Climate Justice
Jean Monnet
Centre of Excellence

1222·2022 800 ANNI

UNIVERSITÀ DEGLI STUDI DI PADOVA

With the support of the Erasmus+ Programme of the European Union

INTERNATIONAL CONFERENCE ON CLIMATE JUSTICE – 27th October

Extreme Citizen Science for Unleakable and Unburnable Carbon in Amazon

Francesco Facchinelli

Contact: francesco.facchinelli@unipd.it

Affiliation: Climate Justice Jean Monnet Centre

www.climate-justice.earth

ICEA

GIScience

STeDe SUSTAINABLE TERRITORIAL DEVELOPMENT

Associazione GISHub

The research group:
Climate change, Territories, Diversity

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

1222·2022 800 ANNI
UNIVERSITÀ DEGLI STUDI DI PADOVA

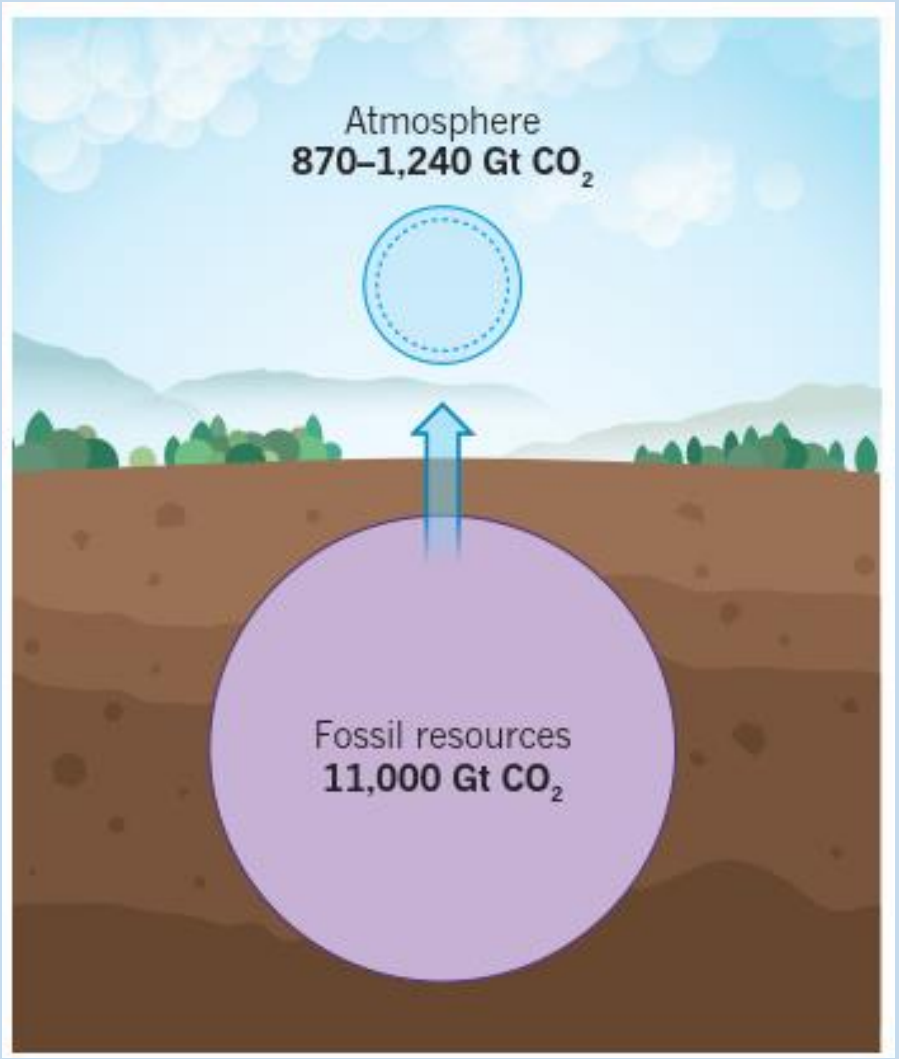
ICEA

With the support of the
Erasmus+ Programme
of the European Union

Unburnable fossil fuel resources

Should remain “locked underground”:

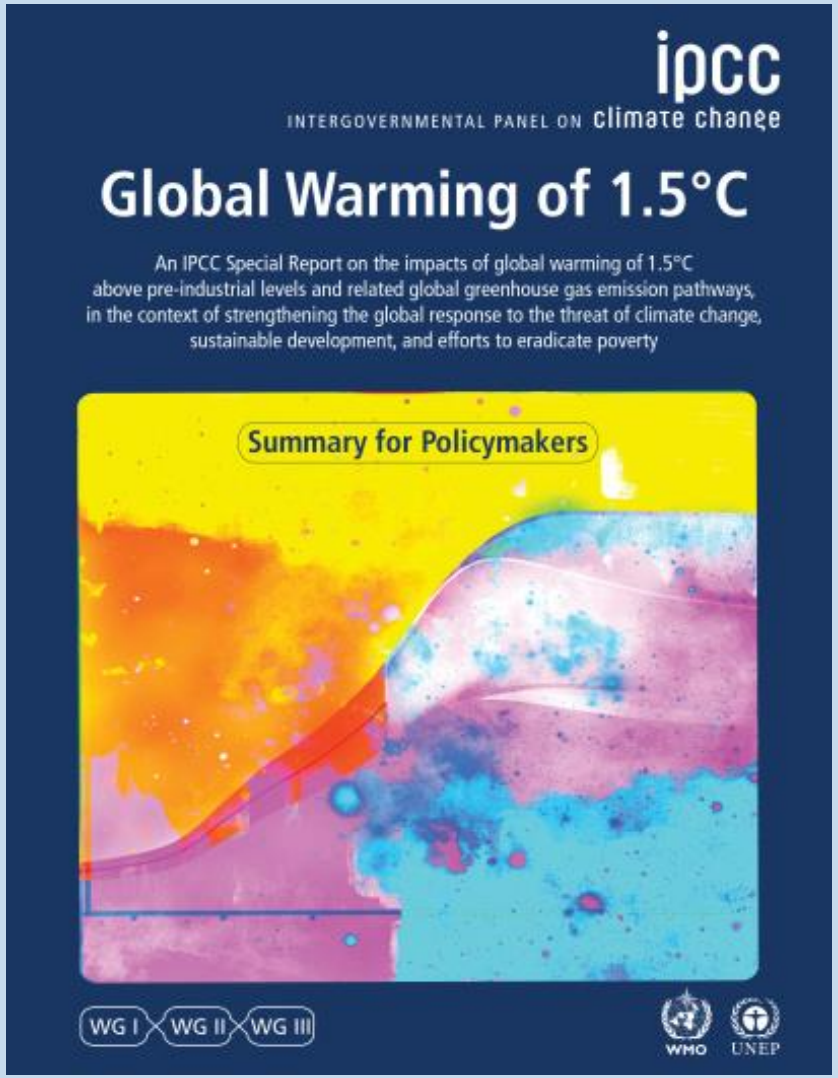
- 35% of oil
- 52% of natural gas
- 88% of coal



McGlade and Ekins, 2015, Nature

Francesco Facchinelli francesco.facchinelli@unipd.it

With the support of the Erasmus+ Programme of the European Union



Remaining carbon budget 1,5 °C

840 Gt CO2 (33 %)

580 Gt CO2 (50 %)

420 Gt CO2 (67 %)

Francesco Facchinelli francesco.facchinelli@unipd.it

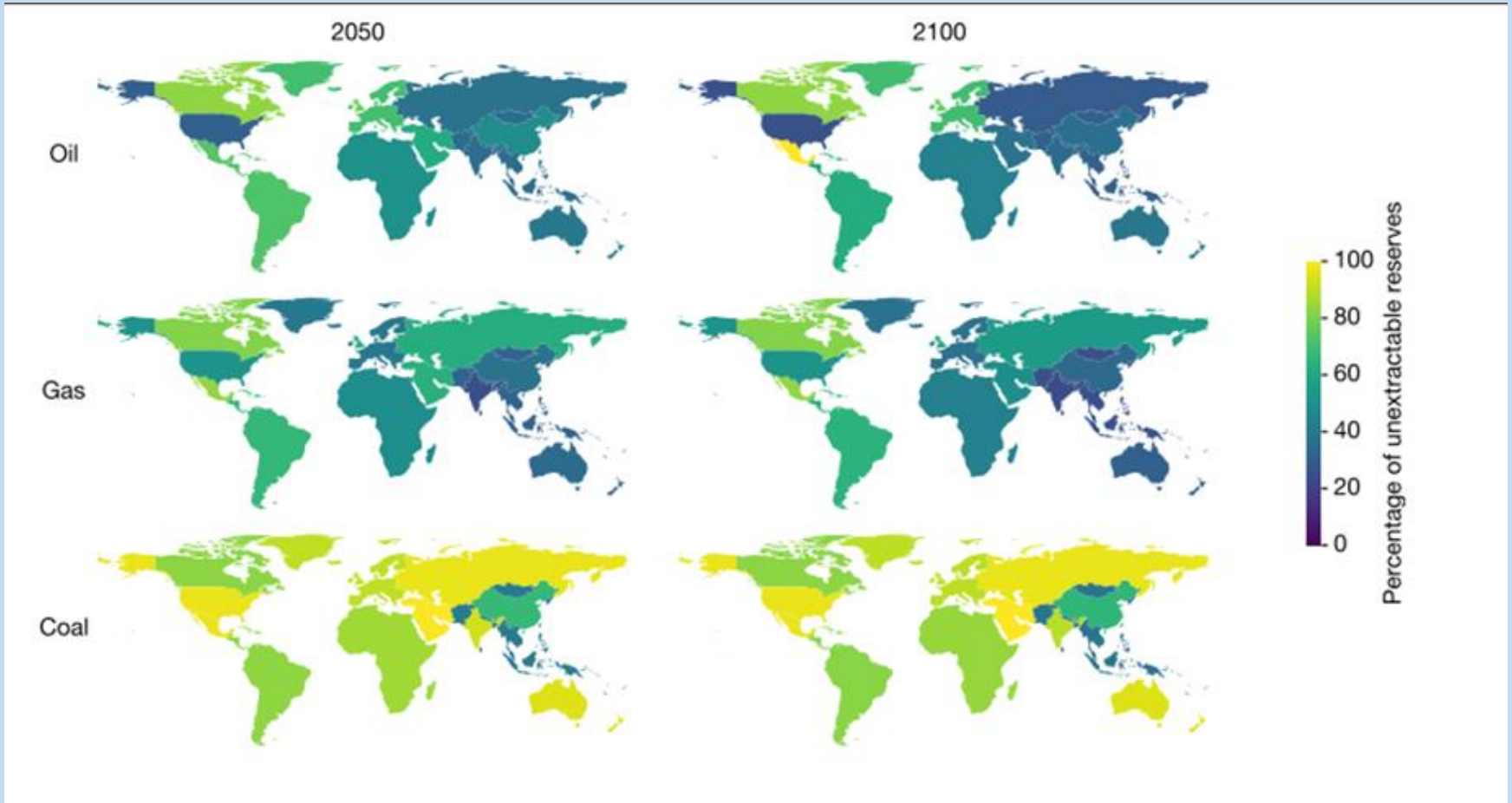
Climate Justice
Jean Monnet
Centre of Excellence

1222·2022 800 ANNI
UNIVERSITÀ DEGLI STUDI DI PADOVA
ICEA

With the support of the
Erasmus+ Programme
of the European Union

Unburnable carbon reserves within +1,5 °C

- 58% of oil
- 59% of gas
- 89% of carbon



Welsby D, Price J, Pye S and Ekins P 2021 Unextractable fossil fuels in a 1.5 °C world Nature 597 230–4

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

1222·2022 800 ANNI
UNIVERSITÀ DEGLI STUDI DI PADOVA

ICEA

With the support of the
Erasmus+ Programme
of the European Union

Unleakable carbon

Unleakable Carbon refers to the uncombusted carbon-based gases that are also associated with the extraction, distribution, and consumption of fossil fuel reserves, otherwise referred to as ‘fugitive’, ‘leaked’, ‘vented’, ‘flared’, or ‘unintended’ emissions

Table 1. Given best- and worst-case CH4 leakage and GWP scenarios we demonstrate that unless unleakable carbon is curtailed, up to 80–100% of our global natural gas reserves must remain underground if we hope to limit warming to 2°C from 2010 to 2050

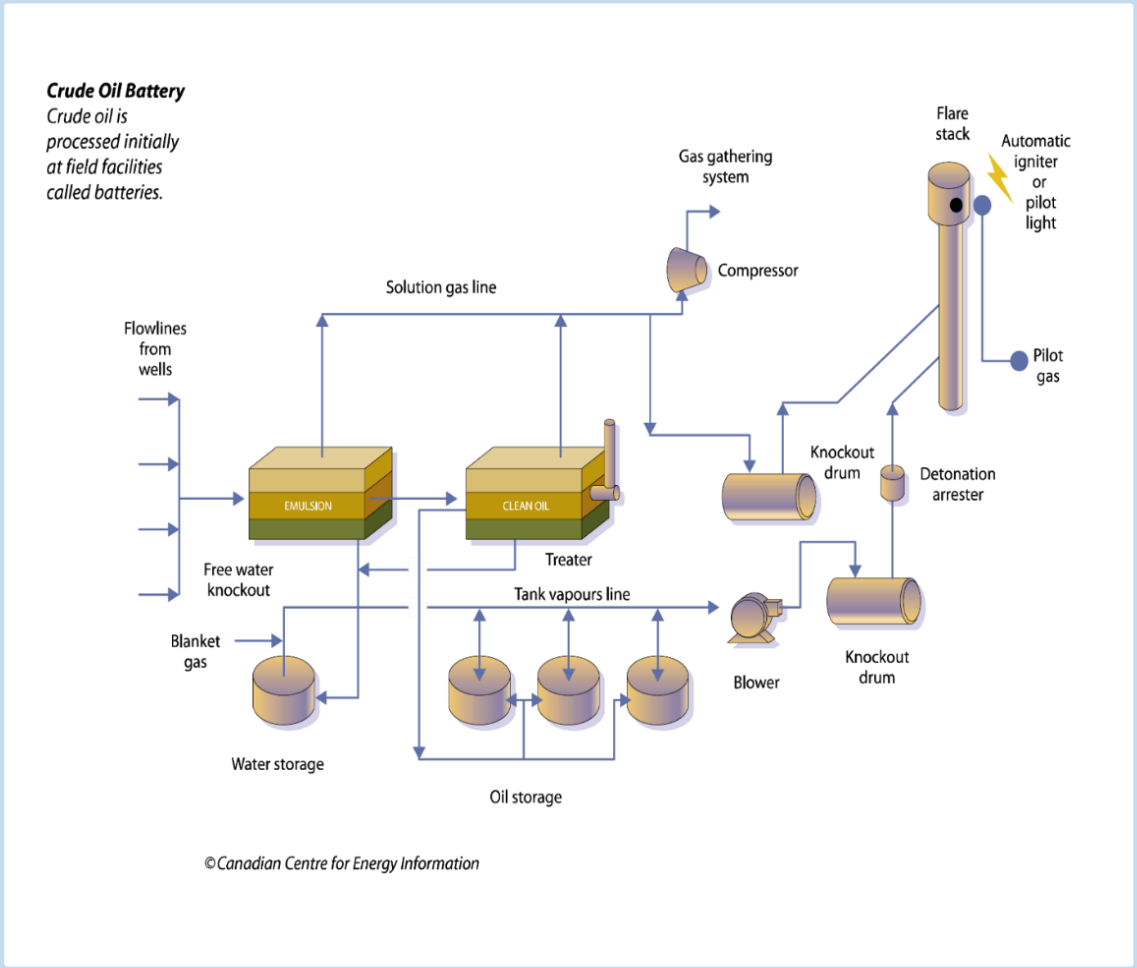
		1.8% Leakage rate	5.4% Leakage rate
GWP	Time horizon (years)	Low	High
34	100	80%	139%
86	20	127%	280%

Notes: When low and high CH_4 leakage rates (Brandt et al., 2014) are applied to the combustion emissions associated with the utilizable portion of our remaining natural gas reserves, estimated to be 50% if we aim to meet a warming target of 2°C from 2010 to 2050 (McGlade & Ekins, 2015), we find that the warming contribution of unleakable carbon is large enough to enhance CO_2e between 30% and 230% over best- and worst-case leakage and GWP scenarios, respectively. Here combustion emissions are converted to CO_2e to reflect uncombusted CH_4 using the most recent GWP data published for 20- and 100-year time horizons (IPCC, 2013). Stakeholders may need to prepare to leave 80% of remaining global natural gas reserves untouched in a best-case scenario, and all reserves untouched in a worst-case scenario where even current, ongoing CH_4 leakage may present a challenge to limiting warming to 2°C from 2010 to 2050. See Supplementary Materials for details.

Hendrick, M. F., Cleveland, S. & Phillips, N. G. Unleakable carbon. Clim. Policy 17, 1057–1064 (2017).

Francesco Facchinelli francesco.facchinelli@unipd.it

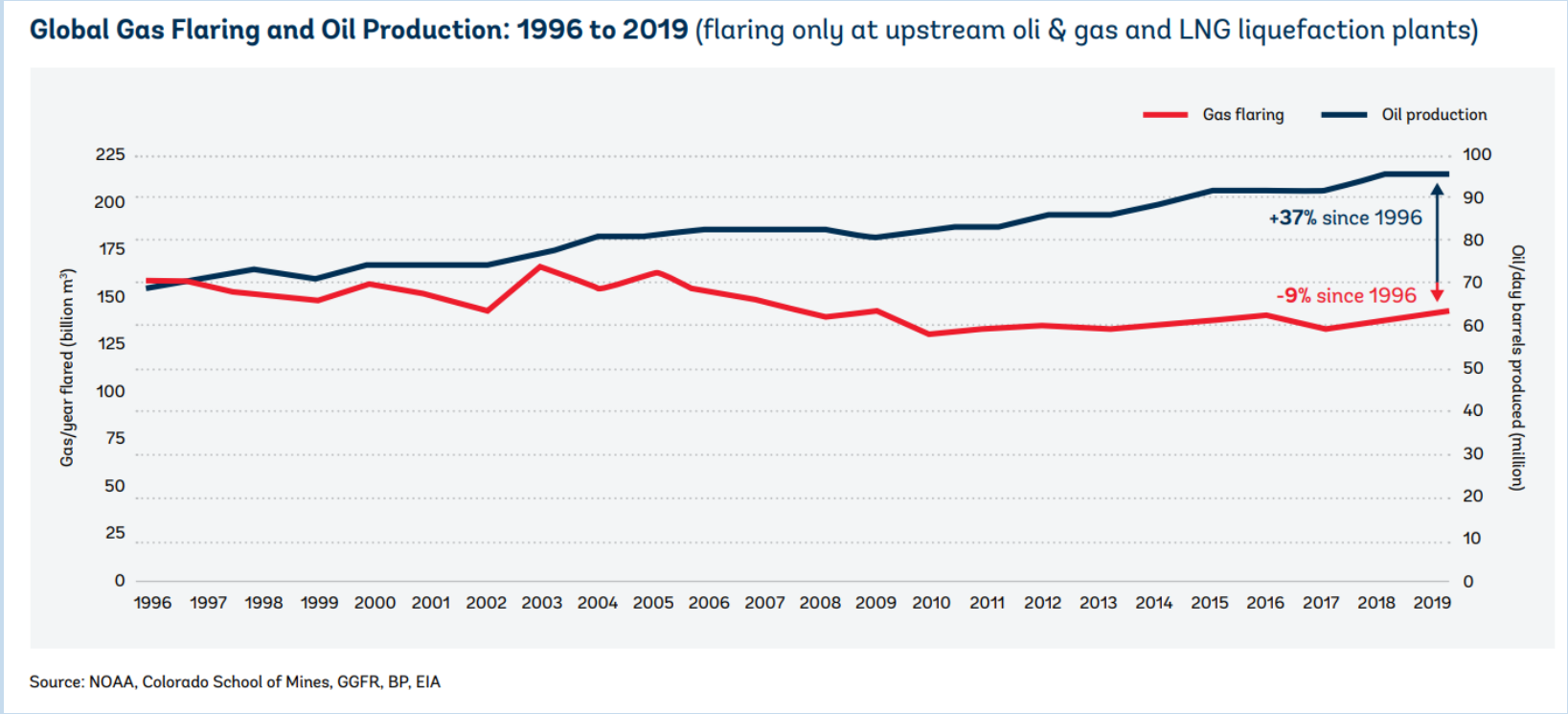
Gas flaring: “mecheros petroleros”



Francesco Facchinelli francesco.facchinelli@unipd.it

Gas flaring in the world

- Estimated emission of 300Mt of CO2 and of 320Gt of black carbon, representing respectively the 1% and the 4% global anthropogenic emissions
- In 2019 were flared about 150 BCM of gas, enough to provide energy to the whole Sub Saharan Africa



Hendrick, M. F., Cleveland, S. & Phillips, N. G. Unleakable carbon. Clim. Policy 17, 1057–1064 (2017).

Francesco Facchinelli francesco.facchinelli@unipd.it

Local impacts of gas flaring

- Emission in the atmosphere of over 150 toxic substances includng H2S, SO2, NOx, VOC, PAH and black carbon
- Impacts on human health
- Acid rains
- Heat Island, which causes the alteration of the microclimate depending on the flame distance
- Alteration of phenological stages of vegetation ad reduction of biomass
- Alteration of biogeochemical cycles of the soil and damages to microfauna

Via Auca (RAE, Ecuador)

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

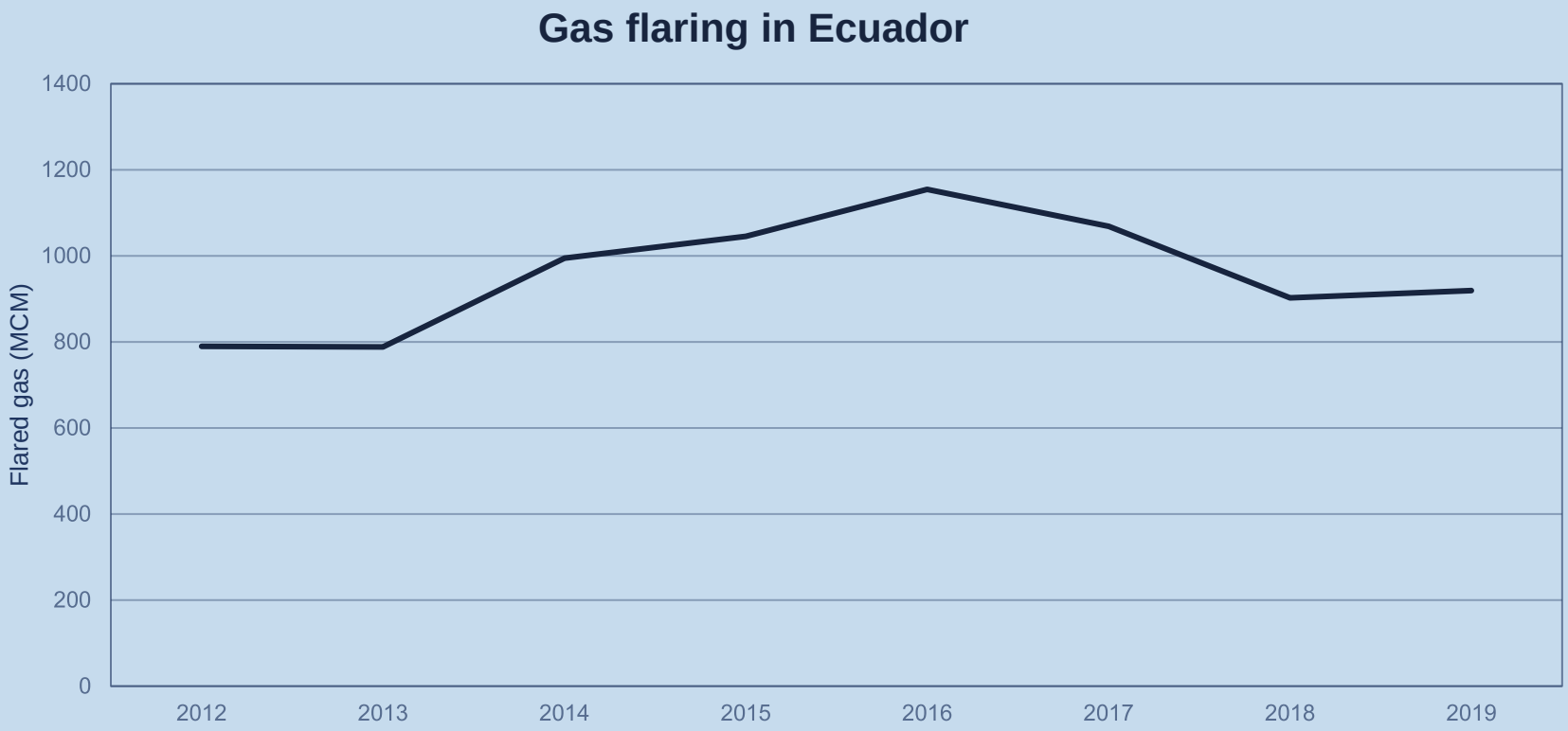
800 1222·2022 ANNI
Università degli Studi di Padova

ICEA

With the support of the Erasmus+ Programme of the European Union

Gas flaring in Ecuador

- 1 BCM yr-1 of gas burned out of a global total of 150 BCM
- 8% of the National Contribution determined by Ecuador during the Paris Climate Agreement.



Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

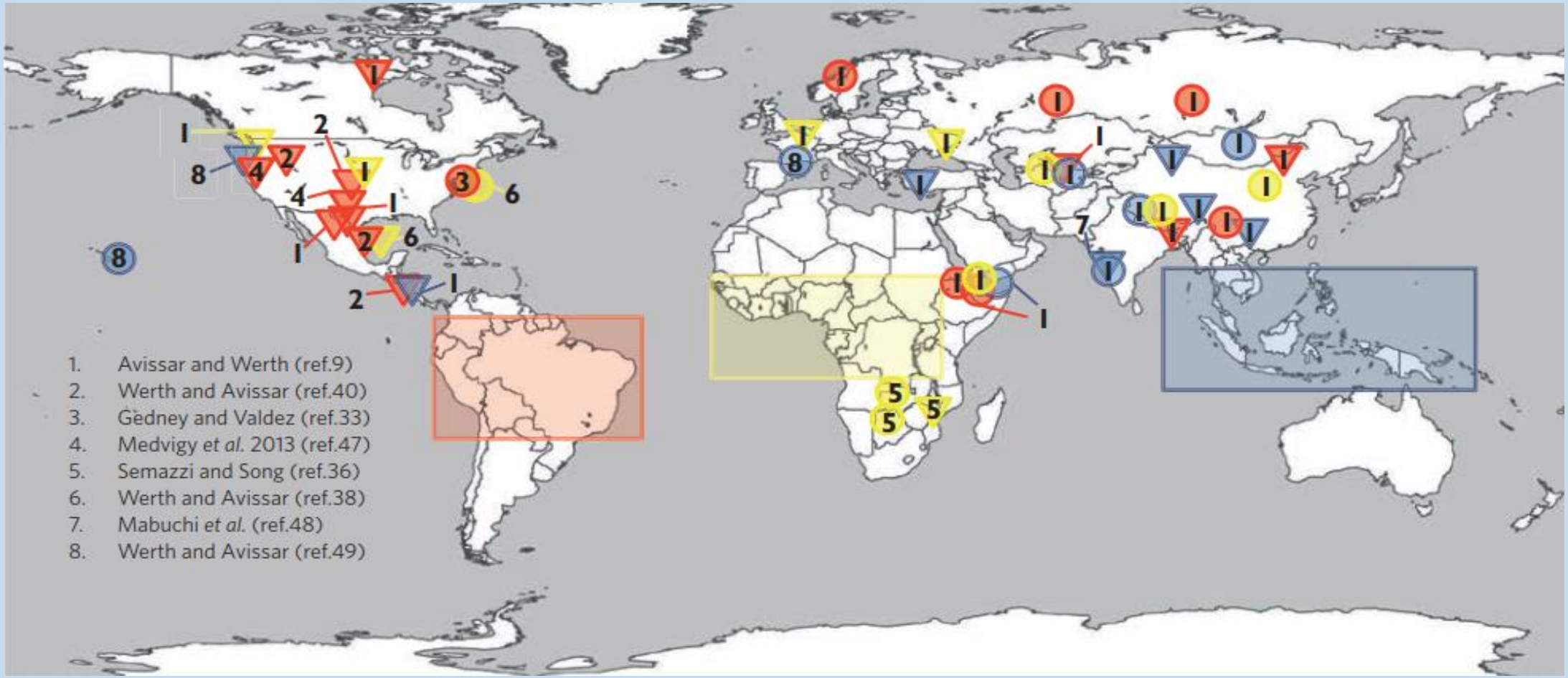
1222·2022 800 ANNI

Università degli Studi di Padova

ICEA

With the support of the
Erasmus+ Programme
of the European Union

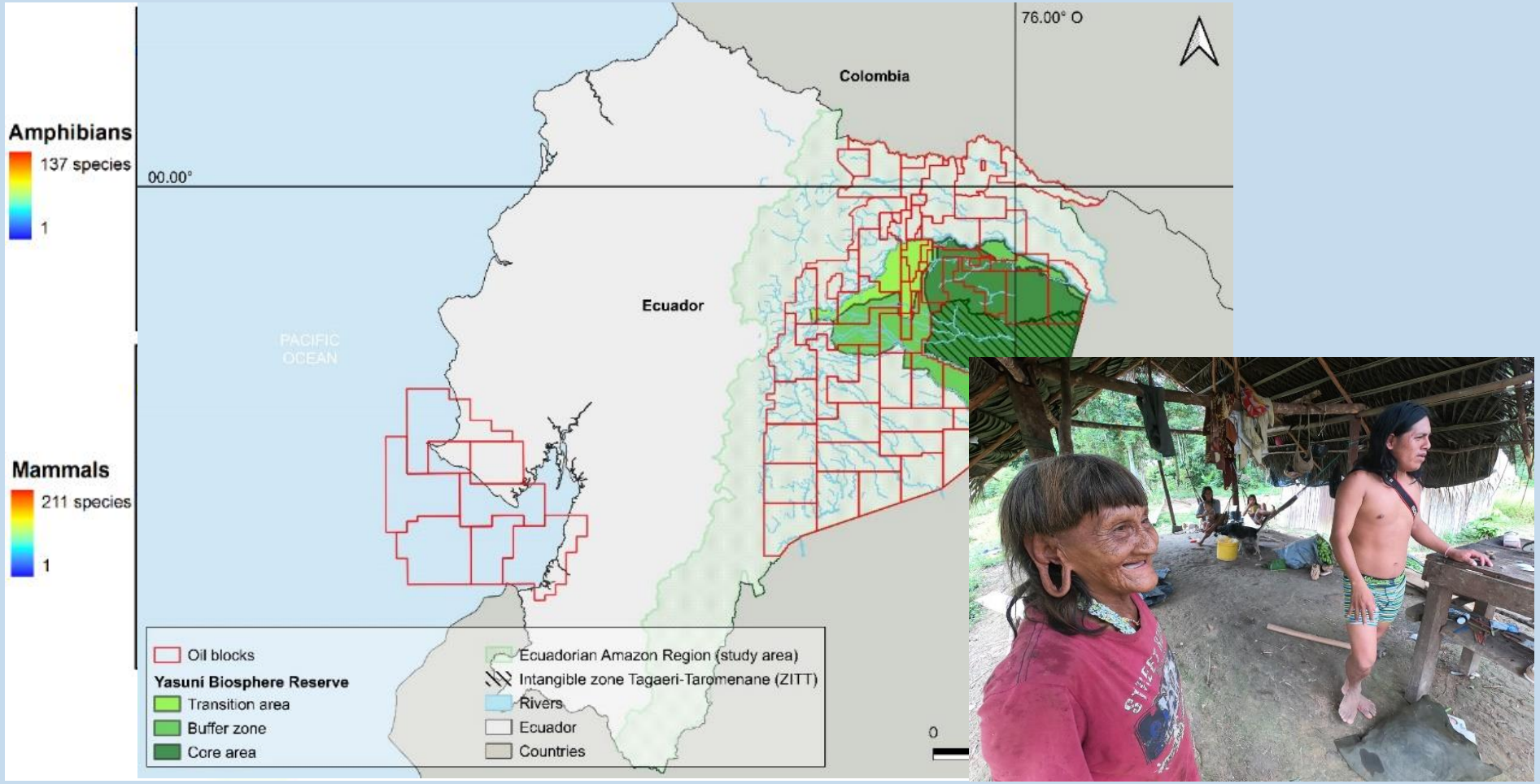
Global importance of the Amazon …



Lawrence, D., Vandecar, K. Effects of tropical deforestation on climate and agriculture. Nature Clim Change 5, 27–36 (2015). https://doi.org/10.1038/nclimate2430

Francesco Facchinelli francesco.facchinelli@unipd.it

Geographical Framework: the Ecuadorian Amazon Region



Francesco Facchinelli francesco.facchinelli@unipd.it

Involved Organizations

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

800 1222·2022 ANNI
Università degli Studi di Padova

ICEA

With the support of the
Erasmus+ Programme
of the European Union

Participatory framework

CBPAR

- Equal relations
- Involvement in all the phases of the project
- Common goal of a social change

PGIS

GIS-based participatory approach which directly aims to the empowerment of local communities

Extreme Citizen Science

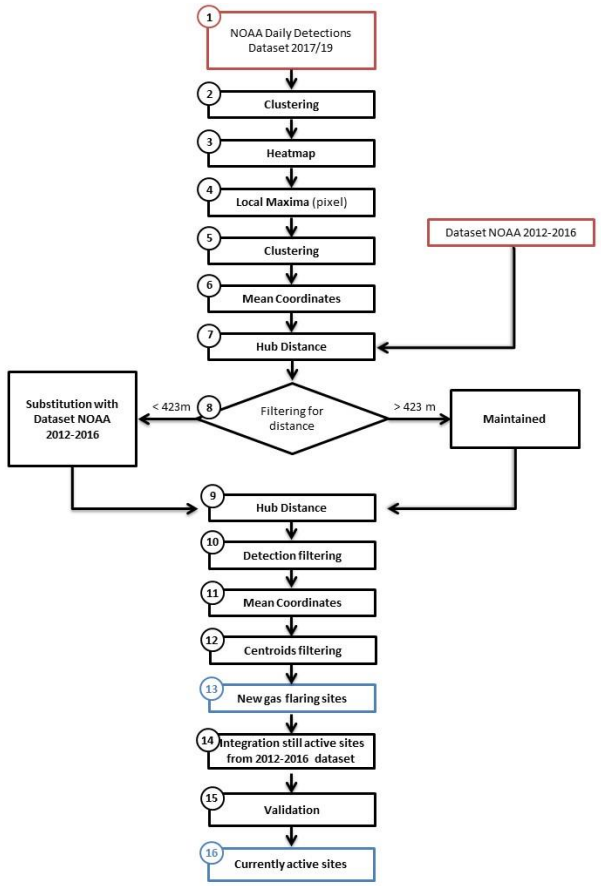
Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

800 1222·2022 ANNI
Università degli Studi di Padova

ICEA

With the support of the
Erasmus+ Programme
of the European Union



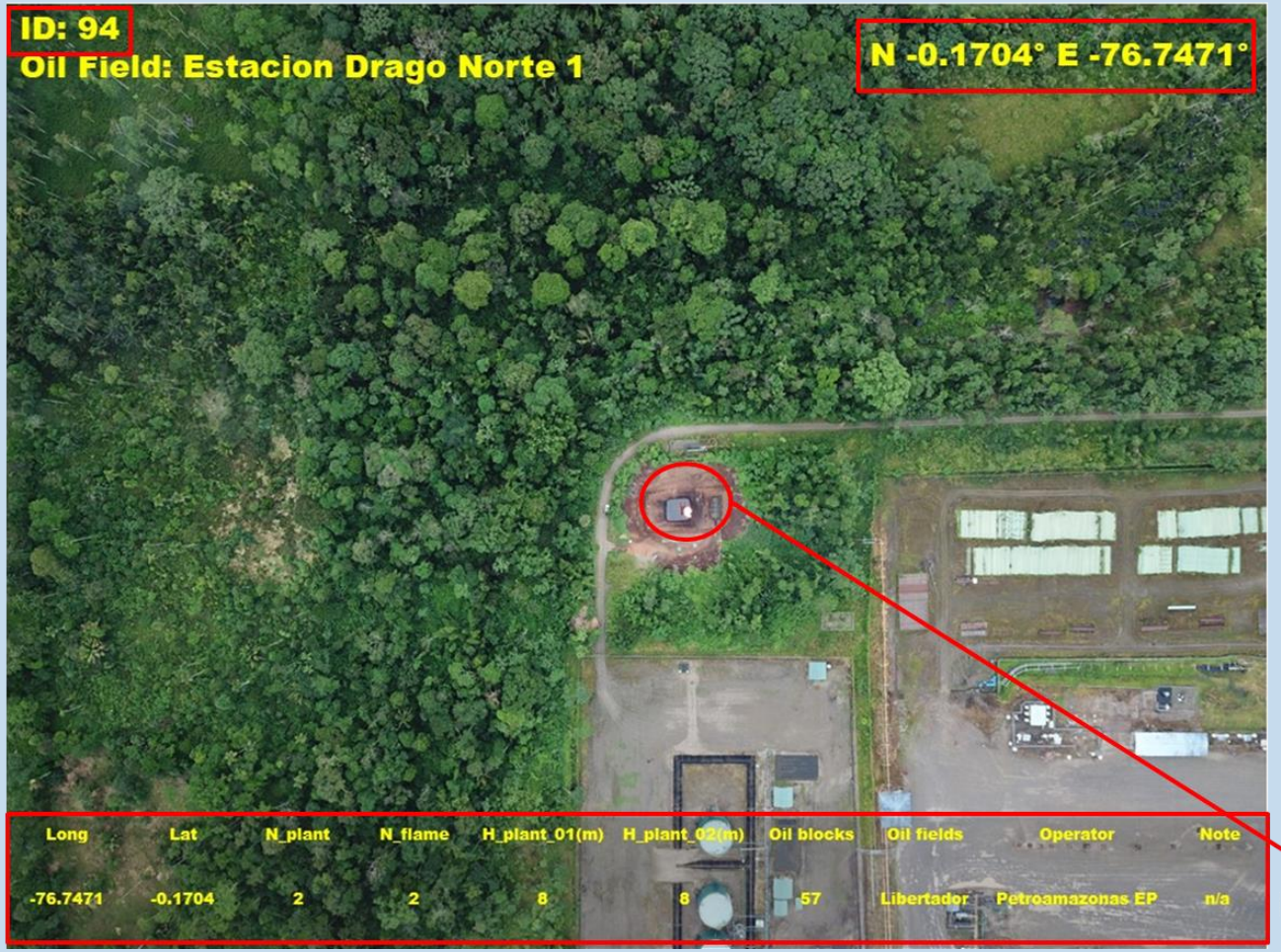
Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

800 1222·2022 ANNI
Università degli Studi di Padova
ICEA

With the support of the Erasmus+ Programme of the European Union

Data aquisition system



Spatial data

Photo

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

800 1222·2022 ANNI
Università degli Studi di Padova

ICEA

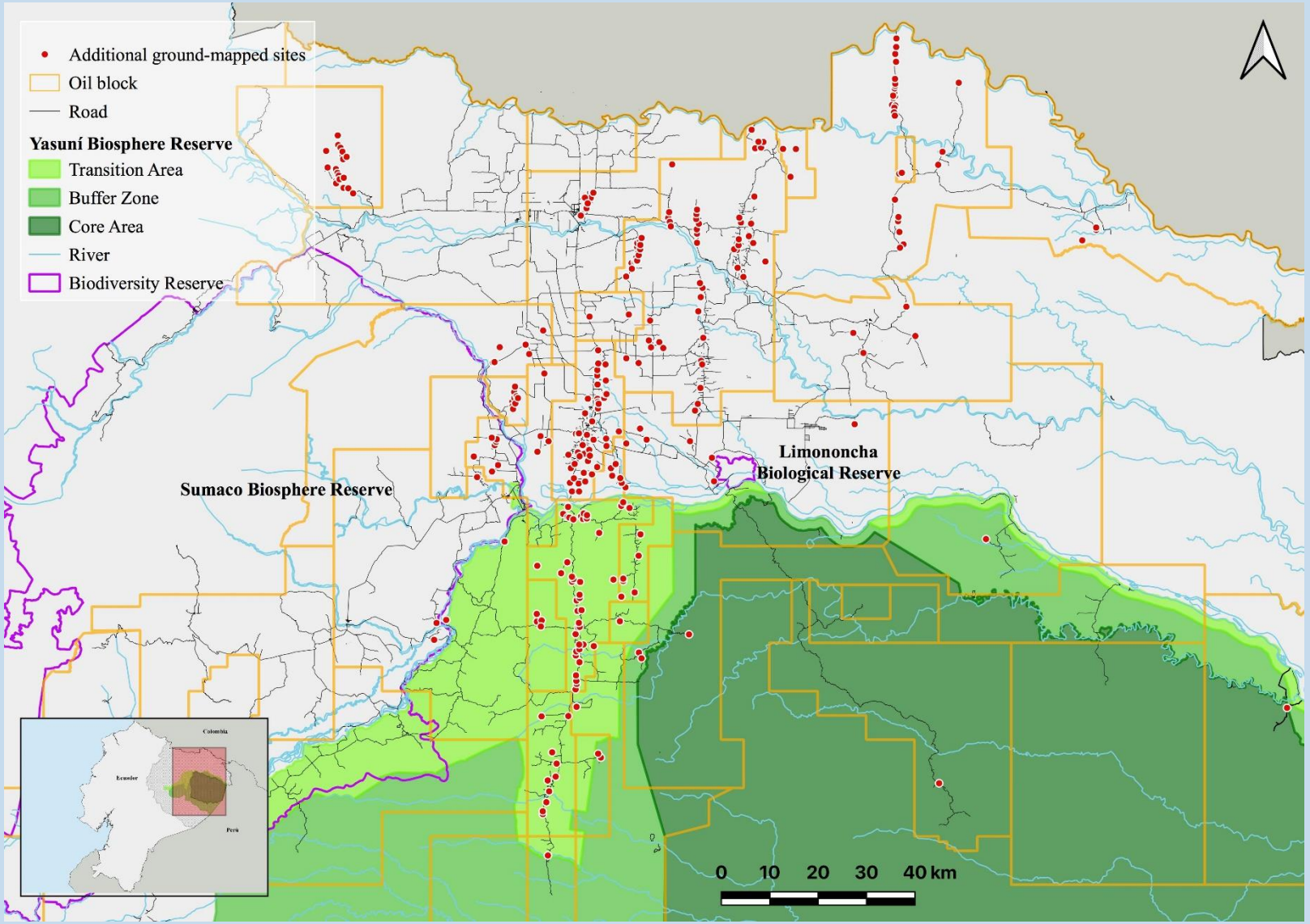
With the support of the Erasmus+ Programme of the European Union

Mapping from below and knowledge transfer

Francesco Facchinelli francesco.facchinelli@unipd.it

With the support of the
Erasmus+ Programme
of the European Union

Participatory mapping



Climate Justice
Jean Monnet
Centre of Excellence

800 1222·2022 ANNI
Università degli Studi di Padova

ICEA

With the support of the
Erasmus+ Programme
of the European Union

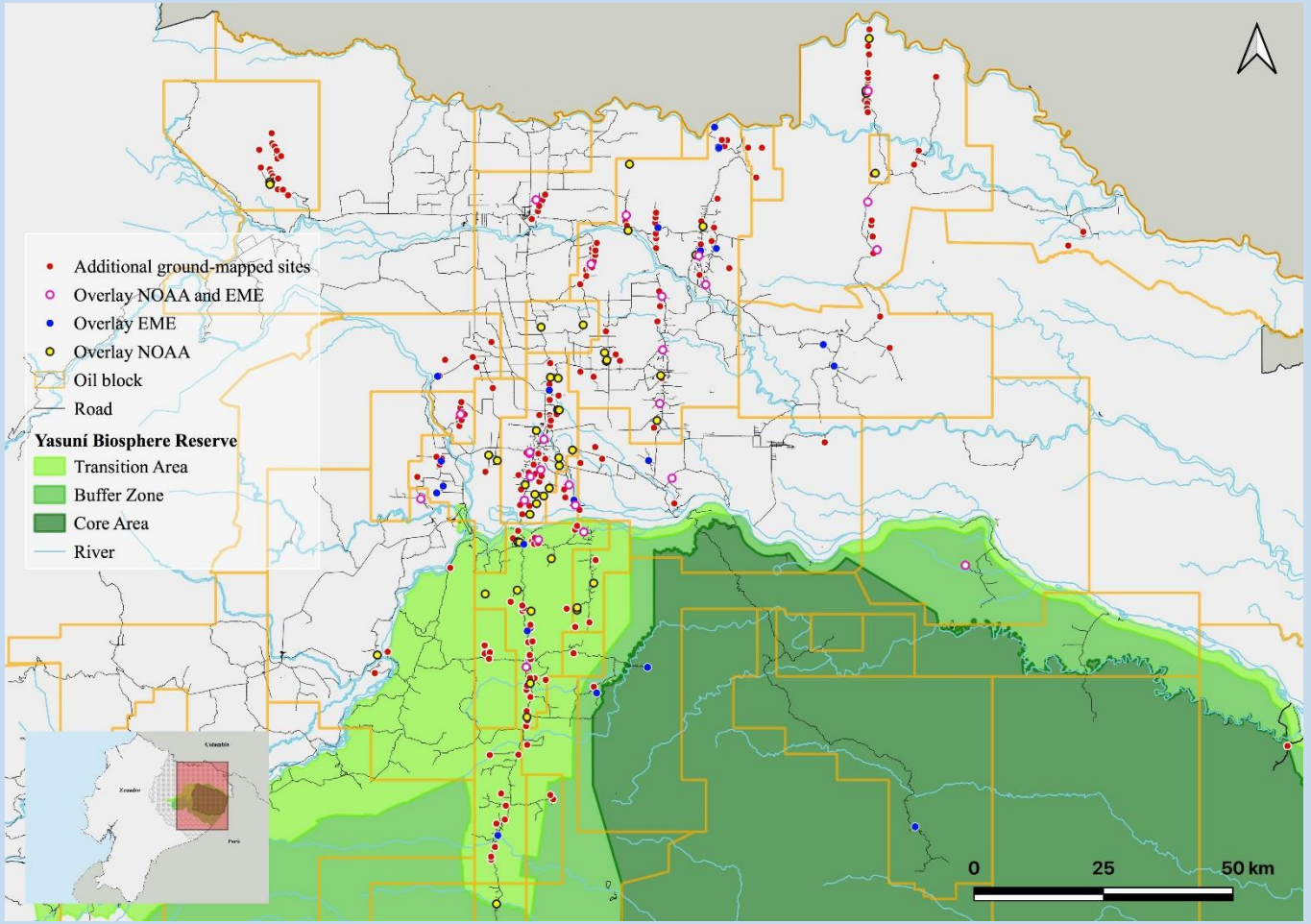
Participatory Mapping

	Sites	Stacks	Active stacks
Study area	305	448	325
Sucumbíos Province	141	211	143
Orellana Province	159	232	179
Napo Province	2	2	2
Pastaza Province	3	3	1

Yasuní Biosphere Reserve (UNESCO)

	Sites	Stacks	Active stacks
YBR - Total	76	104	70
YBR – Core area	4	4	4
YBR – Buffer Zone	5	5	4
YBR - Transition	67	95	62

Near real time monitoring and identification of new flares



200 more than satellite
125 more than MAE

Facchinelli, F.; Pappalardo, S.E.; Codato, D.; Diantini, A.; Della Fera, G.; Crescini, E.; De Marchi, M. Unburnable and Unleakable Carbon in Western Amazon: Using VIIRS Nightfire Data to Map Gas Flaring and Policy Compliance in the Yasuní Biosphere Reserve. Sustainability 2020, 12, 58.

Francesco Facchinelli francesco.facchinelli@unipd.it

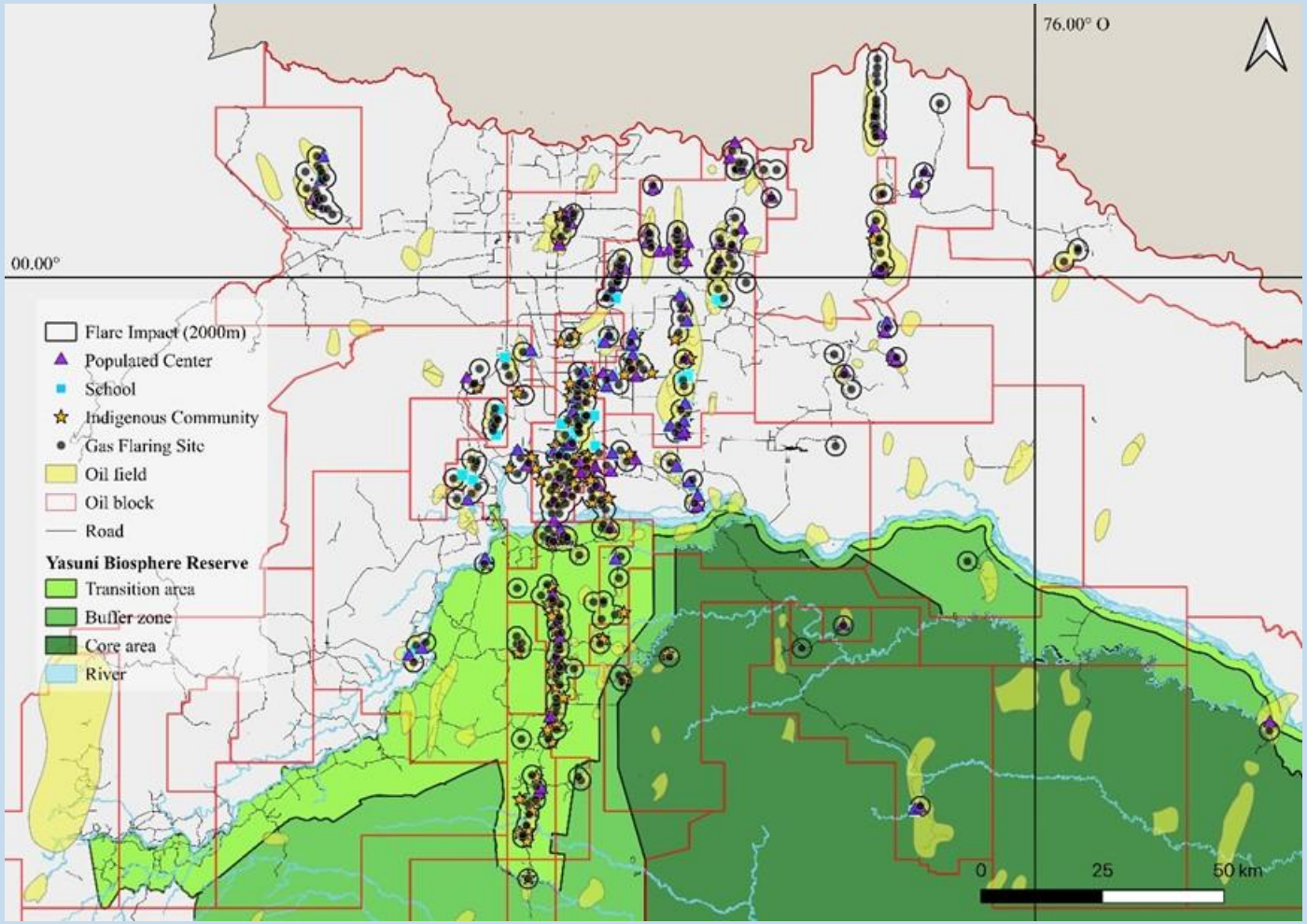
Climate Justice
Jean Monnet
Centre of Excellence

1222·2022 800 ANNI
Università degli Studi di Padova

ICEA

With the support of the Erasmus+ Programme of the European Union

Identification of threatened communities



86 indigenous communities
62 schools

Facchinelli, F.; Pappalardo, S.E.; Codato, D.; Diantini, A.; Della Fera, G.; Crescini, E.; De Marchi, M. Unburnable and Unleakable Carbon in Western Amazon: Using VIIRS Nightfire Data to Map Gas Flaring and Policy Compliance in the Yasuní Biosphere Reserve. Sustainability 2020, 12, 58.

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

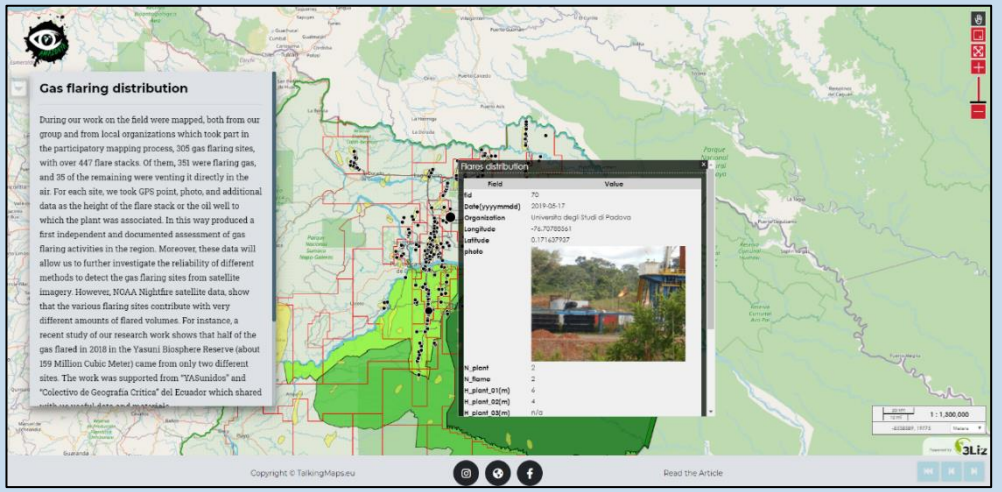
800 1222·2022 ANNI
Università degli Studi di Padova

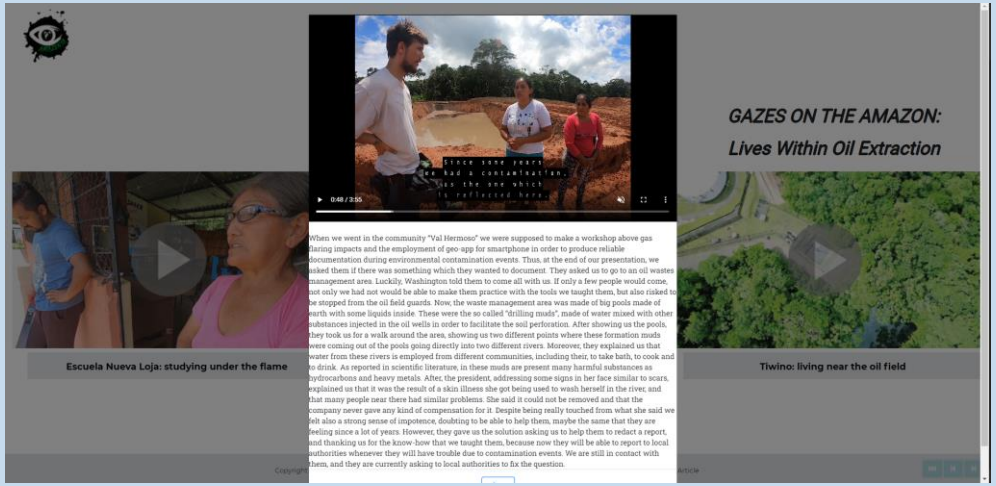
ICEA

With the support of the Erasmus+ Programme of the European Union

Additional Impacts

Outcomes





https://www.climate-justice.earth/amazonya/index.html

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

1222·2022 800 ANNI
Università degli Studi di Padova

ICEA

With the support of the
Erasmus+ Programme
of the European Union

Outcomes

Documento de relación sobre el mapeo de los mecheros

en la Región Amazónica de Ecuador

Autores: Francesco Facchinelli[1], Eugenio Pappalardo[2], Edoardo Crescini[1], Giuseppe Della Fera[2], Alberto Diantini[3], Daniele Codato[2], Massimo De Marchi[2]

[1] Dipartimento Interateneo di Scienze, Progetto e Politiche Del Territorio (DIST), University of Turin, Viale Pier Andrea Mattioli, 39, 10125 Torino;
[2] Dipartimento di Ingegneria Civile Edile e Ambientale, Università di Padova, Via Marzolo n. 9, Padova, Italia;
[3] Dipartimento di Scienze Storiche, Geografiche e dell'Antichita', Università di Padova, Via del Santo n. 26, Padova, Italia; alberto.diantini@unipd.it

Para obtener una estima independente y actualizada de los mecheros en el área de estudio se empezó un trabajo de mapeo de largo plazo entre los años 2018 y 2019. Este trabajo fue realizado con la colaboración de la Unión de los Afectados para Texaco (UDAPT), el Colectivo de Geografía Critica, la Fundación Alejandro Labaka y el proyecto AMAZONYA bajo la supervisión del equipo de investigación "Cambio climático, territorios y diversidades" de la Universidad de los Estudios de Padova, que también se encargó de verificar la integridad y de la elaboración de los datos. Para cada sitio donde había quema de gas se tomaron punto GPS, fotos y se documentó el número de mecheros presentes y su estado de actividad con el fin de clasificar y monitorear las actividades. Los mecheros se presentan com llamas o sin llamas. En algunos sitios se encontraron mecheros sin llama que emitían directamente gases en el aire. Este tipo de practica es llamado en el marco internacional "gas venting" y tiene consecuencias para la salud y el medio ambiente probablemente peores de la quema de gas. Es importante también notar que los presentes datos no pretenden representar una evaluación exhaustiva de todos los mecheros de la Amazonia Ecuadoriana, cuanto establecer una base para permitir de comprender cuanto el fenómeno está ampliamente difundido y evidenciar la necesidad de estructurar un mapeo y monitoreo desde abajo, de forma permanente.

La dinámica de quema de gas en los mecheros es variable y discontinua. En algunos sitios, efectuando el control en diferentes momentos, se constató que algunos mecheros que en inicialmente estaban apagados, después estaban aprendido, evidenciando la natura transitoria de la presencia de la llama, que puede depender por la actividad del pozo o de la presencia de manutención regular por parte la compañía. Por esto se reportaron también las torres sin llama.

En total, se mapearon un total de 305 sitios/plataformas con mecheros, entre los cuales 447 mecheros de los que 351 estaban encendidos, es decir que tenían llama, de las que no tenían llama, 35 estaban emitiendo gas al momento del control.

Francesco Facchinelli francesco.facchinelli@unipd.it

Climate Justice
Jean Monnet
Centre of Excellence

800 1222·2022 ANNI
Università degli Studi di Padova

ICEA

With the support of the Erasmus+ Programme of the European Union

Involvement of local NGOs increased the quality of the project (Balazs and Morello-Frosch, 2013)

- Rigor -> increasing in the study area
- Relevance -> inclusion of sites not “seen” from satellite
- Reach -> employment of the data for social changing

Value of the knowledge of local communities

Considerations

Data alone cannot change politics, but can be an important means to formalize the instances of local communities

Potential of Extreme Citizen Science toward the achievement of climate justice

Francesco Facchinelli francesco.facchinelli@unipd.it

With the support of the Erasmus+ Programme of the European Union

Thank you for your attention!

Francesco Facchinelli francesco.facchinelli@unipd.it