

# Using mobile phones for environmental protection in Africa: The Equatorial Africa Deposition Network case study

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# Agenda

- Objectives
- The African Great Lakes
- The Equatorial Africa Deposition Network (EADN)
- Mobile Environmental Framework
- Recommendations & Conclusions



# Objectives

- To explore how mobile phones can be incorporated to the Equatorial Africa Deposition Network.
- To propose how mobile phones can be used to track human behavior around the African Great Lakes.



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Institute for Water,  
Environment and Health



# The African Great Lakes



# East Africa Rift Valley Region

- Transboundary natural and human habitat that involves the following countries: Ethiopia, Kenya, Sudan, Uganda, Tanzania, Rwanda, Burundi, Democratic Republic of Congo, Zambia, Malawi and Mozambique.
- Includes lakes Victoria, Tanganyika, Malawi, Turkana, Albert, Edward, George and Kivu. These tropical lakes form the African Great Lakes.



# African Great Lakes

## Physical Characteristics

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Lake	Surface Area (m <sup>2</sup> )	Max Depth (m)	Volume (km <sup>3</sup> )	Residence Time (yrs)
Victoria	68,800	79	2,760	23
Tanganyika	32,600	1470	18,900	440
Malawi	29,500	700	7,775	114

(Bootsma,2003)





# African Great Lakes Socio-economic Context

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Lake	Riparian countries	Basin Population density (pp/km2)	Highest HDI range(out of 187)	Basin economic Activities
Victoria	Tanzania, Uganda and Kenya	Up to 1200	145-152	Fisheries, agriculture, manufacturing
Tanganyika	DR Congo, Tanzania, Zambia,Burundi	Up to 250	152-186	Subsistence and small-scale fisheries & agriculture
Malawi	Malawi, Tanzania, Mozambique	Up to 116	152-185	Fisheries, agriculture, tourism.

(Odada,2006)





# African Great Lakes Environmental challenges

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## Environmental challenges

- Eutrophication
- Unsustainable fishing practices.
- Invasive species.
- Untreated wastewater releases.

## Atmospheric deposition of nutrients & Eutrophication

- Biomass burning is a common activity around the AGL due to agriculture practices and lack of electricity access.
- Atmospheric emissions of Nutrients (Nitrogen and Phosphorus) are related to biomass burning.
- Little data related to how much atmospheric deposition contributes to AGL eutrophication.





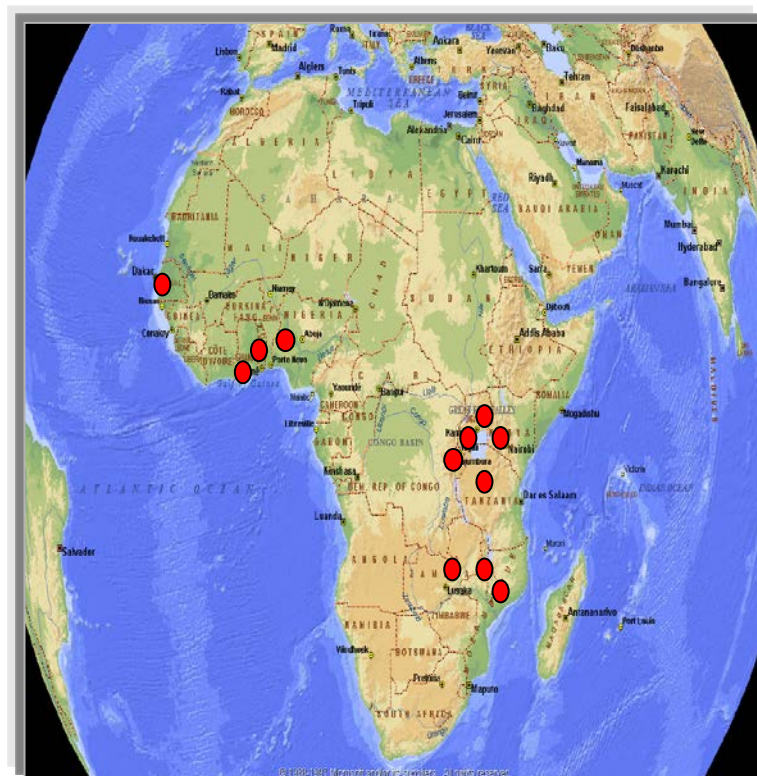
# Equatorial Africa Deposition Network



# EADN General Description

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- First project aimed at investigating atmospheric deposition network that includes measurements out of the lakes' shorelines and basins areas
- 12 countries involved: Burundi, Cote d'Ivoire, Democratic Republic of Congo, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Senegal, Tanzania and Uganda.
- Co-founded by 5 international organizations including GEF and UNU-INWEH.



EADN's monitoring stations  
(Airzone One and Bootsma 2011)



# EADN Technical Characteristics

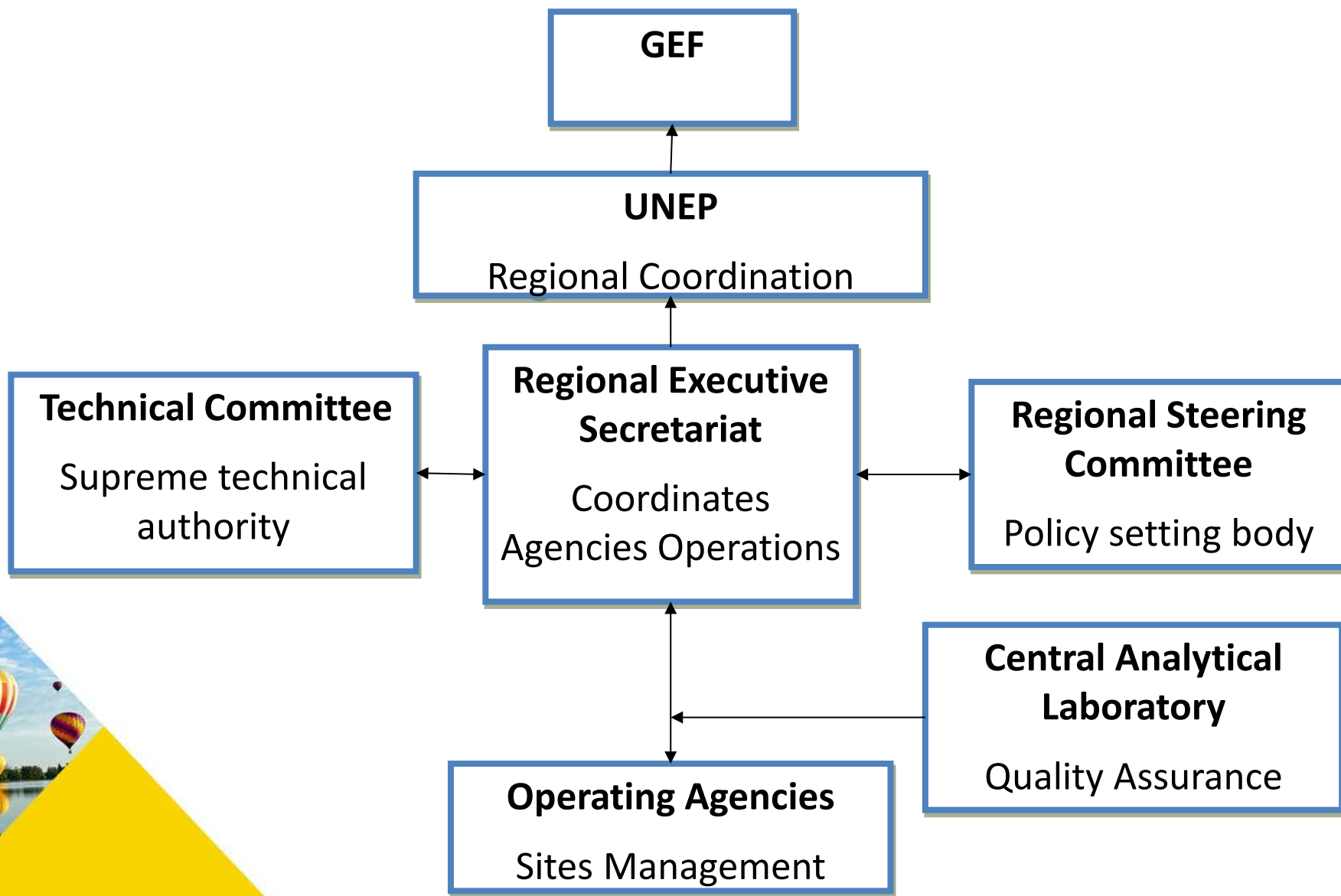
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- Measuring both wet and dry deposition of nitrogen and phosphorus
- Two types of monitoring stations: regional representatives and lake-side sites.
- Capability to collect event-based precipitation.
- Meteorological measurements.



# EADN Institutional Framework

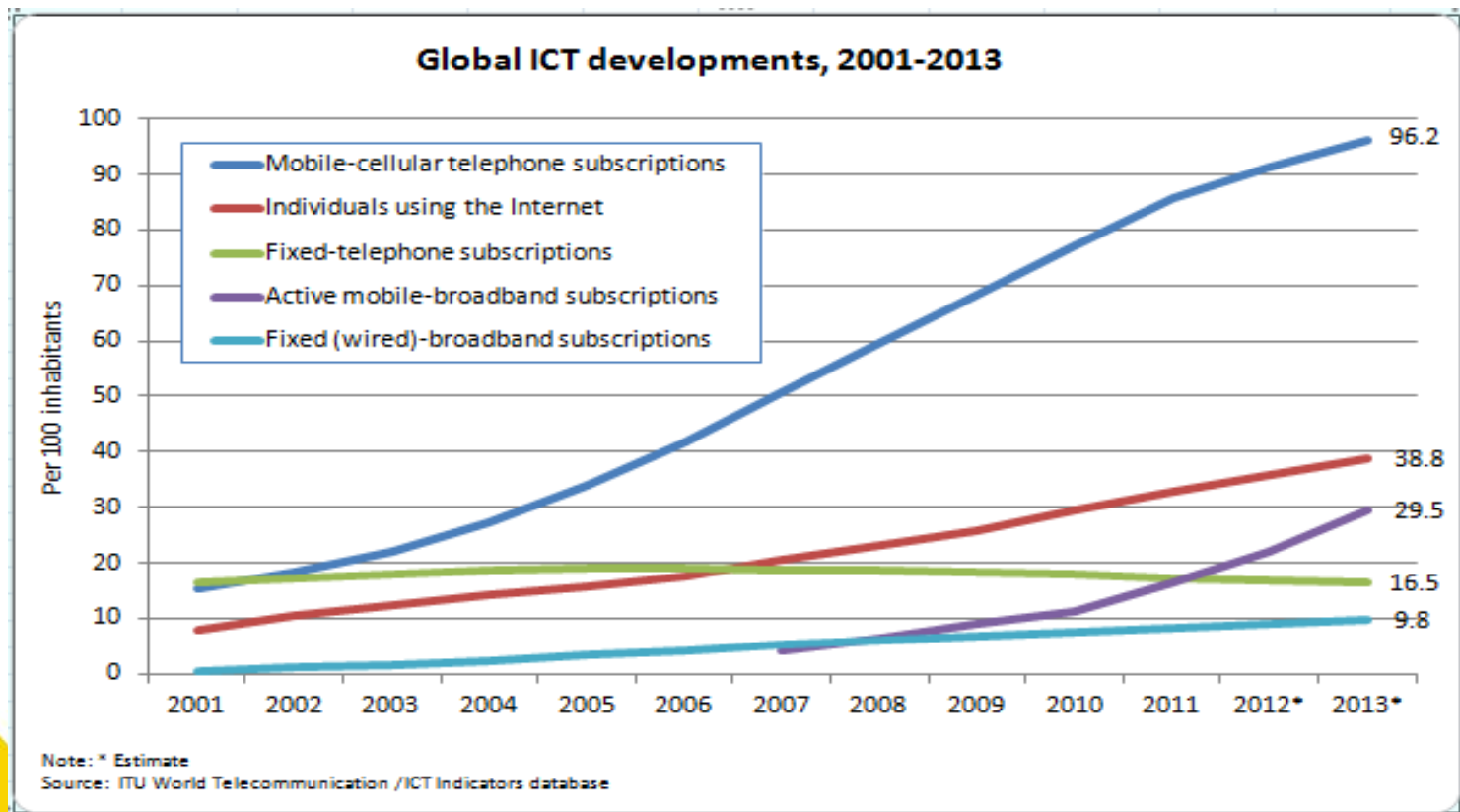
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# Mobile Environmental Framework (mEF)

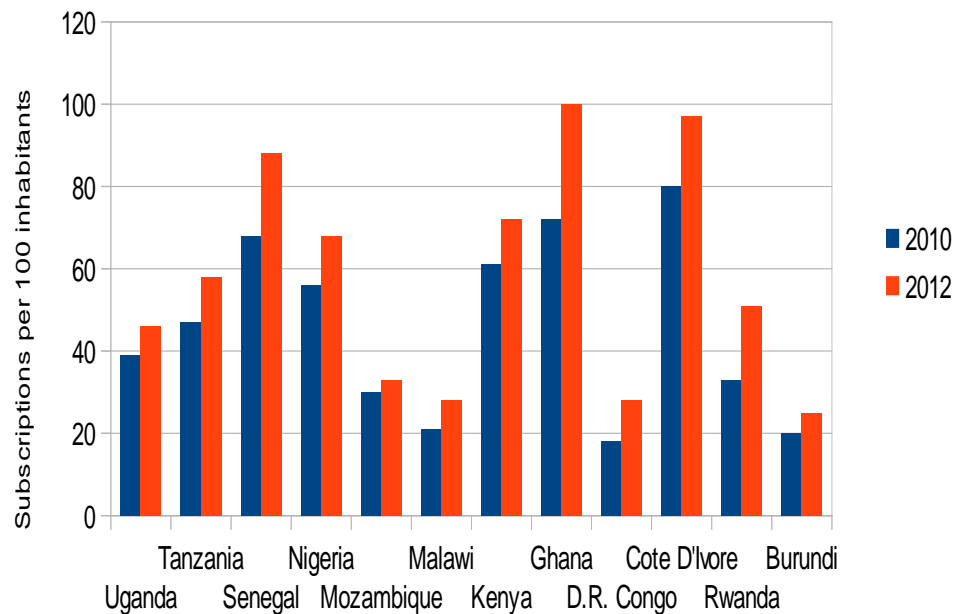


- Access to information has been identified as a source of prosperity and development.



# EADN Mobile Environment

EADN Mobile Penetration 2010/2012



. (ITU,2013)

- Mobile phones could be the only ICT available.
- Cheap phones with no data plans are the most common.
- Mobile sharing is a common practice.
- Unstable power sources and illiteracy represent a challenge
- Data connections are not always available.
- One minute of voice versus one SMS pricing ratio 1:6

(Bhavnani et al. 2008)

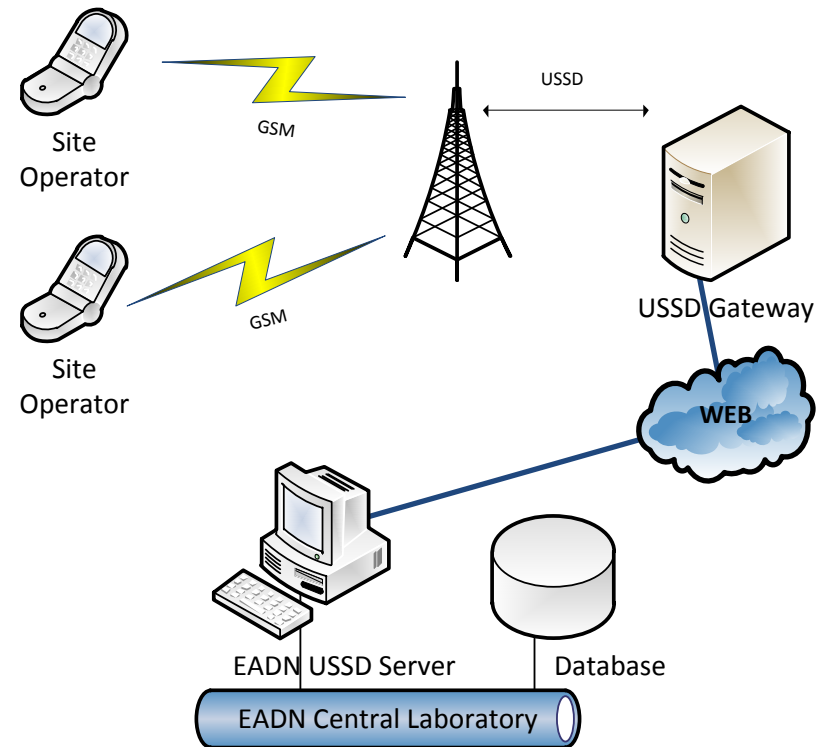
Mobile Environmental Framework (mEF)		
Operational	Educational	Monitoring





# mEF Operational Layer

- Real time upload of Sample History Files to EADN Central Laboratory.
- Based on the Unstructured Service Supplementary Data messaging service.
- Session-based communications.
- No data plans required.
- Works on any kind of mobile phone.
- USSD port open for roaming traffic, one single carrier manages the application.



EADN USSD Application Diagram

- SMS based applications are intensively used and accepted in Africa.
- IVR solutions could be used in parallel to deal with illiteracy.
- Benefits:
  - By implementing a Mobile Government To Citizen App, Operational Agencies can get in touch with remote communities.
  - Awareness campaigns about agricultural efficiency or non-wood fuel sources of energy.
  - Promotion of new economic activities reducing the dependency on agriculture.
  - Using a top to bottom policy, information can be spread throughout the EADN region at a low cost.



## **Citizen to Governments SMS app**

- Bottom to top approach.
- Advocacy has found an ally in mobile phones all around Africa.
- Local civil servants, environmentalists or local public can provides inputs about the effectiveness of the educational layer awareness campaign.





# mEF Monitoring Layer

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## Big Data for Development

- High frequency quantity and diversity of data.
- Based on Call Data Records, metadata generated by Mobile Network Operators to manage the network.
- Privacy issues must be taken into account
- Examples:
  - Identifying human density around the lakeshore areas
  - Identifying work related activities



# mEF Monitoring Layer

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- Nutrients deposition intensity
- Human presence intensity



# Recommendations to Incorporate mEF to the EADN

## Implementation

- The EADN must incorporate a Mobile Data Laboratory.
- The Mobile Lab should have a multidisciplinary team.
- A regional agreement must be done with the MNO's through the African Telecommunications Union.
- MTN should be the MNO hosting the USSD application.

## Operation

- The Big Data analysis should be based only on anonymized CDRs.
- The mEF results should be used as evidence during policy development process.
- Through the SMS-based channel, a continuous feedback between the educational and monitoring layer should be done.



# Conclusions

- The addition of mobile phones to the EADN project will provide meaningful insights to understand nutrient depletion and transport from terrestrial surfaces due to human related practices.
- When encouraging human development, technology should be the one adapting to the social and economic context, not the other way around.



## QUESTIONS?



## THANK YOU!!!!!!

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