Technical Paper on AI for Climate Action

Case Study: AI for Forecasting and Preventing Deforestation in the Brazilian Legal Amazon

Country of the example: Brazil (Brazilian Legal Amazon•)
LDC or SIDS

Entities involved in the development and implementation of the example: Amazon Institute of People and Environment – Imazon, Pará State Public Prosecutor Office – MPPA, Environmental Agency of Altamira-PA, Fundo Vale, Climate Change Land Use Alliance – CLUA, and Microsoft Brazil.

Brief description of the example:
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PrevisIA's risk model uses historical deforestation, topographical data, water bodies, distance to protected areas, and socioeconomic data [1]. In addition, the model relies on an Artificial Intelligence (AI) algorithm that annually identifies the emergence of unofficial roads in the Amazon using Sentinel-2 satellite imagery [2]. These roads are built to access forest resources for logging and frontier expansion and are one of the most predictive variables in the PrevisIA model. Studies have shown that 95% of the accumulated deforestation in the Amazon occurred within 5.5 km of roads [3] and 90% of the annual fires within 4km [4]. The PrevisIA project is anchored in three pillars: i) IT Technology to run the AI road detection model processing a large volume of satellite data; ii) the deforestation forecasting modeling and a geospatial dashboard to disseminate the results; and iii) a collaborative impact approach to use the information to prevent and control deforestation.

For the third pillar, we have partnered with the State Public Prosecutor's Offices network in the Brazilian Legal Amazon, which includes the states of Pará, Amazonas, Acre, and Amapá. Implementing an actionable plan to prevent and control deforestation is advanced in Pará. The Pará State Prosecutor General's Office (PGO) created a Deforestation and Fire Working Group[1] (WG). This group aims to monitor actions combating deforestation and fires in the most critical municipalities of Pará.

The WG is coordinated by the Environmental OEP (Operational Environmental Center) and sub-coordinated by a member appointed by the PGO. The WG is made up of environmental prosecutors from the municipalities of Altamira, Portel, Senador José Porfírio, Uruará, Novo Repartimento, and Rurópolis, as well as prosecutors specially appointed by the Attorney General. All the municipalities that comprise the WG are on the Ministry of the Environment's critical list of deforestation by the Ministry of the Environment (Decree 6.321/2007).

Imazon generates technical reports with a diagnosis of deforestation and fires on a municipal and rural property scale for the 22 Pará municipalities on the Ministry of the Environment's (MMA) critical deforestation list. PrevisIA and its Amazon Deforestation Alert System (SAD) are used for this. The municipalities' reports are forwarded to the MPPA/CAO and the local authorities so that the appropriate administrative and judicial measures can be taken with the command-and-control

• The Brazilian Legal Amazon states have IHD below 0.5 and the Progress Social Index (SPI) score under the national average.

[1] Ordinance No. 0950/2021-MP, issued on April 28, 2021 (Official State Gazette No. 34.572, dated May 4, 2021).

bodies. Here, we present the results of this project and discuss the potential and challenges for preventing and controlling deforestation in the areas of interest to the initiative.

Figure 1. Training sessions on transferring geospatial technology.

Climate change mitigation and/or adaption impacts and results of the example:
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The Amazon region is facing severe climate events, including droughts in 2024 [5], which further harm the forests, along with deforestation and forest degradation. Public policies must prevent deforestation and improve disaster risk management to effectively respond to droughts, floods, and fires, particularly under extreme conditions. Efforts to combat deforestation are underway, while discussions on enhancing disaster response are ongoing with project partners.

Since 2021, the PrevisIA project has evaluated the accuracy of deforestation risk forecasts using data from Brazil's Prodes monitoring system. From 2021 to 2024, the average accuracy of forecasts is 73% within a four-kilometer radius (**Figure 2**).

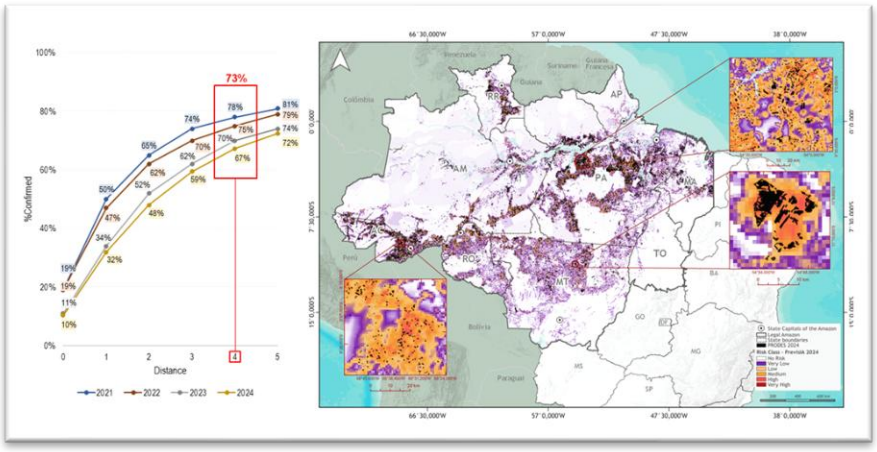

Figure 2. PrevisIA forecast assessment against Prodes deforestation data for 2021 to 2024. The average accuracy for this period is 73% up to 4 km.

Due to the accuracy of PrevisIA's forecasts, the Pará State GPO has received information and technology to help control and prevent deforestation. The OEP WG gets reports on deforestation

risks and alerts from satellite imagery, focusing on municipal and rural property registry levels (CAR - *Cadastro Ambiental Rural* in Portuguese) (**Figure 3**). These reports are sent to municipal prosecutor offices to check for illegal deforestation by verifying prior permits. If deforestation is deemed illegal, the Pará State PGO can impose administrative sanctions such as:

- Embargoing the illegally deforested area
- Imposing fines
- Suspending the CAR and environmental licenses

Prosecutors can also file criminal cases to court. Notifications started in 2024, with an evaluation of operations expected by the end of 2025.

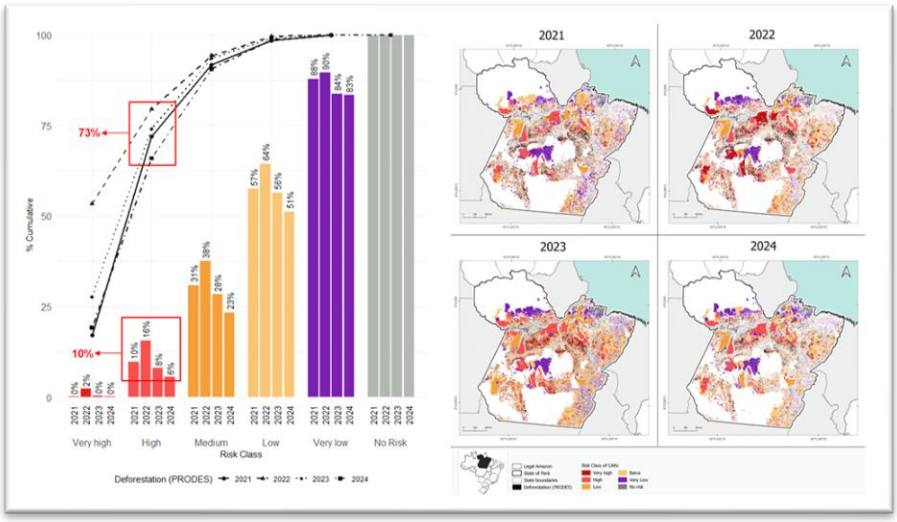

Figure 3. Analysis of deforestation Risk with the PrevisIA forecast for 2021-2024 at the CAR level shows that 75% of the deforestation, as detected with Prodes, occurred in high and very-high-risk rural properties. The Pará State PGO can send prior notifications to landowners indicating their level of deforestation risk.

Challenges and lessons learned regarding the development and implementation of the example:
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There are several lessons from this project. First, there is a change in mindset to implement preventive measures to avoid deforestation in the Pará State GPO, as the accuracy of the PrevisIA forecast demonstrates the technical and scientifically sound use of the information. Second, geospatial capacity building is imperative to allow prosecutors to use the information effectively in an actionable fashion. Capacity building is also required to scale the application to all municipalities. Third, as we advance on implementing the project in Pará, other Amazonia states engaged in the process (i.e., Acre, Amapá, and Rondônia have signed technical agreements with Imazon) indicating that the project can be scaled up. We have also started expanding the partnership with the Federal GOP and the State Audit Court.

There are key challenges to address. First, the initiative needs a financial sustainability plan for large-scale operations, and implementing REDD+ projects at the state level can help with funding. Additionally, developing an impact evaluation component for REDD+ is essential. Finally, improving responses to extreme climate disasters is crucial for protecting communities and biodiversity. We are discussing mitigation and adaptation plans as essential public policy alongside deforestation prevention and control.

References

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