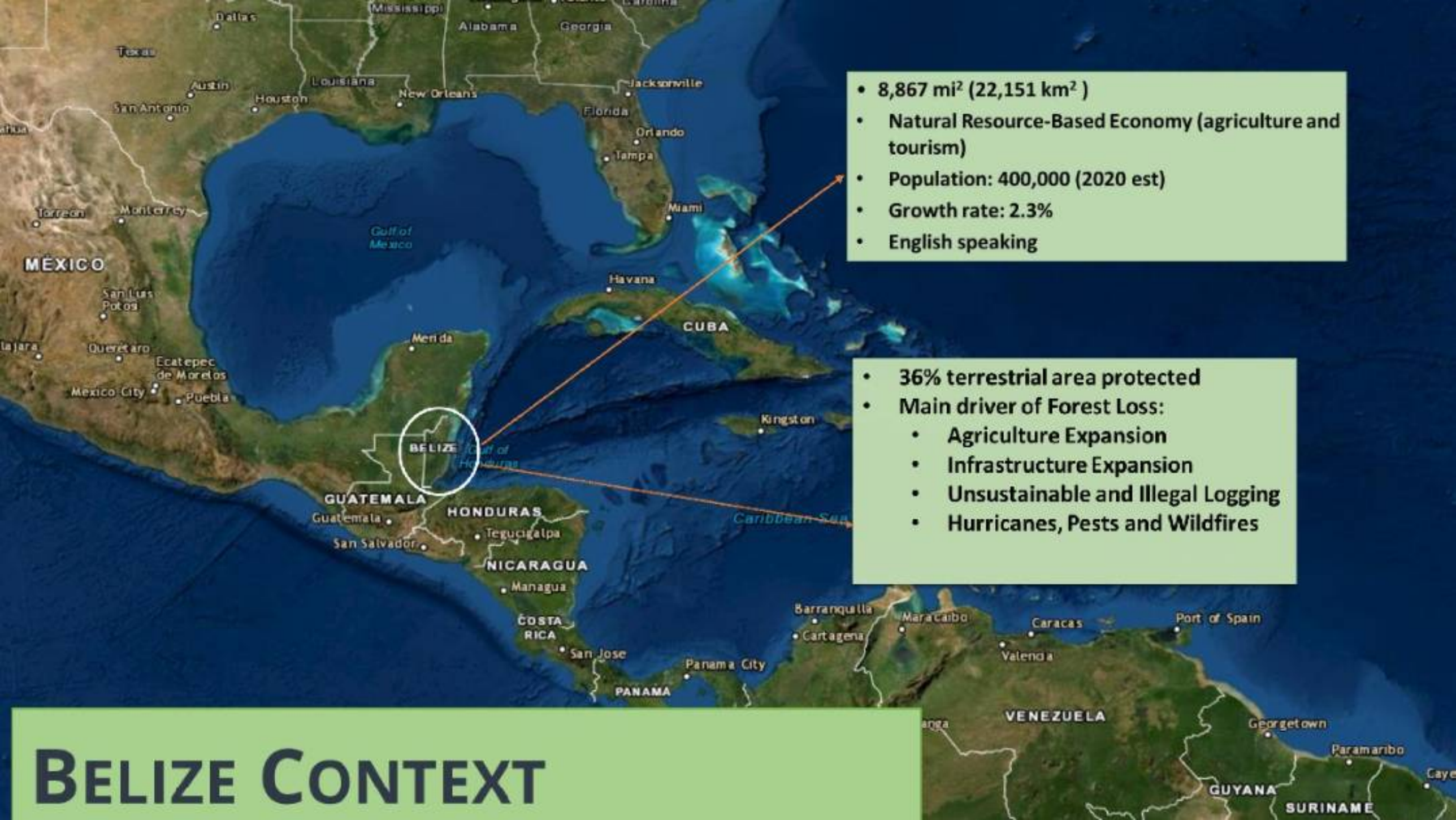
Belize's Preparation of GHG Inventory for FOLU Sector

OUTLINE

- Belize Context
- Processes
  - Activity Data
  - Emission Factor
- Analysis of Results
  - Greenhouse Gas Inventory
- Key Insights



- 8,867 mi² (22,151 km²)
- Natural Resource-Based Economy (agriculture and tourism)
- Population: 400,000 (2020 est)
- Growth rate: 2.3%
- English speaking

- 36% terrestrial area protected
- Main driver of Forest Loss:
  - Agriculture Expansion
  - Infrastructure Expansion
  - Unsustainable and Illegal Logging
  - Hurricanes, Pests and Wildfires

Belize Context

Methodological Approach

ACTIVITY DATA COLLECTION

EMISSION FACTOR COLLECTION

Belize Activity Data Collection

PREPARATION

IMPLEMENTATION

VALIDATION

PREPARATION PHASE

1) LUA App Evolution

2) Expert Consultation

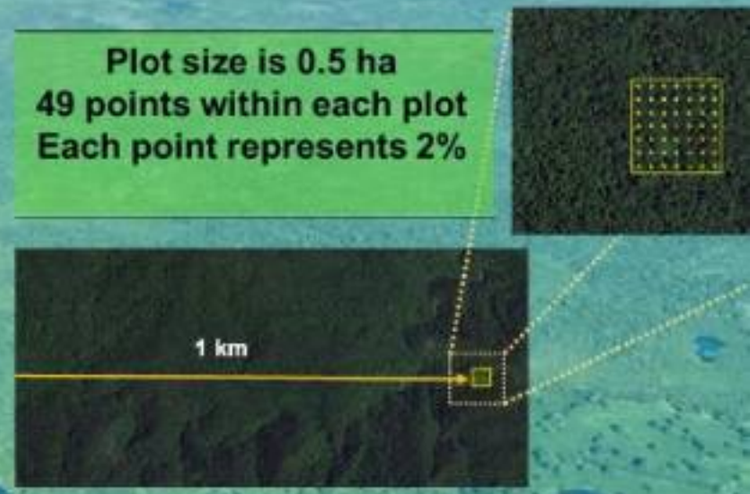
3) Ground truthing

4) Resource Allocation:

- **Personnel selection for diverse expertise.**
- **Equipment provision for effective data collection.**
- **Logistic arrangement for centralized data collection hub**

5) Training Program: Conducted a one-week training covering:

- **Tool usage for efficient data collection.**
- **Remote sensing techniques for accurate interpretation.**



Implementation

Bing Maps API: Aerial | © Microsoft Corporation
• 23,092 sample plots were randomly distributed among the core team
• Ground truthing activities during LULUC
• Quality control done weekly during assessment
▼ Koren
Navigate Through:
External Tools
Re-Zoom
Download Plot KML
Go to GEE Script
Go to LandTrendr UI
Imagery Options
Survey Questions
Pages with a red outline are missing some answers
collection
Is the plot being re-assessed?
Yes
No
Are you confident with this plot
Yes
No
Flag Plot
Team Tools
Center Point
Use same responses as rest of sa
Coding
Save

Land Use Assessment App

PLOT ANALYSIS WITH SUPPORT IMAGES

STEP 1

Zoom out to understand the context and location of the plot.

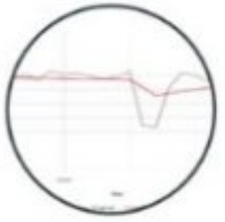
STEP 2

Export the plot to Google Earth Pro to determine land-use, using high-resolution imagery.

STEP 3

Open the auxiliary files in KML format to obtain additional information about the plot.

STEP 4

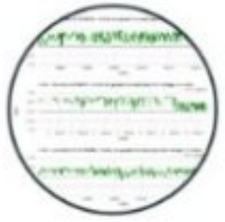


Open the *LandtrendR* tool to assess any past disturbances and the year of occurrence.

STEP 5

Open Google Earth Engine to analyze land use from the year 2000 onwards.

STEP 6



Assess Landsat and Sentinel 2 images, for each year, by exploring the high points in the NDVI graphs.

STEP 7

Fill out the survey with the information on land-use and land-use change.

VALIDATION

- IDENTIFIED ERRONEOSLY LABELED PLOT IN ARCGIS PRO BY CORE TEAM
- 5% EXTRA PLOTS SELECTED FOR QA/QC ASSIGNED TO 3 OPERATORS
- PLOTS LABELED NO-CONFIDENCE WERE IDENTIFIED AND RE-ASSESSED

BEL #	Classification	New Classification
BEL08632	Mangrove	Wetland
BEL09093	Mangrove	Savannah w/ shrub
BEL09468	Mangrove	Savannah w/ shrub
BEL09383	Mangrove	*Ground truthing*
BEL09336	Mangrove	Savannah w/ shrub
BEL09335	Mangrove	Savannah w/ shrub
BEL09234	Mangrove	Savannah w/ shrub
BEL09235	Mangrove	Remain
BEL09236	Mangrove	Remain

ID	Code	REASSESSMENT
BEL15451	CC/INTAGR>INTAGR_2012/	C/INTAGR/
BEL13622	CC/INTAGR>INTAGR_2018/	C/INTAGR/
BEL00999	FF/MBL>MBL_2001/	C/CSHIFTAGR/
BEL19621	G/GABDP/	C/INTAGR/
BEL04062	GG/GPAST>GABDP_2002/	G/GPAST/
BEL14207	GG/GPAST>GABDP_2007/	G/GPAST/
BEL14574	GG/GPAST>GABDP_2007/	G/GPAST/
BEL20654	G/GABDP/Grazing _2017	FGG/MBL>GPAST_2015>GABP_2023/

Emission Factor

- Emission factor represents the relationship between the amount of greenhouse gases emitted and the activity or processes causing those emissions
- The permanent forest inventory has undergone a significant expansion, evolving from the initial 32 one-hectare permanent forest plots
- To a more extensive network of 61 permanent forest plots
- This expansion incorporates updated values derived from meticulous studies conducted on mangrove, pine, and secondary broadleaf forests moving us from tie 1 to tier 2 and 3
- In instances where country-specific values were absent, default values from the IPC were applied

Greenhouse Gas Inventory

Data processing (Estimation)

The Belize GHG inventory employed 2006 & 2019 IPCC guidelines with combination of default values and country-specific emission factors.

The inventory adhered to international standards and utilized IPCC methodology tiers 1, 2, and 3.

Land representation and the definitions of land use categories follows **the 2006/2019 IPCC guidelines.**

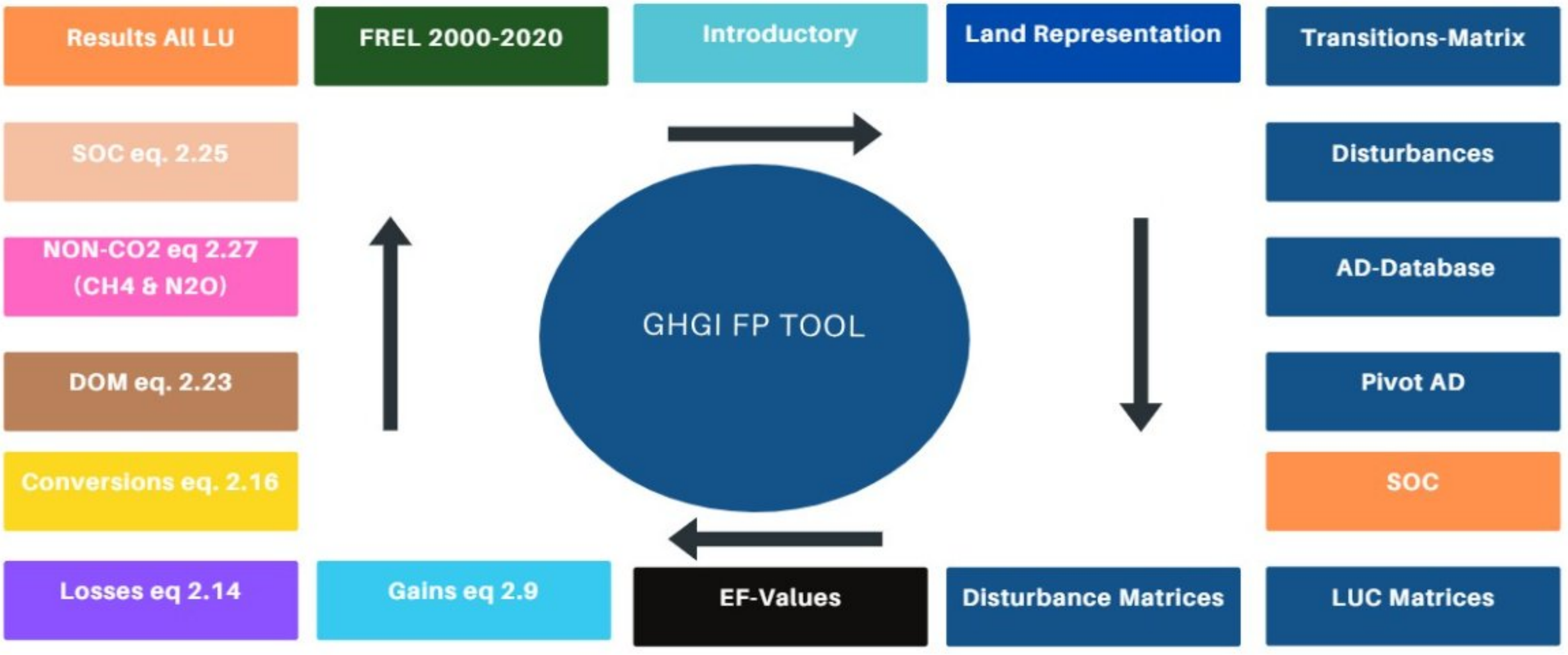
It includes the analysis for Land remaining in a land-use category and Land converted to a new land-use category.

Belize

Land Use, Land Use Change and Forestry Greenhouse gas (GHG) Inventory

and

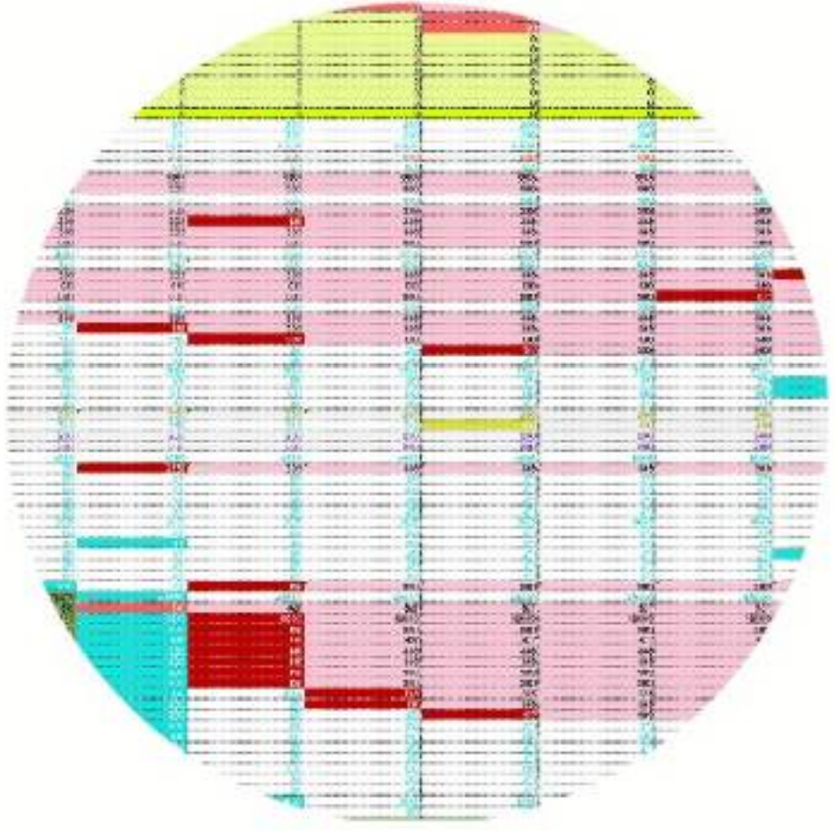
REDD+ Reference Level and REDD+ Results



Foundational Platform
GHGI Process
Data Processing

Organizational Phase

Estimation/Calculation Phase



Verification Phase

Organizational Raw Data Phase

1 Create of the pivot table, arrangement of code by land use type and color code disturbances.

Pivot table aggregating the 21,991 plots into same land use and land use change "trajectories" or situations through the use of the code.

Expansion Factor:	10.58
code	Count of code
C/CSHIFTAGR/	248
C/INTAGR/	930
CC/CFALL>INTAGR_2021/	1
CC/CFALL>INTAGR_2023/	1
CC/CSHIFTAGR>CFALL_2013/	1
CC/CSHIFTAGR>CFALL_2014/	5
CC/CSHIFTAGR>CFALL_2015/	4
CC/CSHIFTAGR>CFALL_2016/	1
CC/CSHIFTAGR>CFALL_2017/	4
CC/CSHIFTAGR>CFALL_2018/	2
CC/CSHIFTAGR>CFALL_2020/	2
CC/CSHIFTAGR>CFALL_2021/	4
CC/CSHIFTAGR>CFALL_2023/	1
CC/CSHIFTAGR>CSHIFTAGR_2011/	1
CC/INTAGR>CFALL_2008/	1
CC/INTAGR>CFALL_2009/	1
CC/INTAGR>CFALL_2011/	1
CC/INTAGR>CFALL_2012/	1
CC/INTAGR>CFALL_2014/	1

GG/GSHRUB>GPAST_2013/
GG/GSHRUB>GPAST_2015/
GGG/GPAST>GABDP_2008>GPAST_2023/DFire_2011
GGG/GPAST>GABDP_2011>GPAST_2021/
GGG/GPAST>GABDP_2015>GPAST_2023/
GGG/GPAST>GABDP_2020>GPAST_2023/
W/WWB/
W/WWET/
S/SAQC/
S/SC/
S/SM/
S/SO/
S/SOI/
S/SR/
S/STOWN/

- Affected by Fire
- Affected by by Grazing
- Affected by by Hurricane
- Affected by Logging
- Affected by Other Human Impact/Infrastructure
- Affected by Shifting Cultivation
- Affected by Pest
- Affected by Mining

3a. ALL- Database | 3c. Pivot AD | 4. SOC | Sheet1 | LUC Matrices | Disturbance Matrices | LI -VALUES | Gains eq 2.9 | Losses

Organizational Raw Data Phase

2.Group categories by land remaining, land remaining with disturbances and land conversion.

A) LAND REMAINING
F/MBL/
F/SBL/
F/PINE/
F/MAN/
F/PLANTF/
C/CSHIFTAGR/
C/INTAGR/

B) LAND REMAINING-DISTURBANCE
F/MBL/DAgri_2000
F/MBL/DAgri_2000,DAgri_2011
F/MBL/DAgri_2000,DFire_2020
F/MBL/DAgri_2000,DLog_2023
F/MBL/DAgri_2001
F/MBL/DAgri_2001,DAgri_2003
F/MBL/DAgri_2001,DAgri_2005
F/MBL/DAgri_2001,DAgri_2007
F/MBL/DAgri_2001,DAgri_2014
F/MBL/DAgri_2001,DAgri_2014,DFire_2016

C) LAND USE CONVERSION
FC/MBL>CSHIFTAGR_2000/
FC/MBL>CSHIFTAGR_2001/
FCC/MBL>CSHIFTAGR_2001>CFALL_2012/
FC/MBL>CSHIFTAGR_2002/
FCC/MBL>CSHIFTAGR_2002>CFALL_2016/
FCC/MBL>CSHIFTAGR_2002>CFALL_2017/
FCC/MBL>CSHIFTAGR_2002>CFALL_2023/
FCCF/MBL>CSHIFTAGR_2002>CFALL_2010>SBL_2020/
FCCF/MBL>CSHIFTAGR_2002>CFALL_2012>SBL_2023/
FC/MBL>CSHIFTAGR_2003/
FCC/MBL>CSHIFTAGR_2003>CFALL_2016/
FCCCF/MBL>CSHIFTAGR_2003>CSHIFTAGR_2004>CFALL_2011>SBL_2021/
FCCF/MBL>CSHIFTAGR_2003>CFALL_2010>SBL_2018/
FCCF/MBL>CSHIFTAGR_2003>CFALL_2011>SBL_2021/
FC/MBL>CSHIFTAGR_2004/

Organizational Raw Data Phase

3. Organize/sort by year

Estimation/Calculation Phase

IPCC equations were applied

Calculation on Gains, Losses, Conversions, DOM, Non-CO2 (CH4), Non-CO2 (N2O),SOC.

Calculations were done in three different section in each sheet:

1. **Land remaining in the same category (Undisturbed)**
2. **Land Remaining in the same category (Disturbed)**
3. **Land Use Conversions**

Gains eq 2.9 | Losses eq. 2.14 | Conversions eq. 2.16

DOM eq. 2.23 | NON CO2 (CH4.) eq.2.27 | NON CO2 (N20.) eq.2.27 | SOC eq. 2.25

2. Land Remaining in the same category (Disturbed)

Losses in forests that remain as forests were assessed due to various disturbances, both anthropogenic and natural.

Group 1

No expected regeneration:

Example: F/MBL/Dinfra_2005/DAgri_2015

Shifting Cultivation

Infrastructure/Other Human Impact

Grazing

Mining

Group 2

Expected Regeneration:

Example: F/MBL/DHur_2010 or F/MBL/DLog_2010

Hurricane

Logging

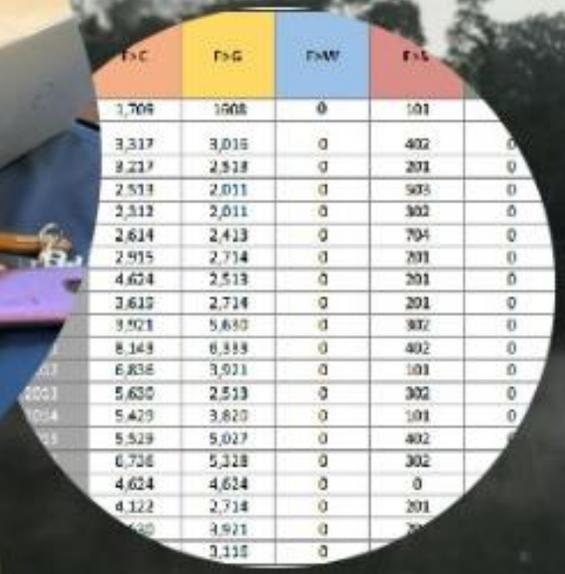
Fire

Expected Regeneration:

Pest

Expected Regeneration:

Verification Phase



1,709	1908	0	101	
3,317	3,016	0	402	0
3,217	2,918	0	201	0
2,513	2,011	0	503	0
2,312	2,011	0	302	0
2,614	2,413	0	704	0
2,915	2,714	0	201	0
4,624	2,513	0	201	0
3,613	2,714	0	201	0
3,921	5,630	0	302	0
8,149	8,349	0	402	0
6,836	3,021	0	101	0
5,630	2,513	0	302	0
5,429	3,820	0	101	0
5,529	5,027	0	402	0
8,736	5,328	0	302	
4,624	4,624	0	0	
4,122	2,714	0	201	
	3,921	0		
	3,115	0		

Quality control:
Reviewing seven calculations sheets(Gain, Losses, Conversion, DOM,SOC, Non-CO2- CH4 & Non-CO2-N2O, Results) with 4,759 rows per sheet.

Three experts were part of the verification

Key Insights

- Capacity Building - Continuous training and the enhancement of in country experts
- Leverage international support and cooperation
- Knowledge sharing
- Develop robust data collection system
- Follow guidelines

Thank You from
BELIZE