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Technologies to Protect Global Forests: The Case of Indonesia

by Lorenzo Colantoni

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This is a key time to protect global forests. While pressure is still strong on many key global ecosystems, such as the Amazon and Borneo, the significant results of governments such as Lula's in Brazil, as well as the ambitious vision of policies such as the recently enacted EU's Deforestation-Free Regulation (EUDR),[1] show that the devastating trend of deforestation of the past decades can indeed be reversed. Yet, a set of tools needs to be delivered to support this new wave of action to protect global forests, which has been triggered by raising awareness of the climate and biodiversity crises – a mix of social, economic and political, but also technological instruments. New technologies can indeed be a game changer in protecting global forests, if adequately understood and implemented: while some can significantly reduce the costs of once expensive activities, such as monitoring large territories, others can achieve what was otherwise impossible in the past, such as easily checking the origin of legal or illegal timber. It will be however necessary to address a series

[1] European Parliament and Council of the European Union, *Regulation (EU) 2023/1115 of 31 May 2023 on the Making Available on the Union Market and the Export from the Union of Certain Commodities and Products Associated with Deforestation and Forest Degradation*, http://data.europa.eu/eli/reg/2023/1115/oj.

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of obstacles – from a policy, legal, but also cultural perspectives – as well as to understand the interaction of such technologies with social and political aspects, for them to be fully effective.

Technologies to fight deforestation

While deforestation is almost entirely caused by the expansion of global agriculture (up to 90 per cent of total clearings),[2] failure to prevent it has been due to a number of issues: the cost of monitoring vast or inaccessible territories, such as the core of the Amazon or Indonesia's islands, the lack of effectiveness of enforcement by authorities at all levels, corruption and the relative easiness in evading national and international regulations (also due to their complexity, as in the case of the Convention on International Trade in Endangered Species – CITES). Technology helps in a number of ways: it reduces the need for specialisation, as many activities can be automatised (such as checking documents through QR codes). It also provides incontrovertible proof of deforestation, raising global awareness on the issue: this has been the case of the sharp increase in the Amazon deforestation under the Bolsonaro administration, which was accurately documented through satellite imagery analysis.[3] It can significantly reduce the cost of monitoring activities and the need for personnel in often understaffed entities, such as NGOs or environmental agencies; drones can cover in a few hours areas that would take entire days to teams on foot. New, experimental technologies also allow for results that were once considered impossible: scanners being now developed by the Spanish police SEPRONA will allow customs officers to trace the origin of wood and eventually declare its legal or illegal origin only by using mobile phones.[4]

While the technologies being applied in the sector are many indeed, a few are particularly promising. Satellite imagery analysis is by far the most relevant and most extensively used. While natural photos are now being coupled with artificial intelligence (AI) to monitor deforestation patterns on a weekly or even daily basis (as in the case of the Forest Watcher app),[5] multispectral images offer new insights that were once impossible even to think of. Drones have helped with patrolling, but they also have other applications, especially if they use advanced instruments (as in the case of the thermal and multispectral cameras now available also on commercial agricultural drones). Among experimental technologies, scanners for the recognition of the origin of timber are instead using DNA and

[2] FAO, "FRA 2020 Remote Sensing Survey", in *FAO Forestry Papers*, No. 186 (2022), p. 47, https://doi.org/10.4060/cb9970en.

[3] M. Cecilia Oliveira and Leandro Siqueira, "Digitalization between Environmental Activism and Counter-Activism: The Case of Satellite Data on Deforestation in the Brazilian Amazon", in *Earth System Governance*, Vol. 12 (April 2022), Article 100135, https://doi.org/10.1016/j.esg.2022.100135.

[4] Lorenzo Colantoni, Giulia Sofia Sarno and Margherita Bianchi, *Fighting Illegal Logging in Europe. An Overview of Trends, Players and Action*, Rome, IAI and Ambitus, September 2022, p. 35, https://www.iai.it/en/node/15859.

[5] ITU News, *How AI Can Help Protect Forest Ecosystems*, 9 November 2022, https://www.itu.int/hub/?p=23702.

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isotope technologies – two methods that can trace the timber sample to the specific region where the tree grew and was harvested. While DNA and isotope technologies are relatively consolidated and, if used in conjunction, have an extremely low margin of error,[6] they also require a significant mapping of forest areas to create the database that will be used to determine the actual origin of timber. This in turn requires a solid collaboration between different authorities – particularly between those in the countries producing the timber and those in the countries buying it – which has historically proved complicated.

While all these methods proved effective over the years, many are indeed the obstacles still ahead. Authorities sometimes do not accept them as valid proof in investigations – this has been the case of several environmental investigations in France, for instance – while their implementation is sometimes impeded by bureaucracy or outdated legislation. This is the case for commercial drones: their technology has made giant leaps in the past ten years, but laws and environmental applications by national authorities are generally based on the low-autonomy drones of the 2010s. Sometimes obstacles are also cultural: technologies are perceived as expensive or inaccessible, even if quick advancements have remarkably changed the landscape in recent years (as again in the case of drones, but also concerning the availability and definition of satellite images). Politics also plays a role: data supplied from sensors, satellite images or drones have in many cases been denied or disregarded by public authorities. Bolsonaro's administration even tried to accuse its own National Institute for Spatial Research, the INPE, of manipulation.[7]

The case of Indonesia

Indonesia is alternatively the first or second country for deforestation rates (depending on the year) globally, and has long faced issues in addressing the problem; agriculture (palm oil production in particular) has been the main cause for the clear cutting of its forests, but also the main driver for the country's economic growth since the end of the Suharto dictatorship in 1998. The management of forests and the landscape has been thus entangled with significant political and economic interests, some even dating back to the dictatorship time.[8] Technology is thus key for Indonesia to fight an issue that is still plaguing its ample and often inaccessible forest. The tools being applied in the country are mostly three: satellite imagery analysis, drones and apps.

[6] David Abrahamson, "It's Time Forensic Timber Tracing Became Mainstream", in *DAI Developments Blog*, May 2022, https://dai-global-developments.com/articles/its-time-forensic-timber-tracing-became-mainstream.

[7] Karla Mendes, "Experts Deny Alleged Manipulation of Amazon Satellite Deforestation Data", in *Mongabay*, 16 July 2019, https://news.mongabay.com/?p=220464.

[8] Tom Johnson, "It's Time to Confront the Collusion Between the Palm Oil Industry and Politicians that Is Driving Indonesia's Deforestation Crisis (Commentary)", in *Mongabay*, 18 April 2018, https://news.mongabay.com/?p=205867.

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Satellite images have been extensively used in the past decade and are an established tool throughout all levels of analysis – institutions, international NGOs such as the World Conservation Society (WCS), but also local NGOs. Professors such as Bambang Hero Saharjo from the IPB University have been using satellite data also to conduct investigations and produce evidence for criminal trials against companies illegally clearing forests to plant palm oil (and other crops). Local NGOs such as Jikalahari (based in the Riau province of Sumatra) or Titian (in West Kalimantan, part of the Indonesian Borneo) use a mix of the NASA Fire Information for Resource Management System (FIRMS) and the ESA Copernicus Sentinel-2 data to detect "hotspots" – that is, large fires on agricultural or forest land – in real time. The staff from these NGOs then selects the most relevant locations and tries to understand the entity of the fire first through a network of local informers, and then perform a final check on the field using drones. Photos and videos are then used as evidence in investigations run by national agencies. Technologies are also supporting the sustainable production of commodities. Apps such as KoltiTrace by the agri service provider Koltiva[9] allow for the geolocalisation of the production of coffee, so that buyers can trace the origin of the commodity to legal plantations outside protected forests (this being also one of the key legal requirements of the EUDR). Farms on mountainous terrain, such as those in South Sumatra, are testing drones to map large areas in a short time.

While all these tools are promising and are already bringing results, it is worth noting that they do not exist in a vacuum: politicians and agencies can ignore the data provided by satellites and drones, for instance. This is an ongoing issue in Indonesia, where the government often overestimated the impact of its regulations against deforestation and underestimated the rate of cutting, in contrast with data supplied from satellite imagery. Concerns about government-supplied data have for example been raised in relation to the debate over the 2020 payments under the REDD+ platform (a UN system to compensate countries that limit deforestation)[10] or the estimations for the devastating 2019 forest fires[11] – the research associate David Gaveau, of the Center for International Forestry Research (CIFOR), had even to depart from Indonesia over disagreement with authorities on the data.[12] Similarly, farmers can also find ways to trick the geolocalisation systems – by, for instance, stating that the apps don't work in their area because of lack of signal, or using farms on unprotected land as their own. Corruption can also represent a significant obstacle, the issue being still highly relevant across the country; corrupted officers can

[9] Koltiva website: *KoltiTrace*, https://www.koltiva.com/koltitrace.

[10] Hans Nicholas Jong, "Experts Question Integrity of Indonesia's Claim of Avoided Deforestation", in *Mongabay*, 8 September 2020, https://news.mongabay.com/?p=234649.

[11] Hans Nicholas Jong, "2019 Fires in Indonesia Were Twice as Bad as the Government Claimed, Study Shows", in *Mongabay*, 16 December 2021, https://news.mongabay.com/?p=250761.

[12] Dyna Rochmyaningsih, "Wildfire Researcher Deported amid Growing Rift between Indonesian Government and Scientists", in *Science*, 12 February 2020, https://doi.org/10.1126/science.abb2763.

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avoid reporting what drones or sensors helped them spot, and automatic monitoring systems can be put offline by simulating a malfunction.

Looking ahead

In order for the anti-deforestation technologies to be fully effective, it will be necessary to implement a series of complementary measures: economic incentives should be provided for sustainable farming, while the cost of using these technologies should not fall entirely on farmers, but be equally distributed throughout the supply chain. In theory this is already the case with most certification schemes and policies such as the EUDR – the final buyer of the commodity has the duty to perform training and tracing, and to bear the cost for this, while also giving farmers a premium price for their sustainability efforts. However, in many cases this extra budget is absorbed by intermediaries in the supply chain and little actually comes to producers, particularly when they are smallholders. At a more general level, international regulations and treaties, such as the EUDR and the CITES, should push for the integration of satellite data into national policies to define a common understanding of the magnitude and causes of deforestation – so far, they only give general recommendations. Integration of regulations is also essential: countries such as Indonesia have worked on providing guidelines for the sustainable production of key commodities in previous years, but these efforts have rarely been integrated into European policies. Particularly from a technology perspective, such integration could instead solve many of the issues being currently debated around EUDR compliance (particularly tracing and geolocalisation). In this sense, technologies can become a key component of a new, holistic approach to the protection of global forests that the world now needs more than ever.

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