CEEJA
យុត្តិធម៌ | ពលរដ្ឋ | បរិស្ថាន

1st Forest Monitoring Report

▸ **Cambodia's wildlife sanctuaries lost 48,000 ha of tree cover in 2020**
▸ **Indigenous Peoples are the most effective in conserving forests**
▸ **Communities should be allowed to monitor forest crimes in wildlife sanctuaries**

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1. INTRO DUCTION

Introducing CEEJA

Tropical forests are threatened by widespread logging, induced by the global demand for valuable timber, the expansion of agribusiness, mining operations and hydropower. **As of 2000, Cambodia had more than 8 million hectares of natural forest cover[1], and the rate of deforestation in the country is one of the highest across the globe[2], Cambodian civil society has long been fighting to protect these precious forests, but systemic inefficiencies, corruption, a lack of the rule of law, as well as increasing harassment of environmental defenders limit the extent to which such initiatives can be successful[3].**

[1] Global Forest Watch. "Tree cover in Cambodia". Accessed on 15/06/2021 at https://gfw.global/3E8E4ex
[2] https://www.dw.com/en/corruption-fueling-deforestation-in-cambodia/a-42674051
[3] CEEJA project report

Citizens Engaged in Environmental Justice for All (CEEJA) is a 5-year action being implemented by a well-established consortium of Danmission, the Cambodia Centre for Independent Media, Cambodia Youth Network, Peace Bridges Organisation, Ponlok Khmer, the University of Copenhagen (UCPH), the International Forest Resources and Carbon Emissions (IFORCE) Unit of the European Commission's Joint Research Centre (JRC), and several local forestry networks.

IMAGE 1
A Kranoun *(Dalbergia cochinchinensis Pierre)* tree reported by patrollers in Sambor District on 12 February 2020.

CEEJA Mission

The overall aim of the action is to improve forest-dependent populations' ability to conserve and benefit from the natural resources that forests hold, through a strengthening of their capacity to peacefully exercise their environmental rights. As such, CEEJA employs a versatile strategy of community-based monitoring, innovative technologies, collaborative forestry protection, policy and trust building dialogues, and advocacy. In practice, CEEJA operates on five different levels:
• **CEEJA provides financial support and institutional strengthening for forestry group networks** to harness their collective voice in advocating for their environmental rights;
• **CEEJA** uses cutting-edge technologies to **build an integrated forest observatory system** (I-FOROS, see below);
• **CEEJA employs outreach and communication strategies to engage Cambodian youth** in rural, as well as urban areas on environmental justice;
• **CEEJA builds on the capacity of forestry networks to enable them to actively participate** in relevant local, national and international policy development processes on environmental protection and biodiversity conservation;
• **CEEJA raises the visibility of its work through active knowledge-sharing platforms** to engage a broad range of local and international civil society stakeholders.

The CEEJA consortium was formed in 2020 but most of the partners in this action have been engaged with natural resource protection area for many years. The action therefore relies on a wide array of expertise and a long history of cooperation. The activities of CEEJA are concentrated on three main regions within Cambodia: **The Prey Lang Wildlife Sanctuary, the Preah Rokar Wildlife Sanctuary and the Sorng Rokha Vorn Wildlife Sanctuary**. Figures 9-11 on pages 17-18 highlight these areas while the following section introduces each of them.

Prey Lang Wildlife Sanctuary and the Prey Lang Community Network

Prey Lang Wildlife Sanctuary is located in central Cambodia and is the largest lowland evergreen forest complex in the Indo-Burma biodiversity hotspot[4]. The greatest forest area covers over half a million hectares and is home to countless precious flora and fauna species. Prey Lang also **supports more than 200,000 people, including Kuy Indigenous communities and Khmer**. Like many forest-dependent communities across Cambodia, a large percentage of these people derive their livelihoods directly or indirectly from Prey Lang, through collecting building materials, as well as non-timber forest products, such as resin, medicine and food. **Although Prey Lang was declared a Wildlife Sanctuary in May 2016, it is surrounded by Economic Land Concession sites (ELCs)**, permitted by the Cambodian government to pursue logging, large-scale conversion to agriculture, mining, and other industrial activities. The companies operating on these ELCs have repeatedly expanded their logging operations into the protected area. A technical report released in August 2020, analysed satellite images and calculated that **almost 103,000 hectares of forest had become barren or were converted into crops, plantations and human settlement areas in Prey Lang Wildlife Sanctuary between 2000 and 2019** (see the most recent findings regarding Prey Lang published in the 9th Monitoring Report on the Status of Prey Lang in the text box below)[5].

The Prey Lang Community Network (PLCN)[6] **is a network of local village groups formed in the 2000s with the aim of documenting the illegal logging activities threatening the forest**. Since 2009, PLCN has been working voluntarily and independently to protect the greater Prey Lang forest complex, undertaking forest patrols to monitor forest crimes and seize chainsaws and other logging equipment. In combination with other grassroots organisations and national and international institutions, **PLCN's ongoing campaign to promote the biodiversity and importance of the Prey Lang Forest led to its inclusion in the national protected area network in 2016.**

Prey Lang Wildlife Sanctuary nevertheless continues to be plagued by encroachment and deforestation. Members of PLCN are continuing their struggle to protect the forest despite **shrinking civil space, alienation and even threats from the Cambodian Ministry of Environment**. The primary manifestation of this is a government ban on local forest patrols put in place in February 2020. Since then, the PLCN has been unable to enter the forest, conduct patrols or collect data (see Methodology section to read more about the technology that patrollers use to conduct forest monitoring).
Despite the difficult situation, **PLCN has continued to advocate for the protection of Prey Lang Wildlife Sanctuary and, as a result of its efforts, the network has so far received five international environmental awards**. Most recently, PLCN was named **2020's Landscape Hero** and received the award from Global Landscapes Forum, the world's largest knowledge-led platform on sustainable land use, dedicated to the Sustainable Development Goals.
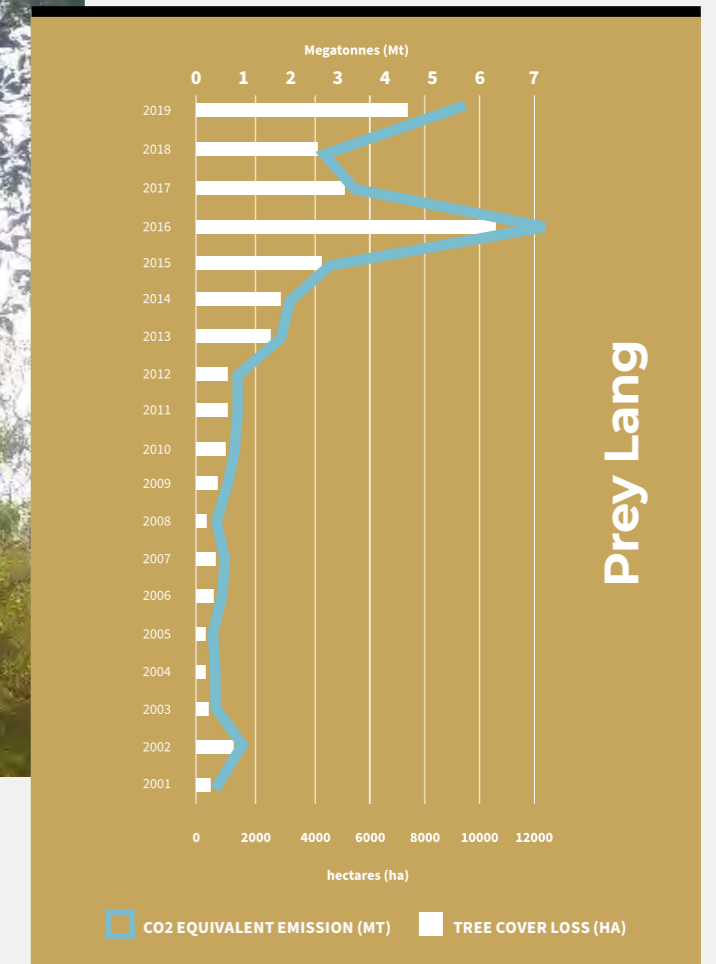
Historic tree cover loss in Prey Lang Wildlife Sanctuary is depicted in Figure 1. In all, **more than 47,000**[8] **hectares (ha) of land were deforested from 2001 to 2019** while an estimated 29.2 Mt[9] of CO_2 -equivalent were emitted into the atmosphere.

Findings of the latest PLCN Monitoring report[10]

» Between 2018 and 2020:
• 2,000 hectares of forest disappeared
• 5.6 Mt (Mega tonnes) of CO_2 equivalent was released due to biomass loss
• Forest canopy disturbance was recorded over 20,000 hectares

» Members of the Prey Lang Community Network were barred from entering the wildlife sanctuary and were thus unable to conduct patrols and collect data on deforestation
» At the same time, satellite imagery recorded an increase in deforestation, suggesting that **the government ban on forest patrols had led to a significant increase in forest loss**.
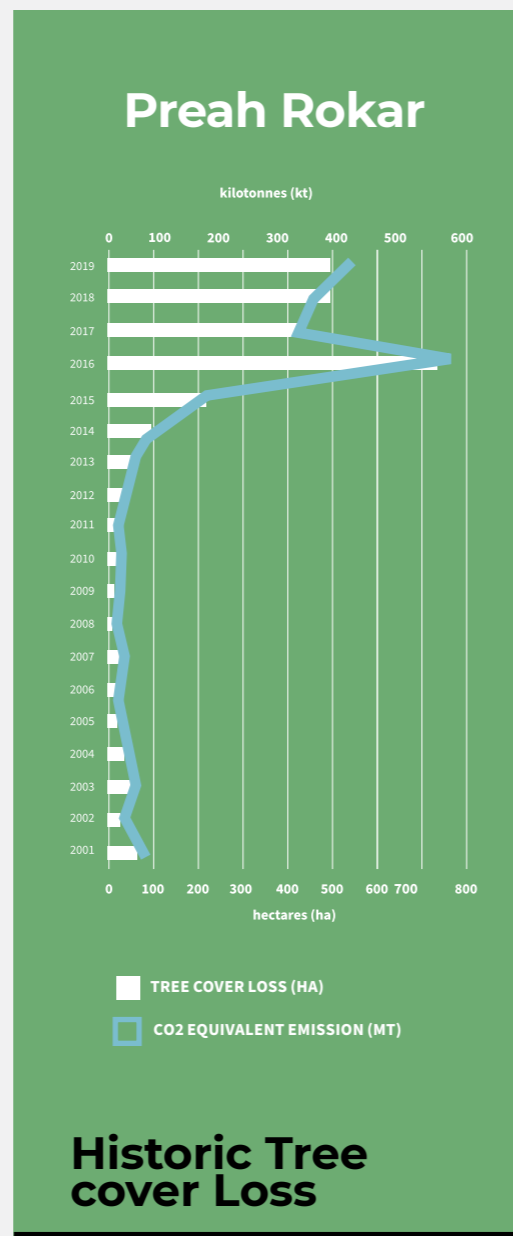
Historic Tree cover Loss

FIGURE 1
Historic Tree Cover Loss in Prey Lang 2001-2019 in hectares[7] (white bars) and associated CO_2-equivalent emissions in mega tonnes (Mt) for the same period[8] (blue line).

[4] Hayes et. Al. (policy brief)
[5] Jesuit Service Cambodia (JSC), Cambodian Youth Network (CYN), August 2020: Technical report on forest cover change detection in the Prey Lang protected area of Cambodia: https://bit.ly/3fYxDPM
[6] The European Union does not fund PLCN as an organisation.
[7] https://news.globallandscapesforum.org/48517/peaceful-protectors-of-cambodias-prey-lang-forest-threatened-by-loggers-and-local-authorities-vow-to-fight-on/
[8] Hansen/UMD/Google/USGS/NASA Global Forest Watch. "Tree cover loss in Prey Lang Wildlife Sanctuary/Cambodia". Accessed on 21/05/2021 at www.globalforestwatch.org.
[9] Harris et al. 2021. Global Forest Watch. "Emissions from biomass loss in Prey Lang, Cambodia". Accessed on 26/04/2021 at www.globalforestwatch.org
[10] https://preylang.net/wp-content/uploads/2021/02/9th-Monitoring-Report.pdf

Preah Rokar Wildlife Sanctuary and the Preah Rokar Forestry Community Network

The illegal logging can be traced back to the early 1990s, when a Thai logging company, protected by military groups felled the forest for its valuable trees[12]. Between 1997 and 2002, Chenda Plywood enjoyed a long period of forest concession, inciting the forest communities of Preah Rokar to campaign against the illegal logging of their resin trees[13]. **In the early 2000s, the community received support from Ponlok Khmer, a local NGO working to promote human rights and the environment in rural communities.** Since 2013, the communities have operated as the Preah Rokar Forest Community Network (PFCN), with 22 core members (one leader per village), 1,640 active members, and 83 resin tree groups. Today, members of PFCN conduct patrols in the forest to document forest loss, biodiversity, climate change, as well as to intercept and seize illegal logging activities.

The historic tree cover loss in Preah Rokar Wildlife Sanctuary is depicted in Figure 2. **In all, more than 2,950 hectares[14] of land was deforested from 2001 to 2019 while an estimated 2 Mt of CO2 -equivalent have been emitted into the atmosphere in the same period.**

Preah Rokar Forest is located in northern Cambodia, near the country's border with Thailand. The forest covers 90,361 hectares across three districts: Tbeng Meanchey, Chaeb and Chaom Ksan. The forest is **surrounded by 22 villages inhabited by more than 15,000 Kuy and non-Kuy Indigenous people, many of whom depend on the forest for their livelihoods** (resin-tapping and non-timber forest products). Preah Rokar Forest was designated a Wildlife Sanctuary by sub-decree of the Royal Government of Cambodia in 2016. Similar to Prey Lang, **Preah Rokar Wildlife Sanctuary is surrounded by Economic Land Concessions**. Cambodia Dawn Plantation lies to the north-east of the sanctuary. Lan Feng, Heng Nong and Heng Rui and Heng Yue Economic Land Concessions lie to the south of the sanctuary. **These companies have been associated with illegal logging and land-grabbing from Indigenous communities**, endangering not only the rich biodiversity contained in the forest but, most importantly, the livelihoods of the communities near it[11].

Preah Rokar

kilotonnes (kt)

hectares (ha)

□ TREE COVER LOSS (HA)

□ CO2 EQUIVALENT EMISSION (MT)

Historic Tree cover Loss

FIGURE 2
Historic Tree Cover Loss in Preah Rokar 2001-2019 in hectares[13] (white bars) and associated CO2-equivalent emissions in kt for the same period[14] (blue line).

IMAGE 3
Resin trees and Preah Rokar Wildlife Sanctuary

[11] Community Network in Action (CAN), Ponlok Khmer, GRAIN, Cambodia Indigenous Youth Association (CIYA), Asia Indigenous Peoples Pact (AIPP), June 2017, Cambodia: Communities in protracted struggle against Chinese sugar companies' land grab https://bit.ly/3vJeTKU
[12] Global Witness, 1998, $50 million worth of Cambodian logs destined for Thailand via Laos in new illegal export deal: https://bit.ly/34MtnNX
[13] Titthara May 2014, Phnom Penh Post: Kuy villagers say patrols put logging on pause: https://bit.ly/3ca1Nym
[14] Hansen/UMD/Google/USGS/NASA Global Forest Watch. "Tree cover loss in Preah Rokar Wildlife Sanctuary/Cambodia". Accessed on 26/04/2021 at www.globalforestwatch.org.
[15] Harris et al. 2021. Global Forest Watch. "Emissions from biomass loss in Preah Rokar, Cambodia". Accessed on 26/04/2021 at www.globalforestwatch.org

Sorng Rokha Vorn Wildlife Sanctuary and the Monks Forestry Community Network

As in many parts of the country, high demand for timber, agricultural expansion and settlements is the **driving force of deforestation and forest degradation in Oddar Meanchey Province**. The underlying causes are global commodity markets and investment (international level) and Economic Land Concessions (national level), while the proximate causes are forest land encroachment by the military and migrants, agricultural expansion, illegal logging, forest fires and fuel-wood extraction (local level)[16].

In 2001, the Buddhist monk Venerable Bun Saluth initiated the protection of an 18,261-hectare stretch of evergreen forest in northwest Cambodia, now referred to as the Monks Community Forest (MCF). Venerable Saluth had witnessed the continued decimation of Cambodia's forests by economic concessions, illegal logging and land encroachment. The unlikely conservationist soon had volunteers from his pagoda and the local community **organised patrols that regularly monitored the forest to stop illegal harvesting activities**. A total of 30,254 hectares of Sorng Rokha Vorn forest was designated as a Wildlife Sanctuary in April 2018.

The main purpose of the MCF group is to **protect forests and conserve biodiversity for future generations, as well as to maintain access to forest resources** that benefit the local people's livelihoods in six villages.

IMAGE4
Ordaining sacred trees is a common practice of Buddhist monks in Monks Community Forest in order to protect them from illegal loggers. Image courtesy of Chantal Elkin

The two primary activities of the group are to **patrol the area under protection and to raise awareness that the forest is protected**. Residents from six villages help spread awareness within their communities about the need to protect the forest, organise community patrol volunteers, and undertake patrols to stop illegal logging and forest-related activities. They also **demarcate forest boundaries, develop co-management committees with local villagers, and link up with government authorities and NGOs**. MCF has thus established the country's largest community forest and finally attracted external support. As a direct result, **forest crime has greatly reduced throughout much of the Monks Community Forest**.
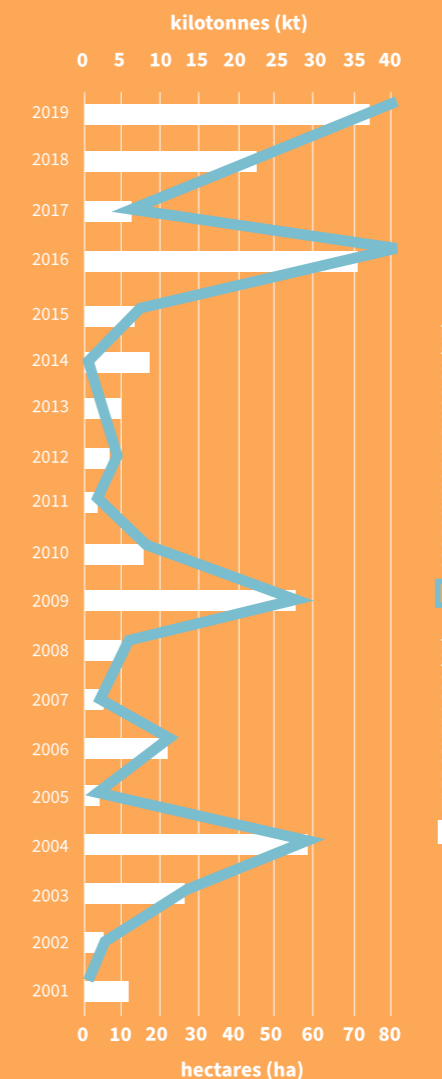
Monks Community Forest has **managed to foster a good relationship with the local and provincial authorities**, including the Forestry Administration, police, and district and provincial governors in their efforts to combat forest crime. As monks, the group is well-positioned to work with a wide range of partners. **Monks are respected in Cambodia**, where the majority of the population is Buddhist and monks are looked to for their wisdom. **The general population view monks as immune from corruption and as those working for the good of the people and the forests**. As villagers living close to the Monks Community Forest have stepped forward to patrol and advance conservation efforts, it has become clear that there are also myriad benefits to local livelihoods from forest resources.
The Community Forestry Management Committee (CFMC) currently comprises nine members, and is further supported by 44 members of village sub-committees from six villages, who are working on a voluntary basis to protect the Monks Community Forest. **Over 3,700 people from six villages are participating in and benefiting from Monks Community Forest activities**. The vast majority of participants and beneficiaries are poor and often landless farmers who are economically marginalised. The community forest provides resources, benefits and services such as shelter, subsistence crops, and commercial products, all of which are essential for their survival and well-being. Participants have also been empowered to have a voice in the management of the community forest through their representatives on the central management committee and on the sub-committees in each village.
Historic tree cover loss for the years 2001-2019 can be seen in the above Figure 3. Over this period, 426 ha[18] of Sorng Rokha Vorn Wildlife Sanctuary were lost, while 202 kt[19] (Kilo tonnes) of CO_2 equivalent were released into the atmosphere as a result of this loss over the same period.

Historic Tree cover Loss

kilotonnes (kt)

0 5 10 15 20 25 30 35 40

2019
2018
2017
2016
2015
2014
2013
2012
2011
2010
2009
2008
2007
2006
2005
2004
2003
2002
2001

0 10 20 30 40 50 60 70 80
hectares (ha)

CO2 EQUIVALENT EMISSION (MT)
TREE COVER LOSS (HA)

Monks Community Forest

FIGURE 3
Historic Tree Cover loss) in Sorng Rokha Vorn[18] Wildlife Sanctuary for the period 2001-2019 in hectares[17](white bars) and associated CO2-equivalent emissions in Mt for the same period[18](blue line).

[16] Poffenberger, Mark & Smith-Hanssen, Kathryn. (2009). Forest communities and REDD climate initiatives. https://bit.ly/2VCVYvf
[17] The forest loss and subsequent calculation of CO2 equivalent emissions uses a modified shapefile of Sorng Rokha Vorn Wildlife Sanctuary that does not take into account the forest loss in the extended area around the Ou Phal River in order to exclude potential errors. The area and emission estimations are therefore conservative. (See also disclaimer 1)
[18] Hansen/UMD/Google/USGS/NASA Global Forest Watch. "Tree cover loss in Sorng Rokavorn Wildlife Sanctuary/Cambodia". Accessed on 26/04/2021 at www.globalforestwatch.org.
[19] Harris et.al (2021). Global Forest Watch. "Emissions from biomass loss in Sorng Rokavorn Wildlife Sanctuary/Cambodia". Accessed on 26/04/2021 at www.globalforestwatch.org

2.
METHODOLOGY

Forest Monitoring
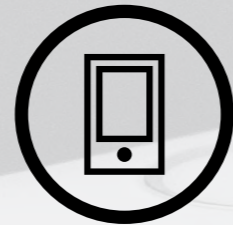
Satellite Monitoring

Integrated Forest Observatory System (I-FOROS)

Smartphones and the Prey Lang app

A crucial element of achieving the aims set out by the CEEJA action is the **collection of comprehensive, reliable and useful data on the forests in the project**. Apart from satellite monitoring and I-FOROS (see next two subchapters), on-the-ground data collection complements satellite data with qualitative data on the causes of illegal logging, biodiversity, climate change and more. A combination of remote-sensing (satellite) data and on-the-ground data provides a powerful tool with which to document forest loss, analyse its causes, and design timely forest protection measures. Furthermore, **CEEJA has shown that such data can be collected through Citizen Science methods**, increasingly used in conservation projects, due to their efficiency, low-cost and potential for empowering key stakeholders[20].

CEEJA has a strong emphasis on enabling the communities bordering the three project areas. This is partly done through smartphones and a custom-built monitoring application, the Prey Lang app. While the Prey Lang and Preah Rokar communities have been using smartphones and the Prey Lang app since 2015 and 2018, respectively, Sorng Rokha Vorn communities only began collecting data with phones in 2021.

New smartphones were distributed to these communities between 24 February and 11 March 2021. In total, **new smartphones were distributed to (at least) 74 members, followed by training and workshops wherever possible**, explaining the use of the application.
The forest monitoring application used by PLCN, PFCN and MCF is the **Prey Lang app co-designed, tested and perfected over six years by PLCN and its partners**. The Prey Lang app was initially based on the Sapelli data collection platform and functionality has been added according to the needs and wishes of PLCN.
The latest version of the app allows patrollers to document observations in four major categories:

ACTIVITIES Referring to extraction activities, such as illegal logging, illegal hunting, and illegal fishing

RESOURCES Referring to natural or cultural resources, such as resin trees, medicinal plants, fishing grounds and spirit forests

REPORTING Referring to interactions with authorities, such as reporting of illegal activities, confiscated equipment, and threats made to patrollers

CLIMATE Referring to instances of a) climate change, such as changing levels of lakes and rivers, extreme weather conditions; and b) climate adaptation initiatives, such as new farming methods, crop varieties and water management

Within the app, users can triangulate recorded data with images, video and voice recordings, GPS location points and time stamps. The data is uploaded automatically to an online database, where entries are validated and analysed by database managers.

[20] Bori, P. J., Argyriou, D., & Theilade, I. (2020). Geographic citizen science for forest monitoring and conservation. Policy Briefs (Copenhagen Centre for Development Research), 2020(2), 1-6. https://curis.ku.dk/ws/files/246728097/2020_No_2_PB_DA_IT.pdf

Over the last few years, satellite monitoring has been advancing at a rigorous pace. **The capacities of satellite technologies in combination with the number of new satellites launched for earth observations, allow for monitoring of forest loss in near real-time: monthly, weekly or even daily.** This progress allows more timely enforcement to tackle deforestation. A lack of political will does, however, remain a significant challenge to the optimal use of such satellite data to curb illegal logging and land conversion[21].

CEEJA is taking advantage of Norway's International Climate & Forests Initiative (NICFI), an agreement with Planet Labs that allows everybody to access Planet's high-resolution, analysis-ready mosaics of the world's tropics in order to help reduce and reverse the loss of tropical forests, combat climate change, conserve biodiversity, and facilitate sustainable development.

Satellite Monitoring

GLAD alerts

The GLAD alert system devised by the University of Maryland's Global Analysis and Discovery (GLAD) lab uses satellite imagery to collect weekly data on deforestation across the tropics. GLAD uses imagery from NASA's Landsat satellites to automatically flag areas where the forest canopy has been disturbed. The GLAD system analyses the **most recent images and compares them to historical data to determine where trees have been lost**. The entire system is run under Google Earth Engine.

Each GLAD alert **indicates a 30x30 metre area** (around the size of two basketball courts) **that has experienced a disturbance in the forest canopy**, which indicates that trees in that area may have been lost or removed. The primary purpose of the GLAD alert system is to **alert people to potential deforestation**, but GLAD alerts also pick up additional disturbances such as rotation cycles in plantations, forest degradation from fires and storms, and natural changes like landslides and windthrows. The alerts are still intentionally titled **"deforestation alerts"** because the purpose is to alert users to the possibility of deforestation, which is what most are looking for in order to quickly respond[22].

The GLAD deforestation alerts are a near-real-time monitoring system from the University of Maryland. The alerts were built to allow people working on the ground to respond to deforestation events as quickly as possible. Although the alerts have some limitations—which make it inadvisable to use them to establish deforestation trends—their locations can indicate where recent deforestation has happened and alert us to new areas of concern[23].

Forest Canopy Disturbance Monitoring (FCDM) tool detections [24]

The FCDM tool supports the detection of forest canopy disturbance from satellite remote sensing and can provide **indications of forest degradation processes**. Reporting on forest degradation is required by many tropical countries participating in the REDD+ (Reducing Emissions from Deforestation and Degradation) programme. Compared to deforestation, however, the mapping of "forest degradation" has proved to be technically far more challenging as the signs of forest canopy disturbance are less prominent and often not reflected in a change in the mapping of land cover.

The FCDM tool developed at the JRC uses **a change detection approach based on the difference (delta) in optical as well as radar satellite data in order to detect forest canopy change over defined periods at pixel and sub-pixel level**. These canopy disturbances may be large-scale, for example derived clear cuts and forest encroachments, or small-scale ("forest remaining forest") resulting, for instance, from single tree extractions, felling damage or from establishing logging roads. While the FCDM-optical approach is based on Landsat 4, 5, 7 and 8 as well as Sentinel-2 imagery (Langner et al., 2018)[25], the newly developed FCDM-radar approach uses Sentinel-1 data that allows monitoring independent of cloud coverage (which strongly restricts optical satellite systems) and, furthermore, provides more reliable disturbance detections within drier and more seasonal vegetation types (Langner et al., in preparation). **The FCDM tool runs under Google Earth Engine (GEE) and allows the user - via a specific GEE user interface - to derive disturbance detections over any desired area by choosing and/ or manipulating the main parameters from simple drop-down menus, without the need for a knowledge of scripting**. Due to the very nature of the forest types analysed (from evergreen to semi-deciduous forests), the FCDM-radar approach is used for reporting.

21 Finer, M., Novoa, S., Weisse, M. J., Petersen, R., Mascaro, J., Souto, T., Stearns, F., García Martinez R., Combating deforestation: From satellite to intervention. Science 360, 1303–305 (2018). https://doi.org/10.1126/science.aat1203
22 M. Weisse and A. Pickens: https://blog.globalforestwatch.org/data-and-research/glad-deforestation-alerts/
23 https://research.wri.org/gfr/forest-pulse
24 https://forobs.jrc.ec.europa.eu/iforce/dNBR.php
25 Langner A, Miettinen J, Kukkonen M, Vancutsem C, Simonetti D, Vieilledent G, Verghghen A, Gallego J, Stibig H-J, 2018 Towards Operational Monitoring of Forest Canopy Disturbance in Evergreen Rain Forests: A Test Case in Continental Southeast Asia. Remote Sensing. 10, 4, 544, doi:10.3390/rs10040544 https://www.mdpi.com/2072-4292/10/4/544

Forest
Monitoring

Satellite
Monitoring

Integrated Forest
Observatory System
(I-FOROS)

I-FOROS

I-FOROS is a unique forest observation platform that aims to inform the general public, policy makers and the inhabitants of the above wildlife sanctuaries. The platform was designed and created in the context of the CEEJA project by the Forest & Peoples Organisation during the first quarter of 2021.
It gathers information from:
1. satellite-based alerts
2. drone footage
3. smart phone data from ground patrols.

The dynamic platform contains information on the nature and status of some of the wildlife sanctuaries in Cambodia.
As such, it is an **online repository of datasets on forest loss from various sources, coupled with on-the-ground forest monitoring data from communities and patrollers, supplemented with historic data on Economic Land Concessions and Mining Concessions**.

More specifically, the platform allows for a visual representation of the following:

- **CEEJA project areas**
- **On-the-ground community patrol data**
- **Forest Canopy Monitoring Detections (Joint Research Centre - European Commission JRC-EC)**
- **Historic forest loss data (University of Maryland)**
- **GLAD deforestation alerts (University of Maryland)**
- **Information on Cambodia's Economic Land Concessions (ELCs) of by main product**
- **Information on Cambodia's Mining Concessions (MCs) by country of origin of the company involved**
- **Satellite imagery: up-to-date analysis-ready mosaics (Planet Labs)**

The platform can be accessed through the link https://iforos.live/platform and will be **continuously updated with the latest datasets on tree cover loss from different sources**. The main beneficiaries of the application are the communities that precariously live in the protected areas and its main function is to inform the general public and raise awareness of the situation and who is behind the ongoing habitat degradation. The public authorities are welcome to **submit forest monitoring data** to the I-FOROS application but also welcome to **embed and complement their monitoring systems with I-FOROS**. They are also welcome to advocate for the **real protection of the wildlife sanctuaries** by sharing the above link to the application or embedding it in their webpages.

3. RESULTS

PLCN Forest monitoring – Illegal Activities and Resources in focus

The year 2020 presented a number of challenges to the patrollers of PLCN: restrictions on movement due to the **Covid-19 pandemic** and a **near-total ban by the Ministry of Environment on PLCN members entering the forest** led to a sharp decline in forest patrol data. While there was an average of approximately 2,200 validated entries per year between 2015 and 2019, 2020 saw only 227. **Compared to 2019, entries declined by almost 90%.**

Of the total entries, **131** were **"Activities"** (mining, plantation, illegal fishing, illegal hunting and logging), **83 "Resources"** (Animals, Non-Timber Forest Products (NTFPs), Sacred and Trees), **7 "Climate", 4 "Reporting"** and **2 "Other"** (Figure 4).

Of the 131 entries in the "**Activities**" category, **130 related to "Logging" and one to a plantation on an Economic Land Concession** (Figure not shown). This data points to the acute problem of illegal logging within the sanctuary.

Of the 130 entries related to "Logging", 49 related to **"planks" (38%)**, 36 to **"cleared areas" (28%)**, 34 to **"stumps" (26%)**, and 11 to **"transportation" (8%)** (Figure 5).

Patrollers also collect data on existing forest resources. Of the 83 **"Resource"** entries, a majority concerned **"Trees" (84%)**, while the remaining three categories of **"Animals"**, **"Non-Timber Forest Products (NTFPs)"** and **"Sacred Sites"** made up **7%, 4% and 4%**, respectively (Figure 6).

A total of 61% of tree entries related to **"Luxury trees"**, which are often felled due to their high demand and high price on international markets. The remaining entries were **"Resin trees"**, which provide an important source of sustainable livelihoods for the communities surrounding Prey Lang Wildlife Sanctuary. **Non-Timber Forest Products (NTFPs)** include plants used for **medicinal purposes, edible plants, as well as plants used for crafts such as basket-weaving and construction**. Finally, Sacred Sites include Burial Sites, Sacred Trees and Temples pointing to the rich cultural history and spiritual heritage of Prey Lang.
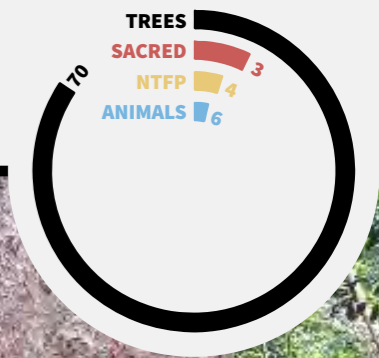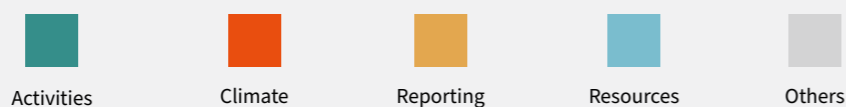
**Figure 4.
Distribution of entries
in main categories for PLCN**

Activities   Climate   Reporting   Resources   Others

IMAGE 5
Resin trees and Preah Rokar Wildlife Sanctuary

**Figure 5.
Distribution of entries
within the Logging category**

PLANKS STUMP TRANSPORT CLEARED AREAS

34 11 49 36

IMAGE 6
Resin trees and Preah Rokar Wildlife Sanctuary

**Figure 6.
Distribution of entries
within the "Resources" category**

TREES SACRED NTFP ANIMALS

70 3 4 6

PFCN Forest Monitoring

Global and national developments in 2020 had a strong impact on patrollers' ability to collect on-the-ground data in Preah Rokar Wildlife Sanctuary. As such, **2020 had only 116 total valid entries, representing an 88% decrease on 2019**.

The majority of these entries were **"Resources" (74%)**, while only 14 entries **(12%)** were **"Activities"**. A further 9 (9%) and 6 **(5%)** entries were on **"Reporting"** and **"Climate"**, respectively (Figure 7).

The 14 entries in **"Activities"** all concerned **"Logging"**: 9 entries from patrollers who came across **"stumps" (64%)**, 3 entries from patrollers who observed the "transportation" of cut trees (21%), and one entry each from patrollers who came across a **"cleared area"** or **"stumps" (7% each)**.

In **"Resources"**, most entries **(77%)** were for trees: **67%** of tree entries were for **"Resin trees"**, while the remaining **33%** were for other **"Luxury trees"**. Furthermore, 12 entries **(14%)** within **"Resources"** concerned "Animals", 7 entries "Non-Timber Forest Products (NTFPs)" (8%) and 1 entry a "Sacred Site" (1%) (Figure 8).

Finally, patrollers also noted a number of interactions with authorities and other actors. A total of 8 entries (88%) were "positive interactions with authorities", while 1 related to incited violence: when a patroller and his team identified illegal loggers at Oksay forest, they managed to isolate him and beat him up. (12%).

MCF Forest Monitoring

The Monks Community Forest has received 18 smartphone devices and training on forest monitoring during February 2021. The training was also attended by members of PFCN and other forest activists.
In total more than 40 people participated in the training. No data was therefore collected in 2020.

IMAGE 7
A patroller reports a logged stump in Preah Rokar Wildlife Sanctuary on 27 June 2020.

IMAGE 8
A patroller reports a resin tree in Chek Chao area in Preah Rokar Wildlife Sanctuary during the August harvest period (15 August 2020). Resin selling supports the livelihoods of many PFCN members.

87
14
9
6
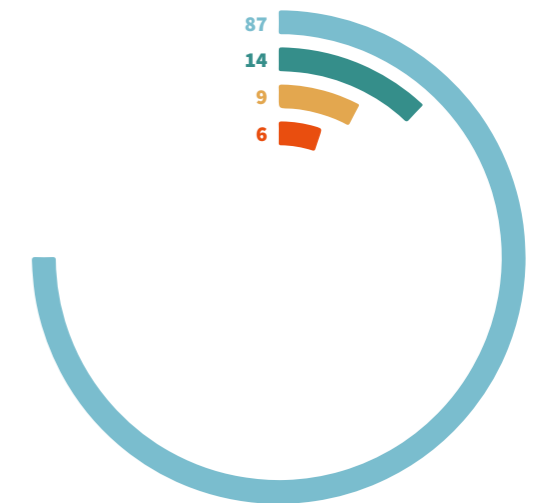
FIGURE 7
Distribution of entries in main categories by the PFCN

Activities   Climate   Reporting   Resources   Others

TREES
ANIMALS
NTFP
SACRED   1
7
12
67
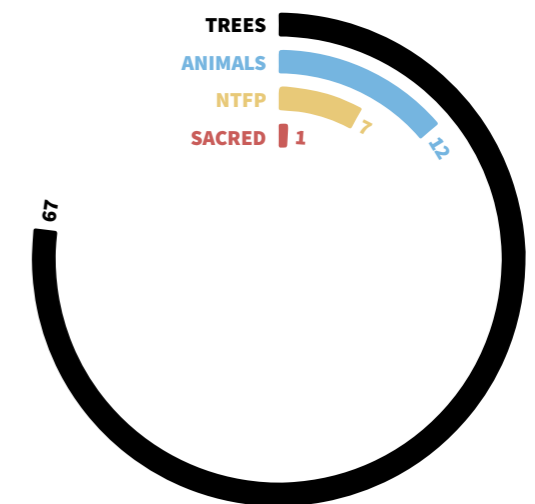
FIGURE 8
Distribution of entries in Resources

Maps to be used for forest protection showing illegal logging and deforestation

Satellite monitoring using the newly released high-resolution images has proved a reliable source for monitoring tree cover loss, especially in 2020 when communities faced challenges in entering the forest. The "Global Forest change" dataset, updated and released in April 2021 by Hansen et. Al.[26] has shown an increase in tree cover loss in year 2020 compared to 2019 in Prey Lang Wildlife Sanctuary and Preah Rokar Wildlife Sanctuary while there was a decrease in tree cover loss in the same years in Sorng Rokha Vorn Wildlife Sanctuary.

More specifically, there was a **22% increase in tree cover loss in Prey Lang Wildlife Sanctuary, as more than 9,000 hectares were lost in 2020**. This amount is equivalent to **5.7 Mt**[27] of CO2 emitted into the atmosphere. **Preah Rokar Wildlife Sanctuary accordingly lost more than 600 ha of tree cover in 2020, a 20% increase on 2019.** This amount is equivalent to **300 kt** of CO2 emitted into the atmosphere. Lastly, tree cover loss in **Sorng Rokha Vorn Wildlife Sanctuary (or Monks Community Forest) reduced by almost 40 ha and 17.5 kt** of CO2 equivalent emitted into the atmosphere.
(See disclaimer 1 - end of document)

COMMUNITY PATROL DATA

- 🟧 Activities (Logging)
- 🟩 Climate; Other; Reporting; Resources

GLOBAL FOREST CHANGE

- 🟦 2020

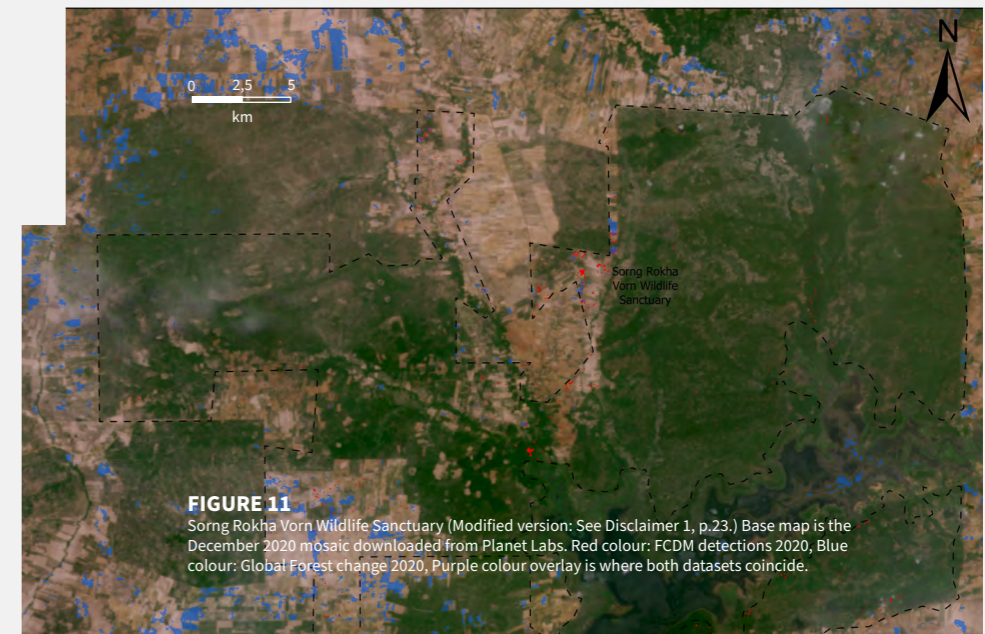**FCDM DETECTIONS**

- 🟥 2020

Prey Lang Wildlife Sanctuary

FIGURE 9
Community patrol findings in Prey Lang Wildlife Sanctuary. Base map is the December 2020 mosaic downloaded from Planet Labs. Red colour: FCDM detections 2020, Blue colour: Global Forest change 2020, Purple colour overlay is where both datasets coincide.

Preah Rokar Wildlife Sanctuary
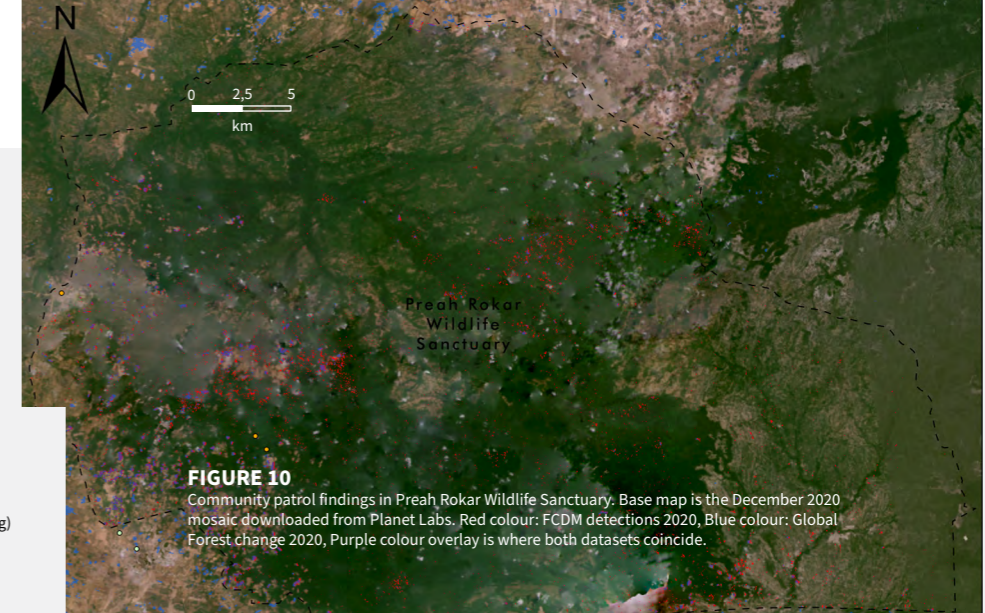
FIGURE 10
Community patrol findings in Preah Rokar Wildlife Sanctuary. Base map is the December 2020 mosaic downloaded from Planet Labs. Red colour: FCDM detections 2020, Blue colour: Global Forest change 2020, Purple colour overlay is where both datasets coincide.

Sorng Rokha Wildlife Sanctuary

FIGURE 11
Sorng Rokha Vorn Wildlife Sanctuary (Modified version: See Disclaimer 1, p.23.) Base map is the December 2020 mosaic downloaded from Planet Labs. Red colour: FCDM detections 2020, Blue colour: Global Forest change 2020, Purple colour overlay is where both datasets coincide.

Global Forest Change dataset	Total area	CO2 equivalents emitted since 2001	Tree cover loss since 2001 (% of total area)	2019	2020
Prey Lang WS	432,380 ha	35 Mt[8]	56,500ha[7] (13%)	7507ha[7] (1.8%)	9134ha[7] (2.2%)
Preah Rokar WS	90,361 ha	2.45[13] Mt	3,550ha[12] (4.6%)	504ha[12] (0.65%)	607ha[12] (0.78%)
Sorng Rokha Vorn WS /(modified)[28]	30,254ha /29,490ha	296 kt /220 kt[17]	630ha[16] (5.5%) /466ha (5.2%)	74 ha (0.64%) /74ha[16] (0.82%)	77ha[16] (0.66%) /39ha[16] (0.44%)

TABLE 1
Overview of the total size of the protected areas and the associated tree cover loss (hectares) as well as the CO2 equivalent emitted into the atmosphere stemming from said tree cover loss. The percentage of total area is given inside parentheses. Regarding Sorng Rokha Vorn Wildlife Sanctuary, the first number relates to the total area of the WS, while the second to a modified area[27] excluding the areas around the Ou Phal River water body in order to provide more conservative results.

[26] Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (15 November): 850–53. Data available on-line from: http://earthenginepartners.appspot.com/science-2013-global-forest
[27] Harris et al (2021). Global Forest Watch. "Emissions from biomass loss in Prey Lang, Cambodia". Accessed on 26/04/2021 from www.globalforestwatch.org
[28] See Disclaimer 1, page 23

Examples
of change in tree cover
based on satellite imagery

Examples
of tree cover loss

FIGURES 13.1 - 13.2
Example of tree cover loss inside Preah Rokar Wildlife Sanctuary.
The **upper satellite image is recorded in December 2019** and the **lower one year later, in December 2020**.
(The coordinates for the central point of this image are *13o 52' 58" N 105 o 03' 54" E*
and it can be accessed through Planet /NICFI)

**FIGURES
12.1 - 12.2**
Example of tree cover
loss inside Prey Lang
Wildlife Sanctuary. The
**upper satellite image
is from December
2019** and the l**ower
one December 2020**.
The coordinates for the
central point of this
image are 13.58678° N,
105.54940° E and it can
be accessed through
Planet /NICFI.

FIGURES 14.1 - 14.2
Example of tree cover loss inside Sorng Rokha Vorn Wildlife Sanctuary.
The **upper satellite image is dated December 2019** and the **lower one December 2020**.
The coordinates for the deforested point of this image are *14.18760° N, 103.76652° E*
and it can be accessed through Planet /NICFI.

IMAGE 9
A Goh-yun (local tractor) full of illegally felled timber
spotted by a patroller in Kratie Province on 12 February 2020

CONCLUSIONS

Between 2001 and 2020, **Cambodia lost almost 2.5 million hectares of tree cover**, equivalent to a 28% decrease in tree cover since 2000 and emitted 1.45Gt of CO_2 equivalent emissions.[29] Cambodia's wildlife sanctuaries lost almost 48,000 ha of tree cover in 2020. Prey Lang Wildlife Sanctuary, Preah Rokar Wildlife Sanctuary and Sorng Rokha Wildlife Sanctuary lost almost 10,000 ha of tree cover over the same period. **Prey Lang Wildlife Sanctuary experienced by far the highest levels of forest loss in 2020.** The last five years were detrimental to Cambodia's forests: **almost 80% of total forest loss has occurred since 2016 in Prey Lang Wildlife Sanctuary (78%) and Preah Rokar Wildlife Sanctuary (79%), while more than 50% of the total loss of Sorng Rokha Vorn Wildlife Sanctuary happened over the same period.** The I-FOROS highlights this massive destruction and calls for an immediate solution.

The communities living inside and around these protected areas, are the first to feel the impact of the forest cover loss as their livelihoods depend on the forest: a scarcity of Non-Timber Forest Products (NTFPs), reduced amounts of resin for harvesting (which is sold in nearby markets), fluctuating weather patterns that affect their crops, to name but a few. These communities are the first to be affected by deforestation and they see their freedom of expression repressed when they report on the problem. In 2020, communities and networks such as PLCN[30] were banned from entering the protected areas to patrol. Many faced arrests,[31, 32] had to flee their homes and even faced death in the precariousness of their activities.

The Royal Government of Cambodia and the Ministry of Environment has continued to deny[33] the evidence coming from journalists,[34] local and international CSOs and NGOs.[35] USAID has recognised the problem and links it to weak law enforcement and lack of accountability on the ground.[27]

We would at this point like to reiterate the findings of two meta-studies published by FAO (2021)[36] and Rainforest Foundation Norway (2021)[37]. **The reports unanimously conclude that Indigenous Peoples are the most effective in conserving forests and that more direct funding should support them in their efforts to conserve the world's tropical forests.** These findings are supported by earlier scientific studies such as Porter-Bolland et al. 2012[38].

Indigenous Peoples have been the stewards of these forest lands for millennia; they have the knowledge and will to protect them and should rightly be at the core of efforts to conserve these protected areas. CEEJA will continue implementation according to science-based findings on effective forest protection and for environmental justice for all.

**SINCE 2016
TOTAL FOREST LOSS**

78% in Prey Lang
Wildlife Sanctuary

79% in Preah Rokar
Wildlife Sanctuary

+50% in Sorng Rokha Vorn
Wildlife Sanctuary

[29] Global Forest Watch. "Tree cover loss in Cambodia". Accessed on 15/06/2021 at https://gfw.global/35kyuFw
[30] https://www.rfa.org/english/news/cambodia/ceremony-02252020125131.html
[31] https://vodenglish.news/award-winning-environmentalist-four-others-arrested-in-kratie/
[32] https://www.voacambodia.com/a/ouch-leng-and-three-environmental-activists-detained-in-kratie-being-questioned-by-court-/5330378.html
[33] https://www.business-humanrights.org/fr/derni%C3%A8res-actualit%C3%A9s/cambodia-prey-lang-community-networks-report-reveals-an-increase-in-deforestation-while-the-community-faces-bans-on-patrolling-the-forest/
[34] https://vodenglish.news/satellite-data-shows-deforestation-of-protected-areas-near-concessions/
[35] https://www.globalwitness.org/en/blog/threats-against-cambodian-forest-defenders-escalate-amid-covid-19/
[36] FAO and FILAC. 2021. Forest Governance by Indigenous and Tribal People. An Opportunity for Climate Action in Latin America and the Caribbean. Santiago. https://doi.org/10.4060/cb2953en
[37] RFN 2021: Falling short, Jeffrey Hatcher, Michael Owen, and Daphne Yin). https://bit.ly/3cJvy9E
[38] Porter-Bolland, L., Ellis, E.A., Guariguatac, M.R., Ruiz-Malland, I., Negrete-Yankelevicha, S. & Reyes-Garcíae, V. (2012). Community managed forests and forest protected areas: An assessment of their conservation effectiveness across the tropics. Forest Ecology and Management, 268, 6–17.

Disclaimer

1. Although the findings derived from the global forest cover loss dataset of University of Maryland demonstrate a decline in tree cover loss for Sorng Rokha Vorn Wildlife Sanctuary and Monks Community Forest, the numbers have been calculated using a modified shapefile. The shapefile does not take into account the extended area around the Ou Phal River. This allows us to exclude potential mistakes from algorithms which, in their attempt to automatically calculate forest loss, misunderstand large water bodies. The estimations for Monks Community Forest are therefore conservative.

2. Graphs displaying the annual greenhouse gas emissions arising from stand-replacing forest disturbances: emissions include all relevant ecosystem carbon pools (above-ground biomass, below-ground biomass, dead wood, litter, soil) and greenhouse gases (CO_2, NH_4, N_2O), and are assumed to occur in the year of disturbance. The methods used to calculate emissions are described in Harris et al. (2021)[39], which introduces a geospatial monitoring framework for estimating global forest carbon fluxes. The methods follow IPCC Guidelines for national greenhouse gas inventories where stand-replacing disturbance occurred, as mapped in the Global Forest Change annual tree cover loss data of Hansen et al. (2013).

3. This publication was produced with the financial support of the European Union. Its contents are the sole responsibility of CEEJA and do not necessarily reflect the views of the European Union.

Front cover photo:
Patrollers in Preah Vihear report a cleared area on 12 April 2020.
Back cover photo:
Patrollers in Kratie report a Chhertheal Preng
(Dipterocarpus turbinatus Gaertn. f.) resin tree

Credits

[39] Harris, N.L., Gibbs, D.A., Baccini, A. et al. Global maps of twenty-first century forest carbon fluxes. Nat. Clim. Chang. 11, 234–240 (2021). https://doi.org/10.1038/s41558-020-00976-6