Food and Agriculture Organization of the United Nations

GLOBAL SYMPOSIUM ON
SOIL INFORMATION AND DATA

MEASURE
MONITOR
MANAGE

NATIONAL ATLAS OF MEXICO 2022

THE ANTHROPOGENIC IMPACT ON THE SOIL

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September 25-28, 2024
Nanjing, China

GLOBAL SOIL PARTNERSHIP

HUMANITY'S CRITICAL PROBLEMS

- Exponential population growth
- Consumptions patterns

LEAD TO OTHER BIG PROBLEM

Ever-increasing soil degradation in pursuit of progress

SOIL CHANGES ON MEXICO 2000-2022

5 Mha deforested soils

0.8 Mha recent sealing or hypersalinity

2.1 Mha new accelerated soil erosion

GLOBAL SOIL PARTNERSHIP

What can we still recover?

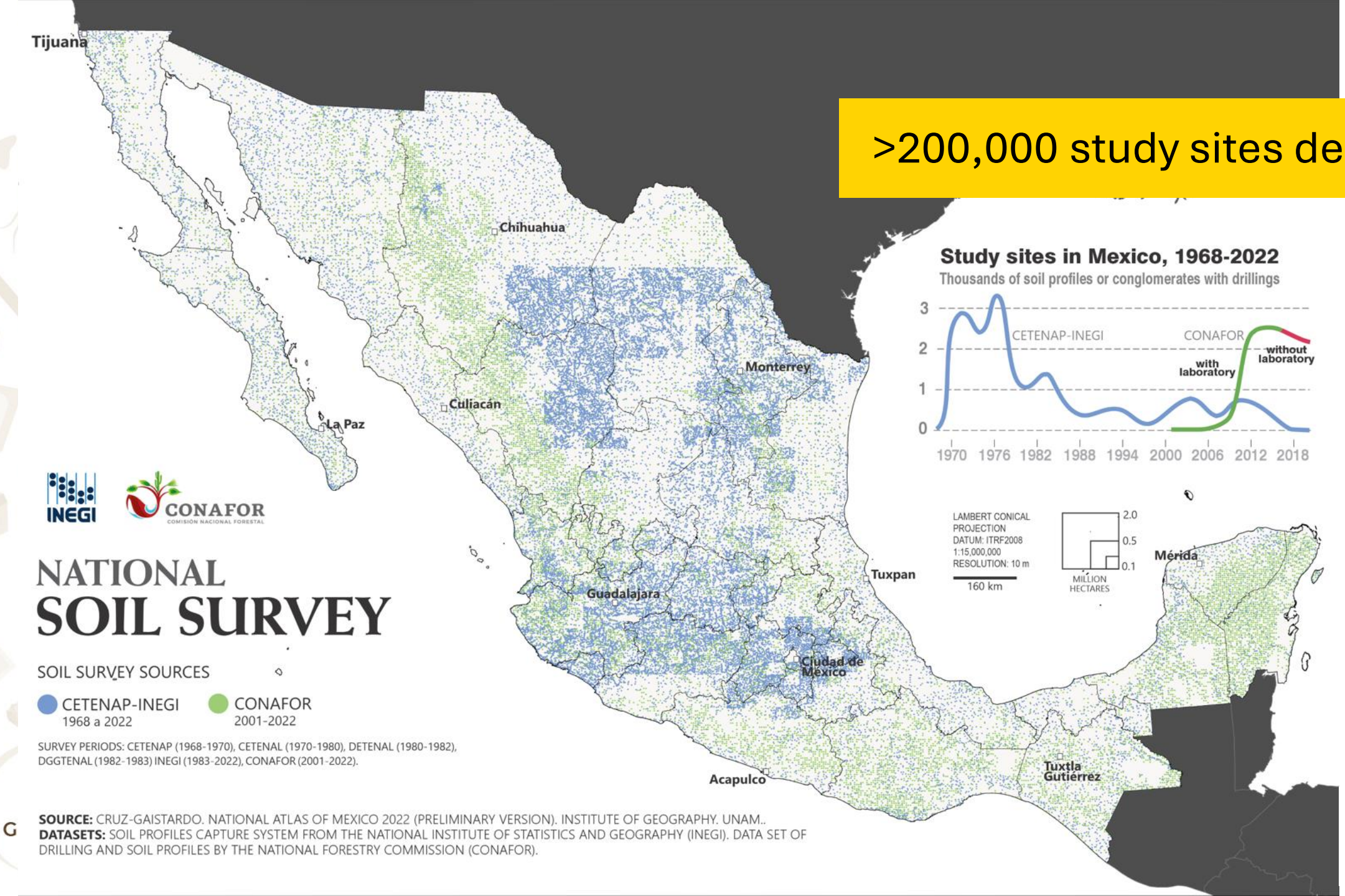
The **National Atlas of Mexico** data and information aims to support public policies and community activities focused on reducing or reversing soil degradation.

IG INSTITUTO DE GEOGRAFÍA U N A M

SHOMS
Soil Health Information and Monitoring System

GLOBAL SOIL PARTNERSHIP

>200,000 study sites depurated



SOURCE: CRUZ-GAISTARDO. NATIONAL ATLAS OF MEXICO 2022 (PRELIMINARY VERSION). INSTITUTE OF GEOGRAPHY. UNAM..
DATASETS: SOIL PROFILES CAPTURE SYSTEM FROM THE NATIONAL INSTITUTE OF STATISTICS AND GEOGRAPHY (INEGI). DATA SET OF DRILLING AND SOIL PROFILES BY THE NATIONAL FORESTRY COMMISSION (CONAFOR).

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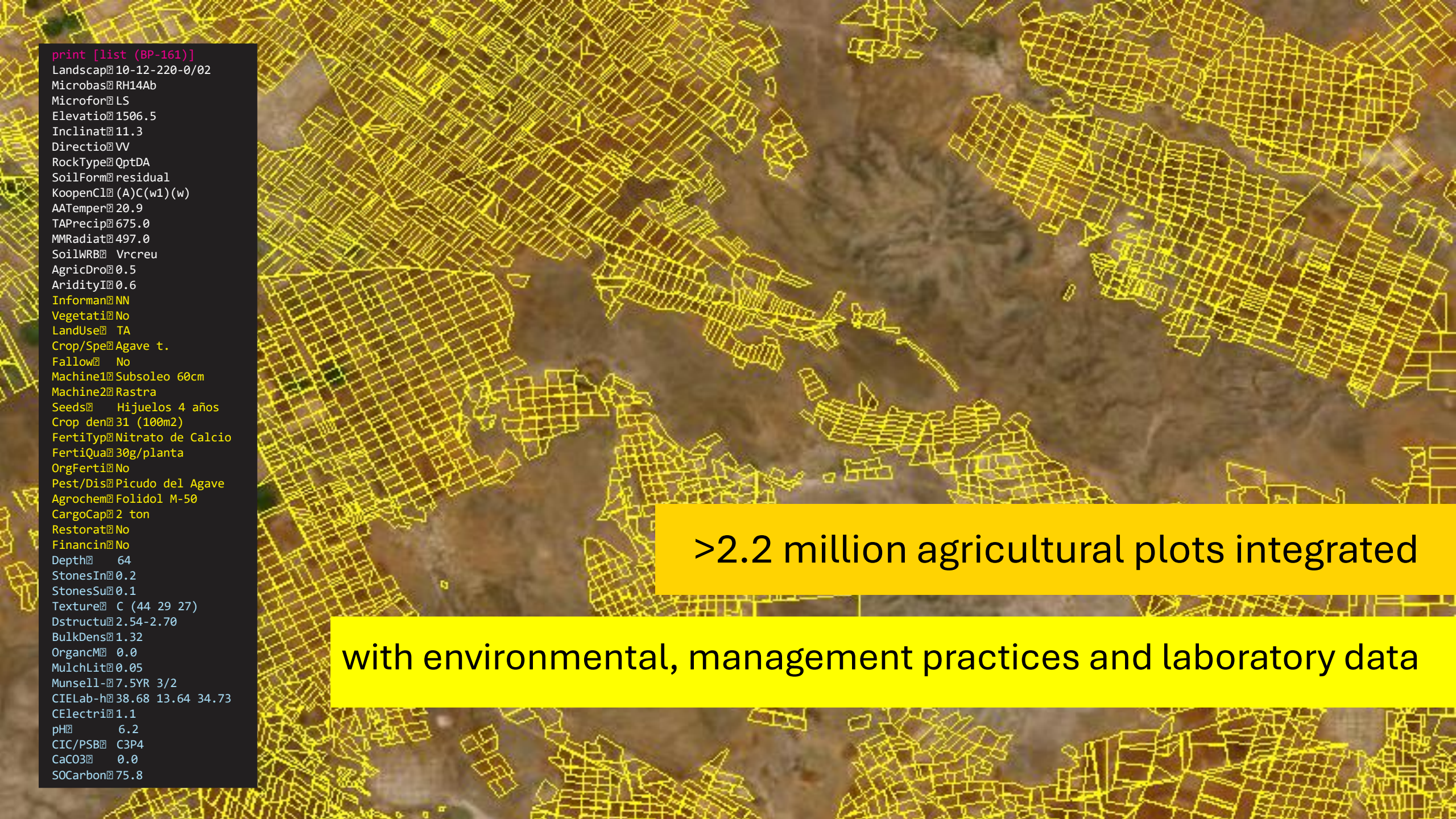
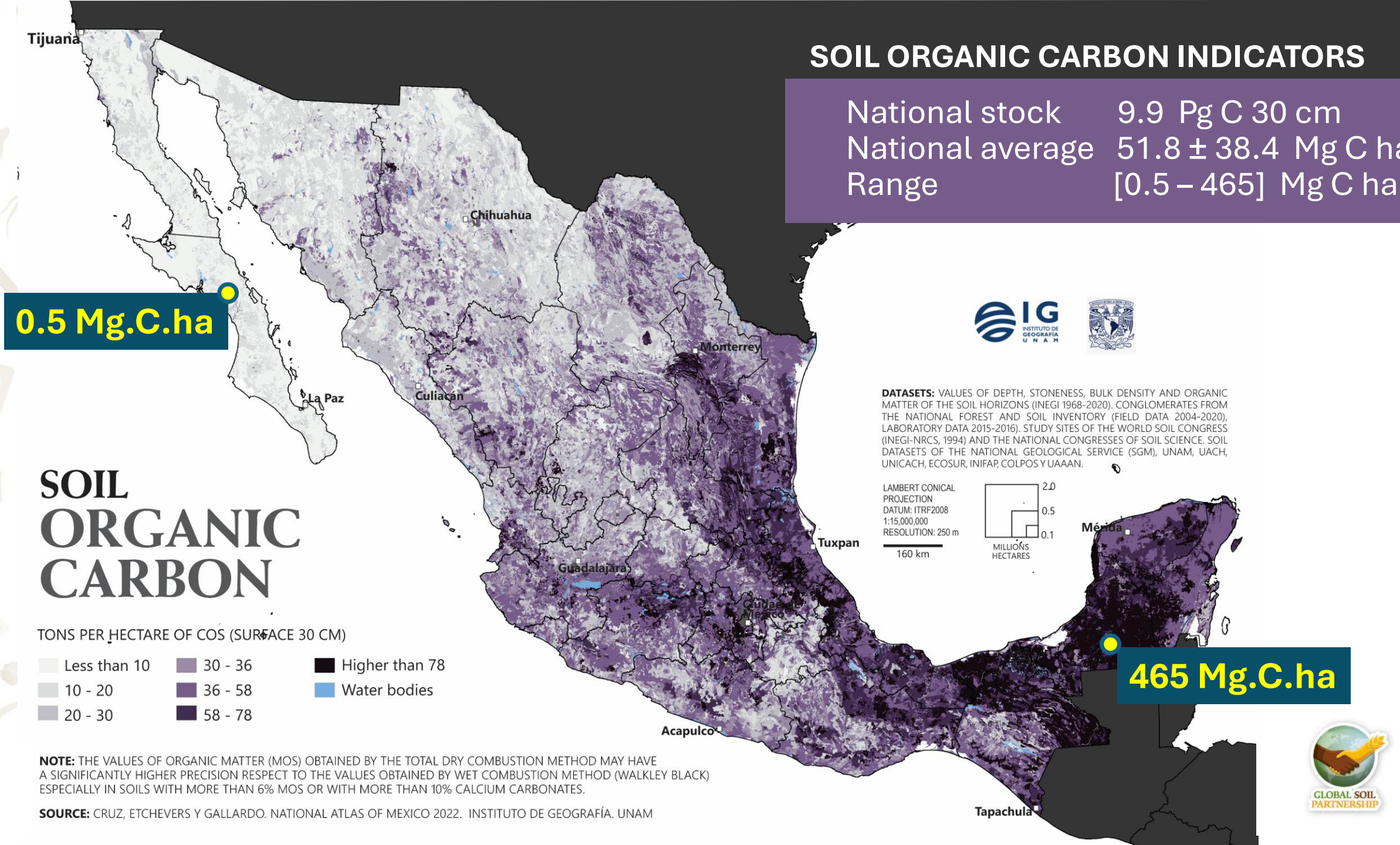
GLOBAL SOIL PARTNERSHIP


print [list (BP-161)]
Landscap 10-12-220-0/02
Microbas RH14Ab
Microfor LS
Elevatio 1506.5
Inclinat 11.3
Directio VV
RockType QptDA
SoilForm residual
KoopenCl (A)C(w1)(w)
AATemper 20.9
TAPrecip 675.0
MMRadiat 497.0
SoilWRB Vrcreu
AgricDro 0.5
AridityI 0.6
Informan NN
Vegetati No
LandUse TA
Crop/Spe Agave t.
Fallow No
Machine1 Subsoleo 60cm
Machine2 Rastra
Seeds Hijuelos 4 años
Crop den 31 (100m2)
FertiTyp Nitrato de Calcio
FertiQua 30g/planta
OrgFerti No
Pest/Dis Picudo del Agave
Agrochem Folidol M-50
CargoCap 2 ton
Restorat No
Financin No
Depth 64
StonesIn 0.2
StonesSu 0.1
Texture C (44 29 27)
Dstructu 2.54-2.70
BulkDens 1.32
OrgancM 0.0
MulchLit 0.05
Munsell- 7.5YR 3/2
CIELab-h 38.68 13.64 34.73
CElectri 1.1
pH 6.2
CIC/PSB C3P4
CaCO3 0.0
SOCarbon 75.8
>2.2 million agricultural plots integrated
with environmental, management practices and laboratory data

SOIL
BASELINES

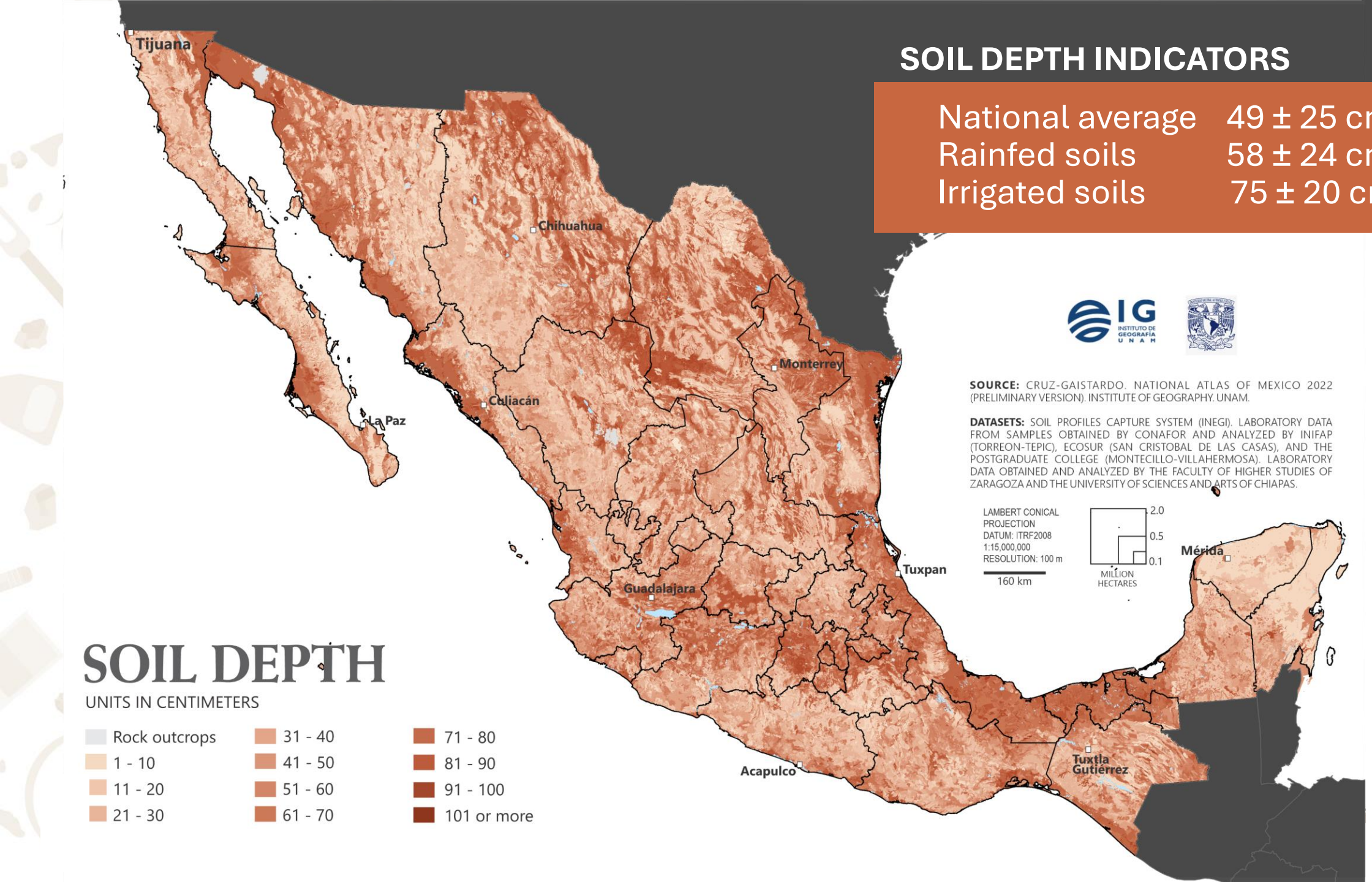
SOIL ORGANIC CARBON INDICATORS

National stock	9.9 Pg C 30 cm
National average	51.8 ± 38.4 Mg C ha
Range	[0.5 – 465] Mg C ha



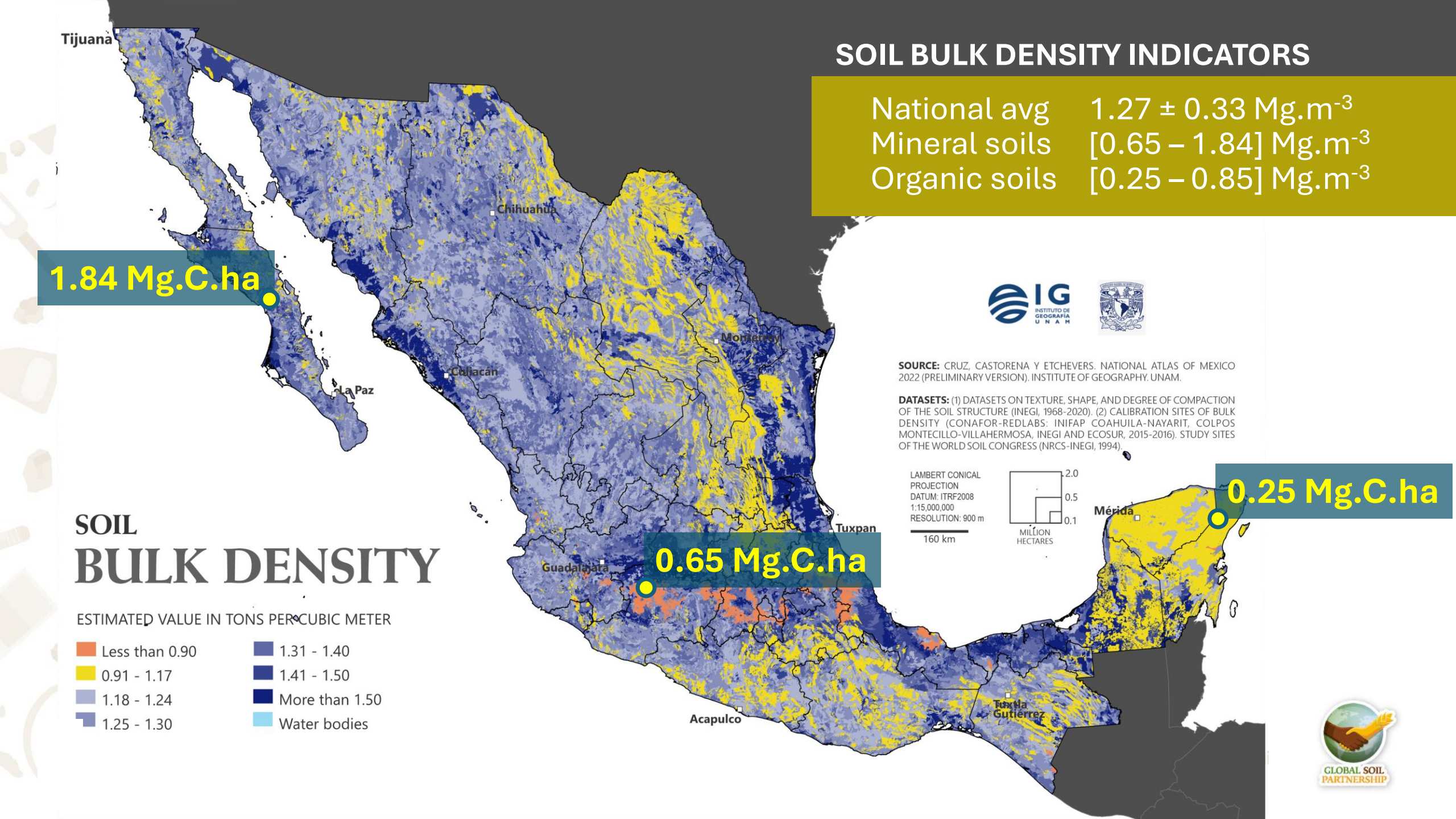
SOIL DEPTH INDICATORS

National average	49 ± 25 cm
Rainfed soils	58 ± 24 cm
Irrigated soils	75 ± 20 cm



SOIL BULK DENSITY INDICATORS

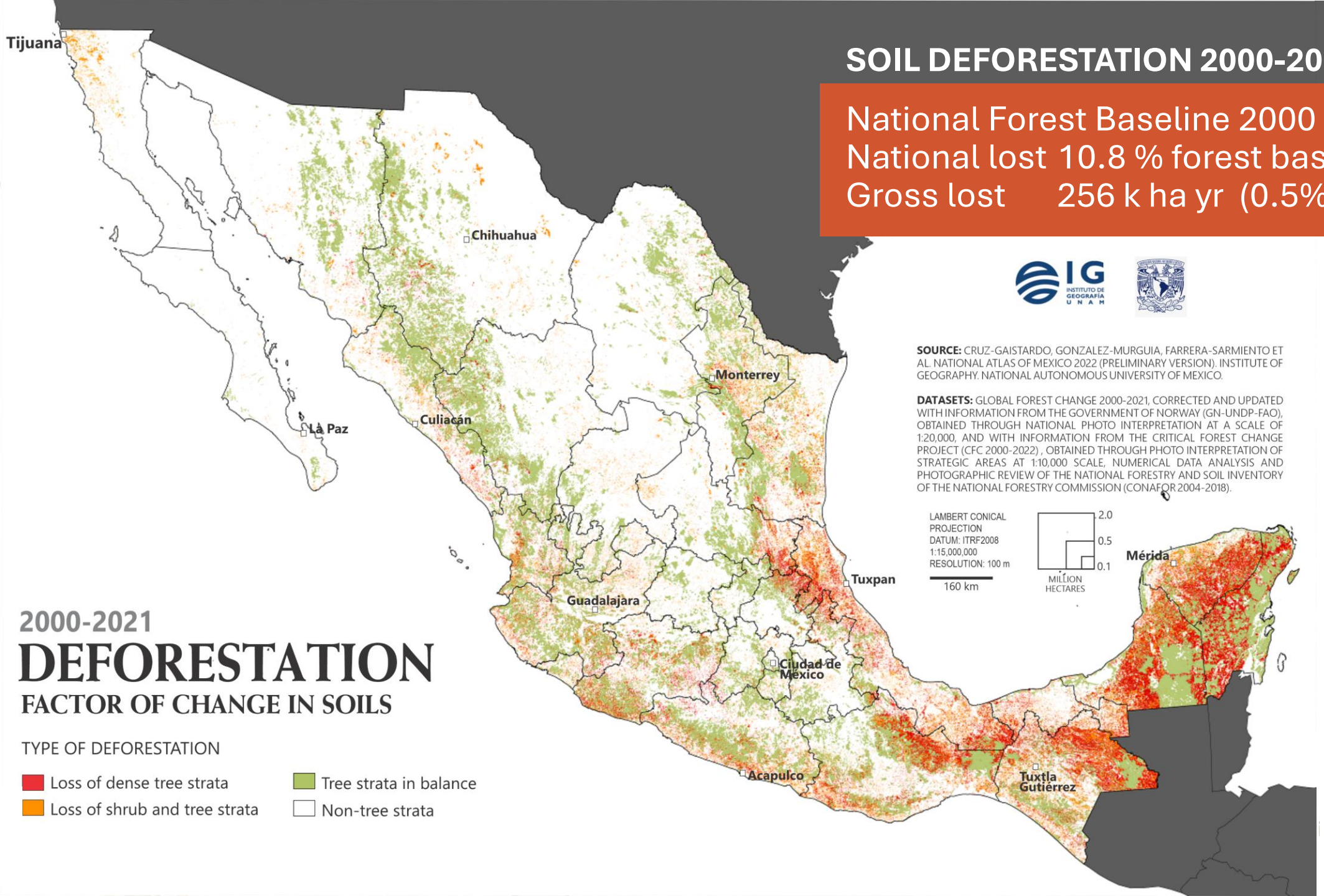
National avg	1.27 ± 0.33 $Mg.m^{-3}$
Mineral soils	[0.65 – 1.84] $Mg.m^{-3}$
Organic soils	[0.25 – 0.85] $Mg.m^{-3}$



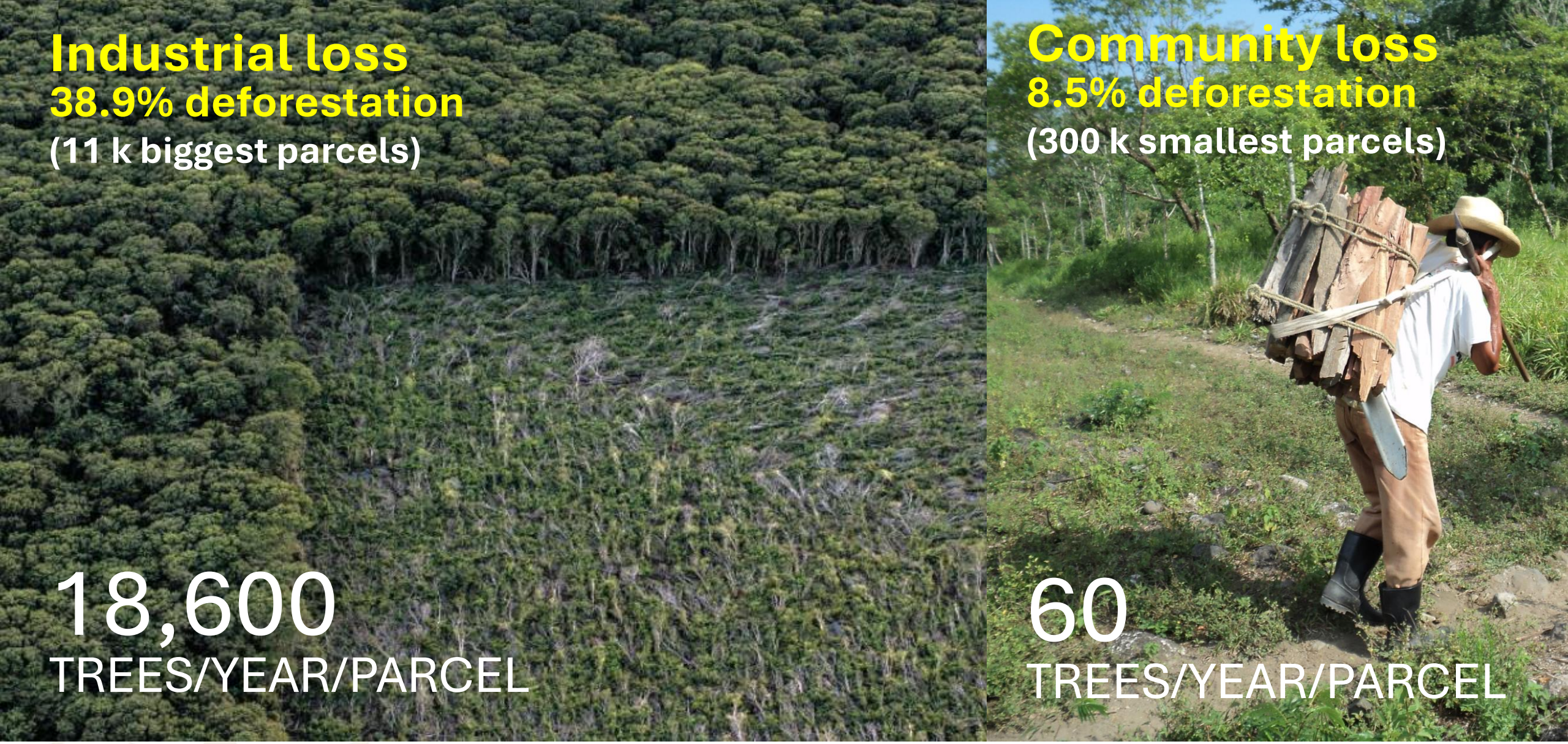
SOIL CHANGE FACTORS

SOIL DEFORESTATION 2000-2021

National Forest Baseline 2000 46.5 Mha
National lost 10.8 % forest baseline 2000
Gross lost 256 k ha yr (0.5% f-baseline)



GLOBAL SOIL PARTNERSHIP


Industrial loss
38.9% deforestation
(11 k biggest parcels)
18,600
TREES/YEAR/PARCEL
Community loss
8.5% deforestation
(300 k smallest parcels)
60
TREES/YEAR/PARCEL

0.0028% yr $^{-1}$ SOC National Stock

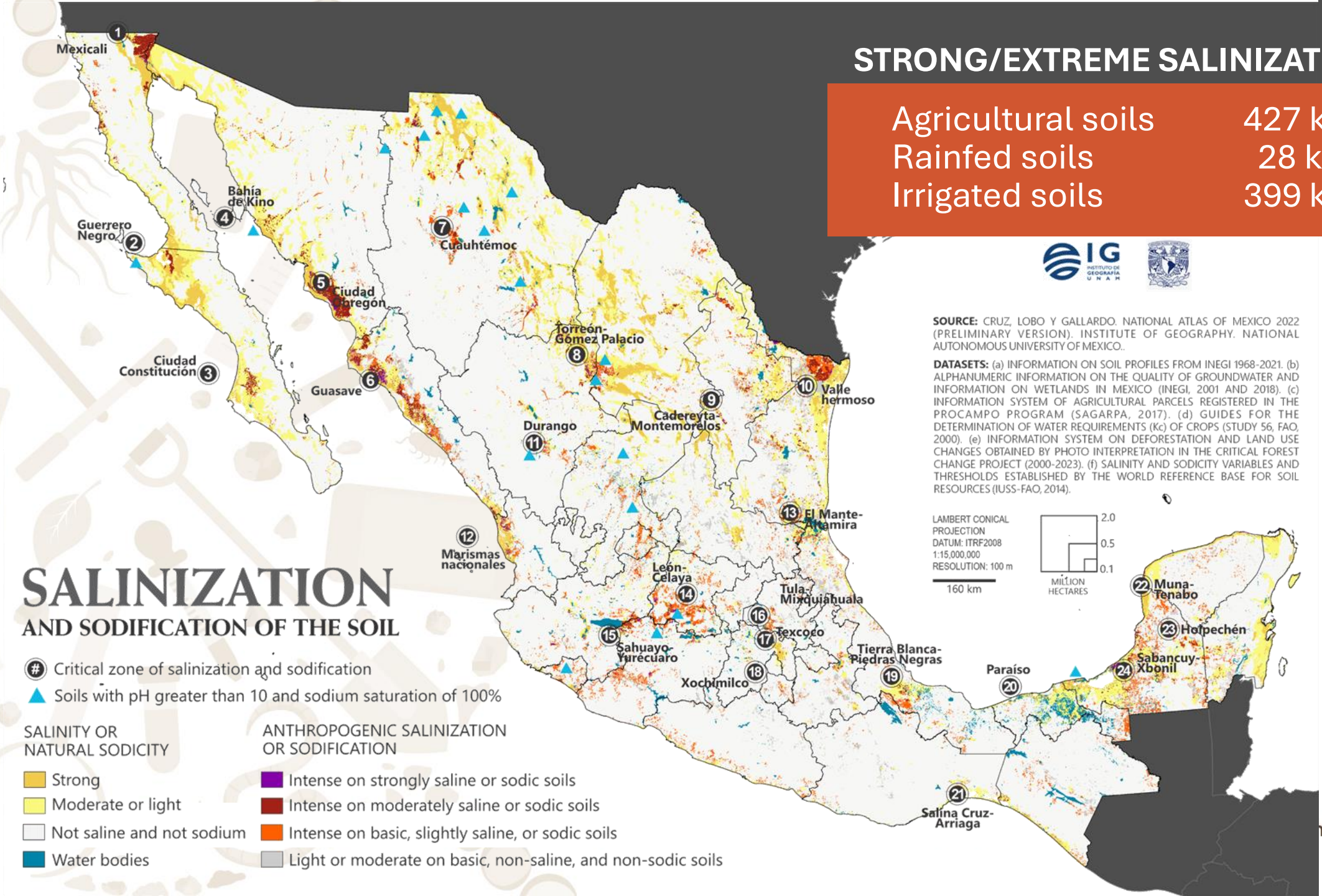
It is being lost only due to deforestation

GLOBAL SOIL PARTNERSHIP

SOIL
HUMAN IMPACTS

STRONG/EXTREME SALINIZATION

Agricultural soils	427 k ha
Rainfed soils	28 k ha
Irrigated soils	399 k ha (93.7%)



SALINIZATION
AND SODIFICATION OF THE SOIL

SOURCE: CRUZ, LOBO Y GALLARDO. NATIONAL ATLAS OF MEXICO 2022 (PRELIMINARY VERSION). INSTITUTE OF GEOGRAPHY. NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO..

DATASETS: (a) INFORMATION ON SOIL PROFILES FROM INEGI 1968-2021. (b) ALPHANUMERIC INFORMATION ON THE QUALITY OF GROUNDWATER AND INFORMATION ON WETLANDS IN MEXICO (INEGI, 2001 AND 2018). (c) INFORMATION SYSTEM OF AGRICULTURAL PARCELS REGISTERED IN THE PROCAMPO PROGRAM (SAGARPA, 2017). (d) GUIDES FOR THE DETERMINATION OF WATER REQUIREMENTS (Kc) OF CROPS (STUDY 56, FAO, 2000). (e) INFORMATION SYSTEM ON DEFORESTATION AND LAND USE CHANGES OBTAINED BY PHOTO INTERPRETATION IN THE CRITICAL FOREST CHANGE PROJECT (2000-2023). (f) SALINITY AND SODICITY VARIABLES AND THRESHOLDS ESTABLISHED BY THE WORLD REFERENCE BASE FOR SOIL RESOURCES (IUSS-FAO, 2014).

LAMBERT CONICAL PROJECTION
DATUM: ITRF2008
1:15,000,000
RESOLUTION: 100 m

160 km

2.0
0.5
0.1
MILLION HECTARES

(#) Critical zone of salinization and sodification

▲ Soils with pH greater than 10 and sodium saturation of 100%

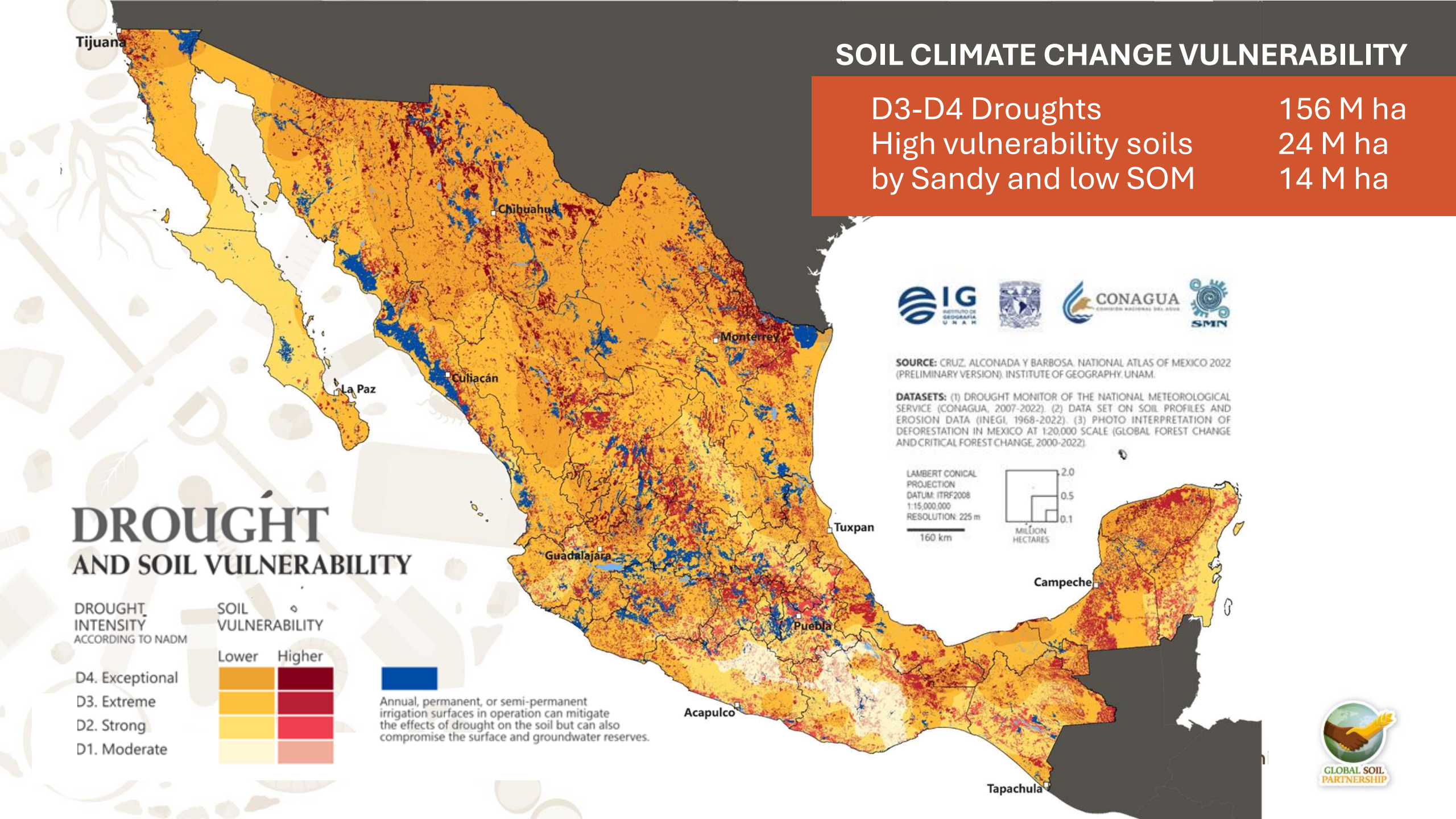
SALINITY OR NATURAL SODICITY

- Strong
- Moderate or light
- Not saline and not sodium
- Water bodies

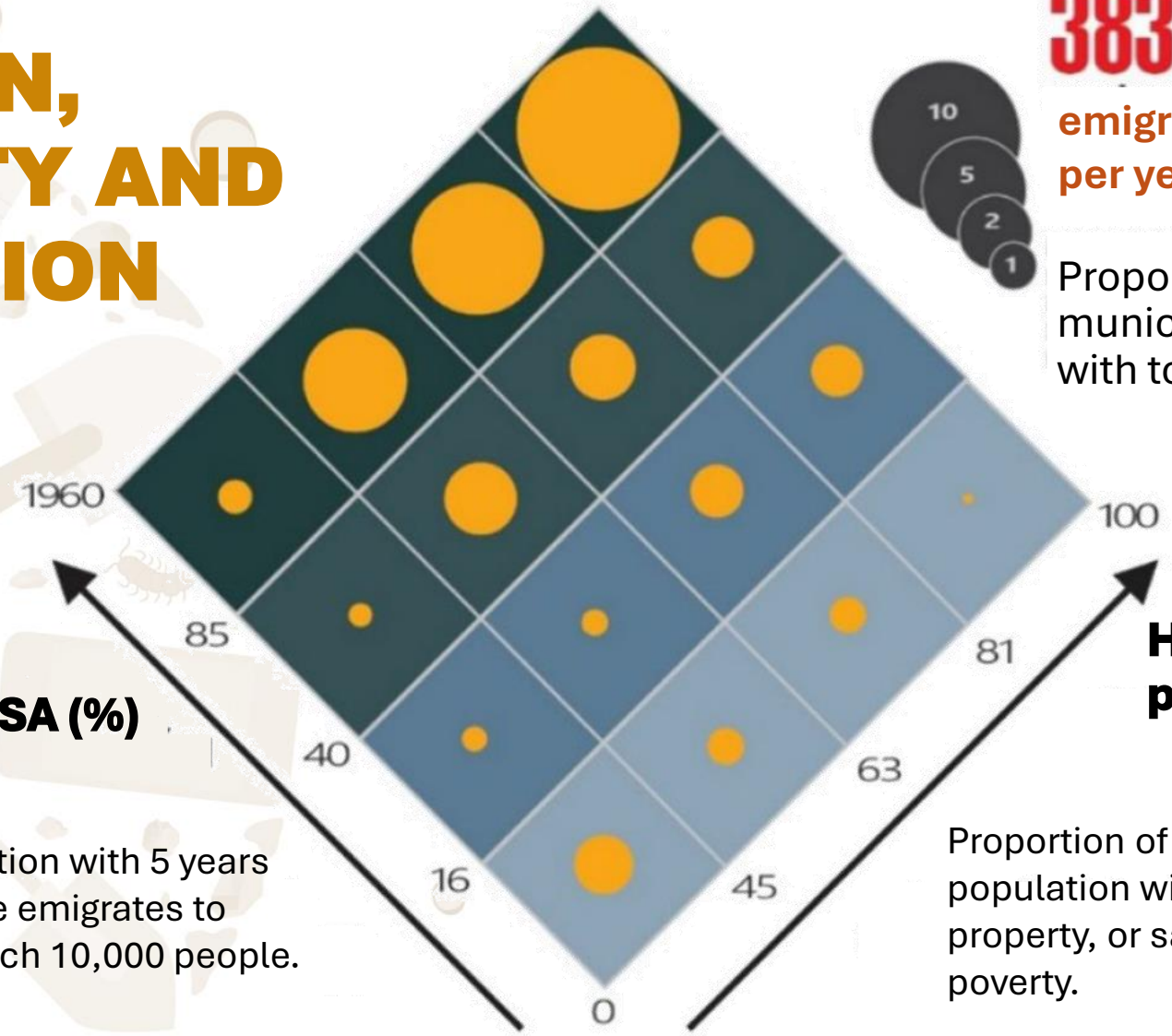
ANTHROPOGENIC SALINIZATION OR SODIFICATION

- Intense on strongly saline or sodic soils
- Intense on moderately saline or sodic soils
- Intense on basic, slightly saline, or sodic soils
- Light or moderate on basic, non-saline, and non-sodic soils

GLOBAL SOIL PARTNERSHIP


SOIL CLIMATE CHANGE VULNERABILITY
D3-D4 Droughts 156 M ha
High vulnerability soils 24 M ha
by Sandy and low SOM 14 M ha
Tijuana
Chihuahua
Monterrey
Culiacán
La Paz
Guadalajara
Tuxpan
Campeche
Puebla
Acapulco
Tapachula
IG
CONAGUA
SMN
SOURCE: CRUZ, ALCONADA Y BARBOSA. NATIONAL ATLAS OF MEXICO 2022 (PRELIMINARY VERSION). INSTITUTE OF GEOGRAPHY. UNAM.
DATASETS: (1) DROUGHT MONITOR OF THE NATIONAL METEOROLOGICAL SERVICE (CONAGUA, 2007-2022). (2) DATA SET ON SOIL PROFILES AND EROSION DATA (INEGI, 1968-2022). (3) PHOTO INTERPRETATION OF DEFORESTATION IN MEXICO AT 1:20,000 SCALE (GLOBAL FOREST CHANGE AND CRITICAL FOREST CHANGE, 2000-2022).
LAMBERT CONICAL PROJECTION
DATUM: ITRF2008
1:15,000,000
RESOLUTION: 225 m
160 km
2.0
0.5
0.1
MILLION HECTARES
DROUGHT
AND SOIL VULNERABILITY
DROUGHT INTENSITY ACCORDING TO NADM
SOIL VULNERABILITY
Lower Higher
D4. Exceptional
D3. Extreme
D2. Strong
D1. Moderate
Annual, permanent, or semi-permanent irrigation surfaces in operation can mitigate the effects of drought on the soil but can also compromise the surface and groundwater reserves.
GLOBAL SOIL PARTNERSHIP

EROSION, POVERTY AND MIGRATION



383k

emigrants per year

Proportion of municipal surface with total erosion

Largest rural emigration to USA (%)

Population with 5 years or more emigrates to USA each 10,000 people.

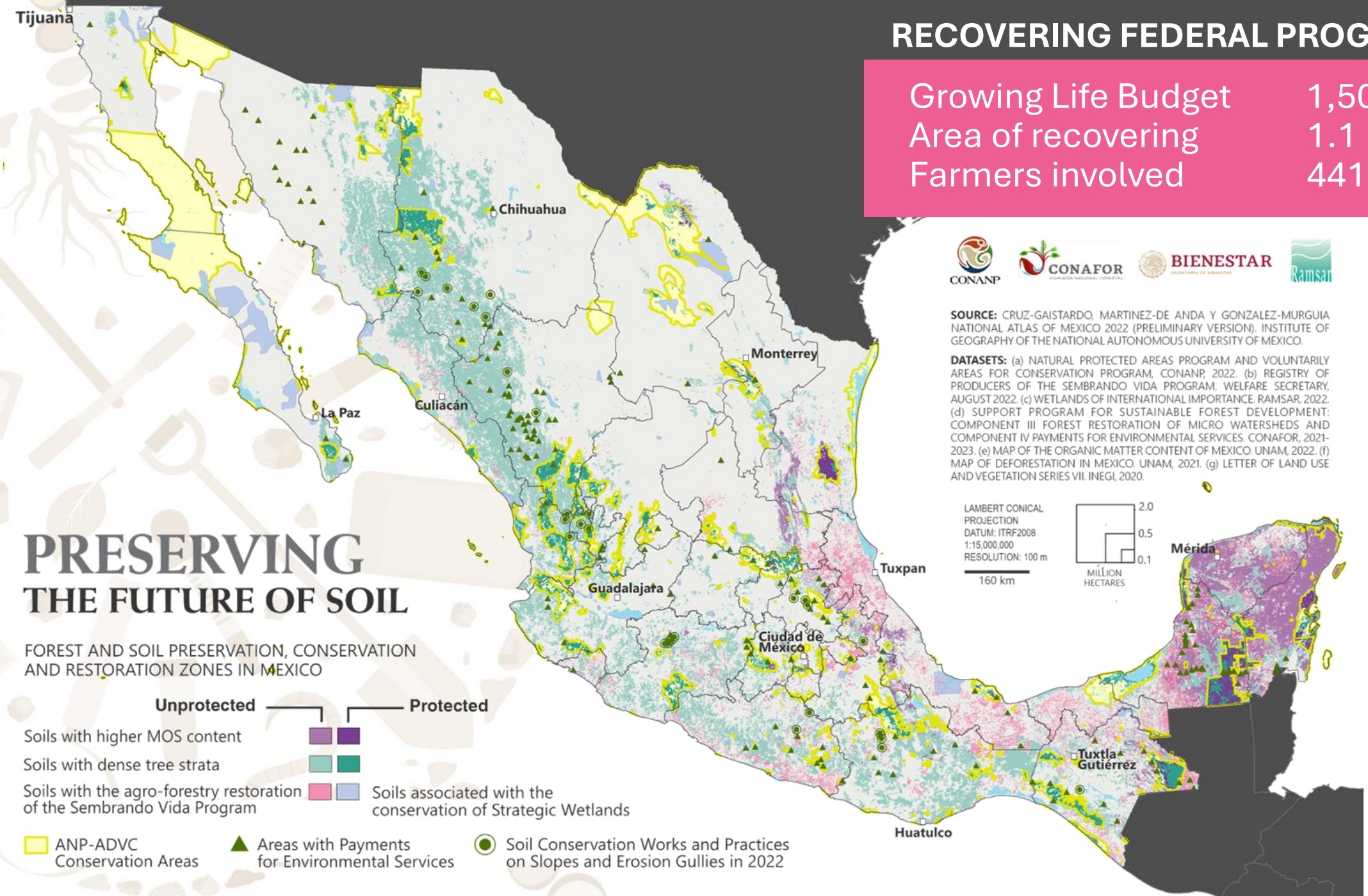
Highest rural poverty (%)

Proportion of the total population with food, property, or satisfaction poverty.

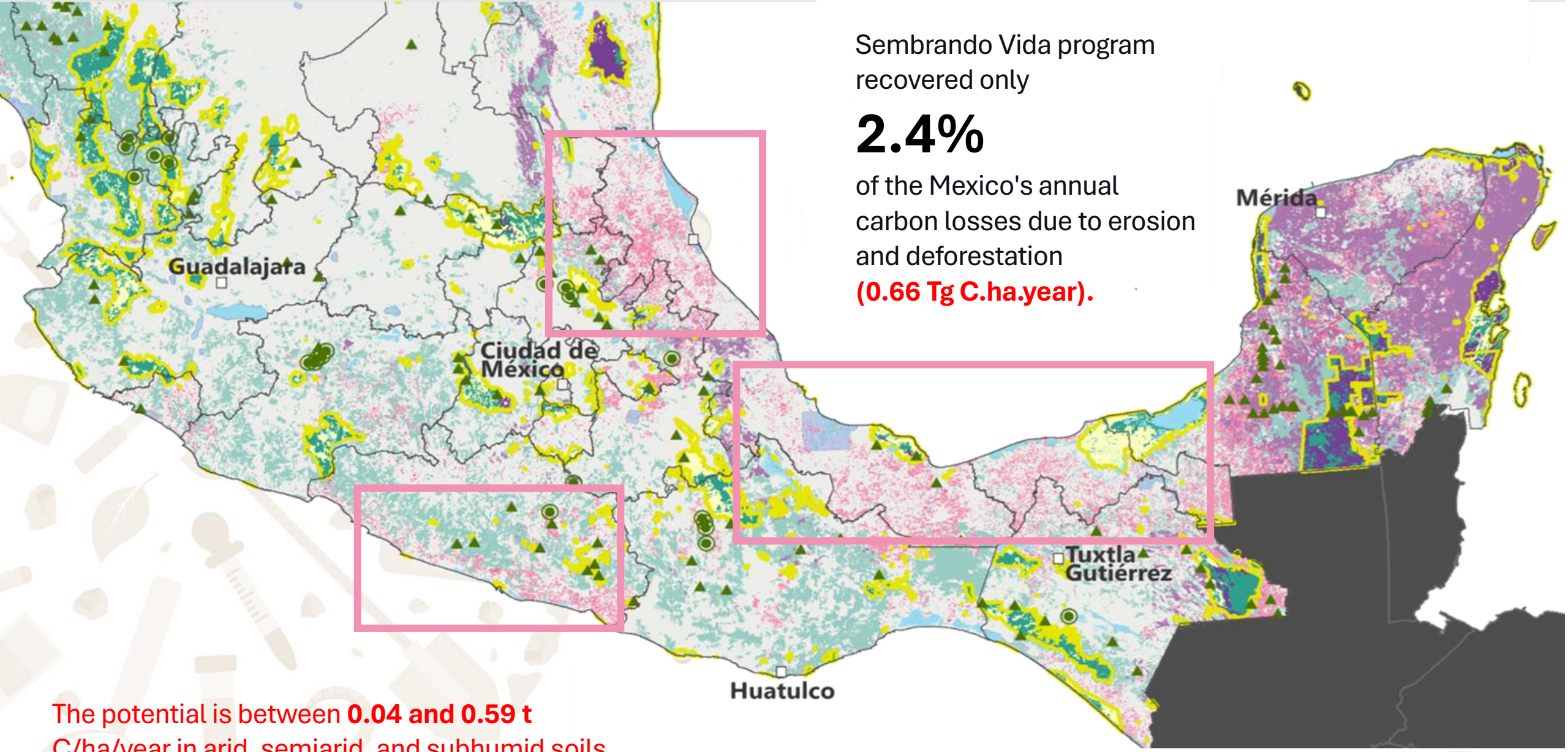
GLOBAL SOIL PARTNERSHIP

RECOVERING FEDERAL PROGRAMS

Growing Life Budget	1,500 M USD yr
Area of recovering	1.1 M ha
Farmers involved	441 k



GLOBAL SOIL PARTNERSHIP

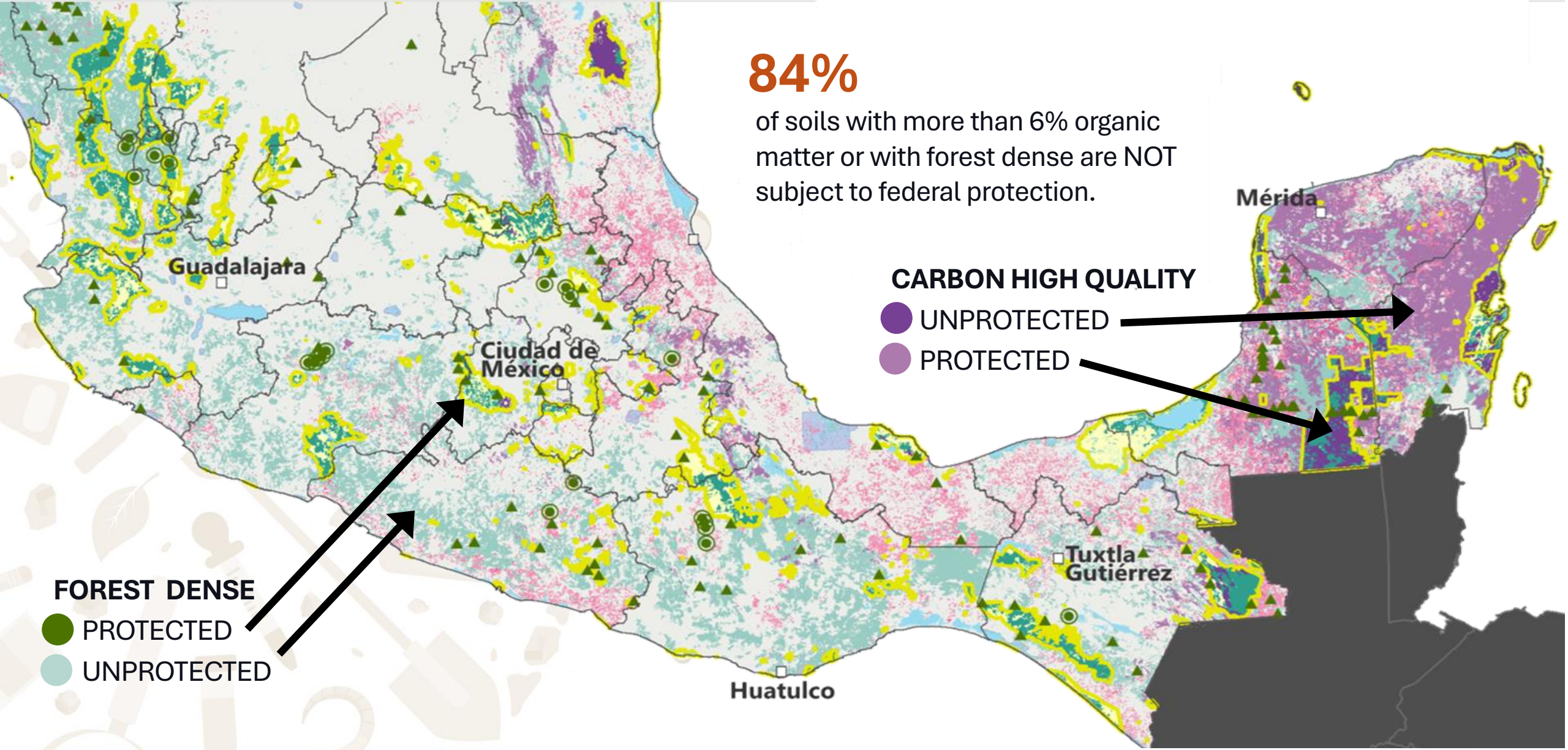


Sembrando Vida program recovered only

2.4%

of the Mexico's annual carbon losses due to erosion and deforestation **(0.66 Tg C.ha.year).**

The potential is between **0.04 and 0.59 t** C/ha/year in arid, semiarid, and subhumid soils.


84%
of soils with more than 6% organic matter or with forest dense are NOT subject to federal protection.
CARBON HIGH QUALITY
UNPROTECTED
PROTECTED
FOREST DENSE
PROTECTED
UNPROTECTED
Guadalajara
Ciudad de México
Huatulco
Tuxtla Gutiérrez
Mérida

FINAL COMMENT

The best time to save our soil from degradation... was yesterday!

Today, there are other options. Now, we must redefine the progress word.

Since my opinion the solution is education with data quality and universal access to information.

THANK YOU

IG INSTITUTO DE GEOGRAFÍA U N A M

INEGI

CONAFOR
COMISIÓN NACIONAL FORESTAL

UNICACH

UNIVERSITY OF DELAWARE

BeeHarvest
Geospatial Analytics Guard

inifap

ECOSUR

JRC
EUROPEAN COMMISSION

CONAGUA
COMISIÓN NACIONAL DEL AGUA

SMN

SGM
SERVICIO GEOLÓGICO MEXICANO

IGAC
INSTITUTO GEOGRÁFICO AGUSTÍN CODAZZI

UACAM
Universidad Autónoma de Campeche

Copernicus
Europe's eyes on Earth

CONANP
COMISIÓN NACIONAL DE ÁREAS NATURALES PROTEGIDAS

BIENESTAR
SECRETARÍA DE BIENESTAR

NRCS
Natural Resources Conservation Service

CSIC

TEXAS
The University of Texas at Austin

FastFarm