



GLOBE Science Working Group

Update

23RD GLOBE Annual Meeting

Detroit, USA

July 14-18, 2019


**Mullica, Claudia, Femi, Becky, Costas,
Hameed, Margaret, Dixon, Amy**




Dixon Butler
Institution: Butler Consulting
Activities: Advise NASA on GLOBE science, history, policy, and management. Report data to GLOBE; GLOBE master Trainer
President: Youth Learning as Citizen Environmental Scientists (ylaces.org)
President: Virginia Environmental Endowment (vee.org)



Margaret Pippin
Institution: NASA Langley Research Center
Activities: Air Quality Student Research Campaigns in U.S., mentoring teachers and students on GLOBE research projects, evaluation of small sensors, GLOBE Aerosol and Ozone Protocol Scientist, GLOBE Atmosphere Master Trainer



Becky Boger
Institution: Brooklyn College, CUNY
Activities: GLOBE Master trainer, co-led e-training materials for hydrology, and biosphere, Mosquito Habitat Mapper Scientist.




Amy Barfield
Institution: GIO
Activities: SWG/GIO Liaison



Claudia Cecilia Caro Vera
Vice Chair of the SWG
Institution: Universidad Nacional Agraria La Molina (Perú)
Activities: Land cover trainer, ocean bundling, El Niño campaign, IVSS judge, mentoring teachers on GLOBE research projects



Constantinos Cartalis
Institution: National and Kapodistrian University of Athens, Greece
Activities: GLOBE Country Coordinator for Greece, IVSS judge, mentoring teachers and students on GLOBE research projects, science education through digital learning, analysis of earth observation data for urban areas and climate applications



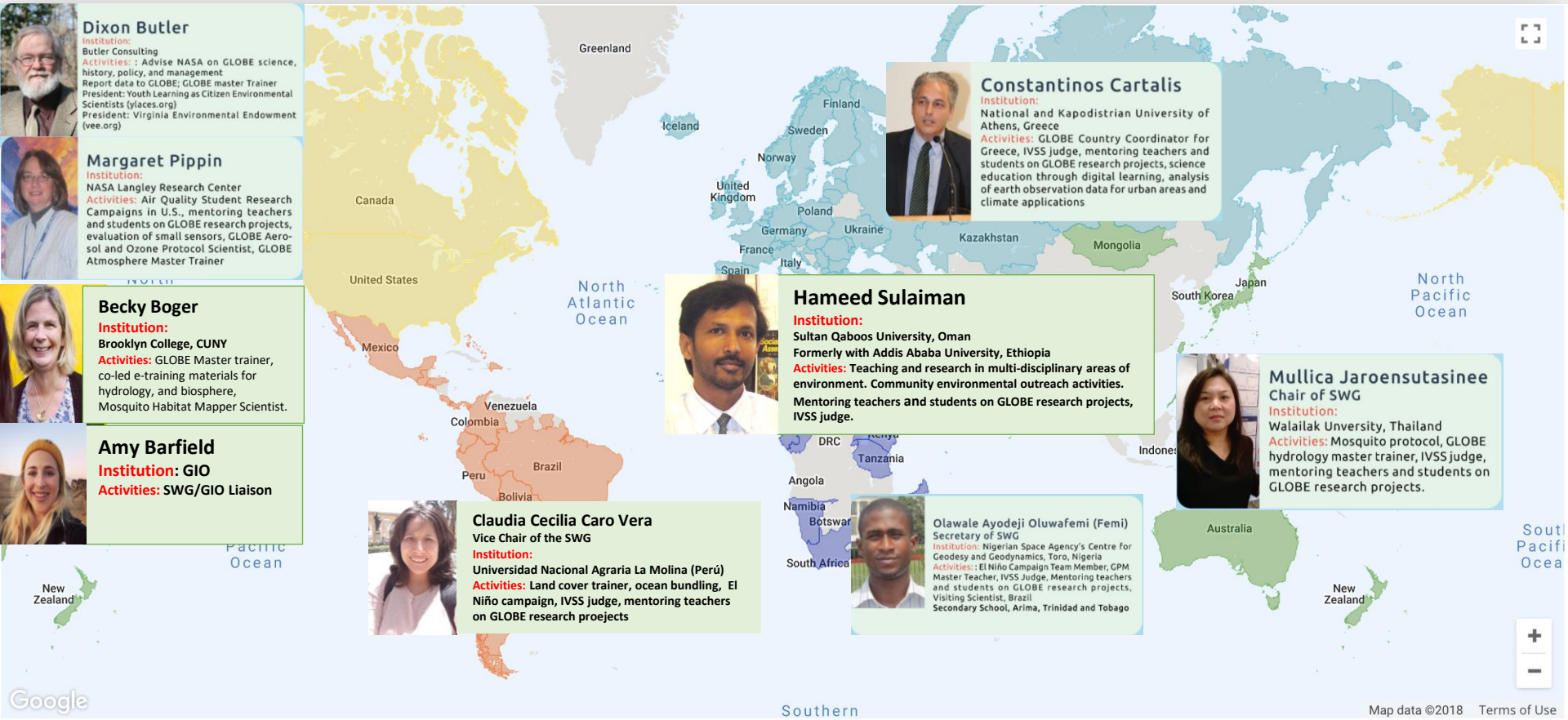
Hameed Sulaiman
Institution: Sultan Qaboos University, Oman
Formerly with Addis Ababa University, Ethiopia
Activities: Teaching and research in multi-disciplinary areas of environment. Community environmental outreach activities. Mentoring teachers and students on GLOBE research projects, IVSS judge.



Mullica Jaroensutasinee
Chair of SWG
Institution: Walailak University, Thailand
Activities: Mosquito protocol, GLOBE hydrology master trainer, IVSS judge, mentoring teachers and students on GLOBE research projects.



Olawale Ayodeji Oluwafemi (Femi)
Secretary of SWG
Institution: Nigerian Space Agency's Centre for Geodesy and Geodynamics, Toro, Nigeria
Activities: El Niño Campaign Team Member, GPM Master Teacher, IVSS Judge, Mentoring teachers and students on GLOBE research projects, Visiting Scientist, Brazil Secondary School, Arima, Trinidad and Tobago



Science Working Group Members

GLOBE Countries and Members Map



GLOBE SCIENCE WORKING GROUP

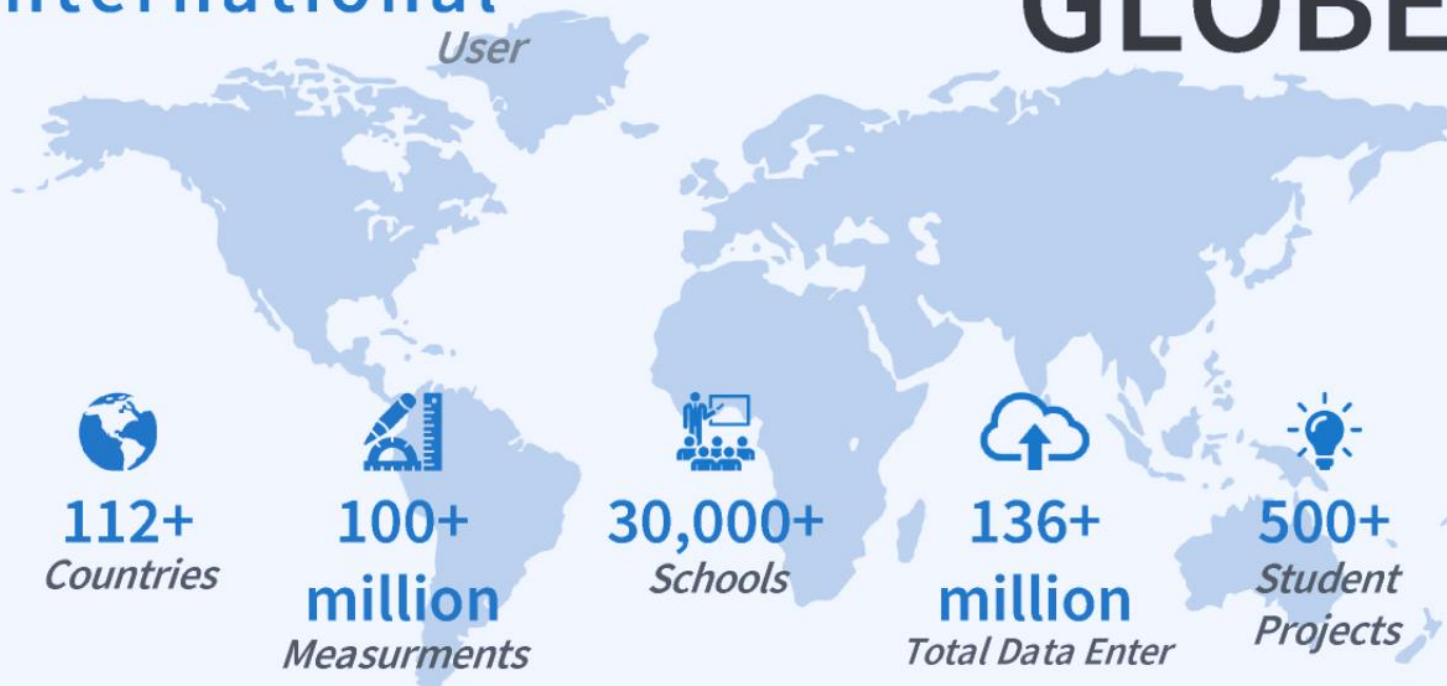
Main Tasks

- ✓ To engage scientists in GLOBE activities by writing blogs, and organizing field campaigns
- ✓ To prioritize new and revise existing protocols

International

User

GLOBE



Implemented by: UCAR



SWG Accomplishments: Protocol Bundles

Hydrology

- Ocean
- River & Lakes
- Water Quality
- Water Cycle

Others

- ENSO
- Mosquito
- Soil
- Urban
- Weather

www.globe.gov/web/earth-systems



Implemented by:





What is in the bundle blog?

Summary

List of GLOBE Protocols

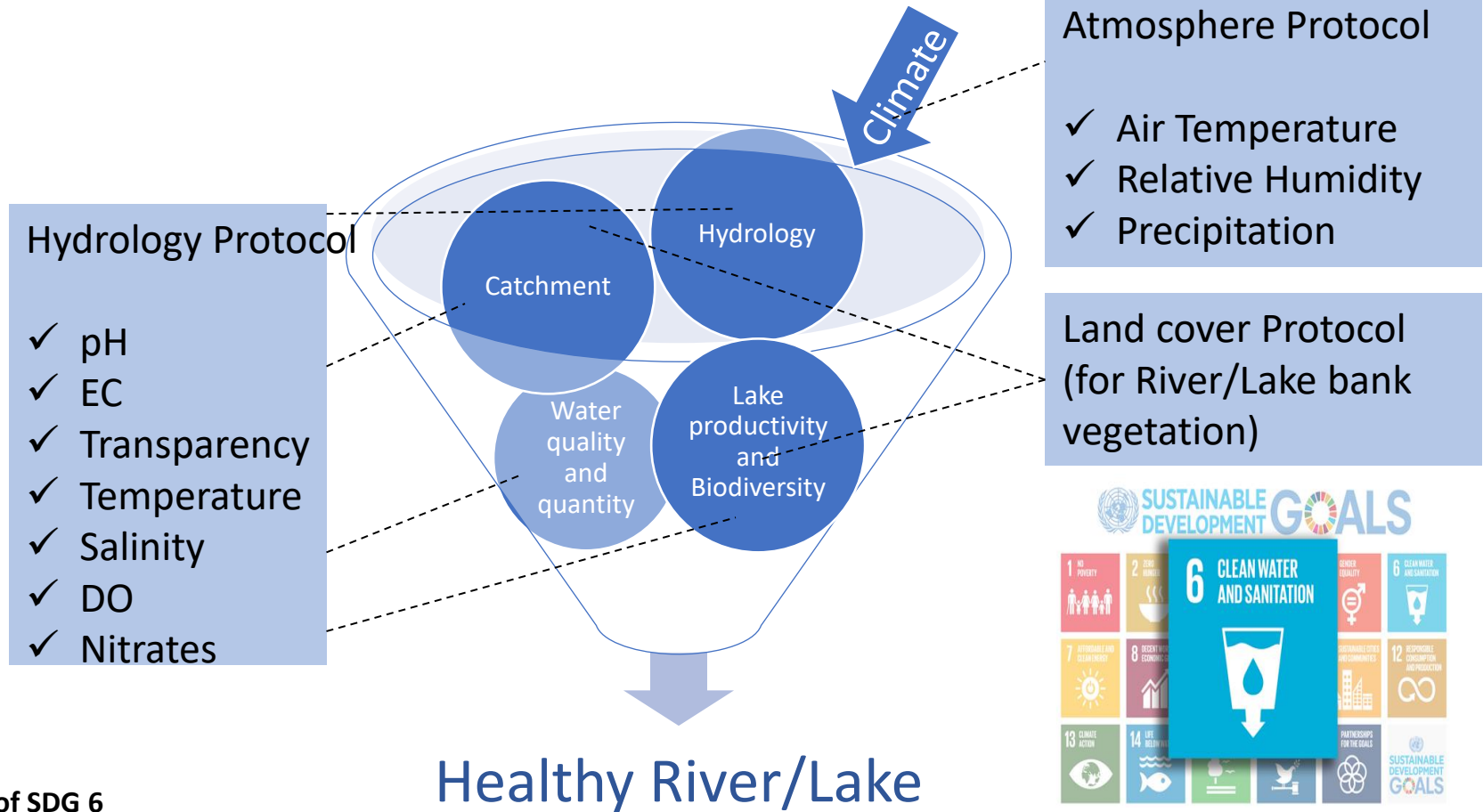
Science Background

Discussion of GLOBE Protocols

Study Case Example, References



Rivers and Lakes protocol bundle



Target 6.6 of SDG 6

By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes





Ocean protocol bundle



Figure 1. Protocols to be included in the Oceans Protocol Bundle.

Ocean systems are complex, interacts with other spheres

Two thirds of Earth's surface (70.9%) is covered by oceans (NOAA, 2018).

Oceans are a vast source of food and raw materials recreation, transportation, and other functions of importance for human well-being (Halpern et al. 2012).

Questions?

- How much does the surface temperature change in relation to the distance from shore?
- What are the most common cloud types close to the ocean?
- How is the land cover close to the coastline and how is it affected by the nearby ocean?
- What is the relation between turbidity and algae biomass?



Ocean bundling study case Title: Influence of environmental factors on marine benthic communities in a man-made mangrove in Pak Nakhon, Thailand

Authors: Students: Pongphak Kanwinphruet and Apisara Santadkarn
School: Princess Chulabhorn Science High School Nakhon Si Thammarat
Teacher: Ms.Rawiwan Chinnawong and Mrs.Kanokrat Singnu

GLOBE protocols used: Biosphere, Atmosphere and Pedosphere

Parameters measured: Atmospheric temperature and humidity. Soil pH, moisture and temperature. Marine benthos (number and composition)

Data Collection: We collected sample from the study site which was divided into three zones according to the distance from the Pak Nakhon estuary. Five samples were collected in each zone

ABSTRACT

This study investigated environmental factors affecting the diversity of Marine benthic communities in man-made mangrove forest at Pak Nakhon, Thailand. The objectives were to study the species and numbers of Marine benthic animals in the study site and also to examine the relationship between environmental factors and numbers of Marine benthic animals. The samplings were collected from mangrove area that was divided into three zones according to the distance from the Pak Nakhon estuary. The parameters measured were benthos number and composition, air temperature, humidity, soil pH, moisture and temperature reflecting three GLOBE protocols namely biosphere, atmosphere and pedosphere. Results showed that among several environmental factors, soil temperature and moisture affect the number of benthos.

Keywords: Environmental factors, Relationship, Benthic community

Results

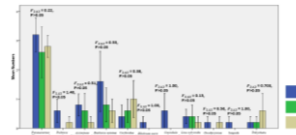
The mean number of different species of Marine benthos is presented in Figure 3 for the three zones under investigation. The relationship between soil (pH, moisture, temperature), Relative humidity, and air temperature and the benthic population are presented in Table 1.

Introduction

In general mangrove forest in the coastal area of Thailand has decreased since 1961. We found from the reports that due to the rehabilitation efforts, mangrove vegetation in Nakhon Si Thammarat province has improved substantially (Figure 1). The mangrove forests in Nakhon Si Thammarat are natural ones as restored by human management. Mangroves are the most important sources providing fish, shrimp, etc for human consumption. Taken that marine benthic animals are sensitive or tolerant to changing environmental conditions, they are considered biological indicators for any change in environmental condition.

Research question: What are the environmental factors that affect benthic communities in the restoration mangrove?

Hypothesis: Most environmental factors may strongly influence the benthic population and diversity



Benthos number and Temperature	Benthos number and Soil temperature	Benthos number and Soil pH
R = - 0.198	R = 0.611	R = -0.147
P = 0.478	P = 0.015	P = 0.601
N = 15	N = 15	N = 15

Discussion:

Results on the biodiversity of benthic communities at the mangrove sites, showed that the numbers of benthos are dependent on soil temperature and soil moisture. Benthos and soil moisture are positively correlated ($P < 0.05$), whereas benthos and soil temperature are negative correlated ($P < 0.05$). The presence and distribution of Marine benthic species depends on the tolerance to the habitat (Suzuki et al., 2002).

Materials and methods:

Study site: The study site was located at Paknakhon mangrove forest, Nakhon Si Thammarat, southern Thailand. Latitude 8.482100 N, Longitude 100.057800 E (Figure 2).

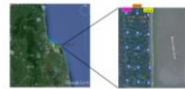


Figure 2. The study site at Paknakhon mangrove forest, Nakhon Si Thammarat, Thailand (Latitude 8.482100 N, Longitude 100.057800 E)

Conclusion:

Among several environmental factors soil temperature and moisture affect the numbers of benthos.

References

Suzuki T., M. Nishihira and N. Paphavasit. 2002. Size structure and distribution of *Ovassimineae brevicula* (Gastropoda) in a Thai mangrove swamp. *Wetlands Ecol. Manage.* 10 (3): 265–271.



Water Cycle

Protocols

Atmosphere

Precipitation

Relative Humidity

Surface Temperature

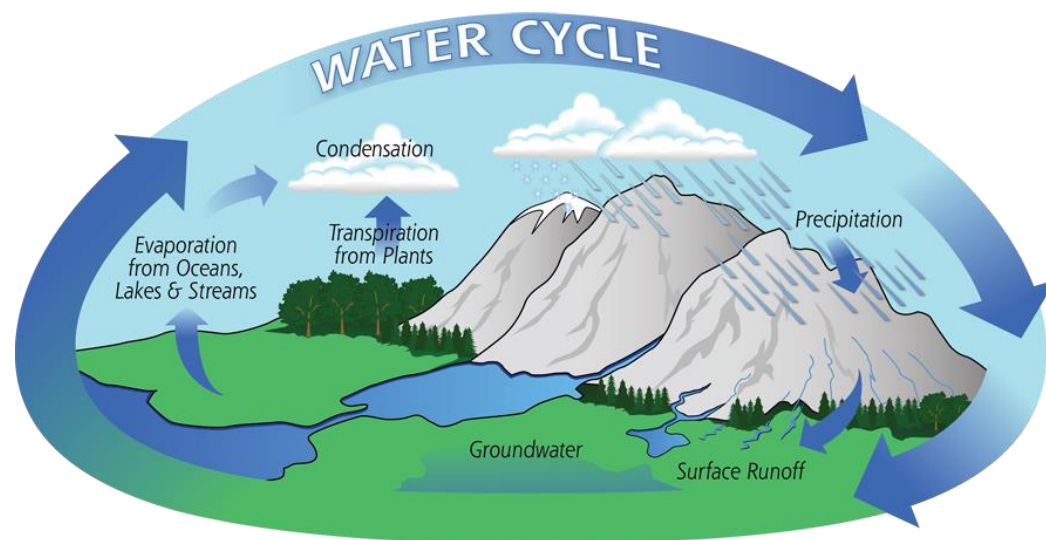
Hydrosphere

Water Temperature

Pedosphere

Soil Moisture

SMAP Soil Moisture



Possible Research Questions

1. How does the water cycle change with seasons throughout the year where you live?
2. Where is there more water stored (e.g., clouds, lakes, soils) where you live? Does this change during the year?



Water Quality Bundle

Protocols

- Precipitation and Precipitation pH
- Soil pH
- Water pH
- Alkalinity
- Salinity or Conductivity
- Dissolved Oxygen
- Nitrates
- Water Transparency
- Water Temperature
- Freshwater Macroinvertebrates

• Guiding Questions

- What is the quality of the water in my environment?
 - Is my water safe to drink?
 - Is my water safe to swim or bathe in?
 - Is my water safe to water crops and plants?
- What impacts does water- both above and below ground- have on our environment?
 - If we have a large rain event, will it flood?
 - Can we grow crops in our soil now?
 - Is my area prone to erosion and landslides?
- How does water quality impact living organisms?
- What types of macroinvertebrates in the water body? How has water quality been affected by human activities?



Mosquito Bundling Protocols

Atmosphere protocol



Digital Hygrometer



Sling Psychrometer



Hydrology protocols



Possible research questions

Indoor/Outdoor containers



Containers with/without lids



Dark/Light-colored containers



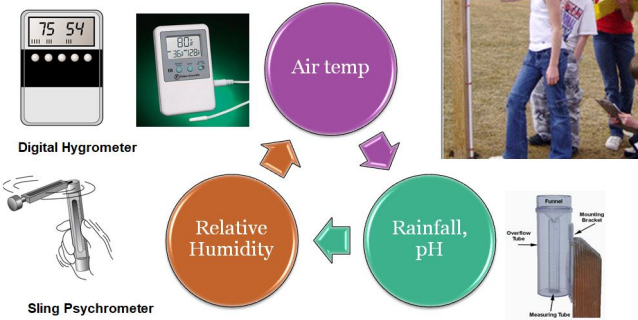
Earthen/Plastic containers



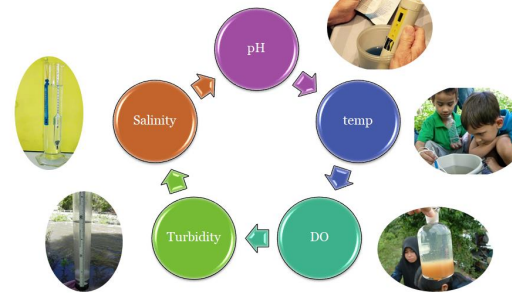


ENSO Bundling Protocols

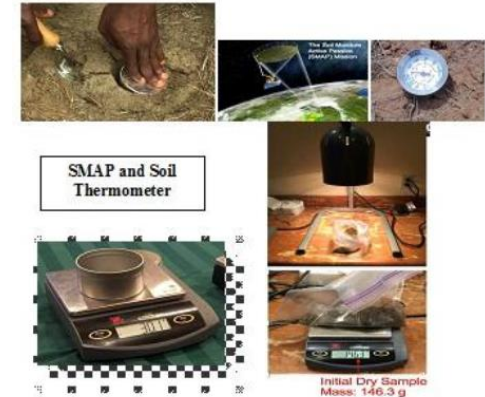
Atmosphere protocol



Hydrology protocols



Pedosphere Protocol



GLOBE ENSO Student Research Campaign

When Phase I: El Nino- March 1, 2016-June 13, 2016

Phase II: Taking Data to the Next Level-Sep 21, 2016-Jun 30, 2017

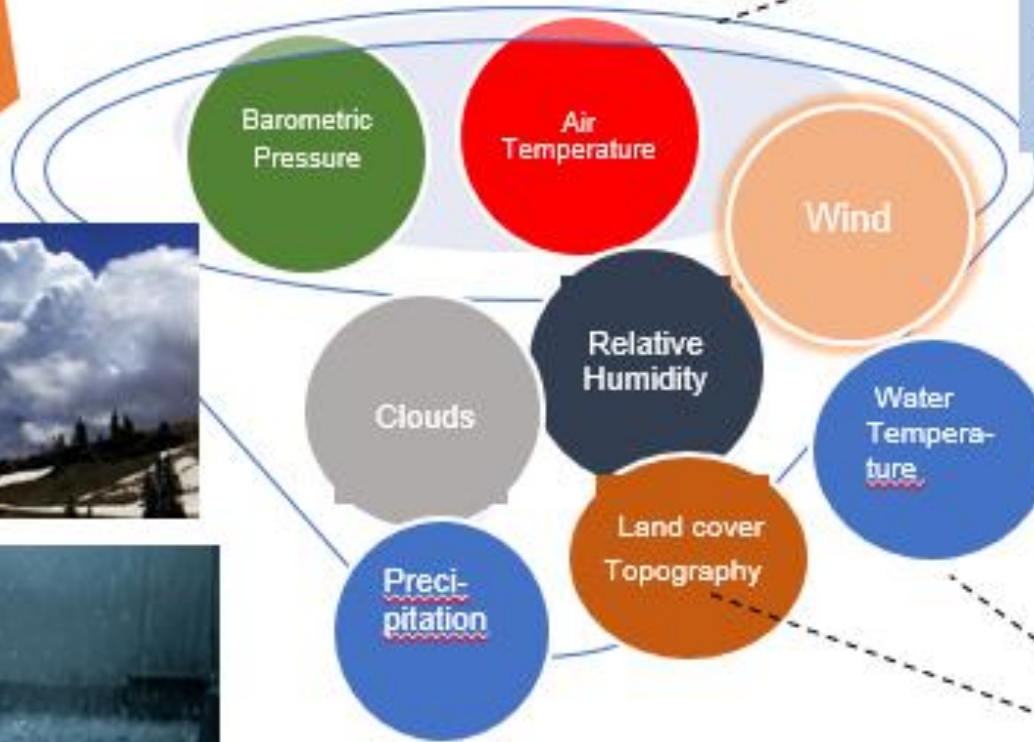
Phase III: Connections and Collaboration-Sep 15, 2017-Jun 30, 2018

Research Question:

- Where and how much El Nino affects your area? Students use the GLOBE protocols of precipitation, air temp, surface temp, soil tem, SMAP, soil moisture and biometry
- Does the ENSO phenomena affect every country in the same way?
- Would ENSO have some effect on the water quality in your area?



Weather Bundling



- Atmosphere Protocol
- ✓ Air Temperature
 - ✓ Relative Humidity
 - ✓ Precipitation
 - ✓ Clouds
 - ✓ Winds

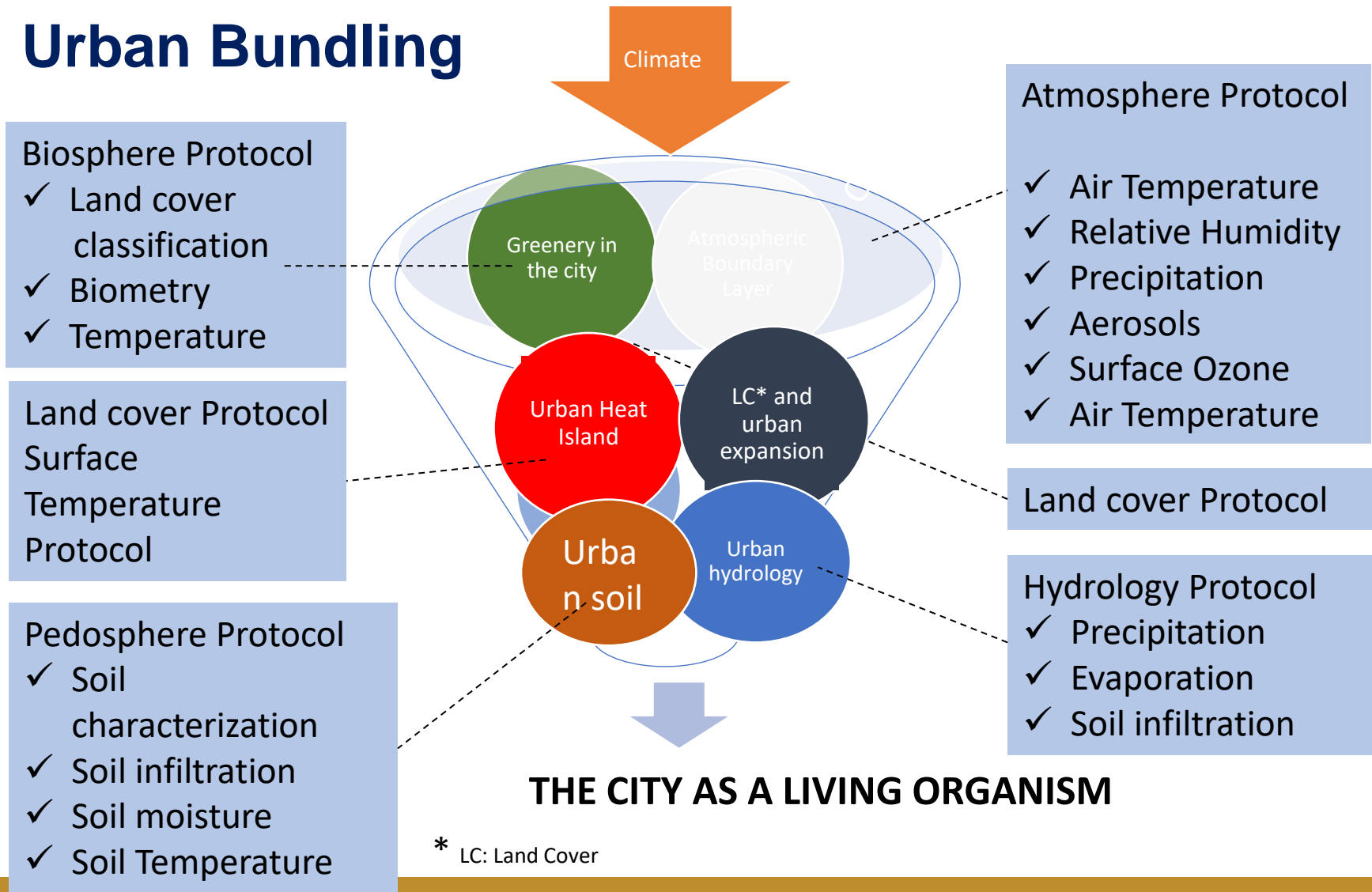


Hydrosphere Protocol

Biosphere Protocol

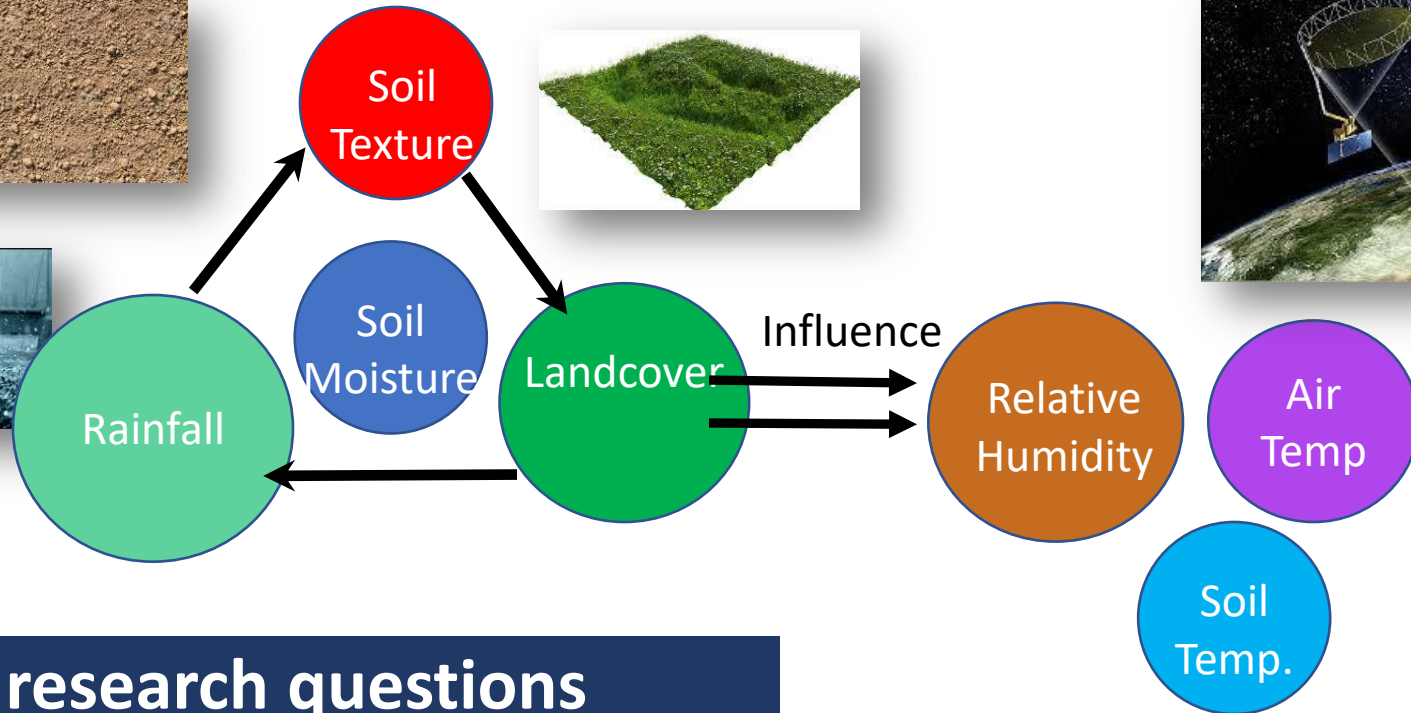


Urban Bundling





Soil Bundling Protocols



Possible research questions

1. How does soil texture, landcover and rainfall influence soil moisture?
2. How does soil moisture influence relative humidity, air and soil temperature?
3. How does soil moisture from GLOBE compare with soil moisture from the SMAP satellite?



What we plan to do next?

Implement SG4 Strategic Goal

- **SG 1-4. Increase the number of projects focused on environmental awareness and contributing to environmental benefits.**





What we plan to do next?

- **GISN member clarifying process**
- **IVSS 2020**
- **Advances in the VIZ and ADAT**
- **Protocols evaluation**
- **Increase Community involvement**
- **# Publications with GLOBE Data**

Current campaigns

- **Mosquitos**
- **Tree campaign**
- **Adopt a pixel**
- **European Phenology campaign**
- **Solar eclipse**

GLOBE Observer
July 2, 2019
Total Solar Eclipse
Chile and Argentina
Download and use the Eclipse Tool!
#NASAGO

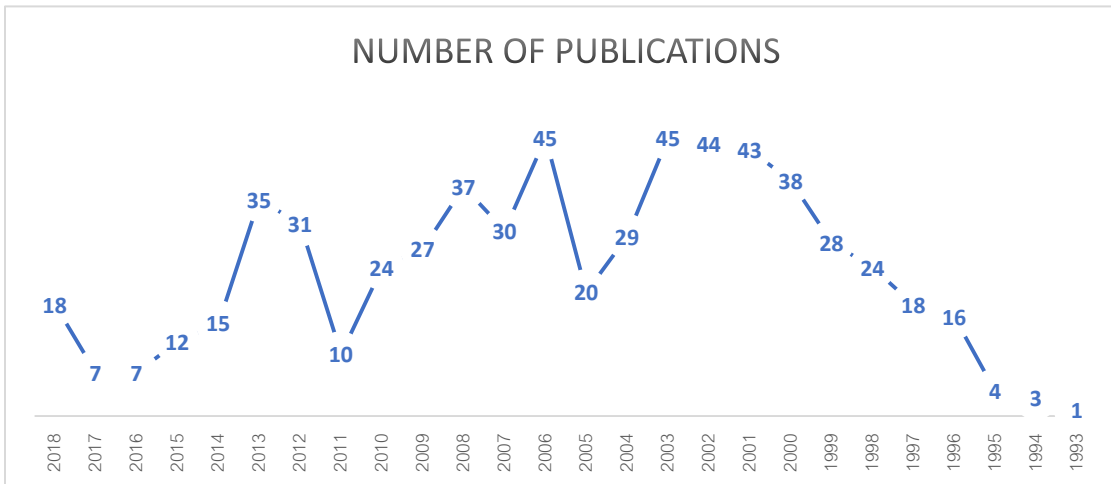
Trees Around the GLOBE Webinar ...
Green-down



GLOBE Publications

• Sample Publications 2019

- Aikpon, R. et al. "Assessment of population dynamics and biting trends of *Aedes aegypti* in northern Benin: Public health implications." *International Journal of Mosquito Research*, vol. 6, no. 2, pp 19-23. 2019. ([link](#))
- Weaver, K., Kohl, H., Martin, A., & Burdick, A. (2019). How Cool Was the Eclipse? Collecting Earth Science Data With Citizen Scientists and GLOBE Observer. In S.R. Buxner, L. Shore, & J.B. Jensen (Eds.), *Celebrating the 2017 Great American Eclipse: Lessons Learned from the Path of Totality* (pp. 511-524). San Francisco: Astronomical Society of the Pacific Conference Series. ([link](#))
- Rahman, I. u., Czajkowski, K., Jiang, Y., & Weaver, K. (2019). Validation of GLOBE Citizen Science Air Temperature Observations Using Data from the Great American Solar Eclipse. In S.R. Buxner, L. Shore, & J.B. Jensen (Eds.), *Celebrating the 2017 Great American Eclipse: Lessons Learned from the Path of Totality* (pp. 501-509). San Francisco: Astronomical Society of the Pacific Conference Series. ([link](#))
- Muñoz, J.P., Boger, R., Dexter, S., and Low, R. Combining State-of-the-art Computer Vision and Citizen Science to Detect Potential Mosquito-Borne Disease Outbreaks, In Delivering Superior Health and Wellness Management with IoT and Analytics (Healthcare Delivery in the Information Age Series), N. Wickramasinghe and F. Bodendorf (eds). In review.



If you publish or present some work related to GLOBE or using GLOBE data, please send an email to help@globe.gov



CONTACT INFORMATION

Join us at the Bundle workshops

- 1. Water Bundles**
- 2. ENSO, Urban, Mosquito, Soil**

Contact:
Science Working Group Members

www.globe.gov



More Information About The GLOBE Program

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