ENSO, Mosquito, Urban, Soil, and Weather Bundle Workshop

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Workshop Agenda

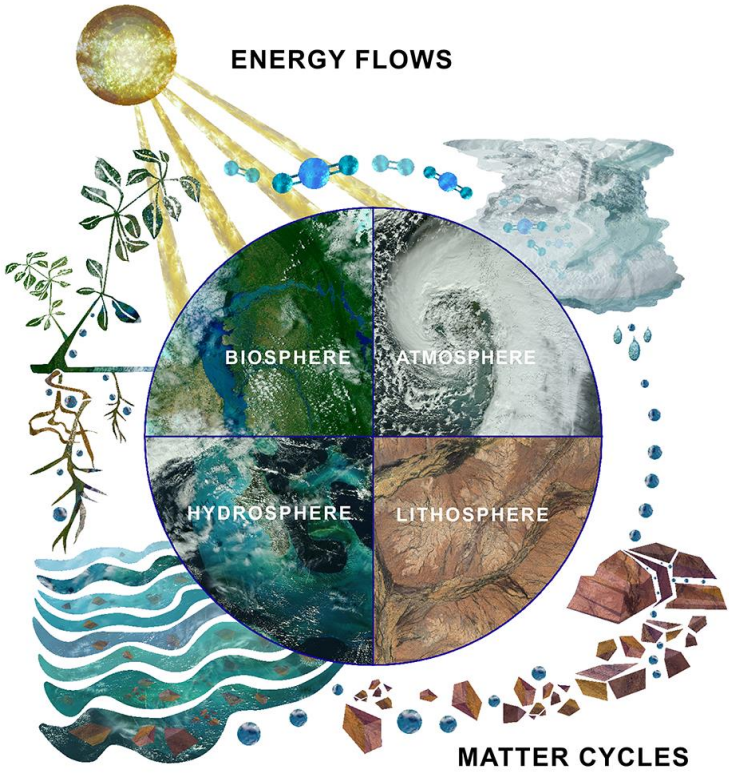
10 minutes	**Welcome and Introduction** • Where are you located? Describe your community (e.g., urban, rural, arid, tropics etc.). • What types of questions/topics are relevant to you, your community, your students? • Which protocols have you done?
10 minutes	**Earth as a System Overview** • Spheres, processes, cycles, reservoirs, flows
10 minutes	**Overview of the Bundles** (2 minutes each)
30 minutes	**Thematic bundle Earth as a system** (Select a group by bundle theme) • What types of questions would your community examine with the selected bundle? • Develop an Earth system diagram and identify how the combined use of the protocols within the same thematic bundle may support the question. • Assess the potential of the integrated approach as supported by the selected thematic bundle as compared to the use of stand-alone protocols.
15 minutes	**Gallery Walk** • Walk around and examine the diagrams for other groups. With post-its, write down suggestions or questions about the diagrams.
15 minutes	**Reflection and Wrap-up** • Reconvene in your group, look at the comments on the post-its, and think about ways you would revise the diagram and implement in your community • Final thoughts and wrap-up

Earth System

- The Earth system behaves as a single, self-regulating *closed* system comprising physical, chemical, biological and human components.
- The fluxes and feedbacks between these components are complex and take place on multiple scales of time and space.
- The focus of Earth system science is understanding the interactions between the oceans and ice, atmosphere, life, geological processes and the land surface, and how those interactions impact each other and lead to changes on our planet.

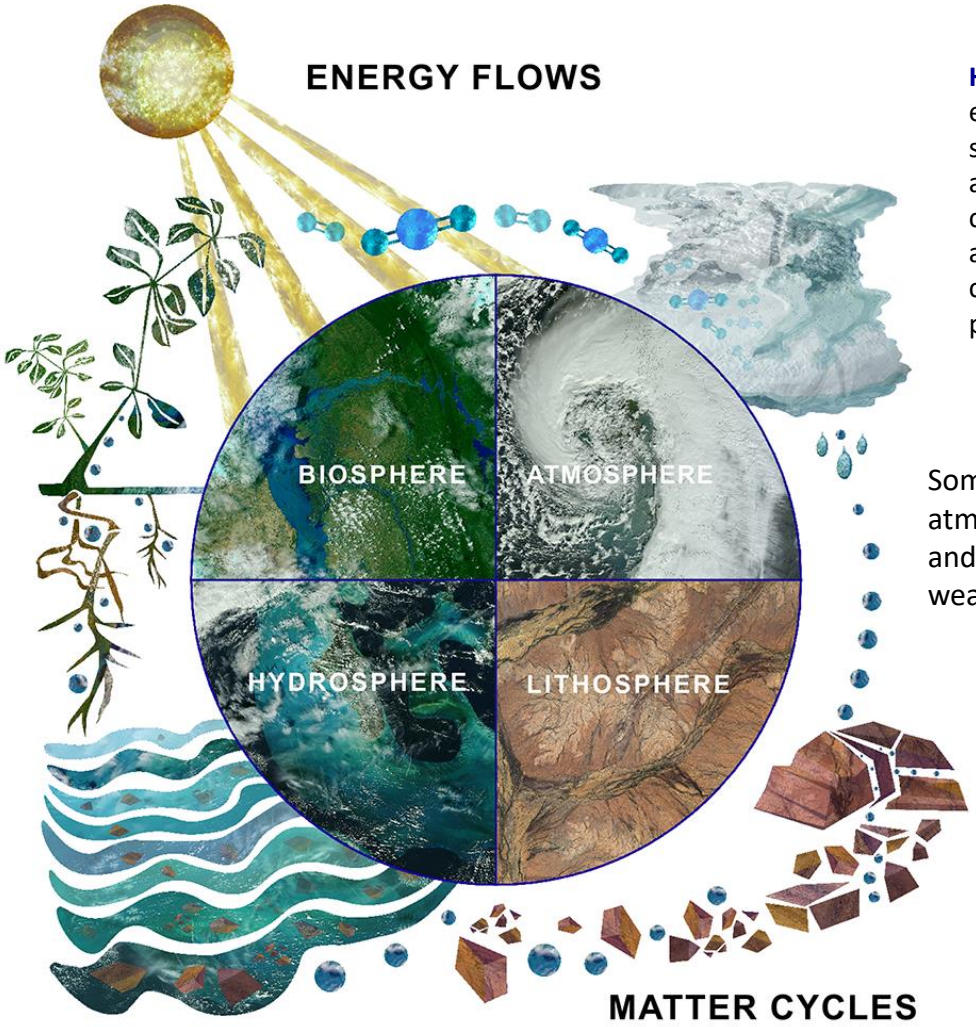
Spheres, Reservoirs, Fluxes, Processes, and Cycles

- Energy Flows: Energy from the Sun enters the Earth system, and it is reradiated back into space.
- Matter Cycles: Matter stays within the system, but can change from one form to another and move between the Earth's component spheres.
- Can you describe one example of matter cycling, using the illustration as an example?



Biosphere: Supplied with a growth medium, plants take root in the soil grow, and exchange gases with the atmosphere. They absorb CO2 from the atmosphere and through the process of photosynthesis they transform solar energy to sugars, and release O2 into the atmosphere. They also breathe in O2 and release CO2 through the process of respiration.

Hydrosphere: Suspended particles are washed into a stream, and during a flood will be deposited on land, along with rich organic nutrients derived from organisms that inhabit the water body, establishing the beginning stages of a soil.

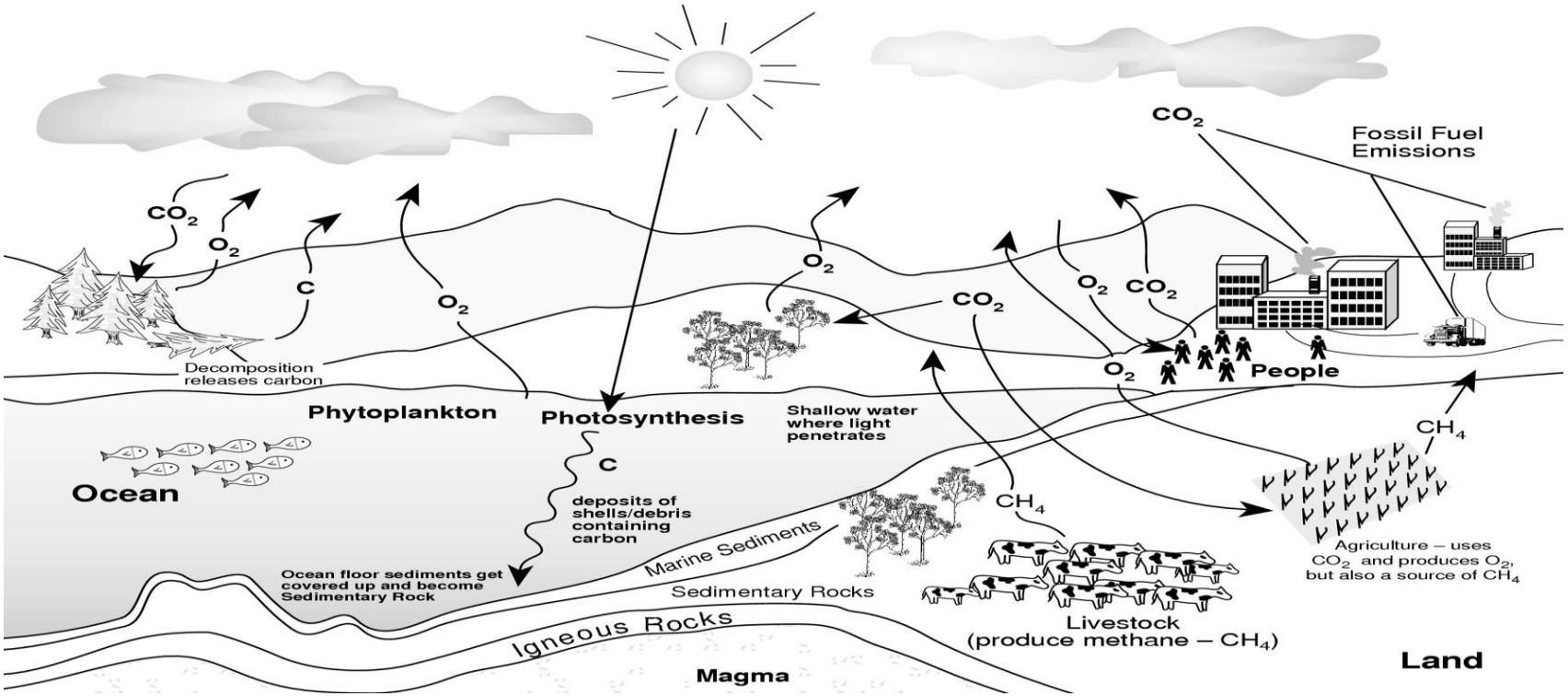


Hydrosphere: Water evaporates from the Earth's surface, and enters the atmosphere. Water vapor cools and condenses in the atmosphere, forming clouds and creating precipitation.

Some CO2 gas in the atmosphere disassociates and makes the rainwater weakly acidic:

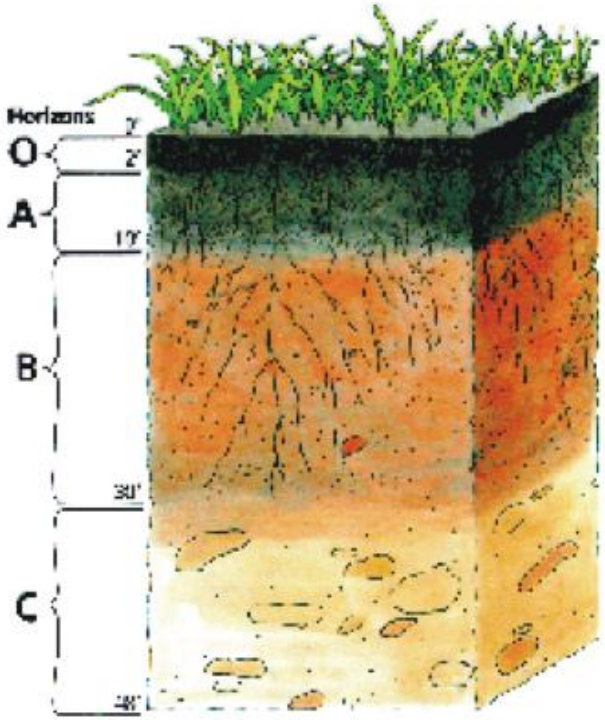
Lithosphere: Over time, the acid in rainwater will chemically weather rock, and break it up into smaller particles.

Carbon Cycle



Carbon, the major building block of life, continuously cycles within and between the spheres. The carbon cycle is one of the most important interconnections within the Earth system.

Matter cycles

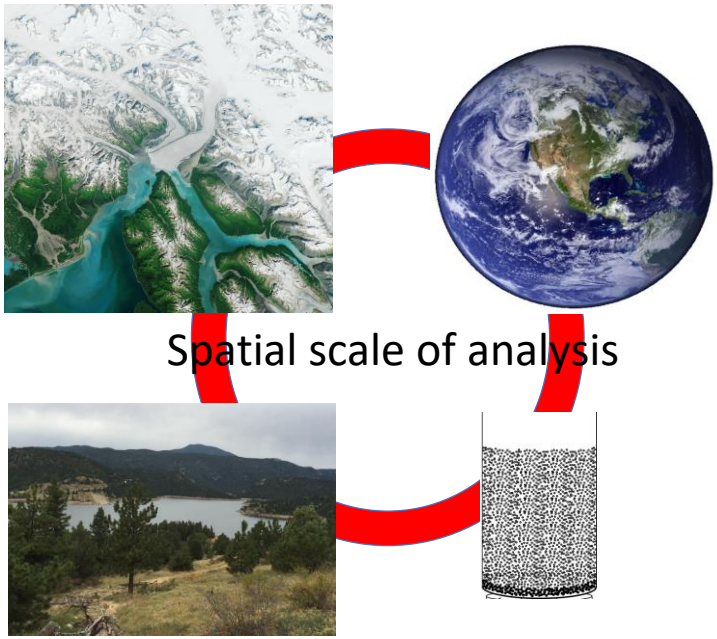


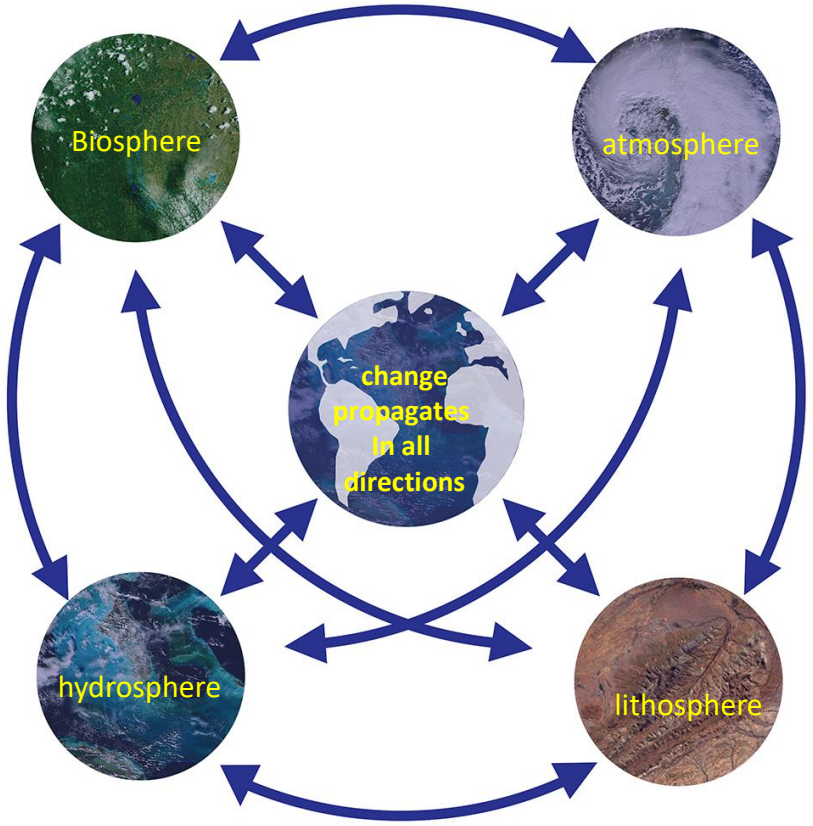
Soil formation as a system

The layers of soil in a soil profile are called soil horizons. They are created through the interaction of soil formation variables:

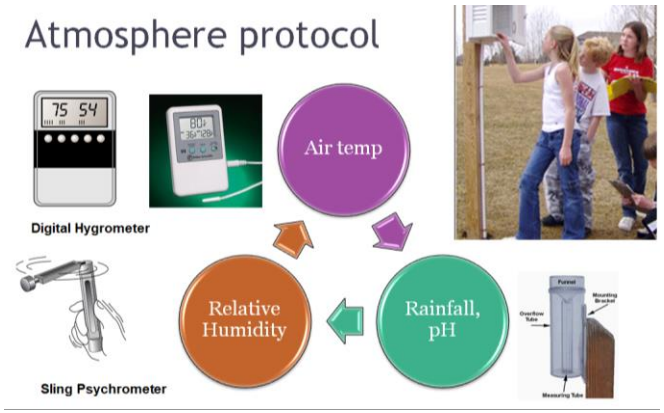
- Climate (hydrosphere and atmosphere)
- Organisms (biosphere)
- Parent Material (lithosphere)
- Topography (lithosphere)
- Time

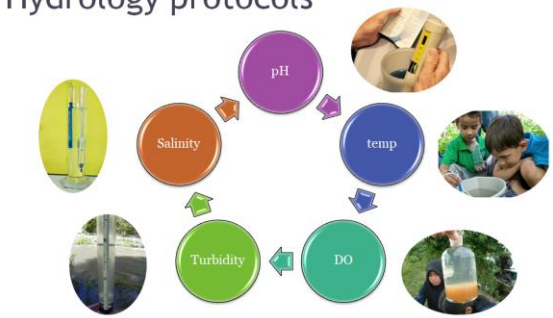
Earth systems can be analyzed at many spatial scales.





ENSO Bundling Protocols





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:

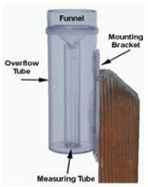
- **Where and how much El Nino affects your area? Students use the GLOBE protocols of precipitation, air temp, surface temp, soil tem, SMAP, soil moisture and biometry**
- **Does the ENSO phenomena affect every country in the same way?**
- **Would ENSO have some effect on the water quality in your area?**

Mosquito Bundling Protocols

Atmosphere protocol

Digital Hygrometer

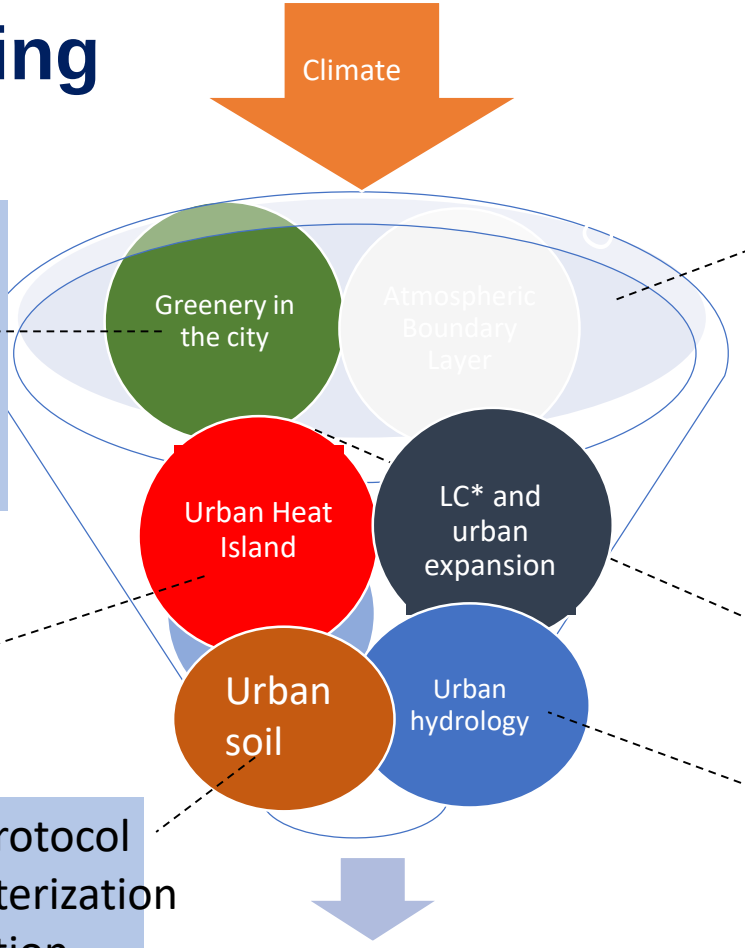
Sling Psychrometer



Hydrology protocols

Possible research questions

Urban Bundling



Biosphere Protocol
- ✓ Land cover classification
- ✓ Biometry
- ✓ Temperature

Atmosphere Protocol
- ✓ Air Temperature
- ✓ Relative Humidity
- ✓ Precipitation
- ✓ Aerosols
- ✓ Surface Ozone
- ✓ Air Temperature

Land cover Protocol Surface Temperature Protocol

Land cover Protocol

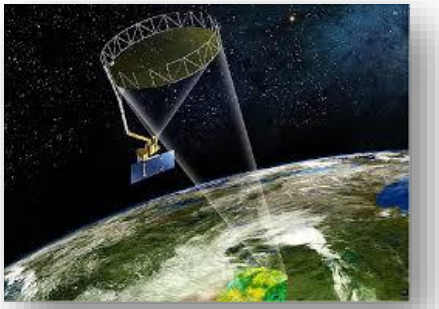
Pedosphere Protocol
- ✓ Soil characterization
- ✓ Soil infiltration
- ✓ Soil moisture
- ✓ Soil Temperature

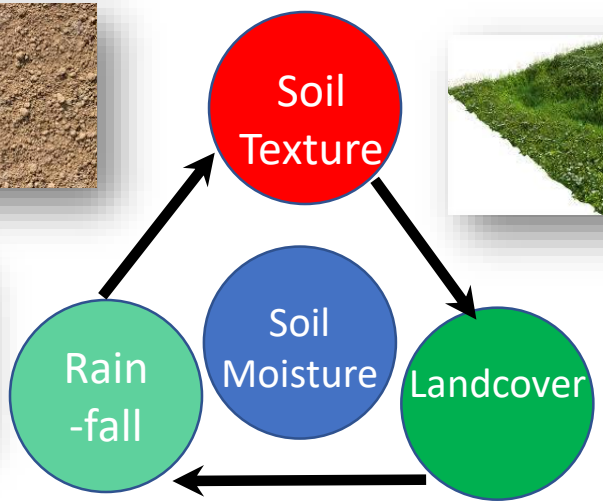
Hydrology Protocol
- ✓ Precipitation
- ✓ Evaporation
- ✓ Soil infiltration

* LC: Land Cover

Soil Bundling Protocols

SMAP Satellite





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?

Weather Bundling

Climate

Barometric Pressure

Air Temperature

Wind

Relative Humidity

Clouds

Land cover Topography

Preci-pitation

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

Land cover Protocol

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Thematic bundle Earth as a system
(30 minutes)

1. **Break into groups by bundle theme.**
2. **As a group, discuss: What types of questions would your community examine with the selected bundle? Select one or more.**
   - How does water move through the urban environment? Where would flooding occur the most? What factors are causing this?
   - How does soil texture, landcover and rainfall influence soil moisture?
   - Are there more mosquitoes at certain times of the year? When and how come?
   - Where and how much El Nino affects your area?
3. **Using the poster paper and markers, develop an Earth system diagram and identify how the combined use of the protocols within the same thematic bundle may support the question.**
4. **Assess the potential of the integrated approach as supported by the selected thematic bundle as compared to the use of stand alone protocols.**

Gallery Walk and Reflection (30 minutes)

- **Walk around to see the diagrams for other groups. With post-its, write down suggestions or questions about the diagrams.**
- **Go back to your group, look at the comments on the post-its, and think about ways you would revise the diagram and implement in your community.**
- **Final thoughts?**