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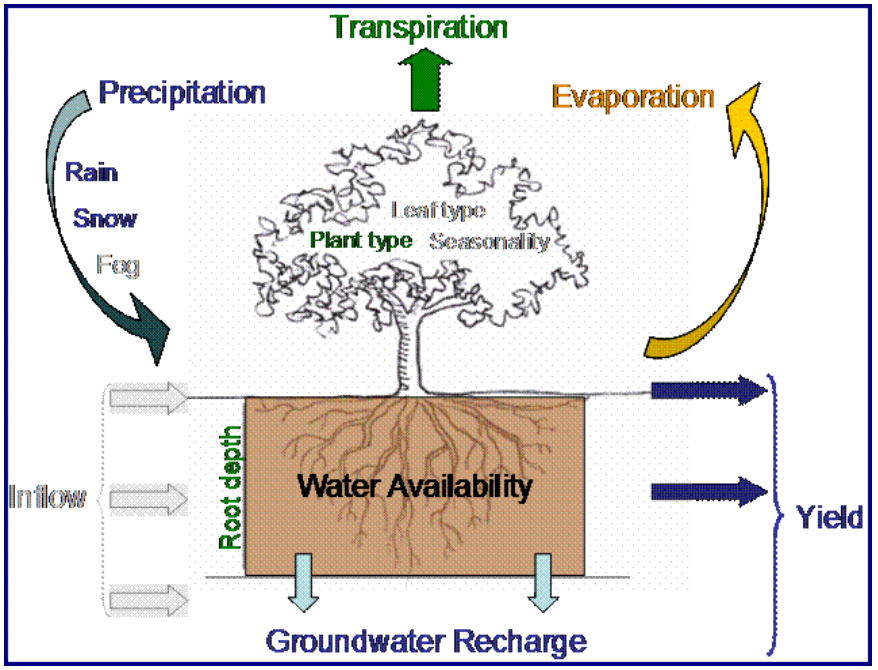
Mapping the importance of forests for water supply and soil erosion control

UNEP-WCMC
Monrovia, 12-16 February 2018

Hydrological services provided by forests

- Forests use and discharge water:
  - Intercept precipitation, evaporation and transpiration
  - Forest removal can increase downstream yields, which can be used to mitigate drought but may also cause flooding
- Mountain cloud forests provide horizontal precipitation



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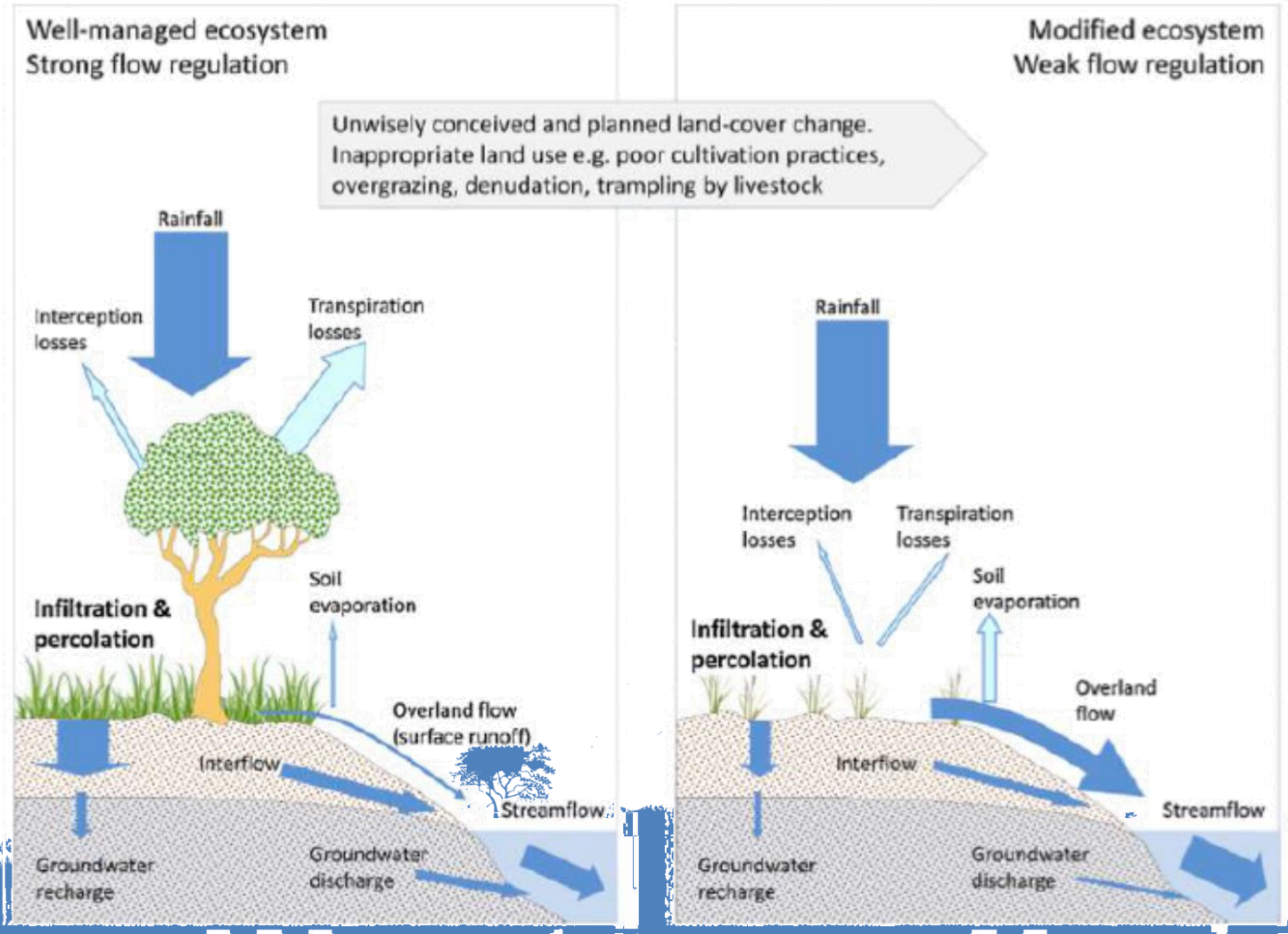
Effects of forest changes on hydrological services



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Hydrological services provided by forests

- Reduce soil erosion and reduce sediment loading
  - Stabilization of slopes
  - Roots trap sediments
  - Lower canopy leaves and ground litter reduce splash force from precipitation
- Mantain water quality by trapping nutrient and pollutants

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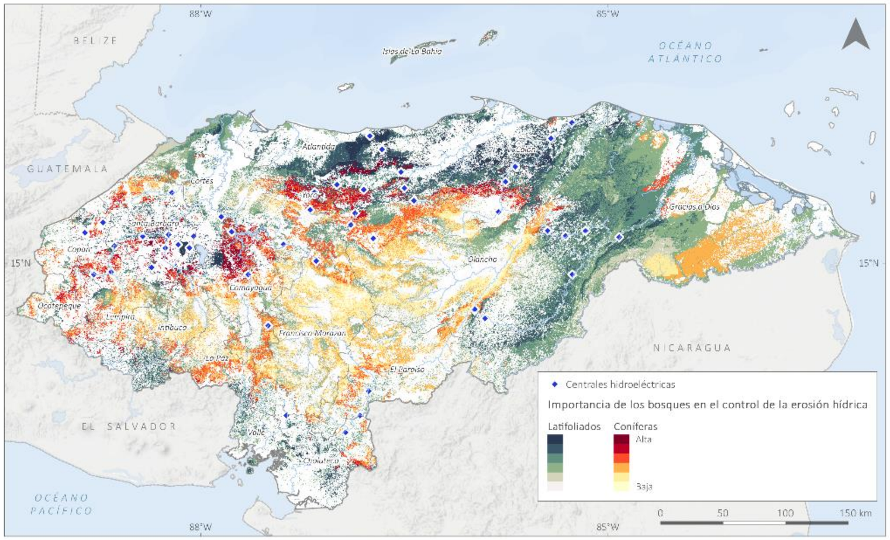
Hydrological services provided by forests

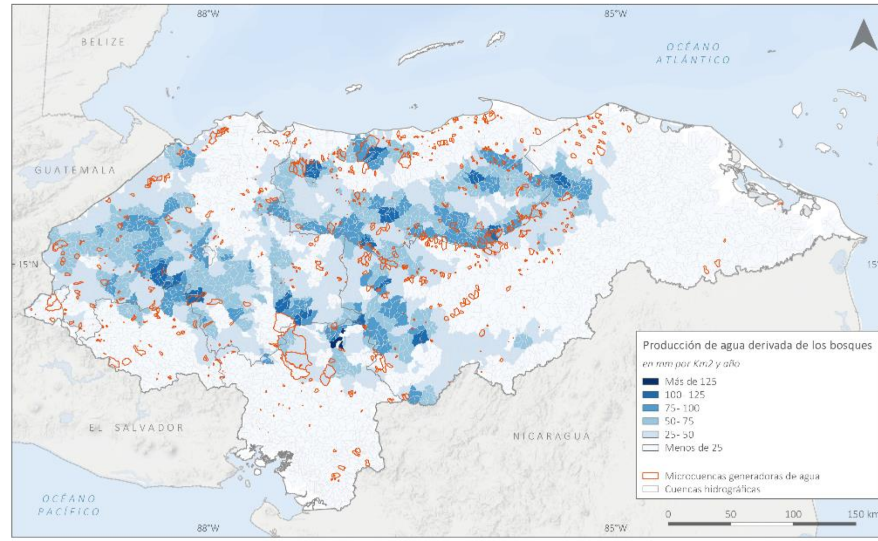
- Regulate seasonal discharge
  - Reduce flooding from high rainfall
  - Reduce drought from low rainfall
- Reduce flooding at local scales

SOIL EROSION CONTROL (Erosion-prone areas)



FUENTES DE DATOS:
Modelo Digital del Terreno: Lehner, B., Verdin, K., Jarvis, A. (2008): New global hydrography derived from spaceborne elevation data. Eos, Transactions, AGU, 89(10): 93-94.
Precipitación: UNAH - V Ambiente (2014). Mapa de precipitación media anual. *Evaluación de los recursos hídricos en su régimen natural potencial a nivel nacional*. Descargado del Geoportal hídrico (http://hidro.sinia.gob.hn) en Marzo de 2017.
Localización de centrales hidroeléctricas: Sistema Nacional de Información Territorial de la República de Honduras. Descargado del Sistema Nacional de Información Territorial de Honduras (http://sinit.hn) en Marzo de 2017.
Cobertura forestal: Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF) (2015). *Atlas Municipal Forestal y Cobertura de la Tierra*. Comayagüela, República de Honduras.

WATER PROVISION (Forest water yield)



FUENTES DE DATOS:
Provisión de agua derivada de los bosques: Modelado a través del sistema de modelización hidrológica Waterworld (*Mulligan 2013. WaterWorld: a self parameterising, physically based model for application in data poor but problem rich environments globally. Hydrology Research Vol. 44, No. 5*). Los resultados obtenidos a 1 km² de resolución fueron promediados a nivel por microcuenca, según definidas por el modelo nacional del Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF) (datos descargados del Sistema Nacional de Información Territorial de Honduras el 23 de Junio de 2016).
Cuencas generadoras de agua: Microcuencas productoras de agua para consumo y uso humano declaradas a nivel nacional a Octubre de 2017. Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF). Descargado de http://geoportal.icf.gob.hn en Octubre de 2017.
Cuencas hidrográficas. Cuencas hidrográficas de Honduras. Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF) (datos descargados del Sistema Nacional de Información Territorial de Honduras en 9 de Octubre de 2017).

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What we want to know?

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What we want to know?

- Where are the hydrological ecosystem services produced?
- Who benefits from them?
- What are the land use change effects?
- What will specific policy/management interventions do?
- What will climate change do?
- What will all of these do combined? Who wins/loses?
- What are the data uncertainties and how can these be reduced?

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Methods to map hydrological services

Traditional hydrological tools: based on daily-runoff hydrological models at the watershed scale, requiring detailed datasets and expert knowledge

SWAT Soil & Water Assessment Tool

Ecosystem services oriented tools: based on ecosystem services indicators and models across large scales, they are more accessible for non-experts users, and they provide a more integrative picture because it considers the demands for the service

InVEST integrated valuation of ecosystem services and tradeoffs

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WaterWorld

- Free spatial modelling tool
- Models hydrology and soil erosion
- All data included
- Runs at 1ha and 1km resolution
- Annual and monthly output maps downloadable in GIS formats
- Runs and compares scenarios of land use change and climate change fast (full analysis in 30 mins)
- Simple to use: chrome or firefox
- Includes free training programme

KING'S College LONDON Department of Geography

AmbioTEK

WaterWorld

supported by:

CGIAR Research Program on Water, Land and Ecosystems

espa

earthH2Observe

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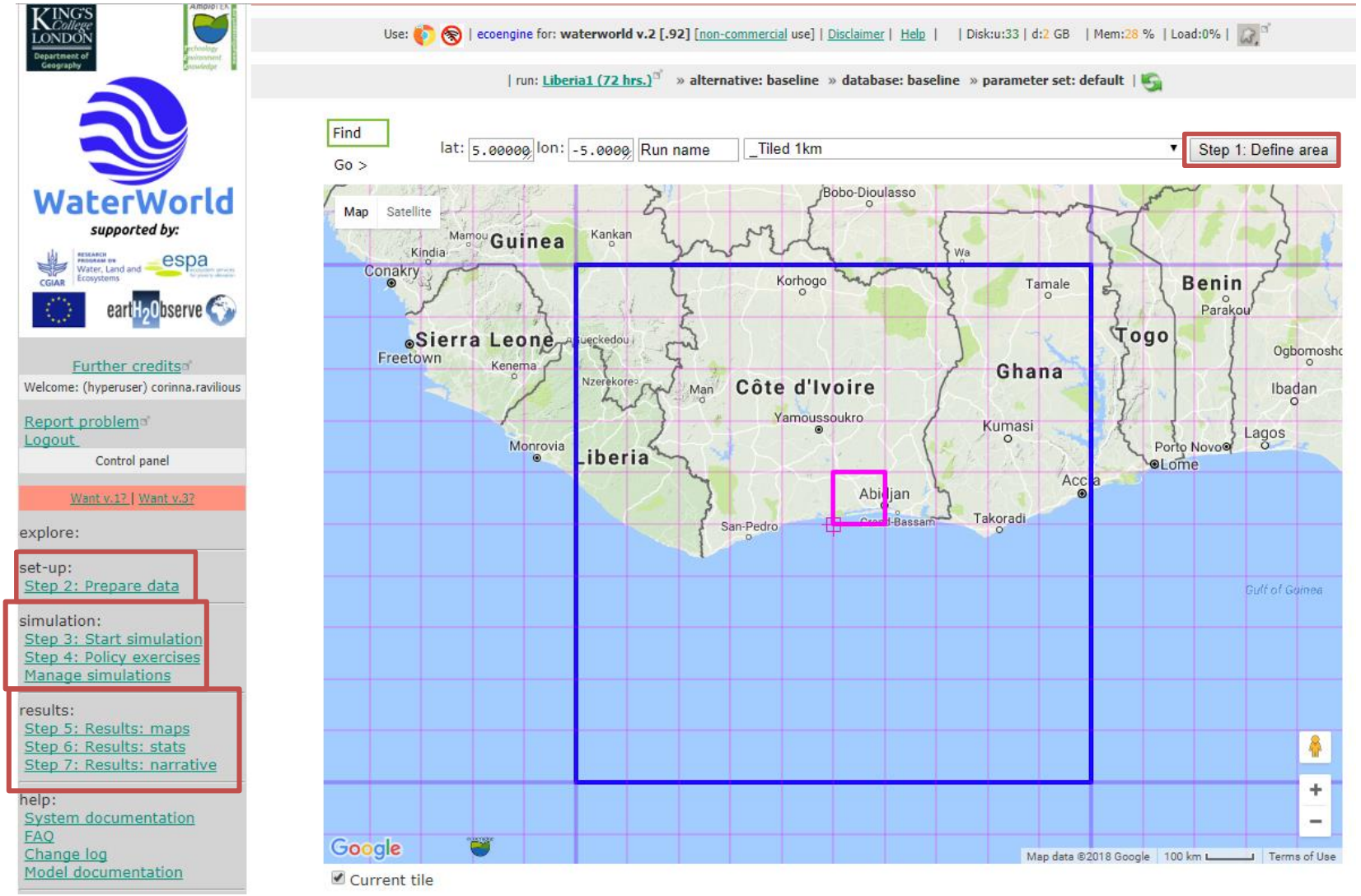
How to use WaterWorld



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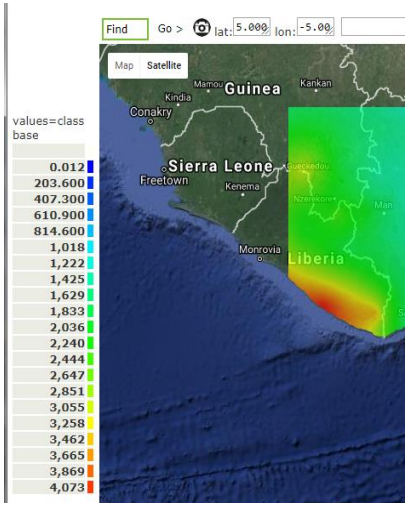
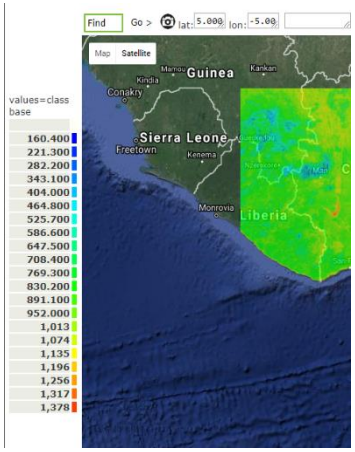
Key outputs: Hydrology

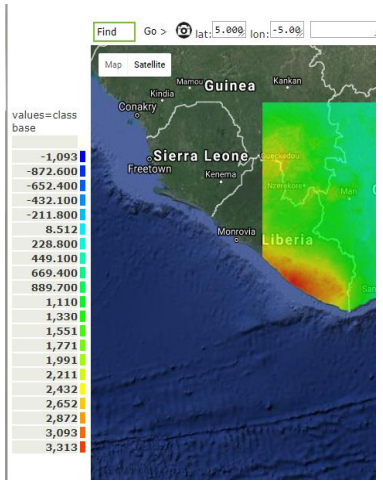
Process based spatial hydrological model



Wind driven precipitation (based on WorldClim)



Actual evapo-transpiration



Pixel based water balance (Prec – ActEvap + Fog inputs)

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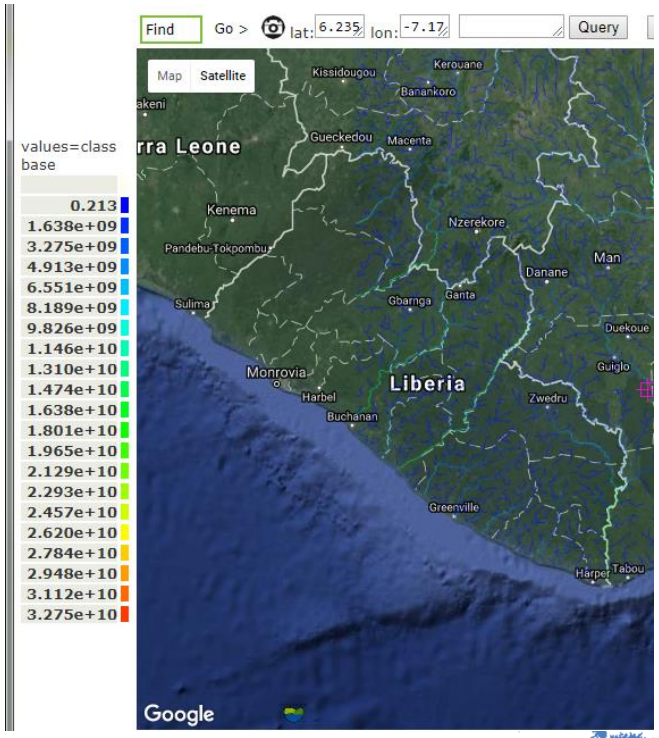
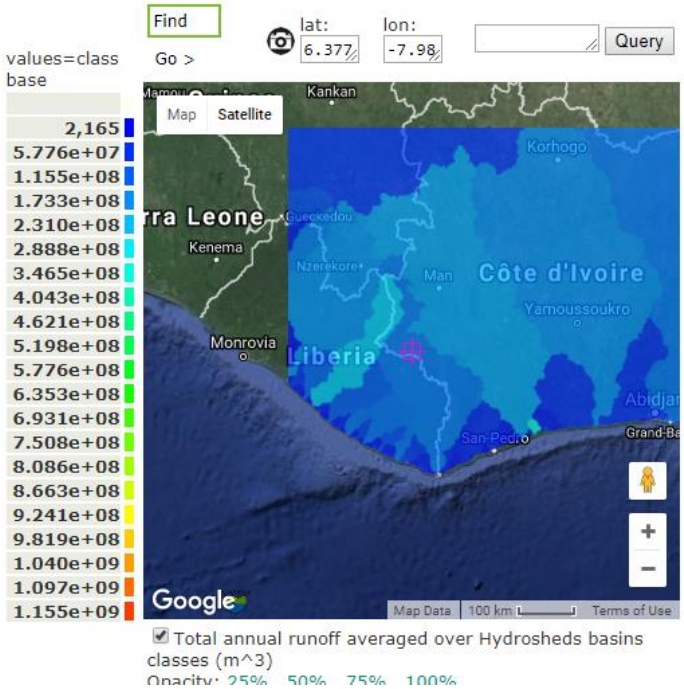
Key outputs: Hydrology





Annual runoff

Runoff (water yield) averaged by sub-catchments

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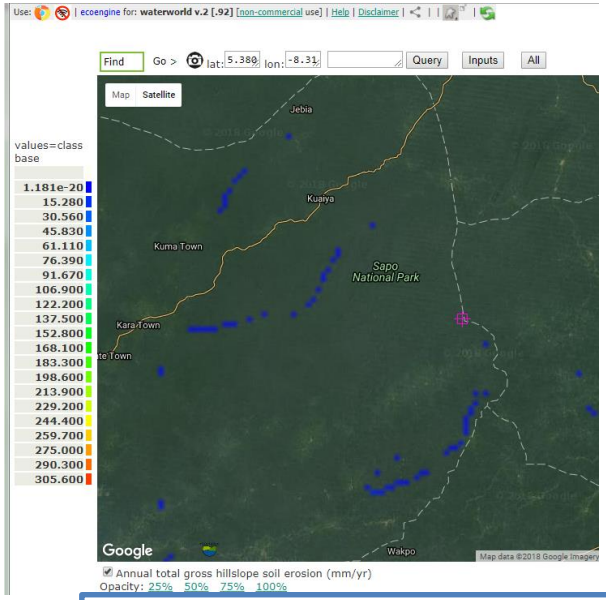
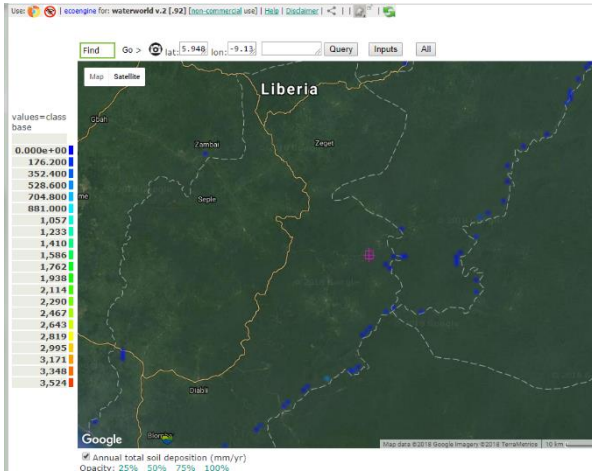
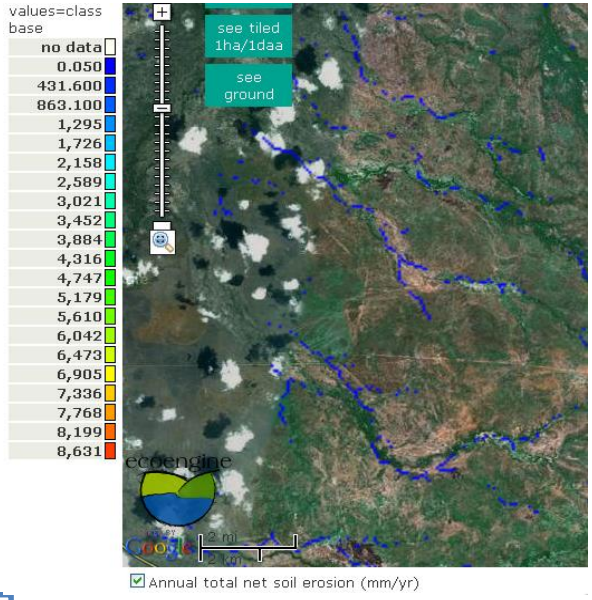
Key outputs: Soil erosion

Full wash erosion model





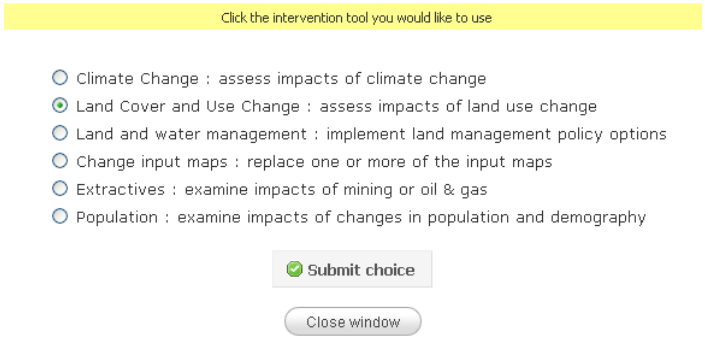


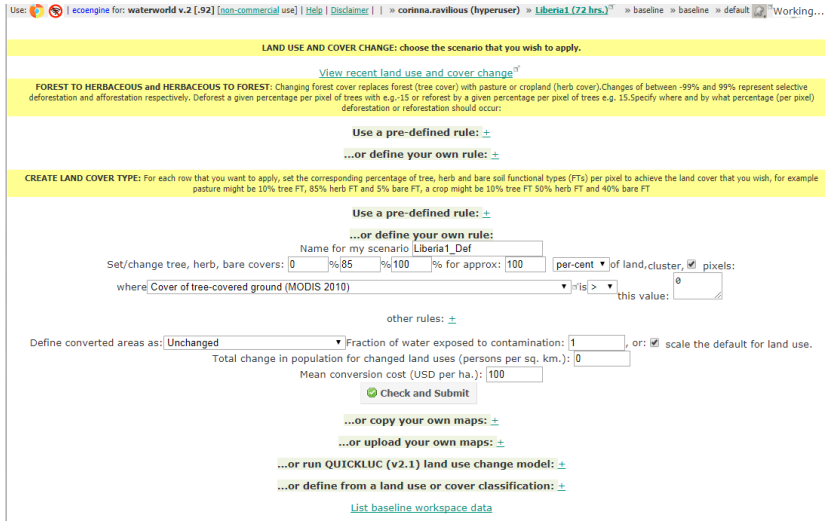
Gross soil erosion: detachment of soil based on runoff, vegetation, slope

Soil deposition: detached soil that gets deposited

Net soil erosion: sedimentation

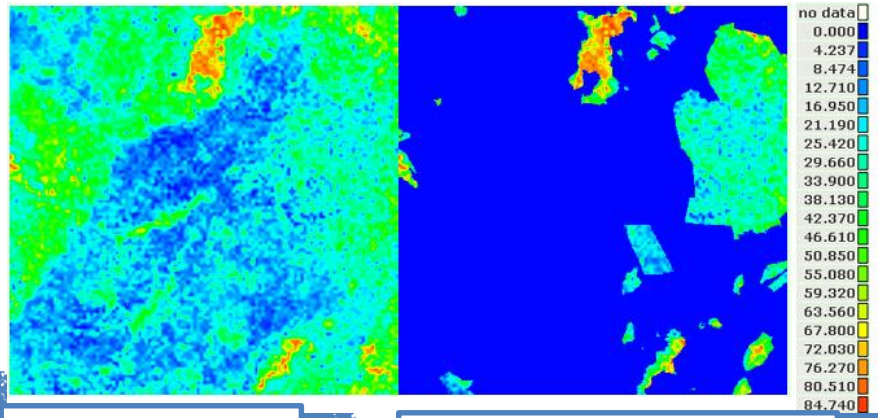
Scenarios





Scenarios for Climate Change and Land cover and use available

For example deforest all land



Baseline tree cover

Scenario tree cover

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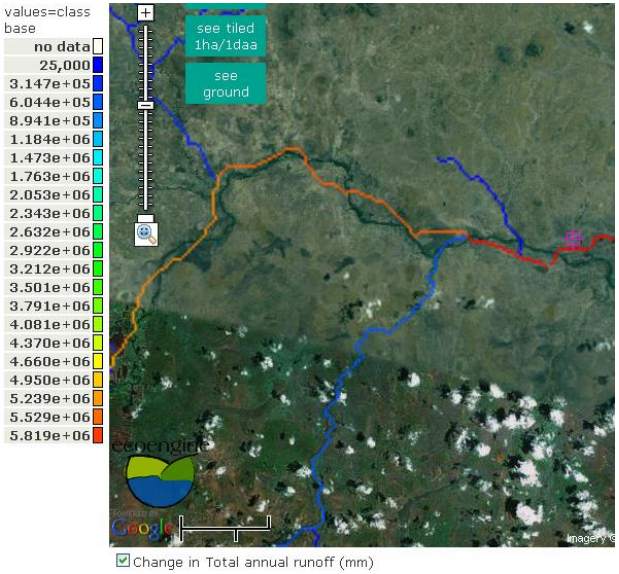
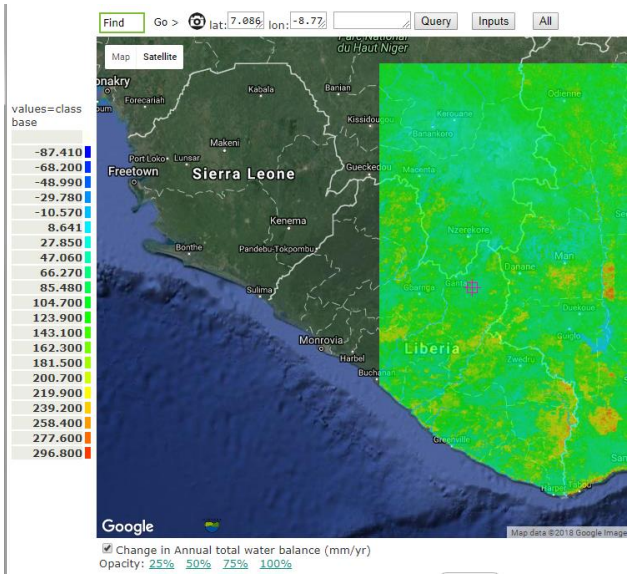
Run scenarios





Deforestation leads to increased runoff (less water use by trees)

Changes to annual water balance

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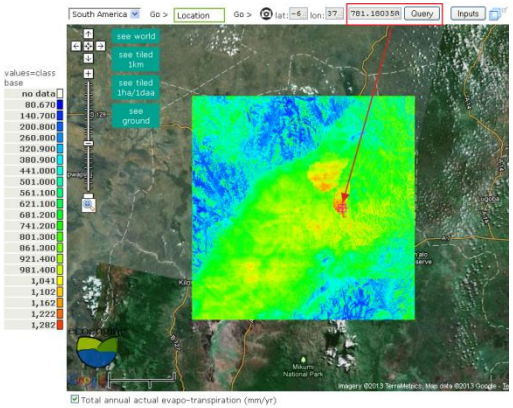
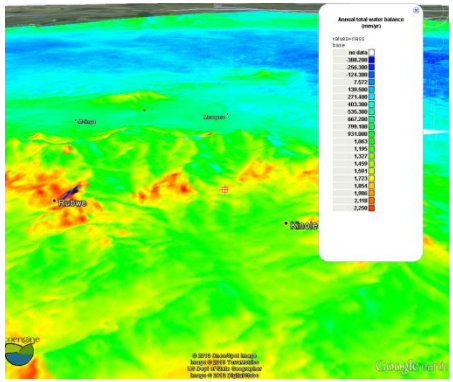
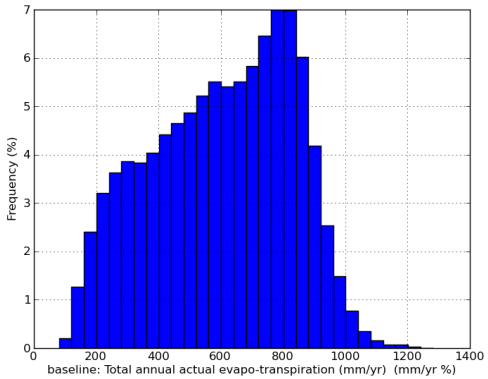
Analyse, visualise and/or download GIS maps



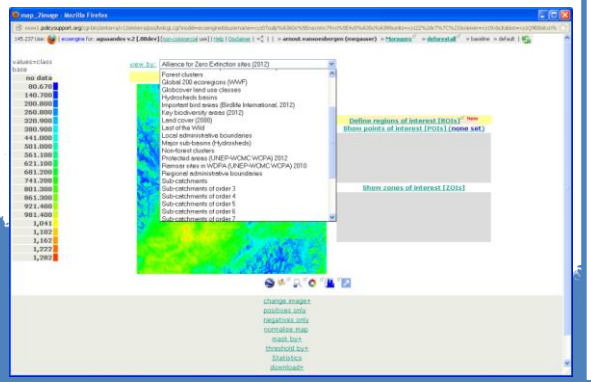
View in Google maps and query map at points



Overlay in Google Earth



Analyse map histogram



Mask by regions from other maps, zones of interest or get values for points

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Remember to think about

- Needed skills are web browsing and basic hydrological knowledge and some GIS skills for your own data. Update your skills using the free training programme and resources (http://../training-course-schedule)
- All data is supplied but you are able to use your own data
- Different scales:
  - Local is 100km x 100km tile at 1ha resolution
  - National is 1000km x 1000km tile at 1km² resolution
- Latest features cost money

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Limitations

- Global datasets are coarse for local needs
- If your catchment crosses two tiles you need to run both separately and stitch using WW's Google Earth integration or in GIS
- You run on WaterWorld's servers so only a limited number of simulations can be stored. ***Download results and delete simulation to start a new one***

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Thank you!