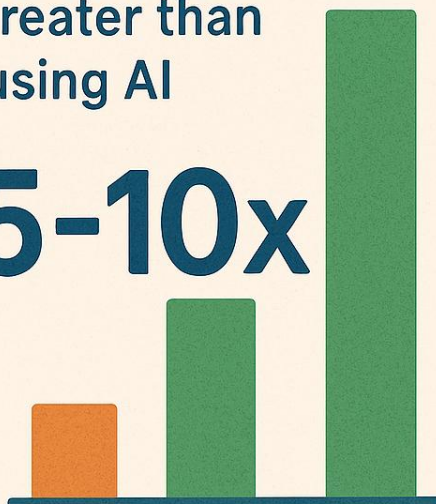
# CONCLUSIONS

- Maximize environmental return on investment to guide more sustainable AI usage

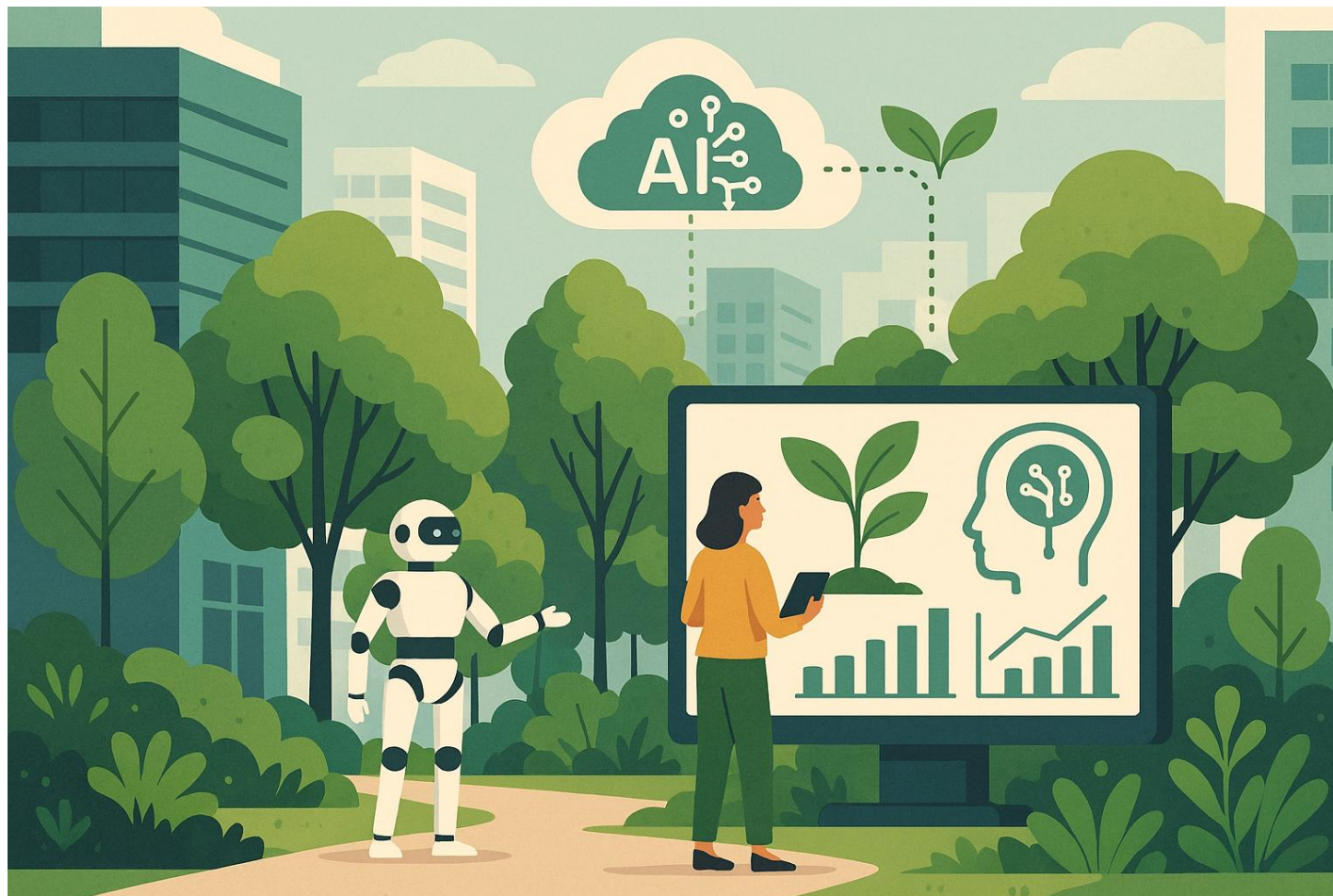


- Environmental benefits to be 5 to 10 times greater than impacts from using AI

5-10x

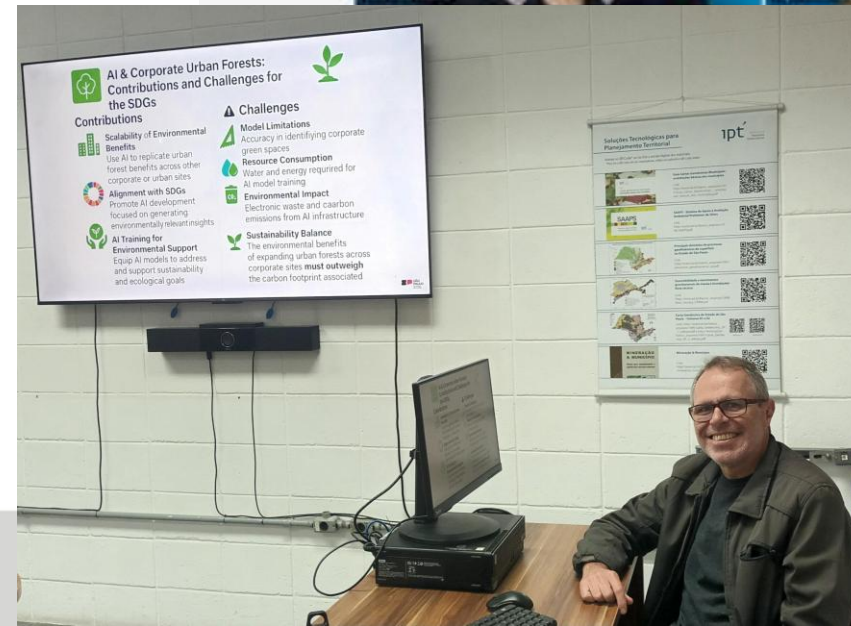


ENVIRONMENTAL  
BENEFITS





# IPT TEAM INVOLVED IN THE DISCUSSION





# Thank you!

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