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THE NATIONAL GEOSPATIAL CONFERENCE

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Geospatial  
Council of Australia

Collaboration, Innovation and Resilience: Championing a Digital Generation

Brisbane, Australia 6-10 April

# Green Cubes: Digital Twins Transforming Biodiversity into Business Value

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Surveying Industry Lead, Hexagon

8 April 2025



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# GREEN CUBES

**Making nature visible**

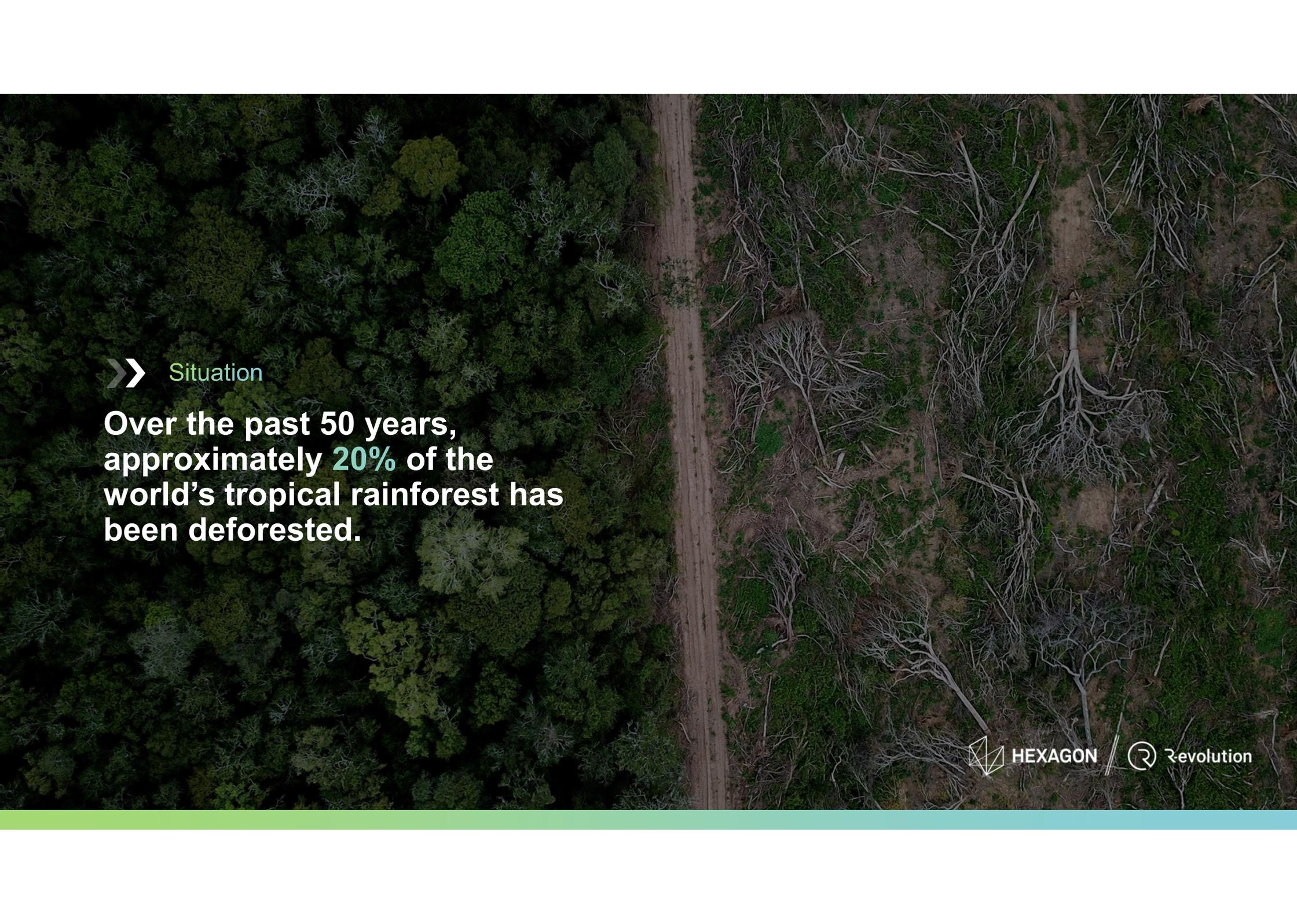
Measuring biodiversity at scale



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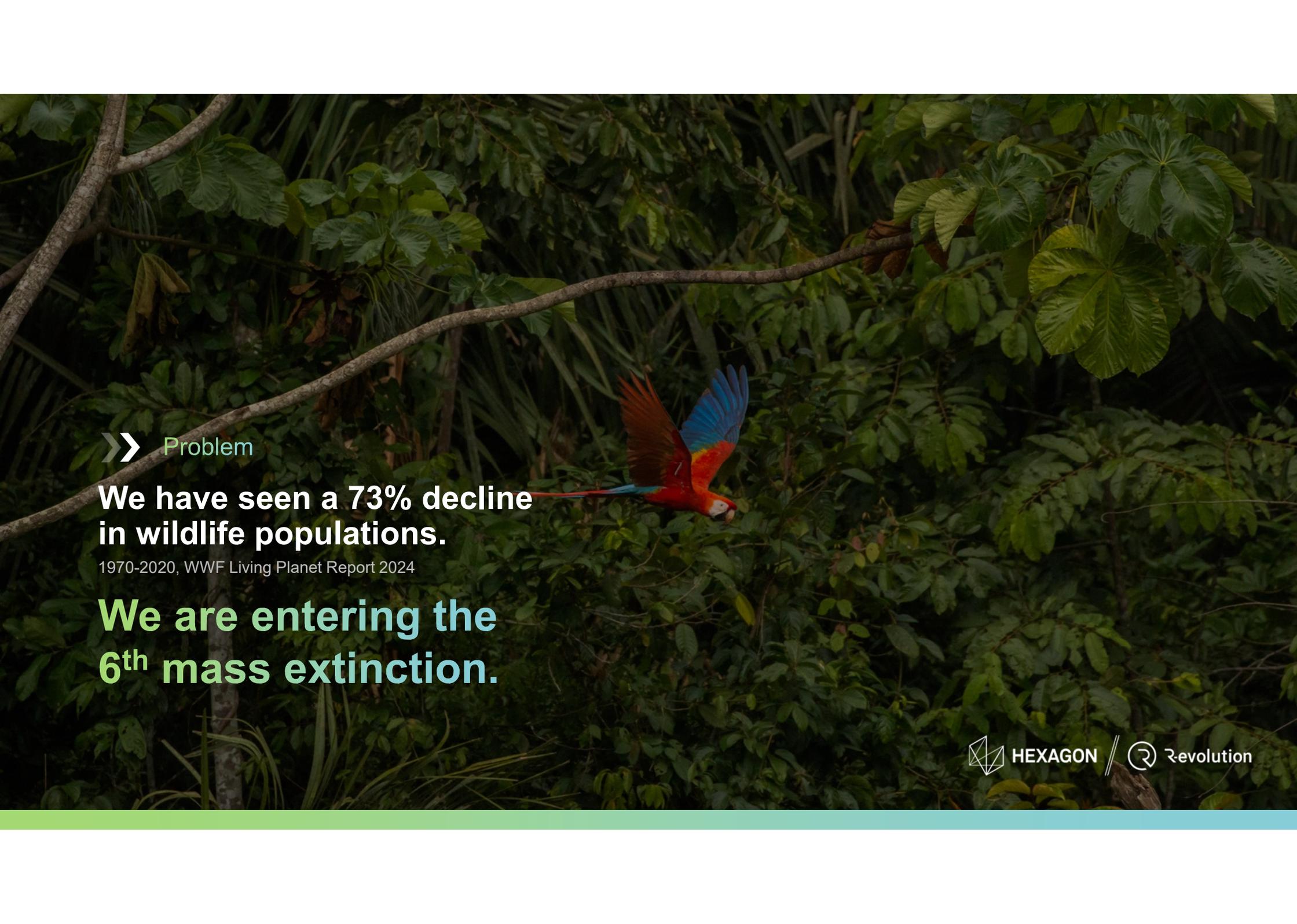


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>> Situation

Over the past 50 years, approximately 20% of the world's tropical rainforest has been deforested.



»» Problem

**We have seen a 73% decline  
in wildlife populations.**

1970-2020, WWF Living Planet Report 2024

**We are entering the  
6<sup>th</sup> mass extinction.**



➤ Opportunity

**What if we can give the rain forest higher commercial returns than deforestation?**



# GREEN CUBES

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# A new way to quantify a forest



## Spot model

Measuring individual trees with manual or laser equipment



## Plot model

Measuring forests on a 2 dimensional level with satellite



## Green Cubes

Accounting for forest volume with multi-dimensional measurement



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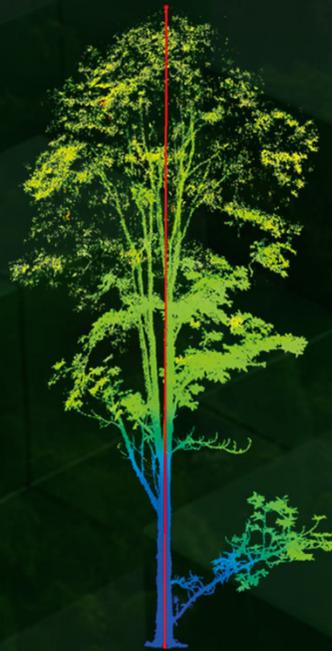
Revolution

# Making nature visible – Unleashing data



## Green Cubes

A volumetric asset class to quantify forest volume based on cubic meters



Earth Observation



Airborne LiDAR



Terrestrial LiDAR



Camera and audio traps



eDNA & radar



Visualisation



Reporting



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# Giving value to nature – Green Cubes offerings

## »» Green Cubes Sponsorship

Committed enterprises sponsor Green Cubes to make a positive nature impact and enhance environmental reporting.

 Providing local landowners with sustainable revenue

 Enabling conservation, preventing deforestation

 Allowing natural growth in the critical biodiversity hotspots



## »» Green Cubes Digital Reality

Environmental monitoring to accelerate restoration in the extraction industry and enhance environmental reporting.

 Meeting regulatory standards and receive permit approvals

 Enabling sustainable mining through the entire life cycle

 Accelerating the restoration process cutting costs

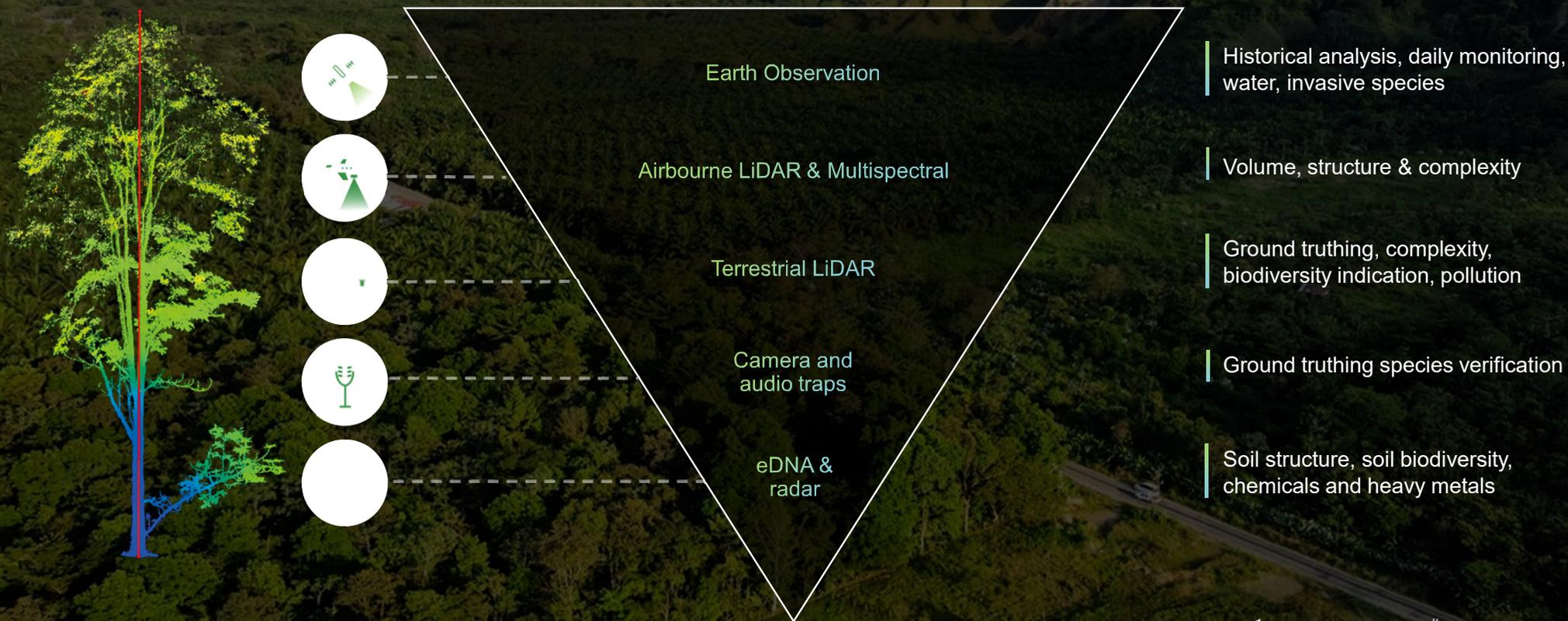




**The Digital Twin of Nature  
Technology**

# Multidimensional mapping

## Triangle of trust



# Multidimensional mapping Earth Observation



Earth  
Observation



Airborne  
LiDAR



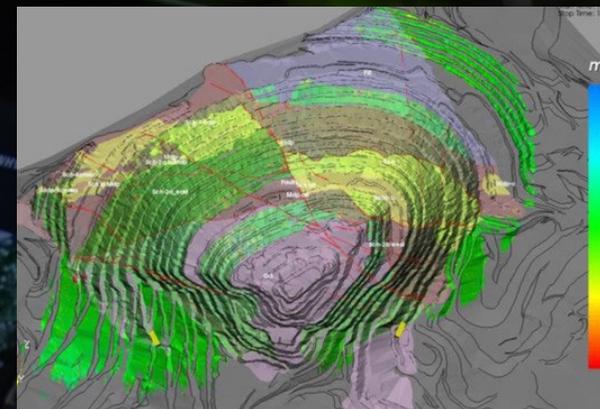
Terrestrial  
LiDAR



Camera &  
Audio traps



Ground  
penetrating radar



## Earth Observation SAR ( Radar ), Multispectral, Photogrammetry

Metrics:

- Sum of total surface area managed by an organisation, total disturbed area and total rehabilitated area
- Extent of land/ecosystem-use change
- Soil structure

# Multidimensional mapping

## Airbourne LiDAR



Earth  
Observation



Airborne  
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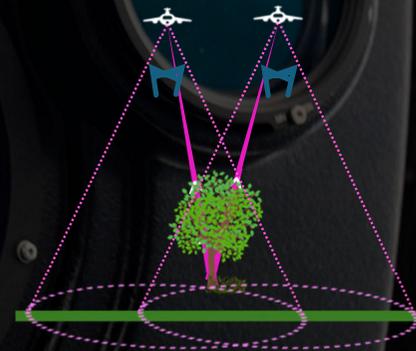
Ground  
penetrating radar



### Airborne LiDAR 5cm resolution

Metrics:

- Forest cover
- Changes in the relevant habitat
- Species richness and abundance
- Ecosystem integrity
- Habitat connectivity



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# Multidimensional mapping

## Terrestrial LiDAR



Earth  
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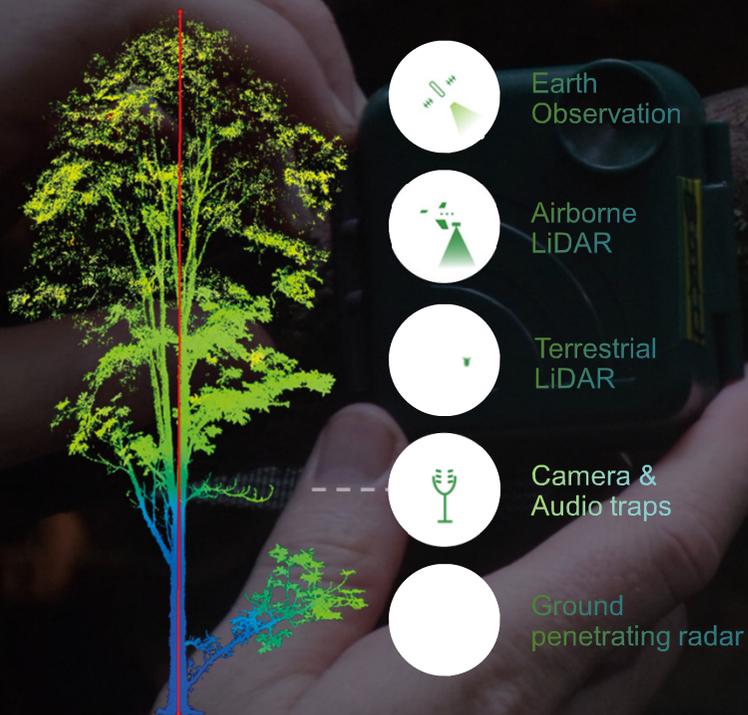
### High Resolution Terrestrial LiDAR

#### Sub-1 cm resolution

Metrics:

- Data capture (flora)
- Bio-mass
- AI structural training data
- AI Leaf area index training data

# Multidimensional mapping Camera & Audio traps



## Autonomous in-situ data collection AI trained acoustics & Camera traps

Metrics:

- Mean Species Abundance (MSA)
- Potentially Disappeared Fraction (PDF)
- Species Threat Abatement and Restoration metric (STAR),
- Potentially Disappeared Fraction (PDF)
- Extent of land/ecosystem-use change

# Multidimensional mapping eDNA sampling



Earth  
Observation



Airborne  
LiDAR



Terrestrial  
LiDAR



Camera &  
Audio traps



Ground  
penetrating radar



## Below ground data collection eDNA sampling

Metrics:

- Mechanical (grain size)
- Chemical (indicators and heavy metal pollution)
- Biological (microfauna, fungi, bacteria)

# Multidimensional mapping

## Hand-held radar



Earth  
Observation



Airborne  
LiDAR



Terrestrial  
LiDAR



Camera &  
Audio traps



Ground  
penetrating radar



## Below ground data collection

### Hand-held radar

Metrics:

- Moisture
- Structure
- Compaction
- Layered depth

# A digital window into the forest

## Making nature visible



**LIVE WEATHER**

28 C Temperature 90% Humidity

| Today | Wed | Thu | Fri | Sat |
|-------|-----|-----|-----|-----|
| ☁     | ☀   | ☀   | ☀   | ☀   |
| 23    | 22  | 22  | 24  | 26  |

**AIR QUALITY INDEX**

7 Good (Updated 10:00 AM)

| PM2.5 | PM10 | PM1 | NO2 | SO2 |
|-------|------|-----|-----|-----|
| 4     | 1    | 2   | 2   | 5   |
| 152   | 61   | 103 | 4   | 7   |

**KEY STATISTICS**

- Monitored Area: 100 km<sup>2</sup>
- Avg. Forest Height: 15m
- Volume: 1,450,000,000 m<sup>3</sup>
- Conservation projects: 3
- Audio Capture Species: 1532 (to date)
- Img Capture Species: 123 (to date)

**STATE OF NATURE & IMPACTS**

Topography and soil

**STATE OF NATURE & IMPACTS**

Forest profile

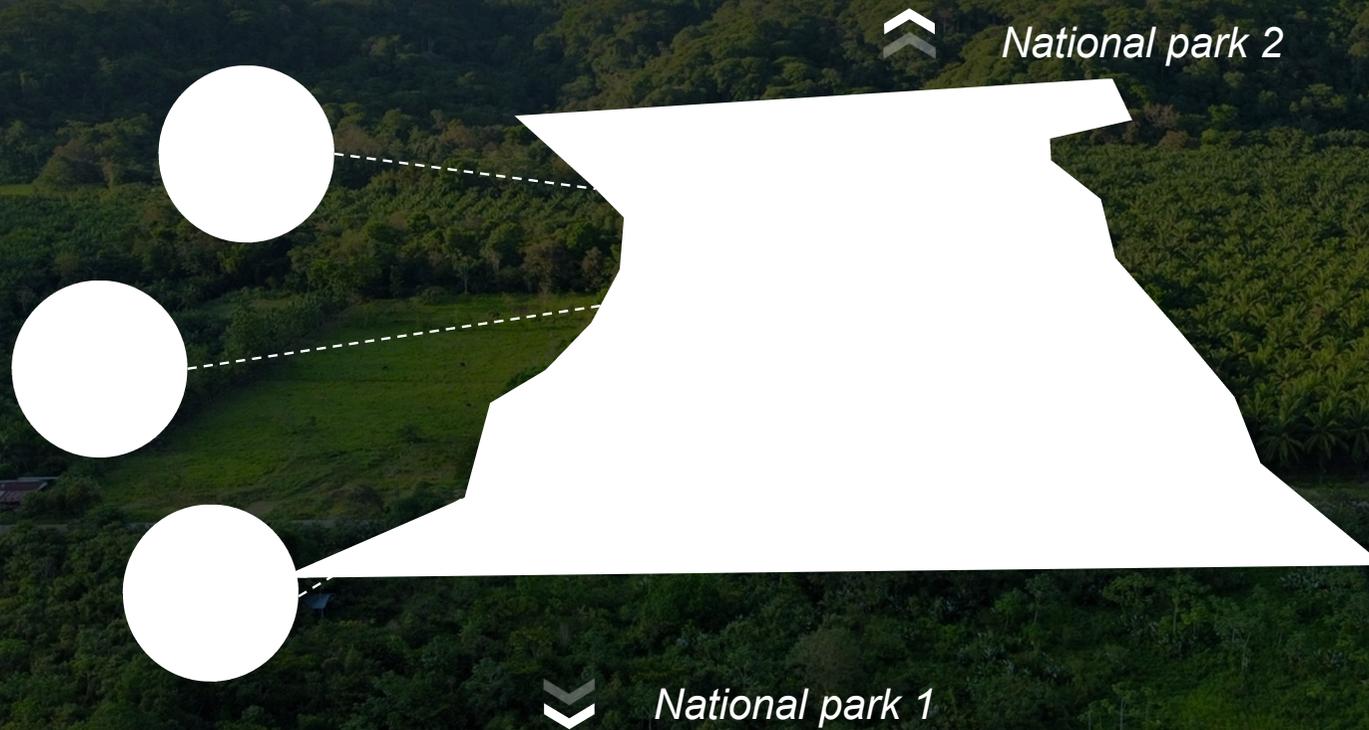
**STATE OF NATURE & IMPACTS**



**GREEN CUBES**

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# Connecting biodiversity corridors COBIGA La Gamba, Costa Rica





## Pater Noster – Proud Green Cubes Sponsor

Pater Noster is a renowned boutique hotel on the beautiful Swedish west coast. **For every cubic meter of accommodation, Pater Noster sponsors an equivalent amount of Green Cubes.** This means that every guest stay is directly contributing to rainforest conservation.



*Our oceans are in crisis. Pater Noster is a tribute to the sea, and we are committed to protecting it on every level—local, national, and global. The connection between deforestation and ocean acidification is undeniable; as CO2 levels rise, our marine life suffers. Protecting our forests is essential to safeguarding our oceans.*

**Mirja Lilja Hagsjö, CEO of Pater Noster**



# EQUALS ONE YEAR OF RAINFOREST PROTECTION



# Making Nature Visible at Mina de Aguas Claras

## Situation and background

Vale is actively engaged in sustainable mining practices, already having showed strong commitments towards nature both in terms of minimizing impact and mitigating with net positive actions.

## Customer challenge

Environmental regulations are expanding, it is difficult to show-case the positive impact to stakeholders, and there is no standard solution that combines integrity, scalability and ease of adoption.

Mina de Aguas Claras (MAC), Future Use Mine in Minas Gerais, Brazil



## How is Hexagon helping

*Digital Twin of Nature to expose Vale's nature positive impact to regulators, optimize future use activities and address Natural Capital, by:*

- **Data Integrity:** High resolution Lidar, imagery and in-situ data (cam & audio traps)
- **Key Metrics:** AI generated, verified by the science ecosystem
- **A Single pane of glass:** User-friendly online application enabling exposure, monitoring, and biodiversity reporting.





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# VALE



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Thank you!



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progress