To conserve nature and reduce the most pressing threats to the diversity of life on Earth
WWF is one of the world’s largest global conservation organizations. We have a presence in nearly 100 countries around the world.
WWF’s work aligns around 6 areas of focus

- Forests
- Freshwater
- Oceans
- Wildlife
- Climate
- Food
The Anthropocene Triple Threat

Climate change
Biodiversity loss
Food insecurity
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (1)</td>
<td>Puerto Rico</td>
<td>7.17</td>
<td>149.85</td>
<td>4.12</td>
<td>4 149.98</td>
<td>3.66</td>
<td>24</td>
</tr>
<tr>
<td>2 (2)</td>
<td>Myanmar</td>
<td>10.00</td>
<td>7 056.45</td>
<td>14.35</td>
<td>1 512.11</td>
<td>0.80</td>
<td>57</td>
</tr>
<tr>
<td>3 (3)</td>
<td>Haiti</td>
<td>13.67</td>
<td>274.05</td>
<td>2.78</td>
<td>392.54</td>
<td>2.30</td>
<td>80</td>
</tr>
<tr>
<td>4 (4)</td>
<td>Philippines</td>
<td>18.17</td>
<td>859.35</td>
<td>0.93</td>
<td>3 179.12</td>
<td>0.54</td>
<td>317</td>
</tr>
<tr>
<td>5 (14)</td>
<td>Mozambique</td>
<td>25.83</td>
<td>125.40</td>
<td>0.52</td>
<td>303.03</td>
<td>1.33</td>
<td>57</td>
</tr>
<tr>
<td>6 (20)</td>
<td>The Bahamas</td>
<td>27.67</td>
<td>5.35</td>
<td>1.56</td>
<td>426.88</td>
<td>3.81</td>
<td>13</td>
</tr>
<tr>
<td>7 (7)</td>
<td>Bangladesh</td>
<td>28.33</td>
<td>572.50</td>
<td>0.38</td>
<td>1 860.04</td>
<td>0.41</td>
<td>185</td>
</tr>
<tr>
<td>8 (5)</td>
<td>Pakistan</td>
<td>29.00</td>
<td>502.45</td>
<td>0.30</td>
<td>3 771.91</td>
<td>0.52</td>
<td>173</td>
</tr>
<tr>
<td>9 (8)</td>
<td>Thailand</td>
<td>29.83</td>
<td>137.75</td>
<td>0.21</td>
<td>7 719.15</td>
<td>0.82</td>
<td>146</td>
</tr>
<tr>
<td>10 (9)</td>
<td>Nepal</td>
<td>31.33</td>
<td>217.15</td>
<td>0.82</td>
<td>233.06</td>
<td>0.39</td>
<td>191</td>
</tr>
</tbody>
</table>
Climate Change 2022: Impacts, Adaptation and Vulnerability

Summary for Policymakers (35 pages)

Technical Summary (96 pages)

Full Report (3,675 pages)

Working Group II contribution to the IPCC Sixth Assessment Report (AR6)

Examines how climate change impacts on people and nature now, risks in the future, and possible pathways for climate resilient development

Published 28 Feb 2022
The report highlights the urgency for Climate Resilient Development, which integrates adaptation measures with mitigation to advance sustainable development.

There is a rapidly narrowing window of opportunity to enable climate resilient development, as pathways are constrained by every increment of warming. This is a critical decade for action.

Although adaptation solutions exist - it is clear that this is not without rapid, deep and sustained emission cuts + enablers such as finance.

Urban systems are critical, interconnected sites for enabling climate resilient development, especially at the coast.

Safeguarding biodiversity and ecosystems is fundamental to climate resilient development. Maintaining ecosystem services & resilience of biodiversity globally will depend on effective conservation of 30-50% of Earth’s land, freshwater and ocean areas.
B Extinctions since 1500

C Declines in species survival since 1980 (Red List Index)

Source: Intergovernmental Science-Policy Platform on Biodiversity And Ecosystem Services (IPBES) Global Assessment
The “State of Conservation Technology”

Rankings of overall performance vs. potential capacity to advance the field

- Blue circle: perceived as having the highest untapped potential

**Current overall performance**

1. GIS/remote sensing
2. Drones
3. Mobile apps
4. PA mgmt tools
5. Acoustics
6. Biologgers
7. Camera traps
8. ML/computer vision
9. eDNA/genomics
10. Data mgmt tools
11. Networked sensors

**Capacity to advance conservation**

1. ML/computer vision
2. eDNA/genomics
3. Networked sensors
4. PA mgmt tools
5. Drones
6. GIS/remote sensing
7. Biologgers
8. Acoustics
9. Camera traps
10. Data mgmt tools
11. Mobile apps

Speaker et al 2021 Con Bio
AI for Social Good: Global Partnership on AI

Geographic distribution of initiatives in the catalogue

- Europe: 34.1%
- North America: 24.3%
- Asia: 15.4%
- Latin America: 7.0%
- Africa: 1.4%
- Oceania: 3.7%
- Cross-regional: 14.0%

Reference: Future Society Paper, GPAI Catalogue
Forest Foresight

An early warning system to predict and prevent deforestation
Deforestation threatens the earth's species and climate

90,000 km²
Each year an area the size of Portugal is deforested. Deforestation decimates habitats for 100,000+ species, among which are the forest elephant, gorilla, orangutan and rhino.

6.7 billion tonne CO₂
The annual greenhouse gas emissions of deforestation-related activities account for 15% of global emissions, equivalent to the emissions of the entire USA.

Disrupting livelihoods
Deforestation can change precipitation patterns, induce erosion and cause floods, thereby disrupting livelihoods of millions of people.

Source: WWF Living forest report
More than 1.6 billion people depend on forests directly for their livelihoods, and many more rely on forests for their food, water and clean air (WWF, UN Environment Programme & United Nations).

20%

Forest degradation and destruction account for up to 20% of global carbon emissions – more than that of the entire global transport sector (Environmental Defence Fund).

Forests are home to 80% of land-based wildlife, housing incredibly complex and unique ecosystems (WWF).
The power of prediction: enabling earlier interventions for forest conservation

Prediction and early detection models enable faster forest conservation

Currently, interventions are often too late, due to long lead times and lack of proper follow-up

Currently, interventions are often too late, due to long lead times and lack of proper follow-up

Source: Photos were taken near the Sebangau National Park border (Central-Kalimantan)
## Existing forest monitoring systems

<table>
<thead>
<tr>
<th>Scope</th>
<th>Global</th>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>previsia</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time horizon</th>
<th>Forecasting model</th>
<th>Medium term forecasting EWS</th>
<th>Short-term preventive EWS</th>
<th>Reactive EWS</th>
<th>Event warning model</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1 year before start of deforestation</td>
<td>6-12 months before start of deforestation</td>
<td>1-4 weeks before start of deforestation</td>
<td>1-4 weeks after start of deforestation</td>
<td>&gt; 1 month after start of deforestation</td>
<td></td>
</tr>
</tbody>
</table>

- **GLAD**
- **GLOBAL FOREST WATCH**
- **WAGENINGEN UNIVERSITY & RESEARCH**
- **CLASlite**
- **JJ-FAST**
- **MIGHTY EARTH**
- **The SAREDD Project**
- **MAAP**
- **SISTEMA DE MONITOREO DE BOSQUES Y CARBONO (SMBYC)**
- **GEO BOSQUES**

Monitoring of the Andean Amazon Project
Existing forest monitoring systems
Introducing FF: We designed a holistic approach from data to interventions and built tools to support rollout.

1. Generate prioritized deforestation alerts
   - Predict deforestation risk
     - Predict hot zones at risk
   - Cluster hot zones in alerts
   - Filter for illegal events
   - Prioritize alerts for follow-up

2. Follow up alerts
   - Review alerts & plan investigations
   - Verify deforestation alerts in the field
   - Determine intervention plan
   - Launch intervention with stakeholders
   - Publish to user interface

3. Measure impact
   - Monitor intervention KPIs & inform policy making
   - Track interventions
   - Steer prioritization

1. Predictions on 15x15m, followed by down-sampling to 480x480m, 2. Exclude deforestation with permits, forest fires etc., 3. Includes desktop research to verify permits, area mgmt. plan etc.
Technical foundation underlying FF

1. Collect historic satellite images, analyze and label changes in forest cover

2. Collect input data and generate data set with static and dynamic indicators
   - Topological data
   - Socio-economic data
   - Satellite data and land cover data

3. Train machine learning models based on historical data, using static and dynamic inputs
   - Predictive model
   - Dynamic indicators:
     - Distance to degradation
     - Distance to deforestation
     - Landscape heterogeneity metrics
     - ...
   - Static indicators:
     - Population density
     - Distance to population center
     - Distance to roads
     - ...

4. Use machine learning model to generate a map of forest cover at risk and validate on historic data
   - New road
   - Forest at risk

Predict hot zones at risk
Dashboard visualizes predictions of 'deforestation hot zones'
When potentially illegal deforestation is spotted, users can create investigations to follow up the alert.
… which are then followed up through in-field investigations
We can accurately predict where deforestation will happen in the next 6 months

Potential follow-up
Lobby for clear non-deforestation legislation in roadside area

Potential follow-up
Collaborate with national park authority to increase patrol frequency in this area

Potential follow-up
Influence spatial planning to stop expanding deforestation front

80% User accuracy
~50% Detection rate
How the prediction model corresponds with actual deforestation

These images show an example of a prediction that was made by our Forest Foresight program, which unfortunately came true. The image on the right shows that deforestation has taken place.

**Before** - June 2021 Central Kalimantan (Indonesia)

**After** - February 2022 Central Kalimantan (Indonesia)

* for illustrative purposes this is a simplification of predicted hotzone representation
Setup of local governance critical to FF success

Designed roles & responsibilities for relevant stakeholders

Set up team to coordinate stakeholders, organize trainings…

Organize regular meeting cadence for each phase

Align governance scheme and set up steerco, user board etc.
MOTION DETECTING CAMERAS AND AI
Motion sensitive cameras are everywhere

1,000s of projects  100,000s of cameras

Many 10,000,000s of images

Steenweg et al. 2017
A big challenge in wildlife conservation

Camera traps can provide the necessary data about wildlife populations

Millions of images are taken around the world every day

Yet most of these images and data are not effectively shared or analyzed, leaving valuable insights just out of our reach
AI helps to identify what's in the image.

Images and metadata are uploaded to the Google Cloud.

Analyzes are calculated automatically.

In development
The AI models in Wildlife Insights catch 79% of blank images with an error rate of less than 12%.
Cameras present lots of challenges for the AI models.

- Overexposed
- Summer/winter fur (Showshoe hare)
- Blurry
- Hard for humans
- Partial animal
- Too Close
For ~100 species Wildlife Insights AI models are able to catch between 80% and 98.6% correctly.
Human experts can label between 300-1000 images per hour.

A single machine can identify 18,000 images per hour, and when we parallelize across hundreds or thousands of GPUs, AI can save biologists a lot of time.
Impact

2400+ approved users

43+ million images

140+ protected areas

993 species in AI model

15 million images in training set

12% Error rate on blanks
Exploring data

wildlifeinsights.org
Eyes on Recovery

Using Wildlife Insights to measure the impact of the 2019-20 summer bushfires on Australia’s wildlife

Abby Hehmeyer & Arno Lyet (WWF US), Emma Spencer (WWF AUS)
Summer 2019-20 bushfires in Australia burned 19 million hectares (about the size of Cambodia)

3 billion animals impacted

Unclear whether priority species were recovering...
The Solution

Convince dozens of organizations to join forces under a single monitoring initiative

Use Wildlife Insights to manage and analyze CT data

Better understand the population trends of target species post fire
## By the Numbers

<table>
<thead>
<tr>
<th>Count</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>18 partners</strong></td>
<td>including Universities, natural resource managers, NGOs, and four state government agencies (SA, NSW, VIC and QLD)</td>
</tr>
<tr>
<td><strong>1,146 cameras</strong></td>
<td>deployed across 15 projects; generating almost 3M images</td>
</tr>
<tr>
<td><strong>126 Wildlife Insights users</strong></td>
<td></td>
</tr>
<tr>
<td><strong>9 target &amp; 123 non-target species</strong></td>
<td>detected across our monitoring sites</td>
</tr>
<tr>
<td><strong>13 management actions</strong></td>
<td>identified to date to facilitate recovery</td>
</tr>
</tbody>
</table>
Here are some of the amazing animals we have captured on camera
Data processed in **Wildlife Insights**

2.5 million images used to train WI computer vision model

Excellent feedback from AUS users: 5x increase in image processing speed

~500 hours of staff time saved per project site location
WildObs – streamlining Australia's camera trap data pipeline

1. Standardise & secure images streams
   - Deployment manual
   - App for field metadata
   - Images secured on Australian servers

2. Efficiently process images into datasets
   - Remove blanks
   - Object detection
   - Segmentation
   - Classification
   - Computer vision AI classifies >95% images
   - Human oversight

3. Collate, curate, and share the national database
   - Interactive dashboard for exploring projects & data downloads

Dashboard:
- Species: 52
- Endangered species: 27
- Projects: 20
- Donors: 30
- Goal progress: 27%
- Conservation connections
Big Outstanding Challenges

• Social Metrics (e.g. poverty, climate resilience)
• Data privacy and sovereignty versus FAIR principles
• Connecting Global and Local (See GLASSNET for example)
• Digital Sustainability (See the Coalition for for Digital Environmental Sustainability - CODES)
• The big one - Impacts, both measuring and attaining
Thanks!