



## EXECUTIVE SUMMARY

# Bringing Radical Transparency to Global Emissions

## How Climate TRACE is harnessing satellites and artificial intelligence to advance emissions monitoring through direct observation and open data

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Tracking greenhouse gas (GHG) emissions from nearly every major human-caused emitting activity worldwide is an enormous undertaking. Climate scientists now have a good understanding of how much carbon dioxide is in the atmosphere. But that insight alone isn't sufficient for informing climate action.

We need data to pinpoint when and where human-caused emissions happen, and what sources are driving them. Data such as these help pivot from accounting to action. Yet many countries must rely on general estimates, broad assumptions, and emitters' self-reported data. Consequently, status quo GHG inventories are often many years out of date, contain gaps, have high levels of uncertainty, are high level and not localised, and are fragmented and not comprehensive.

With recent advances in machine learning and artificial intelligence (AI), and with greater availability of remote sensing data such as satellite imagery from public and commercial sources, it is now possible to harness these technological advances to provide actionable emissions data to all stakeholders and usher in a an era of emissions monitoring that provides open, transparent, granular, timely data.

The inaugural Climate TRACE dataset unveiled in September 2021 covers annual emissions for every country on Earth across 10 sectors and 38 subsectors for the years 2015–2020. From this baseline, Climate TRACE data will continue to get better—rapidly—over time. Some of the biggest

developments coming down the Climate TRACE tech pipeline include adding both temporal and spatial granularity.

Planned upcoming features and capabilities include:

- **Data recency.** We launched with data through 2020, but for certain sectors, updated data will integrate into the Climate TRACE dashboard to show more recency, moving toward near-real-time updates where possible. For example:
  - Data from Climate TRACE member WattTime show power sector emissions rebounding in 2021 in places such as the European Union, United States, and India after 2020 declines due to COVID-related shutdowns.
  - Data from Climate TRACE member TransitionZero show that in Q2 2021, China's steel-related emissions reached record levels, but Q3 saw a sharp drop in the country's steel-related emissions, bringing it closer to meeting its target of keeping 2021 emissions below 2020 levels.
  - Data on mining and quarrying from Climate TRACE member Hypervine show that China continues to be the world's biggest emitter in the sector in 2021, with emissions 3.7x higher for Q1 than for the EU.
  - Data from Climate TRACE member Blue Sky Analytics show that Russia's forest fire emissions for 2021 YTD have already



surpassed each of its record-setting 2019 and 2020 totals. In fact, Russia's total sector emissions for 2021 YTD are higher than Brazil and the U.S. combined for that time period.

- **Time-series data granularity.** Typically, national emissions inventories are aggregated annual emissions numbers. For many sectors, Climate TRACE will be able to document data on finer time scales, such as monthly or weekly emissions fluctuations from certain sectors and individual assets. For example:

- Data from Climate TRACE members WattTime and TransitionZero for three coal-fired power plants in India show changes in emissions that resulted from the impact of major national events (such as India's COVID-related lockdown and civil protests that disrupted power plant operations).
- Looking back at 2020, granular time-series data from Climate TRACE member OceanMind confirms a sudden, sharp decline in maritime-related emissions as pandemic lockdowns and travel restrictions brought a temporary halt to the cruise ship industry.

- **Asset-level spatial granularity.** Although accounting frameworks attribute emissions to certain entities—whether countries or corporations—in practice, all emissions come from specific sources: power plants, ships, factories, etc. That's why asset-level granularity and the ability to 'zoom in' on a specific source and its emissions are central to the tech roadmap. For example:

- Data from Climate TRACE member RMI show that two historic North Sea fields in the widely traded Brent oil basket have significantly different climate footprints. The UK Brent field emits 25x more kgCO<sub>2</sub>-equivalent per barrel oil equivalent than Norway Ekofisk.
- As of 2020, Brazil leads the world in forest-clearing emissions, based on data from Climate TRACE member CarbonPlan. Knowing the locations of deforestation can highlight specific regions in a country that are experiencing rapid deforestation and the resulting CO<sub>2</sub> released.

- **Asset detection.** Measuring emissions from specific assets is dependent on knowing those assets exist in the first place. Yet in some instances, important sources of emissions remain undocumented—and therefore, uncounted in emissions inventories. Climate TRACE data will put these emissions sources on the map for the first time. For example:

- Concentrated animal feeding operations (CAFOs) are a major source of methane emissions. Attempts to regulate them have largely failed, because knowing how many of these facilities there are or where they are located remains opaque. Climate TRACE modeling contributor Synthetica is using high-performance computing, generative AI, and deep neural networks to map CAFOs from satellite imagery.
- Climate TRACE member Earthrise is supporting the Global Plastics Watch by the Minderoo Foundation to identify collections of plastic waste from high-resolution satellite imagery—documenting landfill area change over time and associated emissions.

As a continually improving project developed by a global coalition, Climate TRACE welcomes feedback from experts and peer reviewers. In addition, we also invite new collaborators who have domain expertise, access to high-quality ground truth data that could be used to train algorithms, or have expertise in sectors not yet covered by Climate TRACE.