Annex Methods

GHG calculations

Datasets & Documents Used

MWE (2017). Uganda LULC for the years 2000, 2005, 2015, 2017. <https://data.apps.fao.org/map/catalog/static/api/records/00956087-b187-4327-b05e-ce7539a150b2> Access date: 06 September 2023

1. OCHA (2023). Uganda - Subnational Administrative Boundaries [Version 1]. <https://data.humdata.org/dataset/cod-ab-uga>
2. Ministry of Water and Environment. (2018). Final - Uganda Forest Reference Emission Level Document - February 2018. Retrieved from <https://www.mwe.go.ug/sites/default/files/library/Final%20-%20Uganda%20Forest%20Reference%20Emission%20Level%20Document%20-February%202018.pdf> Access date: 06 September 2023

# Process

## LULC classes are converted to FREL classes

The LULC classes in the Uganda LULC maps for 2000, 2005, 2015 and 2017 were converted to the classes used in the Uganda FREL (MWE 2018) as per Table 1.

Table 1 LULC classes from the Uganda LULC maps and their equivalent classification in the Uganda FREL (MWE 2018)

|  |  |  |
| --- | --- | --- |
| **Class** | **LULC classes** | **FREL class** |
| 1 | Plantations broadleaved | Plantation |
| 2 | Plantations coniferous | Plantation |
| 3 | Tropical high forest well-stocked | Forest |
| 4 | Tropical high forest low-stocked | Forest |
| 5 | Woodland | Woodland |
| 6 | Bushland | Non-forest |
| 7 | Grassland | Non-forest |
| 8 | Wetland | Non-forest |
| 9 | Subsistence farmland | Non-forest |
| 10 | Commercial farmland | Non-forest |
| 11 | Built up areas | Non-forest |
| 12 | Water | Water |
| 13 | Impediment | Non-forest |
| 0 | Unknown | Non-forest |

## Automatic consistency checks

As per section of 1.8.1.2 of the Uganda FREL (MWE 2018) automatic consistency checks were applied to eliminate unrealistic change trajectories. Most of these unrealistic change trajectories covered very small areas, covering less than 1% of the map area. An example of an unrealistic change trajectory would be “Tropical high forest – Woodland – Tropical high forest – Tropical high forest” because a conversion from tropical high forest to woodland and back is very unlikely. In this case, the trajectory was changed to “Tropical high forest – Tropical high forest – Tropical high forest – Tropical high forest”.

The following principles were applied in the automatic consistency check:

* Areas of ‘No data’ were replaced with the previous epoch’s LULC label except for epoch 2000, where ‘No data’ was replaced with the label from epoch 2005.
* If water was detected in any epoch, the class label was applied to all other epochs unless the area was classified as forest in at least 3 epochs, in which case the area was classified as forest.
* Areas exhibiting a single-epoch change in class label then reverting to the previously designated class label were made consistent by re-labelling the ‘odd’ epoch to match the majority (i.e. Tropical high forest – Woodland – Tropical high forest becomes Tropical high forest – Tropical high forest – Tropical high forest).
* Areas where natural forest was detected after an epoch mapped as non-forest, also the non-forest epoch was reclassified to natural forest. This was not applied to plantations.

## Calculate FREL class changes

Change in forest, woodland or plantation cover was calculated in ha by comparing the 2000 and 2017 LULC maps. We focus on woodland in this analysis as plantations and tropical high forests only account for a tiny fraction of the total cover (<0.2%, Table 3).

Table 2 Total area of each district in this proposal (area\_ha) and the area (ha) of stable and changing FREL classes in each district between 2000 and 2017.

A screenshot of a computer

Description automatically generated

Table 3 Change classes totals as the percentage of the total project area (2000 vs 2017).

|  |  |
| --- | --- |
| **FREL Class** | **Total area (%)** |
| NA | 0.05 |
| Non-forest | 66.34 |
| Woodland->Non-forest | 25.55 |
| Non-forest->Woodland | 2.42 |
| Woodland | 5.05 |
| Water | 0.47 |
| Woodland->Plantation | 0.03 |
| Non-forest->Plantation | 0.08 |
| Plantation->Non-forest | 0.01 |
| Plantation | 0.01 |
| Plantation->Woodland | 0 |
| Non-forest->Forest | 0 |

## Calculate change in woodland cover

We calculate the percentage change in woodland cover and the compound rate of change for 2000-2017. Compound rate of change was calculated as where years is 17.

Table 4 Change in woodland cover between 2000 and 2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **District** | **Total 2000 (ha)** | **Total 2017 (ha)** | **Net change (ha)** | **Change (%)** | **Compound rate (%)** |
| Abim | 4249.325 | 2899.428 | -1349.9 | -31.8 | -2.2 |
| Agago | 9968.94 | 863.8223 | -9105.12 | -91.3 | -13.4 |
| Amuru | 21959.08 | 2389.671 | -19569.4 | -89.1 | -12.2 |
| Arua | 2784.978 | 1185.201 | -1599.78 | -57.4 | -4.9 |
| Karenga | 3554.431 | 3534.891 | -19.5402 | -0.5 | 0 |
| Kitgum | 6803.152 | 2906.182 | -3896.97 | -57.3 | -4.9 |
| Koboko | 2597.14 | 544.4251 | -2052.71 | -79 | -8.8 |
| Lamwo | 15367.99 | 1785.635 | -13582.4 | -88.4 | -11.9 |
| Maracha | 15.30802 | 31.15631 | 15.8483 | 103.5 | 4.3 |
| Moyo | 4624.461 | 2030.383 | -2594.08 | -56.1 | -4.7 |
| Nwoya | 20215.58 | 4654.717 | -15560.9 | -77 | -8.3 |
| Pader | 3202.797 | 423.4917 | -2779.31 | -86.8 | -11.2 |
| **Total** | **95343.18** | **23249** | **-72094.2** | **-75.6** | **-8** |

## Calculate emissions

We convert change in woodland (Woodland net change in Table 4) to emissions using the emission factors (EF) presented in Table 11 of the Uganda FREL where the conversion of woodland to non-forest has an EF of 91 tCO2/ha (MWE 2017). Then using the compound rate of woodland loss (Table 4) for the historical period we estimate woodland loss in 2018 and convert this to emissions using the woodland EF.

Table 5 Emissions from change in woodland cover and project change in woodland cover and associated emissions for 2018.

|  |  |  |  |
| --- | --- | --- | --- |
| **District** | **Emissions 2000-2017 (Mt)** | **Projected Loss 2018 (ha)** | **Projected Emissions 2018 (Mt)** |
| Abim | 0.123 | -64.466 | 0.006 |
| Agago | 0.829 | -115.755 | 0.011 |
| Amuru | 1.781 | -292.302 | 0.027 |
| Arua | 0.146 | -58.09 | 0.005 |
| Karenga | 0.002 | -1.146 | 0.000 |
| Kitgum | 0.355 | -141.825 | 0.013 |
| Koboko | 0.187 | -47.806 | 0.004 |
| Lamwo | 1.236 | -212.366 | 0.019 |
| Maracha | -0.001 | 1.33 | 0.000 |
| Moyo | 0.236 | -95.968 | 0.009 |
| Nwoya | 1.416 | -385.227 | 0.035 |
| Pader | 0.253 | -47.518 | 0.004 |
| **Total** | **6.561** | **-1852.034** | **0.169** |