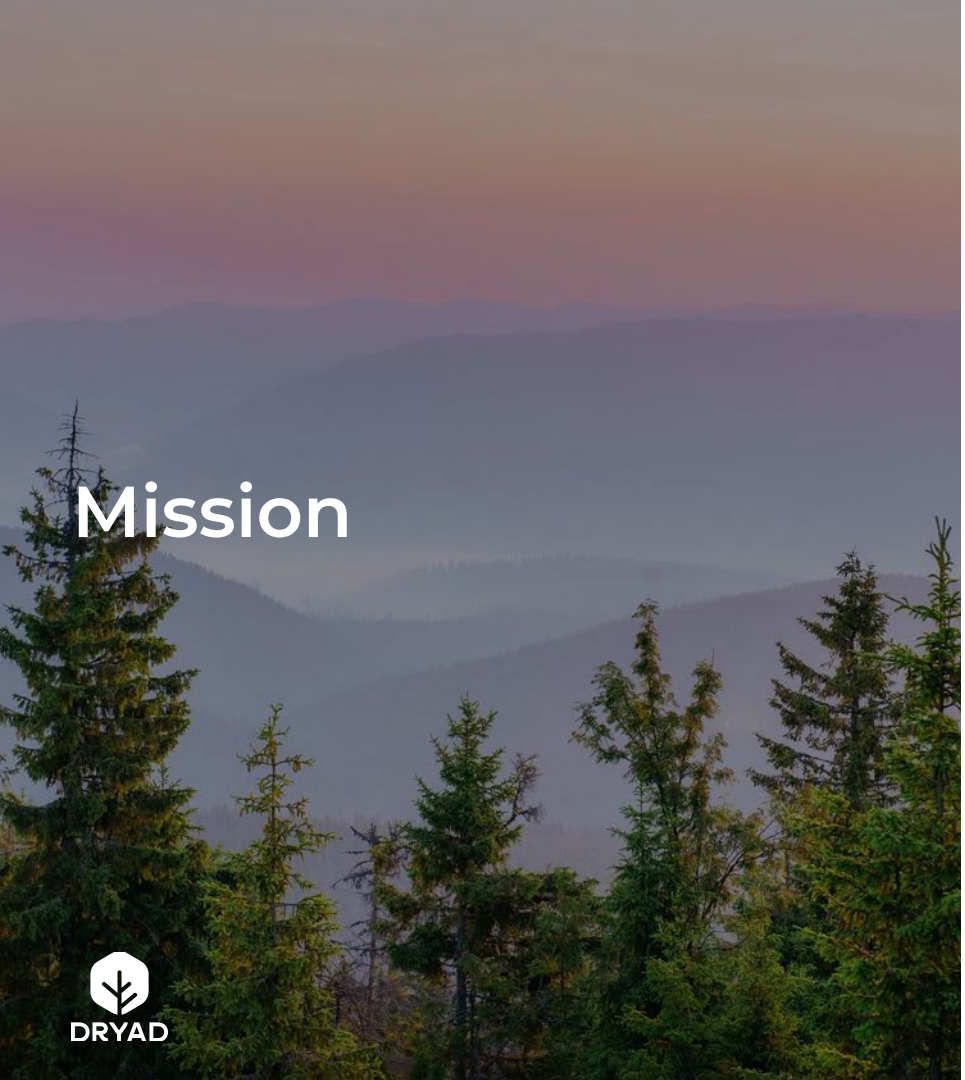

DRYAD
CONNECTING THE NATURAL WORLD
Overview
January 2021



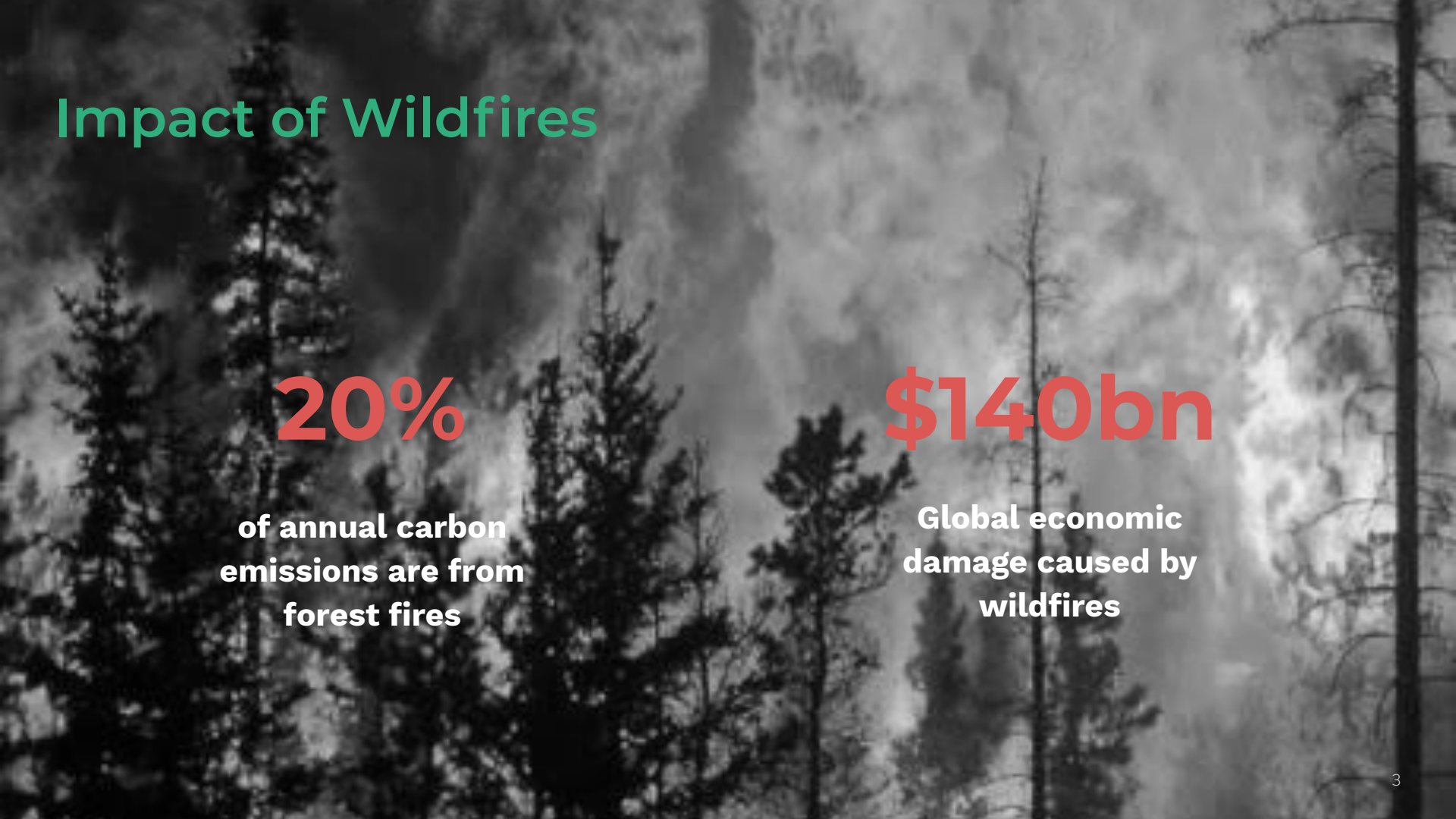
# Mission

DRYAD

Build a global network of sensors to monitor, analyze and protect natural resources.

- Reduced reaction time for wildfires, floods, pollution
- Protect natural assets, reduce carbon emissions
- Data, analysis and trends for scientists and policy-makers

# Impact of Wildfires



**20%**

**of annual carbon emissions are from forest fires**

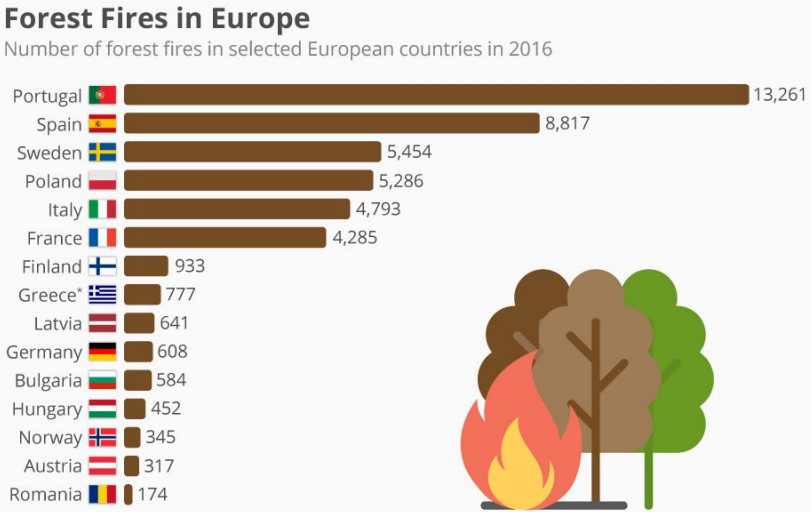
**$140bn**

**Global economic damage caused by wildfires**

# It's not just the Amazon or Australia

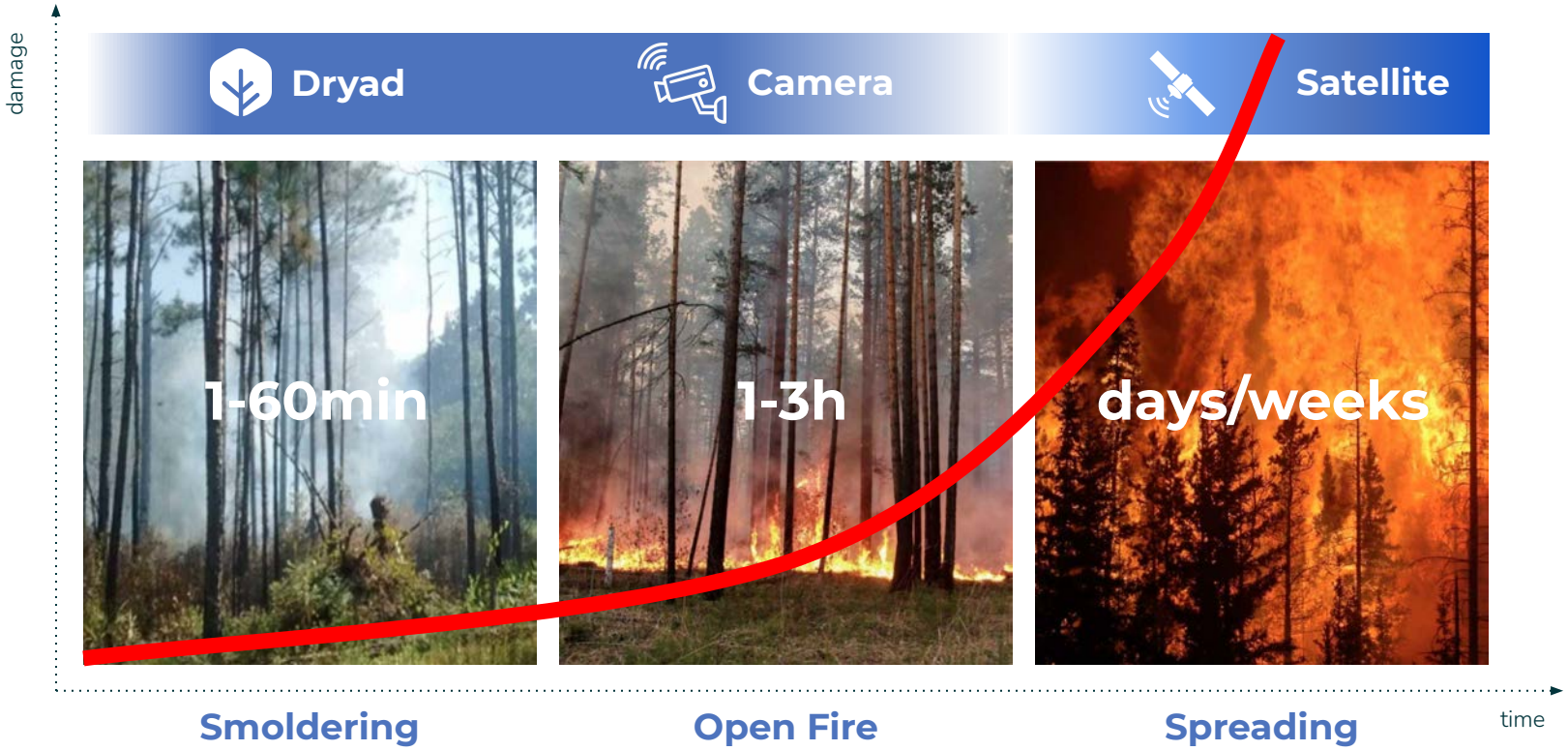
**160m ha**
Forest In Europe

**46,727**
Wildfires Annually




Souce: EU Commission

# Time is of the Essence



# How it works

**Patent on Energy Harvesting**

## Sensor Nodes

Solar-powered gas sensors can detect wildfires already during the smoldering phase.

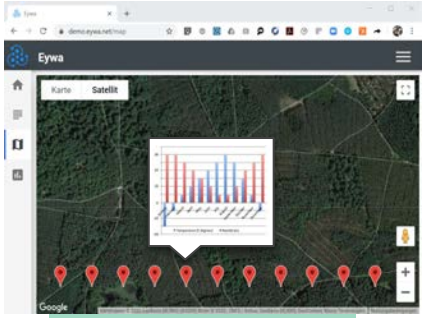
Wireless connectivity using LoRa, the open standards long-range network.


**Patent on LoRa Mesh Gateway**

## Distributed Gateways

Distributed LoRa Gateways connect in a mesh network and via Border Gateways to the Cloud.

Enables large-scale deployment of IoT sensor network.

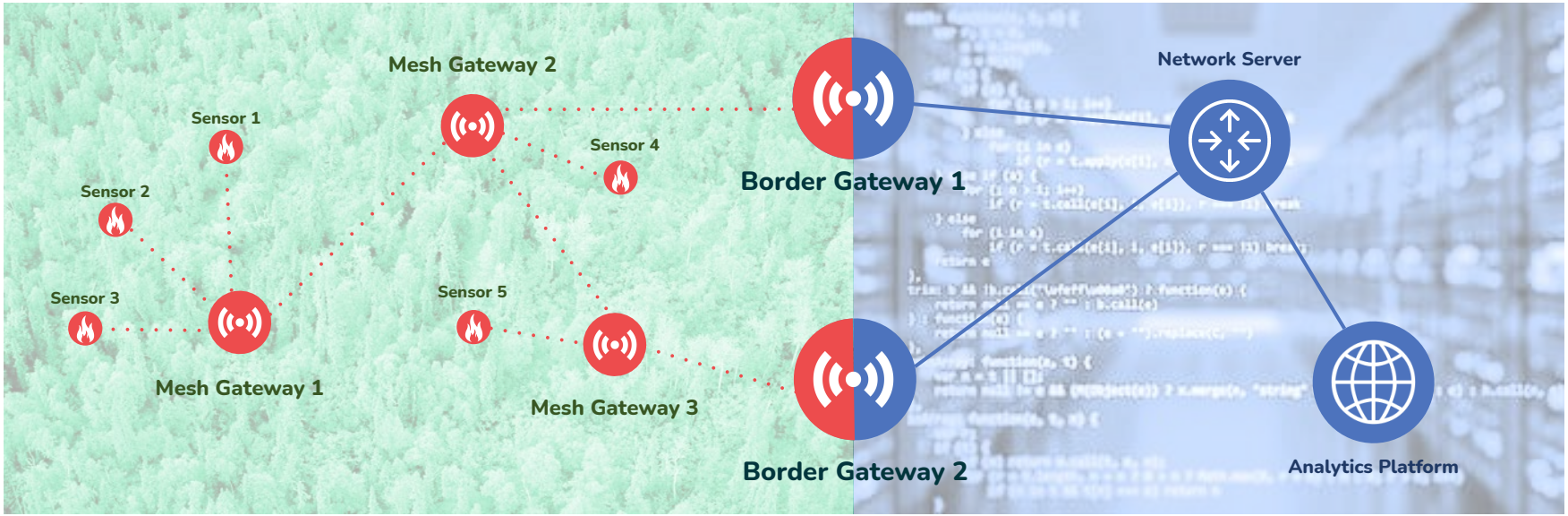



## Cloud Monitoring

Centralized big-data tools monitor, correlate, analyze and send alerts to fire fighters or others.

Actionable info for firefighters, forest owners and scientists.

# Dryad Network Architecture



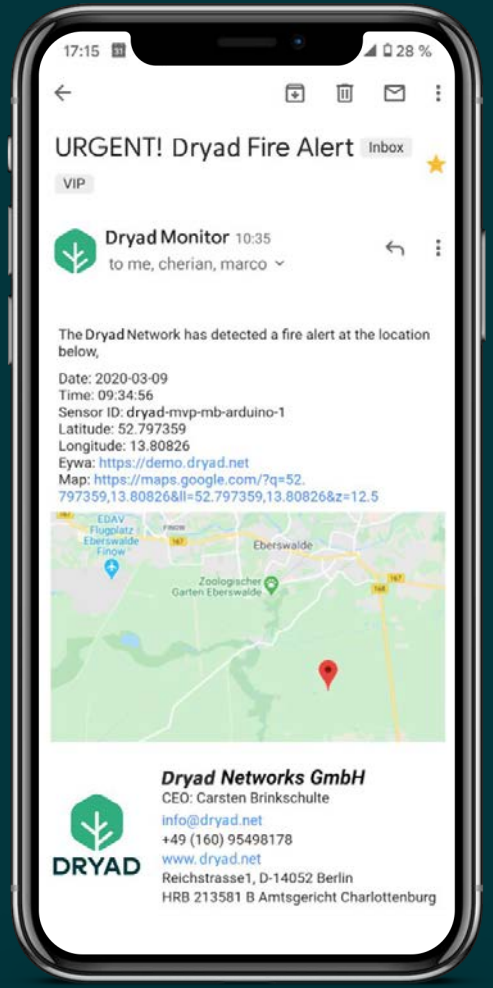
# Protecting the forest

## Fire Detection System

- Large area monitoring
- Real time warning
- Reliable prevention

## Benefits

- Immediate reaction
- Damage control



# Use-Cases & Benefits

DRYAD

## Ultra-Early Fire Detection

Enable firefighters to extinguish wildfires before they spread

- Dramatically reduces costs of firefighting
- Prevents financial damages to economy
- Saves human and wildlife
- Reduces insurance payments

**Public Forests**

**Private Owners**

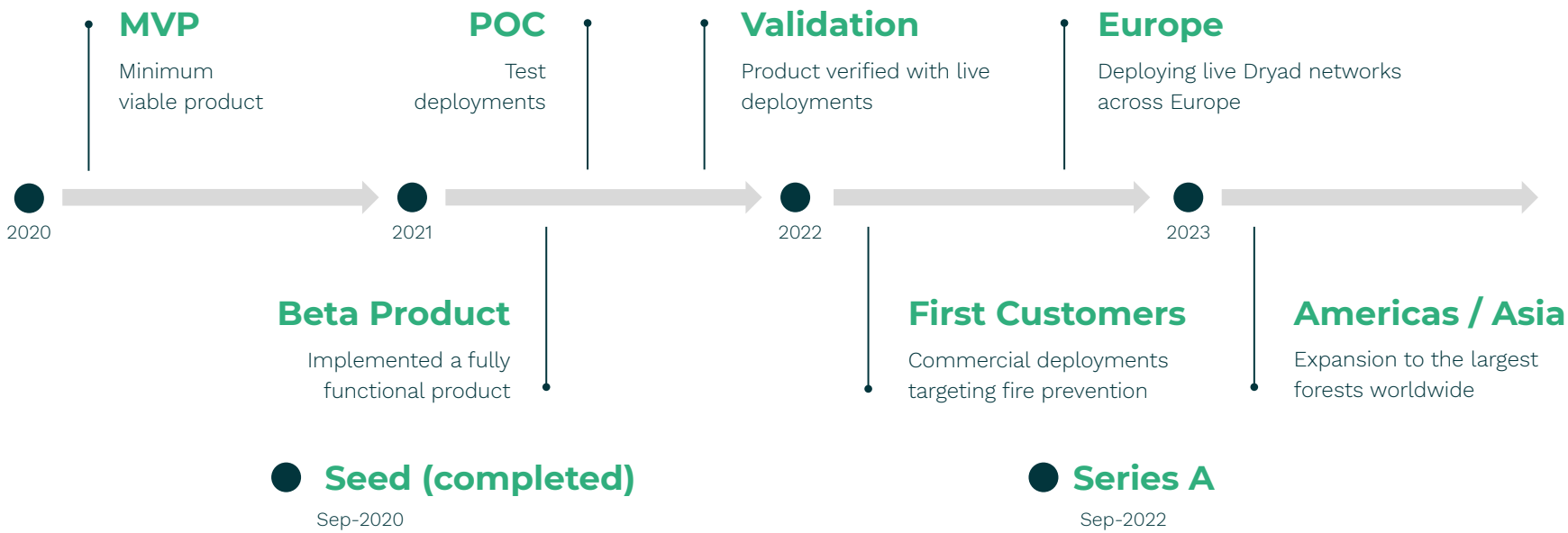
## Health & Growth Monitoring

Enable forest owners to monitor health and growth of the forest

- Reliable, repeatable data collection
- More effective pest control
- Prevent diseases and counter droughts
- Optimize tree growth and ROI

**Private Owners**

# Milestones


MVP
Minimum viable product
POC
Test deployments
Validation
Product verified with live deployments
Europe
Deploying live Dryad networks across Europe
2020
2021
2022
2023
Beta Product
Implemented a fully functional product
First Customers
Commercial deployments targeting fire prevention
Americas / Asia
Expansion to the largest forests worldwide
Seed (completed)
Sep-2020
Series A
Sep-2022

# Dryad Team

## Experienced team covering business, technology, marketing and science

**Carsten Brinkschulte**

Management, Technical and Corporate Strategy, Marketing & Sales

Serial entrepreneur with 20 years experience in building mobile network infrastructure companies (previously Movirtu, Core Network Dynamics)

**Equity: 26.1%**

**Marco Bönig**

Hardware and Embedded Software Engineering, Sensor Development

Seasoned expert in RF-hardware and custom design of electronic solutions, patent for energy harvesting in smart-home products

**13.1%**

**Eike Marx**

Financial Planning, Corporate Strategy

Experienced CFO, investment banking & VC background. Previously Movirtu, Blackberry, Morgan Stanley, Arma Partners. PhD Nanotech/ Optoelectronics

**6.5%**

**Daniel Hollos**

Embedded Software Engineering, Mesh Gateway Development

Experienced CFO, investment banking & VC background. Previously Movirtu, Blackberry, Morgan Stanley, Arma Partners. PhD Nanotech/ Optoelectronics

**6.5%**

**Cherian Mathew**

Cloud and Analytics Software Development

16+ years of experience in software architecture, design and development in both industry and academia with a focus on cloud based data analysis systems

**6.5%**

**Dr. Jürgen Müller**

Research and Scientific Advice, Strategic Partnerships

Until recently leader of department of forest ecology Thünen-Institute of Forest Ecosystems. Developed INPRIWA, a prototype for early forest fire detection

**3.2%**

**Ben Banerjee**

Business Development and Sales

Until recently Partner and head of sales TME at Infosys. Previously, global sales head at Wipro Technologies and VP worldwide sales at Synchronica

**3.2%**


**Dryad Networks GmbH**

Turmstraße 4 | 10559 Berlin | Germany
www.dryad.net

# Addendum

Australia's fires emitted

**409,700,000**

metric tons of CO2
in summer 2019

Fires across the continent burned more than 6 million hectares, including national forests, with smoke reaching as far as Argentina.

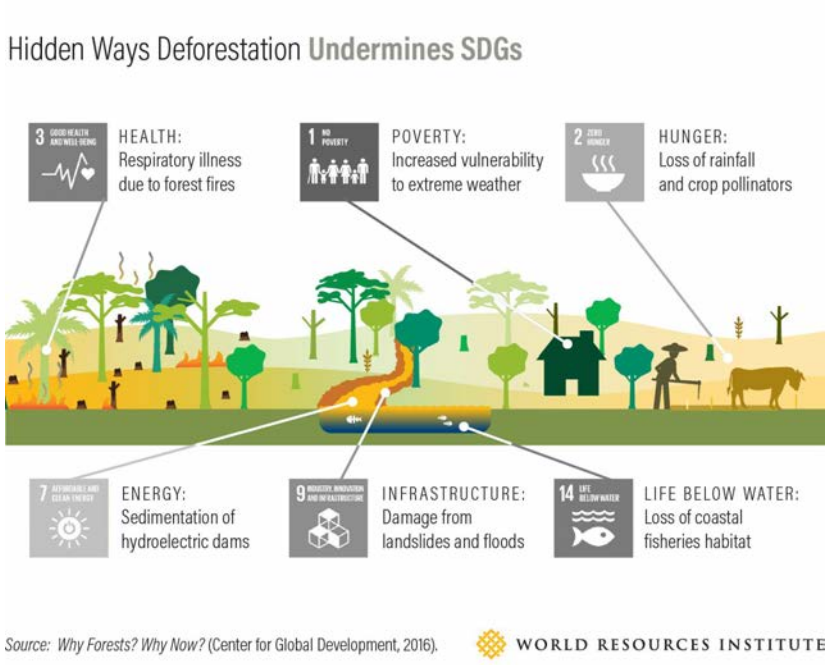
Source: Japanese Meteorol. Agency

## CO2 Emissions

In 2019, forest fires generated 7.8bn tonnes of CO2

That is 21% of all emissions from burning fossil fuels worldwide

# Sustainable Development Goals

# Sustainable Development Goals


## SDG #13: Climate Action

Reduced wildfires protect the world's largest carbon sink, prevents CO2 emissions from fires.


## SDG #15: Life on Land

Reducing deforestation protects the environment of ¾ of biodiversity on land.


## SDG #9: Industry and Infrastructure

Reducing forest fires helps to protect from economic loss caused by forest fires.


## SDG #3: Health & wellbeing

Reducing respiratory illnesses and eye irritations caused by forest fires and associated haze.

## SDG KPIs

| | 2025 | 2030 |
|---|---|---|
| **Climate Action (SDG #13)** | | |
| SDG 13.1: Net carbon impact (tonnes) | 6,226 | 412,845 |
| SDG 13.B: Value of carbon credits ($m) | 0.5 | 31.0 |
| SDG 13.B: Cumulative carbon credits ($m) | 1.2 | 78.6 |
| **Life on Land (SDG #15)** | | |
| SDG 15.1: Saved forest from fires (ha) | 24,959.5 | 1,655,061.2 |
| SDG 15.2: Protected forest (ha '000) | 1,088.5 | 35,886.5 |
| SDG 15.5: # of animals saved from fires ('000) | 1,487.1 | 98,608.5 |
| SDG 15.5: # of animals protected (million) | 64.9 | 2,138.1 |
| SDG 15.5: # of insects saved from fires (kg) | 57,406.9 | 3,806,640.8 |
| SDG 15.5: # of insects saved from fires (tonnes) | 2,503.6 | 82,538.9 |
| **Industry, Innovation and Infrastructure (SDG #9)** | | |
| SDG 9.4, 9.B: Protected economic loss (US$m) | 169.8 | 11,259.1 |
| SDG 9.4, 9.B: Total protected loss (US$m) | 423.0 | 28,048.5 |
| **Good health and wellbeing (SDG #3)** | | |
| SDG 3.2: # of deaths prevented (annually) | 432 | 57,344 |
| SDG 3.2: # of deaths prevented (cumulative) | 649 | 144,442 |
| SDG 3.9: # of people protected ('000) | 2,826 | 187,362 |

# Comparing Ecosystems

NB-IOT depends on operators, lack of coverage in rural areas and costly.

Sigfox depends on a single operator (Sigfox), its network coverage is limited in rural areas, no FOTA.

MIOTY is a promising technology, but very early stage (no products, no live deployments).

LoRa is the best choice with an established ecosystem, support for private networks and no license cost.

| Ecosystem | LoRa | Sigfox | MIOTY | NB-IOT |
|---|---|---|---|---|
| Technology | LPWAN (spread-spectrum) | LPWAN (binary phase-shift keying) | LPWAN (telegram splitting) | WAN (LTE-based) |
| Main Licensor | Semtech | Sigfox | Fraunhofer, TI | 3GPP |
| Standardization | LoRa Alliance | Sigfox | MIOTA Alliance | GSMA |
| Available Since | 2012 | 2010 | 2020 | 2016 |
| Status | Millions of sensors, 137 live operator networks | Millions of sensors, 50 live networks | Pilot Installations only, no live operators or devices available | 142 operators live (NB-IOT and LTE-M combined) |
| Alliance Members | 500 | Proprietary | 6 | 370 |
| Private Networks | Yes | No | Yes | No |
| Spectrum | 868Mhz (Europe), 915MHz (USA), 433MHz (Asia) | 868 MHz (Europe), 915 MHz (USA), 433 MHz (Asia, LatAm) | 868 MHz (Europe) | Europe: 1800, 900, 800 MHz, USA: 1700, 700, 850 MHz |
| Max. Throughput | 50 kbps | 100 bps | Unclear (claims high)? | 200 kbps |
| Real. Throughput | 100 bytes / minute | 12 bytes / minute | Unclear (claims high)? | 50-70 kbps |
| FOTA | Yes | No | Unclear | Yes |
| Battery life | 2-5 years (1200 mAh) | 1-2.5 years (2400 mAh) | Up to 20 years (Battery?) | Up to 10 years (2400 mAh) |
| Range | < 20km | < 40km | < 15km | < 10km |
| Pricing | Free | €9 per device / year @ 2 messages / day | Free? (No info) | €1.7/SIM/Month + Data |
| Certified Products | 176 | 866 | - | Few |
| Pros | Established and thriving ecosystem of many chipset manufacturers, sensor and gateway vendors as well as operators. Operator and private networks supported. Backend by operators or private networks. LoRaWAN protocol open source. No limit of max. Messages per day. | Good support by Sigfox as it controls the backend of all live networks globally. | Telegram splitting prevents message collision, decreasing error packet rates, better handling of interference than other LPWAN protocols. ETSI (TS-UNB) Compliant. Supports mobility up to 120km. Substantially improved battery life. | Live networks of many operators worldwide. Reliable operation - no spectrum interference as it uses licensed spectrum of operators. 1600 bytes payload. |
| Cons | Limited support for mobility. Payload limited to 243 bytes. Uses free spectrum, subject to interference. | Backend dependent on Sigfox. Limited support for mobility. Limited network coverage in rural areas, spotty coverage in USA, Norway, Sweden, No coverage in Africa, Asia. Protocol proprietary to Sigfox. Payload limited to 12 bytes. Maximum of 140 messages / day. Uses free spectrum, subject to interference. | New, unproven protocol with no existing ecosystem and no live installations. May take several years to establish the standard. Uses free spectrum, subject to interference | Costly for large number of devices. Dependency on network coverage by operators (no private networks). German coverage good, but blind spots in forests. Rural network coverage in USA limited. Sparse network coverage in Asia, South America and Africa. Does not support mobility. |

# Pricing


## Sensor

| | |
|---|---|
| Hardware COGS[(1)]: | €29.50 |
| Installation COGS: | €15.60 |
| Margin (15%): | €4.40 |
| **Resell Price:** | **€49.60** |
| Service (15%): | €7.60 |

## Gateway

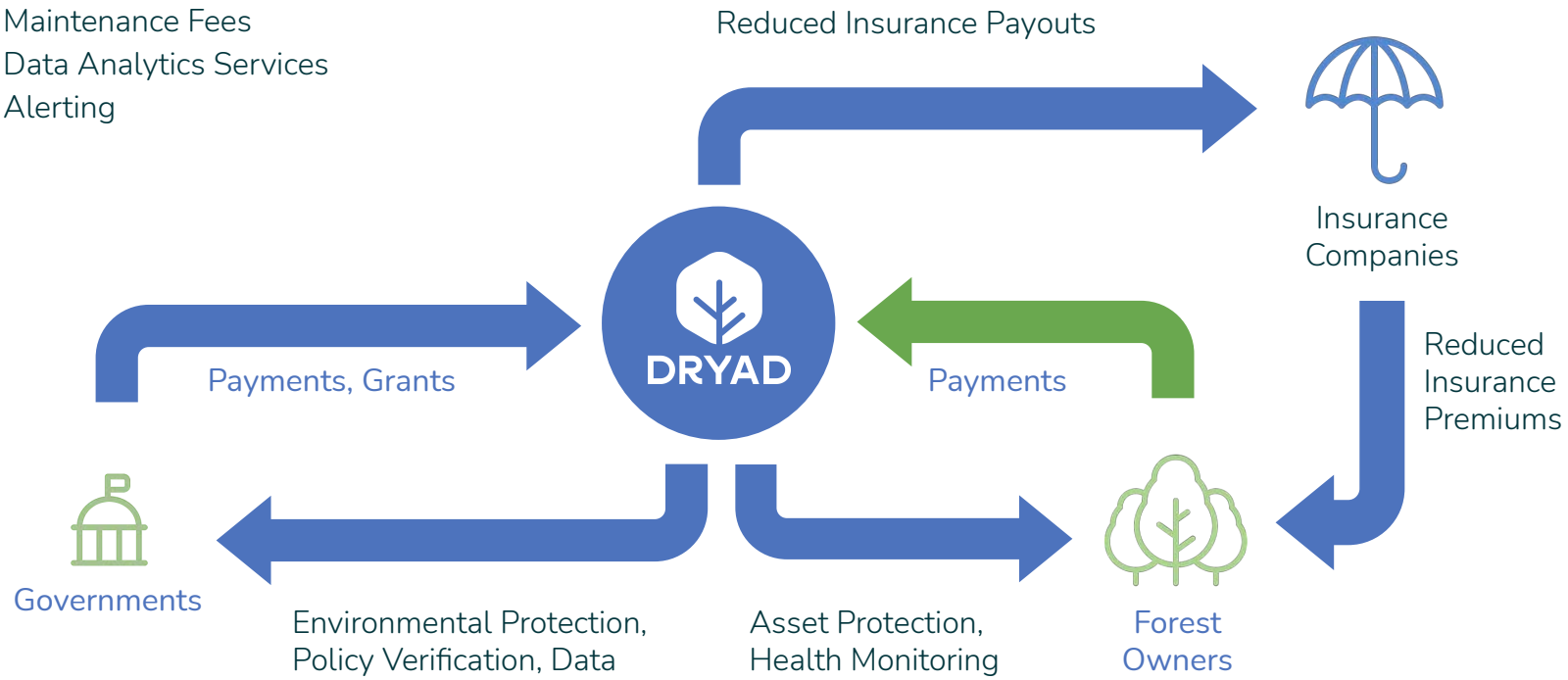
| | |
|---|---|
| Hardware COGS[(1)]: | €120.60 |
| Installation COGS: | €15.60 |
| Margin (15%): | €18.10 |
| **Resell Price:** | **€154.30** |
| Service (15%): | €23.14 |

**Annual service fees includes access to analytics platform and alerting**
**Number of sensors required: 0.7 per hectare**

Note: (1) Volume discount: >10,000 devices: 15%, >100,000 devices: 25%

# Revenues

- Device & Deployment Fees
- Maintenance Fees
- Data Analytics Services
- Alerting



# Return of Investment: Insurance

## Insurance vs. Dryad

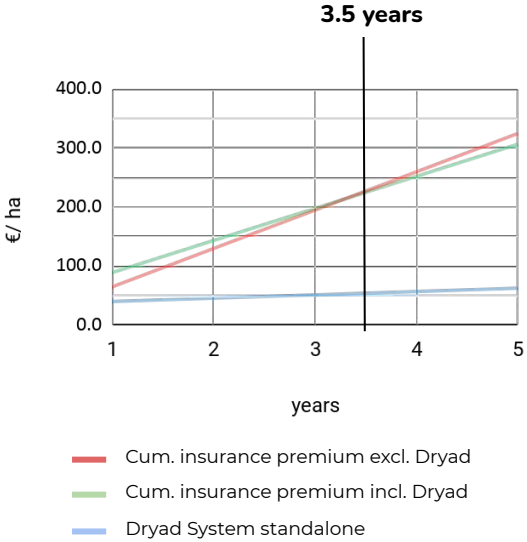
Cost for Dryad is a fraction of forest fire insurance

- Avg. insurance is €325/ha over 5 years[1]
- TCO for Dryad is €63 over 5 years
- Less than 1 year insurance premium

## Insurance + Dryad

Insurance premium can be reduced by Dryad deployment[2]

- Insurance risk considerably lower
- Assumed discount 25%
- ROI Dryad is 3.5 years




Notes: (1) Quote by AXA Online tool for small mixed forest (10 ha) in Berlin-Brandenburg, (2) Confirmed in discussions with R&V Insurance

# Return of Investment: Monitoring

## Manual Monitoring

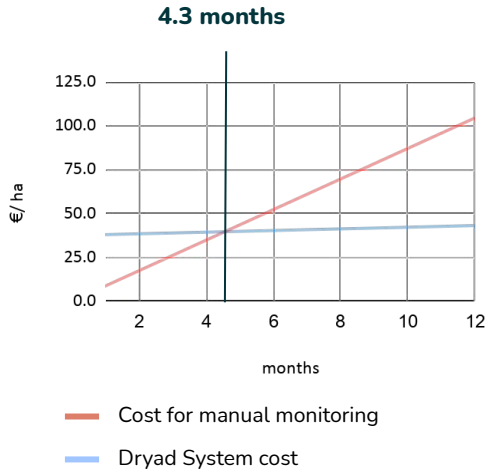
Growth and health monitoring required to manage yield class[1]

- Quality of wood determines the sale price
- Cost of manual monitoring €104/ha/year

## Automated Monitoring

Dryad reduces cost with repeated, reliable automated monitoring

- Dryad ROI of 4-5 months[2]
- Cost of Dryad negligible, as it helps to keep:
  - Yield Class in 1.3% of target[3]
  - Sale prices in €1 of target[4]

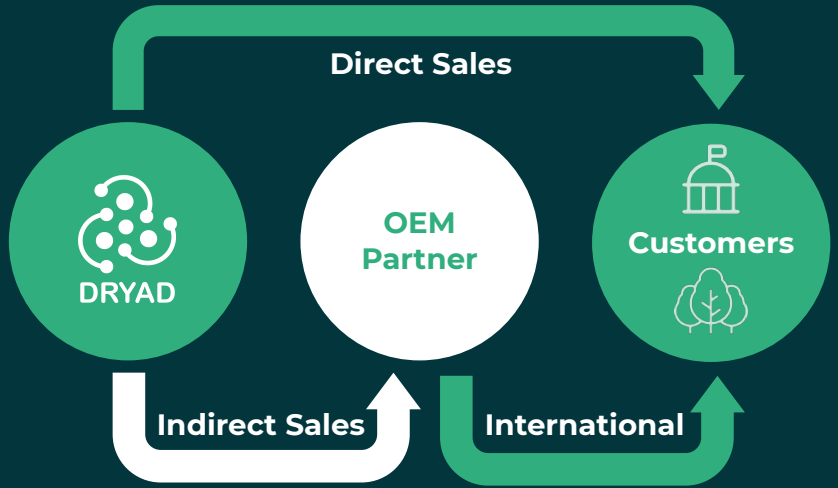



Notes: (1) Quality of wood determines the sale price; (2) Assumes manual monitoring 4 times per year; (3) Assumes target Yield Class of 8; (4) Assumes target sale price of €70 per solid cubic meter

# Go to Market

## Sales Pipeline

- Pilot deployment in Eberswalde
- LOIs with 9 private forest owners for pilot installations
- Discussions with Brandenburg Forest Agency
- LOI with Competitor IQ Wireless
- OEM Potential with STIHL
- LOI in preparation with R&V Insurance Company




# Potential

## Reduced Wildfire Damage Costs

Dryad shortens reaction times and prevents fire escapes

### Reduced Wildfire Suppression Costs

Dryad's early warning system reduces the costs of firefighting

DRYAD

# Why is the forest so important?


Capturing **110 bn metric tons CO2 per year**

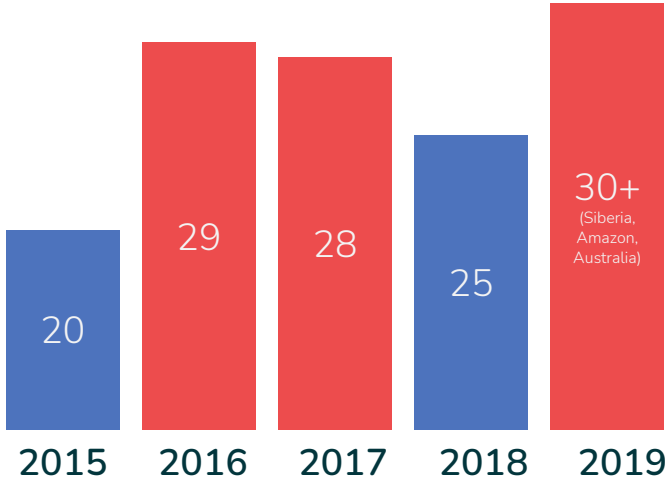
Source of food for **1bn people**

Home to **¾ of all biodiversity** on land

**Protection** against erosion, avalanches and landslides

# We are Losing the Forest

Up to 170m ha of forest could be lost until 2030 if current trends continue




Million ha lost per year, Source: Global Forest Watch, WWF

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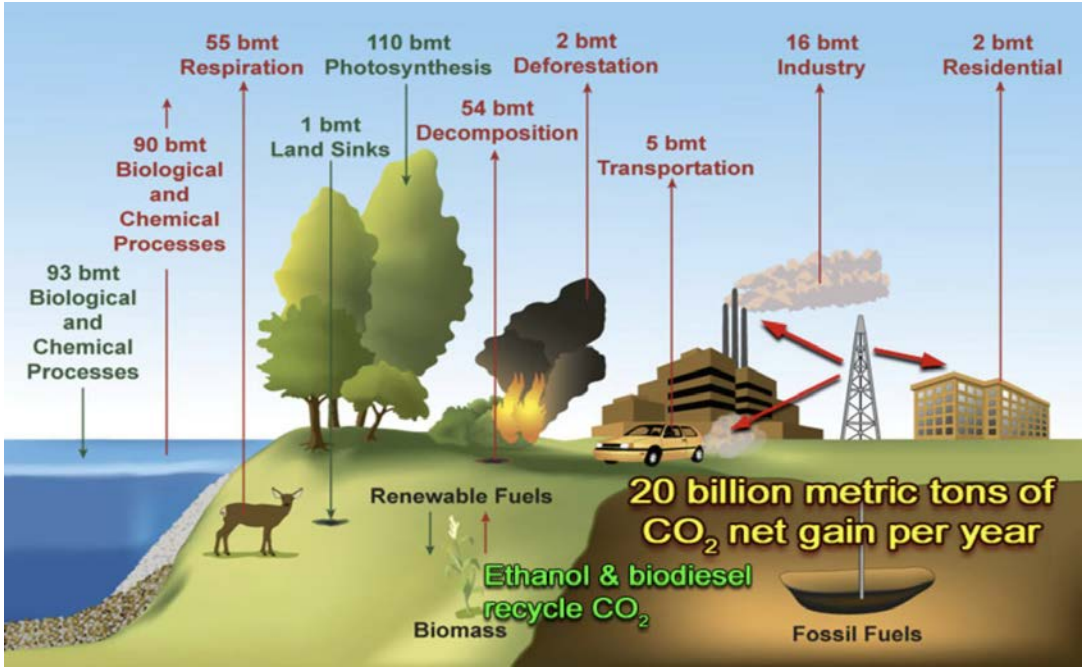
# Forest - the Great Carbon Sink

Forest is the largest carbon sink consuming 110 bn metric tons CO2




Source: Chemistry Land

# German Forest under Threat

Repeated drought years increase threat of fires and beetle plagues

**Most affected:**
Brandenburg, North Rhine-Westphalia, Thuringia, Lower Saxony and now even Bavaria (56% of total forest area)

**Trees most under threat are:**
Spruce, Beech, Ash, Norway Maple and Sycamore (68% of all trees)

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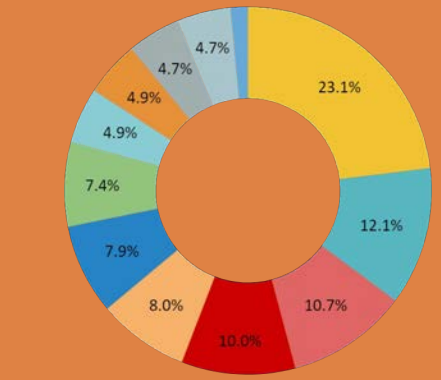
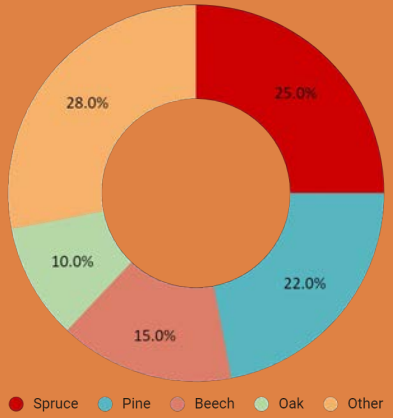
## Forest Area

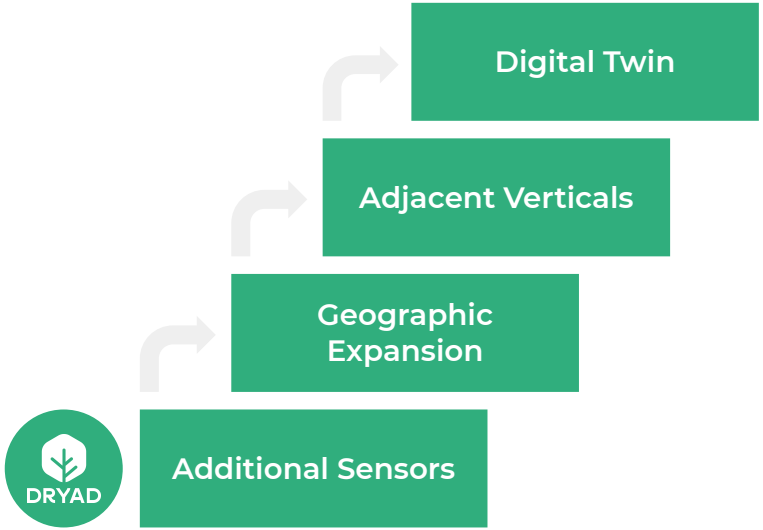



## Tree Types




Most Affected — Least Affected

# Roadmap and Vision




DRYAD

**Forest**
Ozone, water consumption, tree growth and health

**Water**
Temperature, O2 concentration, flow speed and water levels

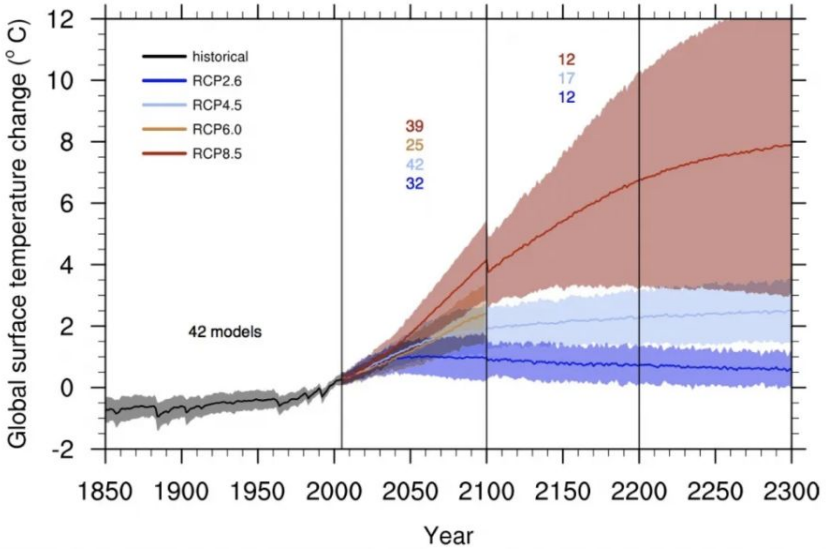
**Communication**
2-way pager, SOS button, anti-theft alarm

**Climate**
Ozone, CO2, NOX, VOC levels, wind speed, humidity and temperature

# Climate Change - Ultimate Challenge

Reducing carbon emissions is critical

Carbon Capture and Storage (CCS) considered as mitigating technology




Source: IPCC