An Innovative Early Warning System To Tackle Illegal Deforestation

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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
Case for change: enabling earlier interventions to bring the forest conservation practice to the next level

Prediction and early detection models bring forest conservation to the next level

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

0. Pristine forest
1. Road & canal development
2. Illegal logging
3. Land clearing and conversion

Prediction and early detection enable earlier interventions, cutting short the deforestation chain

Source: Photos were taken near the Sebangau National Park border (Central-Kalimantan)
SMART SURVEYORS FOR LAND AND WATER MANAGEMENT
CHALLENGES IN A NEW REALITY

Wageningen University and Research
Deep dive: Strong technical foundation underlying EWS

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
3. Train machine learning models based on historical data, using static and dynamic inputs
4. Use machine learning model to generate a map of forest cover at risk and validate on historic data

- Topological data
- Socio-economic data
- Satellite data and land cover data

Dynamic indicators
- Distance to degradation
- Distance to deforestation
- Landscape heterogeneity metrics
- ...

Static indicators
- Population density
- Distance to population center
- Distance to roads
- ...
Predict deforestation between 1-6 months in the future

Achieved user's accuracy for 6-months prediction (at ~50% detection rate$^1$)

Ensemble Trees (XGboost)

Best performer
What a typical end-to-end EWS process looks like…

1. **EWS team** opens dashboard to review monthly predictions using filters and contextual data.

2. **Area Manager** is informed of predictions and logs in to dashboard to prioritize predictions and check permits.

3. **Area Manager** plans field investigations that are uploaded in the intervention tracking app.

4. **Patrol team** verifies deforestation by visiting predictions in the field, taking photos & completing survey / checklist.

5. **Lead by the Area Manager**, **EWS team** reviews the investigation report and agrees intervention plan if needed.

6. **Area Manager** instructs to carry out intervention plan, monitors results and reports back to EWS team.
Deforestation (red) and forest degradation (orange) (2015-2020)
Predicting deforestation 6 months into the future (black squares)
Observed new deforestation 6 months later (yellow)
“Predictive information helps, especially for patrols because it can allocate limited resources to areas that have the potential for change.”

“The alerts put in evidence effective deforestation on the ground.”

“Recent field visits to predicted deforestation locations show no signs of upcoming deforestation.”
EWS is currently active in 5 countries with potential impact of up to 30% reduction in illegal deforestation.

- **Amazon & Guiana shield**: 23-48 million ha
- **Congo Basin**: 12 million ha
- **Cerrado**: 15 million ha
- **Greater Mekong**: 15-30 million ha
- **New Guinea**: 7 million ha
- **Borneo-Sumatra**: 27 million ha
- **Gran Chaco**: 10 million ha
- **East Africa**: 12 million ha

The hectares indicate projected forest loss between 2010 and 2030.

Source: WWF Living Forest Report, 2015
Thank you

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