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Introduction to WaterWorld and Co$tingNature

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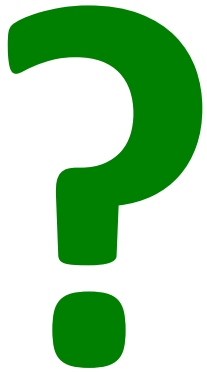
CONSERVATION INTERNATIONAL

AGENDA

PARTICIPANT INTRODUCTIONS



TRAINING OBJECTIVES

By the end of the course ensure all participants are able to:

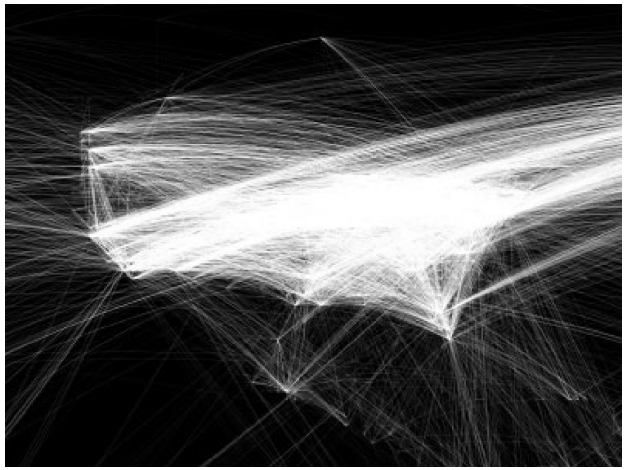
- **Apply the WaterWorld tool** to examine the hydrological baselines
- **Understand how to assess the impacts of scenarios for land use change** on hydrological ecosystem services using WaterWorld
- **Apply the Co$ting Nature tool** to map conservation priorities on the basis of realized ecosystem services (water, carbon, tourism, hazard mitigation), biodiversity and endemism, current pressure and future threat.
-

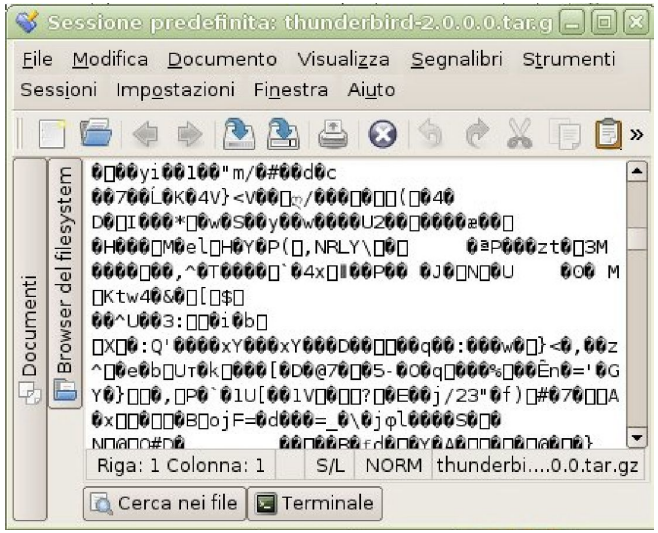
BACKGROUND ON CO$TING NATURE AND WATERWORLD

- Scientific data are often little used in policy formulation in South America and Africa
  (based on questionnaires in Andean countries and interviews in Volta and Nile basins)
- Reasons include lack of knowledge/ access to data, lack of training / capacity

(SPATIAL) DATA CAN BE DIFFICULT TO USE

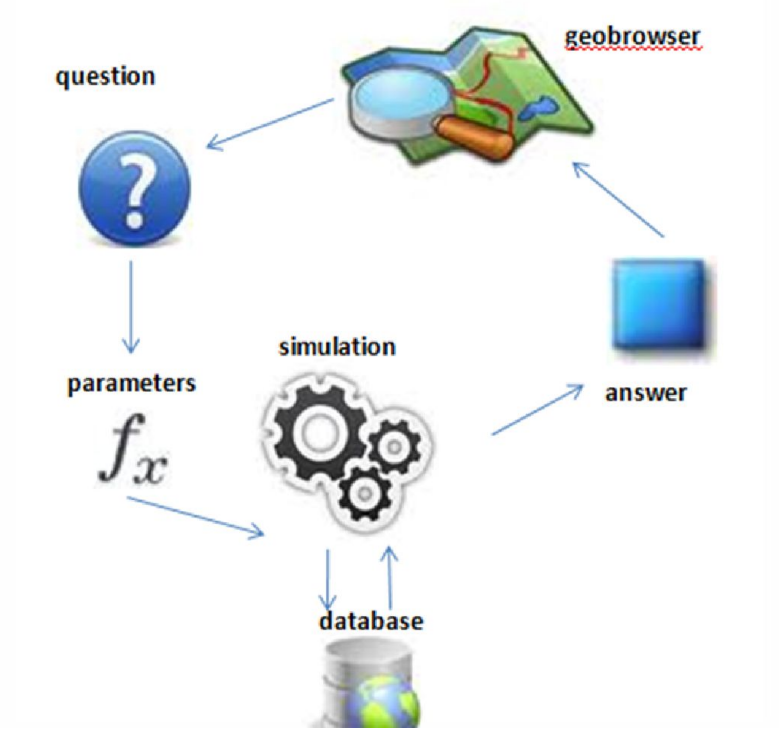
- Do not exist
- Not accessible
- Difficult to find
- Expensive
- Unusable





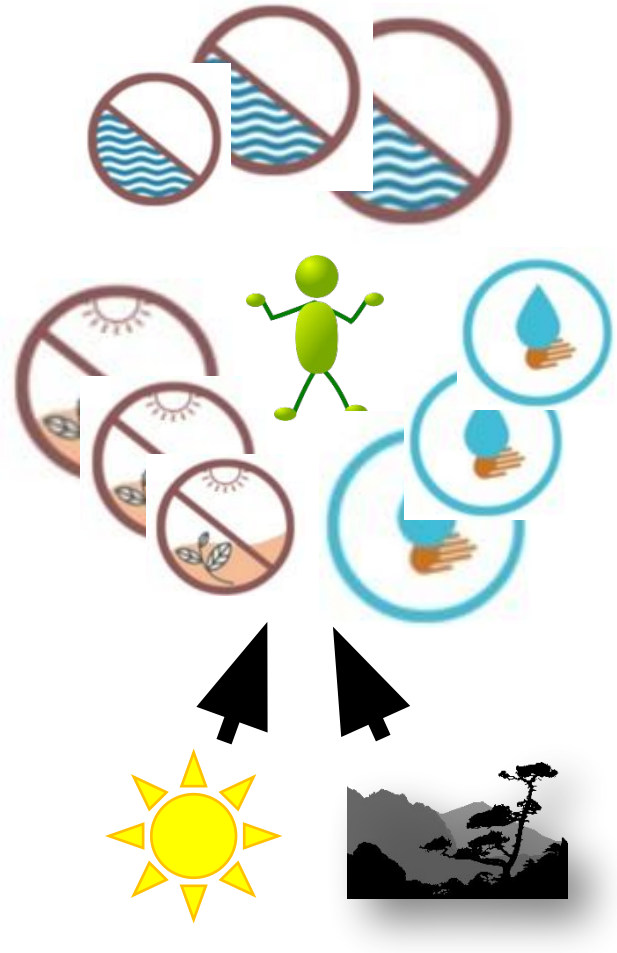
CO$TING NATURE AND WATERWORLD MAKE SCIENTIFIC DATA ACCESSIBLE AND ACTIONABLE

- Provide access to data rapidly and freely
- Use models to process these data to answer policy questions
- Low local capacity requirements (rapid training, no software)



WATERWORLD

- ✓ Part of **policysupport.org** suite of tools
- ✓ Sophisticated model providing about 50 output datasets relating to **water quality, quantity and regulation ecosystem services**
- ✓ Contains **scenario tools** to assess impacts of climate change and land use change on water related services
- ✓ Contains **policy option/intervention tools** for e.g. reforestation, mining

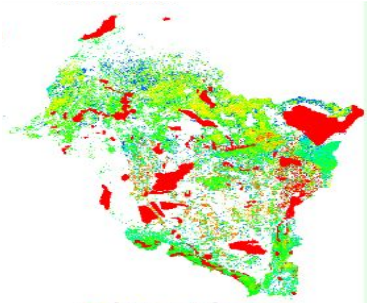


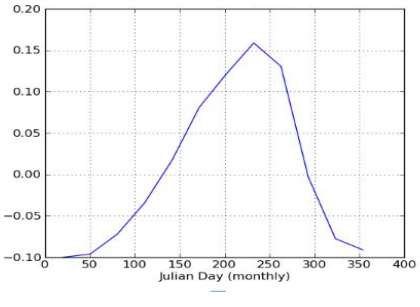
CO$TING NATURE

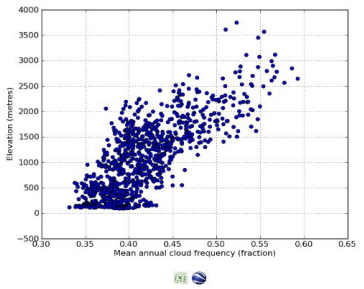
- ✓ Part of **policysupport.org** suite of tools
- ✓ Model providing about 25 outputs relating to a wide range of **ecosystem services (benefits ecosystems provide to people)**
- ✓ Includes **water, carbon, tourism, hazard mitigation, biodiversity**
- ✓ Distinguishes between where ecosystem services are supplied but not yet used (**potential service**) from where people actually currently benefit from them (**realised service**)
- ✓ Provides information on pressures, threats and thus overall relative conservation priority

BOTH TOOLS

- Allow online visualisation, analysis and GIS download of outputs
- Allow users to summarise outputs according to river watershed, administrative area, dam watersheds, protected areas, urban areas, and more.
- Are ready to run using data from global datasets but users can substitute their own data if they want to
- Can be run at 1ha or 1km^2 resolutions for anywhere, free of charge







When and where Co$ting Nature and WaterWorld should(n't) be used

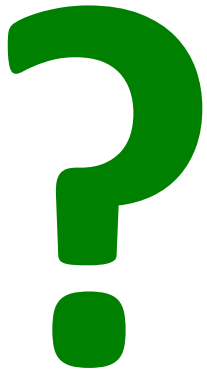
Use when:

- There is no – or a poor – ecosystem service **baseline**
- There is a **paucity** of local data, capacity or infrastructure around ecosystem services
- A rapid, **cheap but detailed** assessment is required at management- or policy- relevant scales
- The problem requires a **projection** of change factors or **deltas** (i.e. % changes) from the baseline and/or mapping of areas **sensitive** to particular scenarios or policy options

But not when:

- You need to **predict** exact current or future magnitudes at a particular point (e.g. flow or sediment volumes at a dam)
- A locally **calibrated** model is required (by default we do not calibrate).
- Your site is very small (<1km^2 and the environment around it is not relevant to the problem)

ANY QUESTIONS

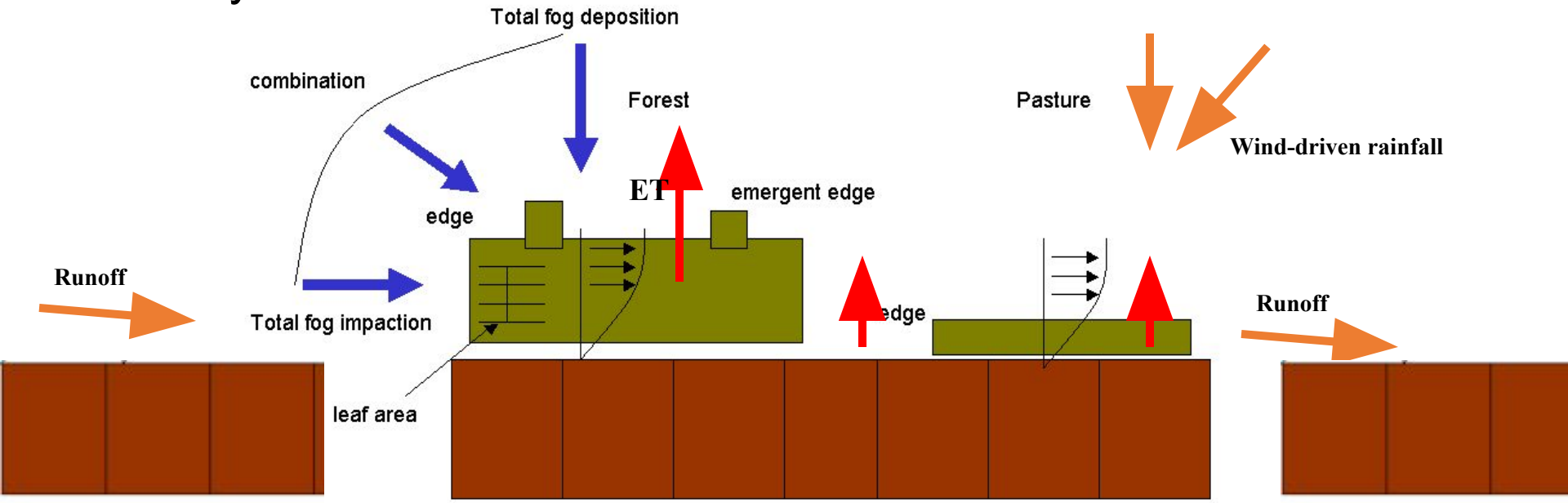


ADDITIONAL SLIDES FOR THOSE THAT WANT FURTHER INFORMATION ON CO$TING NATURE AND WATERWORLD INCLUDING HOW THEY COMPARE TO OTHER TOOLS

(THESE WILL NOT BE PRESENTED DURING THE TRAINING COURSE)

WaterWorld (V1) Scientific principles

1. Based on FIESTA model (Mulligan and Burke, 2005; Bruijnzeel et al, 2011)
2. Physically based (rather than empirical)
3. Not calibrated (e.g. to observed flows)
4. Gridded representation of water balance (wind-driven rainfall+fog minus evapotranspiration)
5. Positive water balances cumulate downstream as flows
6. Changes in climate or land cover/use change water balances locally and downstream



Summary of WaterWorld functions

Visualise

- summarise by zone (e.g. Admin region, IBA,KBA..)
- change colour scale
- change min max
- log scales
- maps/ map animations
- time series
- scatterplots of relationships
- Google Earth or Google Maps
- Permalink
- Frequency distributions

Download

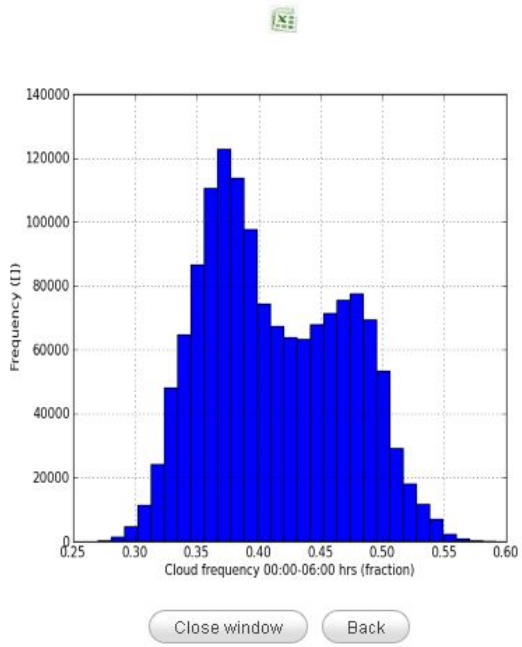
- output Maps: Geo-ARCASCII, GeoTIFF, IDRISI etc
- output data as Excel
- output data as KML

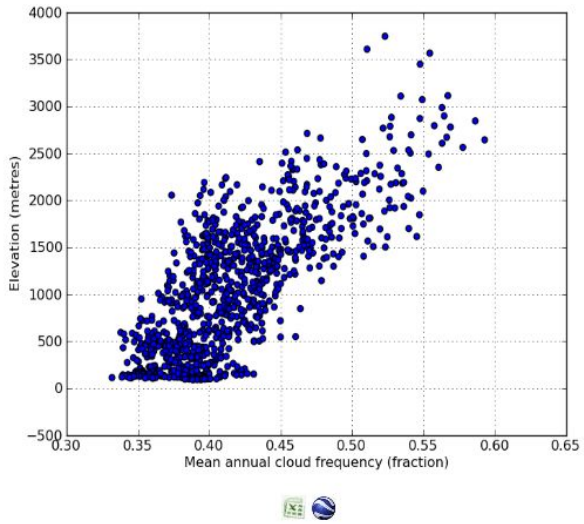
Analyse

- map statistics
- scatterplots of relationships
- seasonality
- sensitivity

ROI (Region of Interest)

- values for points of interest
- values (min, max,m ean *etc*) for zones of interest





Summary of WaterWorld outputs

Annual:

Total annual actual evapo-transpiration (mm/yr)
Per capita water availability (Mm^3/person)
Annual total water balance (mm/yr)
Annual total soil deposition (mm/yr)
Total fog deposition (mm/yr)
Annual total gross soil erosion (mm/yr)
Fog inputs as a percentage of water balance (%)
Fog inputs as a percentage of total precipitation
Total annual fog runoff (m^3)
Total annual fog runoff (mm/yr)
Total fog inputs (mm/yr)
Annual total gross hillslope soil erosion (mm/yr)
Annual total hillslope net soil erosion (mm/yr)
Total annual hillslope runoff (m^3)
Total fog impaction (mm/yr)
Mean percentage of water may be polluted (%)
Annual total net soil erosion (mm/yr)
Annual % of runoff generated by fog (%)
Runoff ratio by subcatchment (fraction)
Total annual runoff (m^3/s)
Total annual runoff (m^3)
Total annual runoff (mm)
Total annual potential evapo-transpiration (mm/yr)
Total wind-corrected rainfall (mm/yr)
Annual total soil transportation (mm/yr)
Water storage capacity (mm)
Mean annual terrain corrected wind speed (m/s)
Difference between rainfall and wind driven rainfall (mm/yr)
Freq. of potentially condensing conditions (%)
River network (dimensionless)
Total annual rainfall (not wind corrected) (mm/yr)
Mean annual wind exposure (topex scale)

Monthly:

Terrain-corrected wind direction (degrees from N)
Actual evapo-transpiration (mm/hr)
Water balance (mm/hr)
Water storage (mm)
River flow generated from fog inputs (mm/hr)
Hillslope Runoff (mm/hr)
Percentage of runoff derived from fog (%)
Percent of water that may be polluted (%)
Wind-corrected rainfall (mm/hr)
Runoff (mm/hr)
Snow Pack Water Equivalent (mm)
Fog inputs as a % of total precipitation (%)
Meltwater production (mm/hr)
Mean terrain-corrected wind speed (m/s)

Summary of WaterWorld scenarios and interventions

CLIMATE
Inbuilt: IPCC AR4 A2a & CMIP5 17GCMs 2020s, 2050s,2080s
By connection: UEA/Tyndall Centre CIAS CLIMGEN
By upload: Your own
By specification: simple seasonal temperature and precipitation changes
LAND USE
Afforestation/Deforestation: according to pre-defined rules
Afforestation/Deforestation: specify rule e.g. deforest a particular IBA
Change to land cover type: according to pre-defined rules
Change to land cover type: specify rule e.g. deforest a particular IBA
Land use change model – based on historic LUC
Upload your own land cover type maps
LAND MANAGEMENT
Riparian buffer strips, bench terracing, contour ploughing, check dams, eco-efficiency for agriculture, change industrial inputs
WATER MANAGEMENT
Sanitation and domestic water treatment.
MINING (OIL and GAS) – opertaionalise concessions
OTHERS
By upload of appropriate input ARCASCII maps

Summary of Co$ting Nature outputs

Relative biodiversity index of red-list species
Relative conservation priority index
Net carbon sequestration (dry matter NPP t C/km^2/yr)
Carbon stock (t C/km^2)?
Endemism richness of red-list species
Relative socio-economic exposure to ES relevant hazards
Relative potential for ES relevant hazards
Relative potential carbon value index
Relative potential hazard mitigation
Relative potential recreational value
Relative potential water provisioning services
Relative realised hazard mitigation ecosystem services
Relative realised recreational value index
Relative realised water provisioning services index
Potential recreational magnitude (index)
Relative pressure index
Relative threat index
Species richness of red-list species
Relative ES relevant risk (exposure x vulnerabilty)
Realised tourism magnitude (index)
Relative untapped recreational value
Relative untapped water provisioning services
Relative socio-economic vulnerability to hazards
Clean water provided (Mm3/year)
Per capita clean water provided (Mm3/person)

Relative aggregate nature conservation priority index	Pressured and threatened conservation priority areas with high potential service provision	
Relative biodiversity priority index	Relative richness and endemism for redlisted mammals, reptiles, amphibians	
Relative conservation priority index	Conservation priority by overlap of EBAs (Birdlife), Global200 Ecoregions (WWF), Hotspots (CI), Last of the Wild (WCS,CIESIN), Important Bird Areas (Birdlife) and Key Biodiversity areas (IUCN, BI, PI,CI)	
Relative pressure index	Current pressure according to population, wildfire frequency, grazing intensity, agricultural intensity, dam density, infrastructure (dams,mines,oil and gas, urban) density	
Relative threat index	Future threat according to accessibility, proximity to recent deforestation (MODIS), projected change in population and GDP, projected climate change, current distribution of nightime lights	
Relative realised natural hazard mitigation index	Relative hazard mitigation services for flood/drought, landslide/erosion, inundation/tsunami/cyclone according to relative risk protected against	
Relative realised water provisioning services index	Relative volume of clean (not human impacted) water available to downstream people and dams	
Relative potential and realised carbon services index	Relative carbon sequestration and relative carbon stock services (all potential is realised)	
Relative realised recreation services index	Realised tourism services measured as relative density of Panoramio photos in non-urban areas	

A comparison of site-scale ecosystem service tools

	ARIES	INVEST	WaterWorld & Co$ting Nature
Baseline Services:			
Water quantity	☑	☑	☑
Water quality	☑ (sediment only)	☑	☑
Water regulation	☑	☒	☑
Carbon	☑	☑	☑
Hazard Mit.	☒	☑ (coastal only)	☑ (all)
Others	☑	☑	☑
Scenarios:			
Climate change impacts	☒	☒ (supplied by user)	☑
Land use change impacts	☒	☒ (supplied by user)	☑
Land management impacts	☒	☒ (supplied by user)	☑
Water management impacts	☒	☒ (supplied by user)	☑
Spatial resolution	depends on module	depends on input	1ha. to 1km^2
Temporal resolution	annual	depends on input	
Requires biophysical data	yes	yes	supplied
Data:	user supplied	user supplied	provided globally
Time to complete an analysis	200-300hrs* (BSR, 2011)	160-260hrs* (BSR, 2011)	15mins
Software	Web-based	needs ArcGIS and extensions	Web-based
GIS expertise required	No	Yes	No
Download results for analysis	No	Yes	Yes
Development	Beta version not yet released	Released	Released V 2