ANNUAL LAND COVER
PRODUCTION IN
GOOGLE EARTH ENGINE

Workflow in Google Earth Engine to produce an annual
land cover map

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STEP 1: REFERENCE DATA CLEAN-UP

Reference data (partly) loses its **validity over time** due to changes on the ground.

Workbench takes reference data from the baseline year (2021) and runs a **sanity check** on the data to make sure the data is still “valid”.

Possibility to use 2021 reference data for all years, but the more years pass, the less viable this becomes, due to this **“decay” in reference data validity** (see slide 5).

<table>
<thead>
<tr>
<th>Land cover year</th>
<th>Number of reference samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>2 875</td>
</tr>
<tr>
<td>2018</td>
<td>2 881</td>
</tr>
<tr>
<td>2019</td>
<td>2 908</td>
</tr>
<tr>
<td>2020</td>
<td>2 959</td>
</tr>
<tr>
<td>2021</td>
<td>3 290 (2 931 if clean-up applied)</td>
</tr>
</tbody>
</table>
STEP 2: RANDOM FOREST CLASSIFICATION

https://www.earthengine.app/
STEP 3: LAND COVER TIME SERIES HARMONIZATION

*Harmonization* is necessary to ensure that the land cover change information derived is interpretable.

STEP 3: LAND COVER TIME SERIES HARMONIZATION

List of rules:

Three-consecutive-year rule: if middle pixel is different than previous and following year, and previous and following year are the same class, it is converted to that class

1. Applied for built-up, agriculture (assumption is that 1-year fallows are too uncommon), forest, wetland, grassland, bare soil
2. This does not apply for water (dam water extent fluctuates yearly)

Impossible transitions:

1. Water to built-up
2. Built-up to agriculture
3. Bare Soil to Agriculture (the degradation level makes is close to impossible unless a commercial/irrigated agriculture comes along)
4. Any class to forest aside from wetland and shrubland
5. Any class to wetland aside from grassland and cropland
6. Any class to shrubland aside from wetland grassland and forest
7. Any class to grassland aside from bare soil, cropland and wetland
8. Built-up to bare soil
STEP 3: LAND COVER TIME SERIES HARMONIZATION

https://www.earthengine.app/
STEP 4: LAND COVER POST-PROCESSING

Post-processing aims to increase the overall quality of the land cover product, both in terms of accuracy and usability.

https://www.earthengine.app/
STEP 4: LAND COVER POST-PROCESSING

List of rules:

1. Remove **Cropland** on steep slopes (> 30°) to surrounding majority class

2. Remove **Water** on slope (>10°) and Height Above Nearest Drainage (HAND) > 45m to surrounding majority class

3. **Irrigated Cropland**: Kmeans clustering of cropland (2 clusters), Highest mean NDVI cluster selected, s2_integral > 0.5, slope < 10°, HAND < 45m, pixel groups > 100 pixels

4. Remove **Wetland** on slope (> 20°), HAND > 90m, and within 5 pixels (50m) of built-up areas

5. **Gullies**: GLCM Correlation and contrast of bands 2, 3, 4 and 8, trained a RF model using 1000 sampled gullies pixels from the LCDB2015 dataset, with HAND < 45 m, + Carry over Gullies from previous year

STEP 4: LAND COVER POST-PROCESSING

STEP 5: INTEGRATION OF NEW DATA TO DASHBOARD

The **dashboard** is powered by the land cover data produced.

Additional **temporal indicators** support the interpretation of the land cover change.

STEP 5: INTEGRATION OF NEW DATA TO DASHBOARD

Deployed dashboard link: https://ocsgeospatial.users.earthengine.app/view/lcstatslesotho

https://code.earthengine.google.com/4a8bc9df385d91f7158718ae7c648441?noload=true
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