WaterWorld: impacts of business as usual land use change for the CAZ

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Running a Business As Usual deforestation scenario in WaterWorld

- Project recent rates of deforestation forward for the next 30 years (based on GFC net loss data) and a land use change model.
- This is not the same scenario as run by Jenny Hewson for P4GES. Jenny used Clark Labs land Change Modeller. We will use QUICKLUC in WaterWorld, which is similar.
- Convert forest to most suitable agriculture for the pixel
Step 4: policy exercises

Apply a scenario for land use change

1. Click **Step 4: Policy exercises from the main menu (A)**

2. Select Land use and cover change (B) and click on **Submit choice (C)** to see window (D)
Setting up the land use change model:

1. Select the QUICKLUC land use change model by clicking the + (A)
2. Give your scenario a name, e.g. BAU (B)
3. Set the % change values for the three land cover types to -100 for tree, and 0 for herb and bare (C)
4. Use the GFC net loss data for recent rates of tree cover loss and gain and project forward 30 years (D)
5. Allocate deforested pixels by agricultural suitability by selecting ‘yes’ at (E)
6. Include likely new transport routes in allocation by selecting ‘yes’ at (F)
7. Define converted pixels as most suitable agriculture for the pixel (G)
8. Once all the above values are set, click ‘Check and Submit’ (H) to build the scenario
9. You can develop a wide range of scenarios with this tool
Once the scenario is built, click on Show baseline and scenario (A) to see what changes under your scenario (this will take a few minutes). You can then look at land use and land cover changes under your scenario. Look at cover of tree-covered ground (B).
- Land use change scenario: tree cover changes
- Baseline and scenario tree cover remaining.
- The mean % tree cover decreases from 41% to 21%
- Difference (showing non-zero’s only) between baseline and scenario shown on the right.
- The coloured areas have lost tree cover 0-100% from the scenario.
- There is no change in areas covered by tarmac, with no trees to start with or far from current and likely future access routes (these are transparent)
- **Land use change scenario**: change in cropland (left) and pastures (right).
- More of the area is suitable for grazing than cropland (according to the global datasets used)
- Therefore deforestation is mostly for pasture lands, increasing from around 4% to around 37%
- Allocating by existing agriculture (rather than suitability) would produce different results
Close the compare maps window and go back to the main scenario window (A). Click on Run scenario to start the scenario simulation (B). The scenario will take around 15 minutes to run as before. DISCUSSION/REST while model is running.
Land use change: step 5: results maps

Once the run has completed, go back and click **Step 5: results maps (A)** from the main window.

Results now have a new compare icon as results will be expressed as difference from the baseline. Click on the change in water balance icon (**B**)
Water balance changes are variable over space:

- reduced water use (AET) by trees leads to increased water balance in some areas (left)
- but decreased cloud capture by trees results in decreases in water availability elsewhere (right), usually on steep, fog-exposed slopes
Actual evapo-transpiration (left) and total fog inputs (right)

- Both AET and total fog inputs decrease as a result of deforestation. The changes in water balance depend on the balance between reduction in AET and fog inputs.
Changes in runoff

- Runoff is cumulative downstream and increases in some areas (left) and decreases (right) in others due to the changed water balance.
- In general, rivers flowing west see an increase in runoff as these areas are less cloud affected (i.e. AET decrease > decrease in fog capture)
- Rivers flowing east mainly see a decrease in runoff as changes in fog capture are greater than the changes in AET (i.e. AET decrease < decrease in fog capture)
- The hydrological impacts of deforestation are not simple!
Changes in human footprint on water quality index (pixel based increase left, mean for sub-catchments, right)

- Potential water pollution mostly increases due to deforestation and conversion to agriculture (affected by coarsity of baseline pasture map around Mantadia)
- Some areas see a small potential decrease in water pollution due to increased water availability (dilution)
WAVES reporting customized versions of WW/CN

WW customizations exist for:
- WAVES reporting
- SDGs reporting
- EPA water quality limits reporting

These provide customized metrics and added functionality on top of WW.
### Some initial WW/C$N SDG-relevant metrics: baseline view

<table>
<thead>
<tr>
<th>SDG</th>
<th>Indicator</th>
<th>Baseline map</th>
<th># people</th>
<th># urban people</th>
<th># rural people</th>
<th># poor people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal #1: End poverty in all its forms everywhere</td>
<td>Goal #1:</td>
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<tr>
<td>1.2 Water poverty</td>
<td>Population without access to sufficient quantity of quality water</td>
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<tr>
<td>1.2 Lack of productive resources</td>
<td>Per-capita agricultural production</td>
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<tr>
<td>1.2 Health poverty</td>
<td>Population exposed to diarrhoeal disease</td>
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<tr>
<td>1.5 Natural hazard vulnerability</td>
<td>Persons in areas of unmitigated natural hazard risk</td>
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<td>Goal #2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture</td>
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<td>2.3 Water-for-food</td>
<td>Population with limited water-for-food (E&lt;0)</td>
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<td>2.3 Productivity</td>
<td>Per-capita agricultural productivity</td>
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<td>2.4 Sustainability</td>
<td>Fraction of agricultural land with E&gt;&lt; rainfall (irrigation)</td>
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<td>Goal #3: Ensure healthy lives and promote well-being for all at all ages</td>
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<td>3.3 Water-borne disease</td>
<td>Population with (seasonal) exposure to diarrhoeal disease</td>
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<td>3.9 Lack of domestic water</td>
<td>Population with less than (seasonal) 20L/day (WHO) of quality water</td>
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<td>Goal #6: Ensure availability and sustainable management of water and sanitation for all</td>
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<td>6.1 Access</td>
<td>Population with less than (seasonal) 20L/day (WHO) of quality water</td>
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<td>6.2 Sanitation, hygiene</td>
<td>Persons benefiting from natural footprint on water quality</td>
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<td>6.3 Pollution load</td>
<td>Total human footprint on water quality</td>
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<td>6.4 Water scarcity</td>
<td>Mean per-cent of time in which demand is not met by supply</td>
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<td>6.6 Protected hydrological services</td>
<td>Proportion of realised clean water provision from protected areas</td>
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<td>Goal #7: Ensure access to affordable, reliable, sustainable, and modern energy for all</td>
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#### 7.2 Renewable energy
- Goal #11: Make cities and human settlements inclusive, safe, resilient and sustainable
- 11.5 Ecosystem based natural hazard mitigation
- 11.5 Flood protection by green infrastructure
- 11.7 Urban green infrastructure and ecosystem services
- Goal #13: Take urgent action to combat climate change and its impacts
- 13.1 Hazard resilience
- 13.2 Climate change planning

#### 15.1 Ecosystem service protection
- Goal #15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- 15.2 Forests and forest loss
- 15.3 Desertification
- 15.5 Species richness
- 15.6 Endemism