DANDA RIVER ENVIRONMENTAL MONITORING PROGRAM (DEMP) IN SIDDHARTHANAGAR, NEPAL

ENVIRONMENTAL SENSORS (CITIZEN SCIENCE INITIATIVE)

Sustainable Development Action Lab, Nepal Study Center, U. of New Mexico

in collaboration with

Pratiman-Neema Memorial Foundation (PNMF), Siddharthanagar, Nepal and its PNMHI College

Southwestern Society of Economics (SSE) Annual Meeting

March 9, 2018

COLLABORATING TEAM

Corinne Fox- Graduate in Water Resource Management

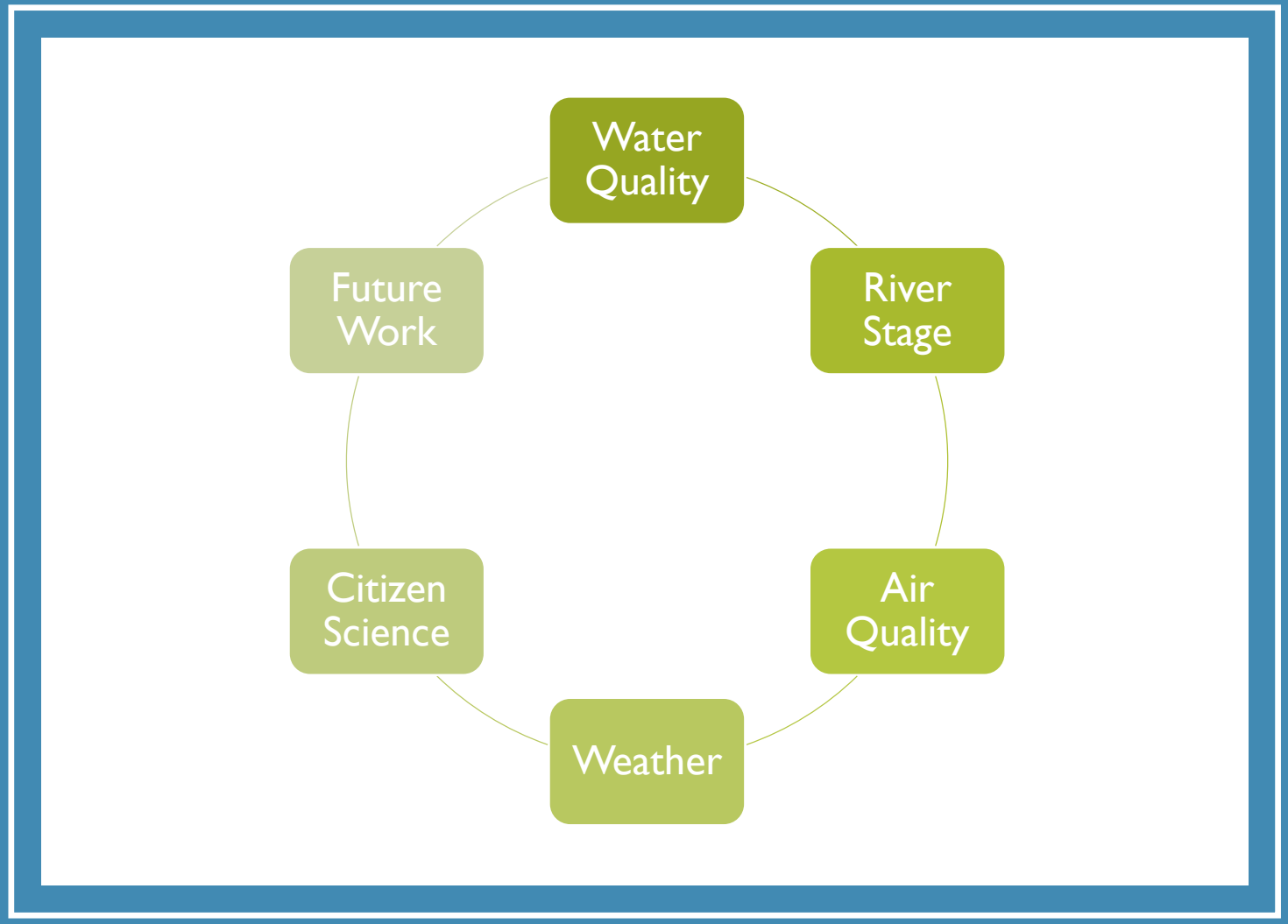
Nick Slade- Undergraduate in Economics

Thomas Farnham- Undergraduate in Economics and History

Mentors: Dr. Alok K. Bohara (Professor of Economics, Director of Nepal Study Center) and Michael Benjamin Goodwin (Graduate Student, Department of Economics)

Local Collaborating Partners: Science Coordinators at PNMF-PNMHI college-- Prakash Rayamajhi and Brijesh Khanal

DEMP PROTOCOLS



WATER QUALITY

Health

Ecosystem

Biodiversity

Recreational

Agriculture

Domestic Usage

Climate

Run off

WATER QUALITY TESTING

LA MOTTE KIT

PERIMETERS

E. coli (Coliform)
Dissolved Oxygen
BOD
Nitrate
pH
Phosphate
Temperature
Turbidity
Ammonia
Heavy Metals

Water Quality calculated through World Health Organization's (WHO) water quality index (WQI)

WATER QUALITY SAMPLING

WATER QUALITY SAMPLING

WATER QUALITY TESTING

WATER QUALITY WORK SHEET

INSTRUCTIONS:

Step 1: Collect water sample from all sampling sites using labeled, sterile collection bottles. Write site names in Table 1 below. Take temperature of water at each collection site. Record temperature in Table 1 below.

Step 2: First, follow the instructions included for the Micrology Laboratories Colsican Easygel E. Coli Testing kit to perform coliform and E. coli tests. Label each petri dish with the site location. Once completed, place in incubator at 35° for 24 hours.

Time and date placed in incubator: _____

Step 3: Follow the instructions included for each parameter from the La Motte Earth Force low-cost water quality monitoring kit, ammonia kit, and heavy metals bottle. Record the results in the table below and on data spreadsheet.

Date to test BOD sample (5 days from today): _____

Step 4: Clean out all tubes and dry. Replace everything back in water quality testing bucket.

Table 1: Results from water quality testing.

Parameter	SITE 1 Name _____	SITE 2 Name _____
Water Temperature (°C)		
Dissolved Oxygen (ppm)		
Dissolved Oxygen (% saturation) *Use table from La Motte booklet		
BOD* (ppm)		
BOD* (% saturation) (Use table from La Motte booklet)		
Nitrate (ppm)		
pH		
Phosphate (ppm)		
Turbidity (JTU)		
Ammonia (ppm)		
Heavy Metals (ppb)		

Danda Ecological Monitoring Program (DEMP)

Lumbini Center for Sustainability (LCS), PNMF

&

Sustainable Development Action Lab (SDAL)

Nepal Study Center (NSC), University of New Mexico

Water Quality Assessment Data Sheet

Date and time when collecting samples: _____

Names of people that collected the water samples:

_____

Names of people conducting water quality tests:

_____

Name of city, location and sample sites (Example Location: Siddharthanagar, PNMHI, sample site: river & channel):

_____

From the weather station:

Air Temperature (°C): _____ Humidity (%): _____

Current and recent weather (raining, foggy, sunny, dry, rained yesterday, etc.):

_____

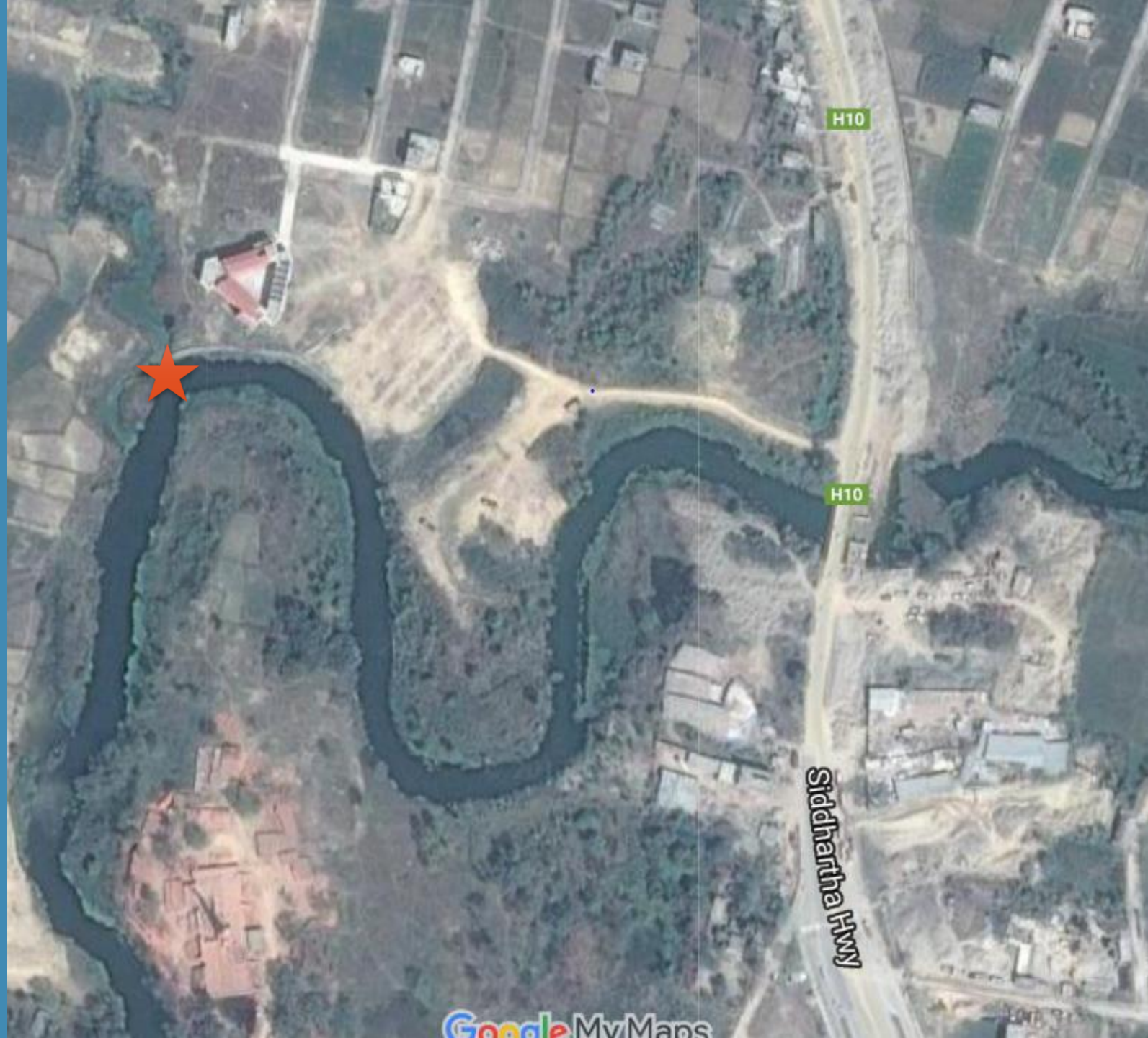
_____

Visual inspection of river and surrounding areas (vegetation, pollution, movement of water, anything unusual):

RIVER STAGE

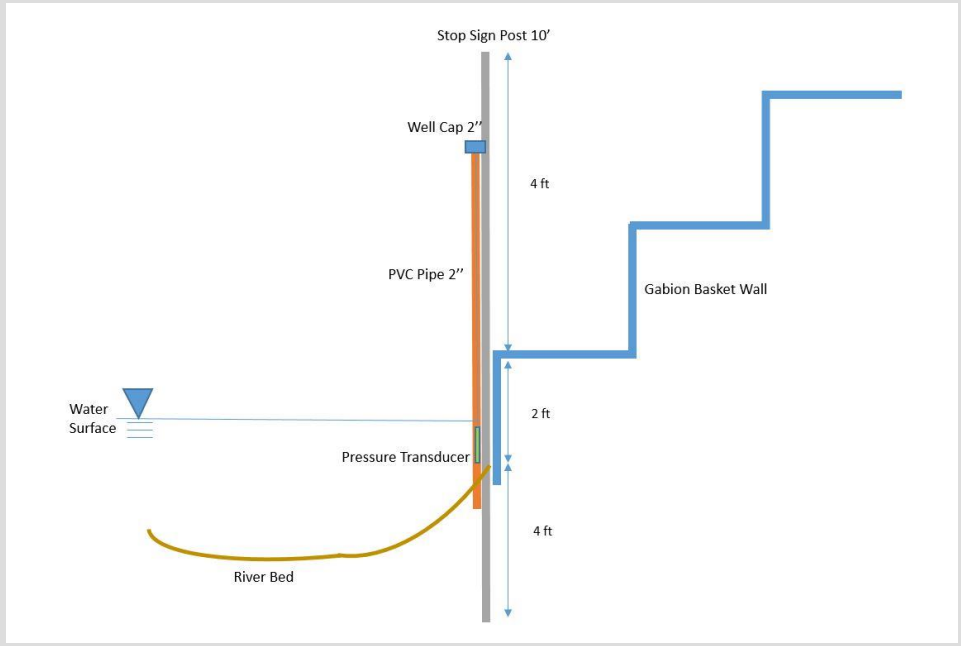
Is an important concept when analyzing how much water is moving in a stream at any given moment. Stage is the water level above some arbitrary point, usually with the zero height being near the river bed, in the river and is commonly measured in feet.

- Flooding
- Water management for irrigation
- Water quality analysis
- Natural and unnatural flow analysis patters
- Ecosystem services
- Safety
- Ground water monitoring



LEVELOGGER PRESSURE TRANSDUCER

- Measures absolute pressure (water pressure + atmospheric pressure) using a Hastelloy pressure sensor and temperature
- High corrosion resistance in harsh environments
- High resolution and an accuracy of 0.05% Field Strength ratio
- Memory for up to 120,000 readings
- 10 year battery life
- Used barometric reading from 1 and 5 Pro Weather Station



INSTALLATION

- Drive post right on the edge of the lowest gabion basket.
- 4ft deep should suffice.
- Installation downstream
- Post in stream bed about 1 ft.

Some things to note:

- This setup probably won't capture low flows very well. We can address that with future designs.
- The pressure transducer won't be accessible during flood flows. That's okay. It will continue to collect data that can be downloaded after the flows drop to a safe level.

AIR QUALITY

The condition of the air in the surrounding environment.

Good air quality pertains to the degree which the air is clean, of pollutants.

Pollution is any harmful gases, dust, or smoke that enters into the atmosphere ad makes it difficult for plants, animals an humans to thrive.

IMPORTANCE

HEALTH

"Air quality" - condition of the air in the surrounding environment.

- Good air quality pertains to the degree which the air is clean, of pollutants.
- Pollution – any harmful gases, dust or smoke that enters into the atmosphere and makes it difficult for plants, animals and humans to survive

ENVIRONMENT

LASER EGG AND KAITERRA APPLICATION

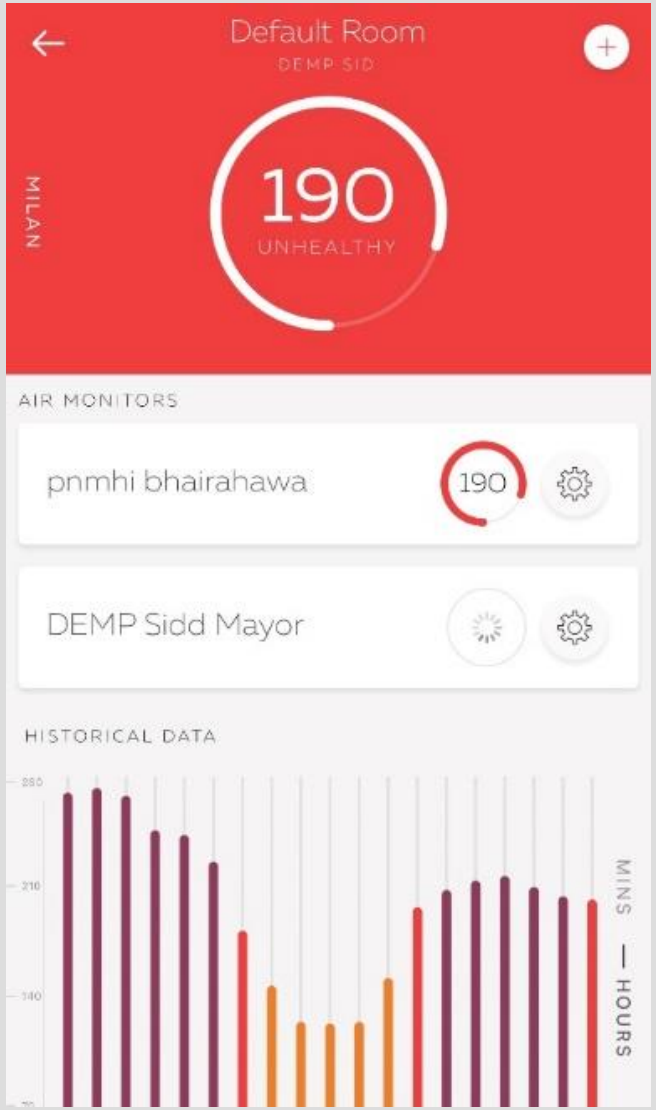
How does the laser egg work?

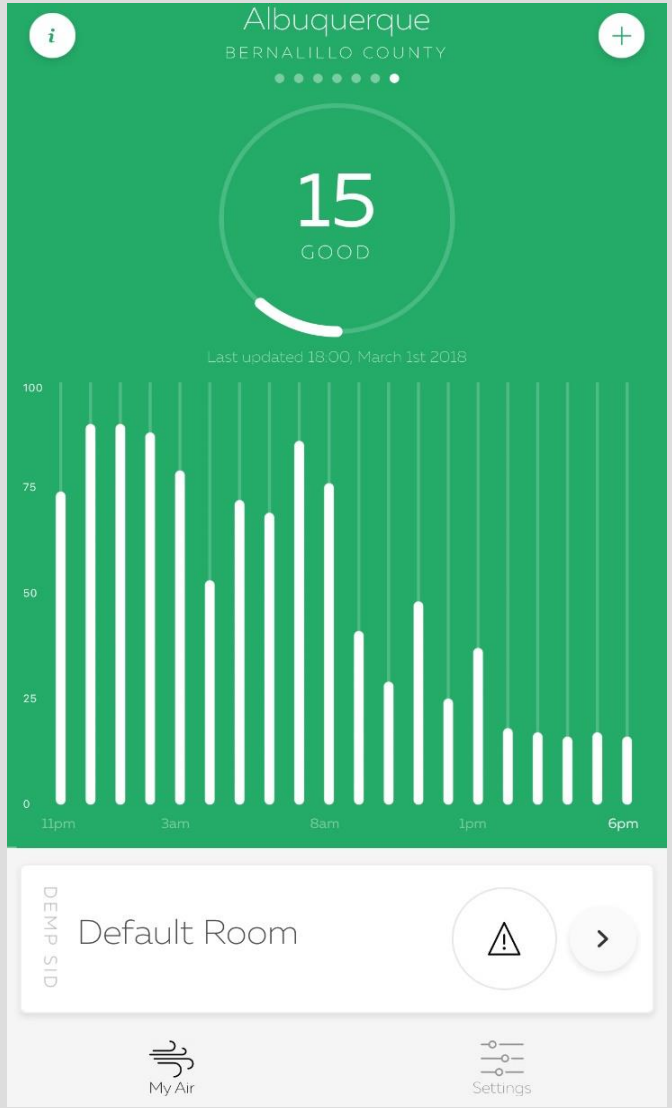
-Fan

-Laser

-Calibration

-Phone App





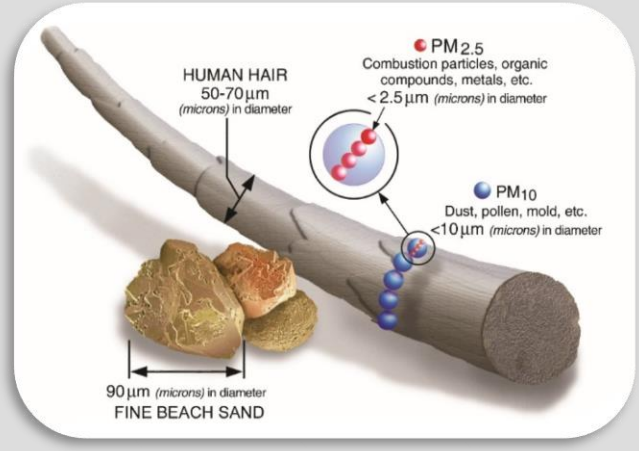
AQI AND CITIZEN SCIENCE WORKSHEET

Air Quality Index (AQI) Assessment Data Sheet

Water quality index is important to know because it tells you how many particles are in the air. When pollution is heavy the air quality is not healthy for humans and animals. In Table 2, fill in the date and the air quality number you see on the Laser Egg. In Figure 1, you will see the different levels of AQI and why they are important to understand.

Table 2. Air quality index from laser egg.

Date	AQI Measurement	AQI Rating (see Figure 1)



The **AQI** is **calculated** for four major **air** pollutants regulated by the Clean **Air** Act: ground level ozone, particle **pollution**, carbon monoxide, and sulfur dioxide.

CLEAN AIR PARTNERS

AIR QUALITY ACTION GUIDE

Your "how to" guide for cleaner air

Air Quality Rating	Steps to Protect Your Health and Our Environment
GOOD 0-50	Enjoy the great outdoors. · Rather than drive - bike or walk when possible. · Conserve energy. Replace incandescent bulbs with CFLs. · Plant a tree to improve health and air quality.
MODERATE 51-100	Some pollution. Even moderate levels pose risks to highly sensitive groups. · Bundle errands. Eliminate unnecessary trips. · Check AirAlerts to see if tomorrow's forecast is unhealthy. · Perform regular maintenance on your car.
UNHEALTHY For Sensitive Groups 101-150	Pollution levels are harmful to children, older adults and anyone with a respiratory or heart condition. Limit physical outdoor activity. · Don't drive alone. Carpool, take public transit. · Refuel your car in the evening. · Put off lawn care until air quality improves. · Use a gas or electric grill instead of charcoal.
UNHEALTHY 151-200	Everyone should limit strenuous outdoor activity when the air is unhealthy to breathe. · Telework and take public transit. · Turn off lights and electronics when not in use. · Avoid lawn mowing or use an electric mower. · Sign up for health alerts at cleanairpartners.net. · Don't use chemicals on your lawn and garden.
VERY UNHEALTHY 201-300	Pollution levels are very unhealthy for everyone. Avoid any physical outdoor activity. · Follow all of the action steps above.

WEATHER

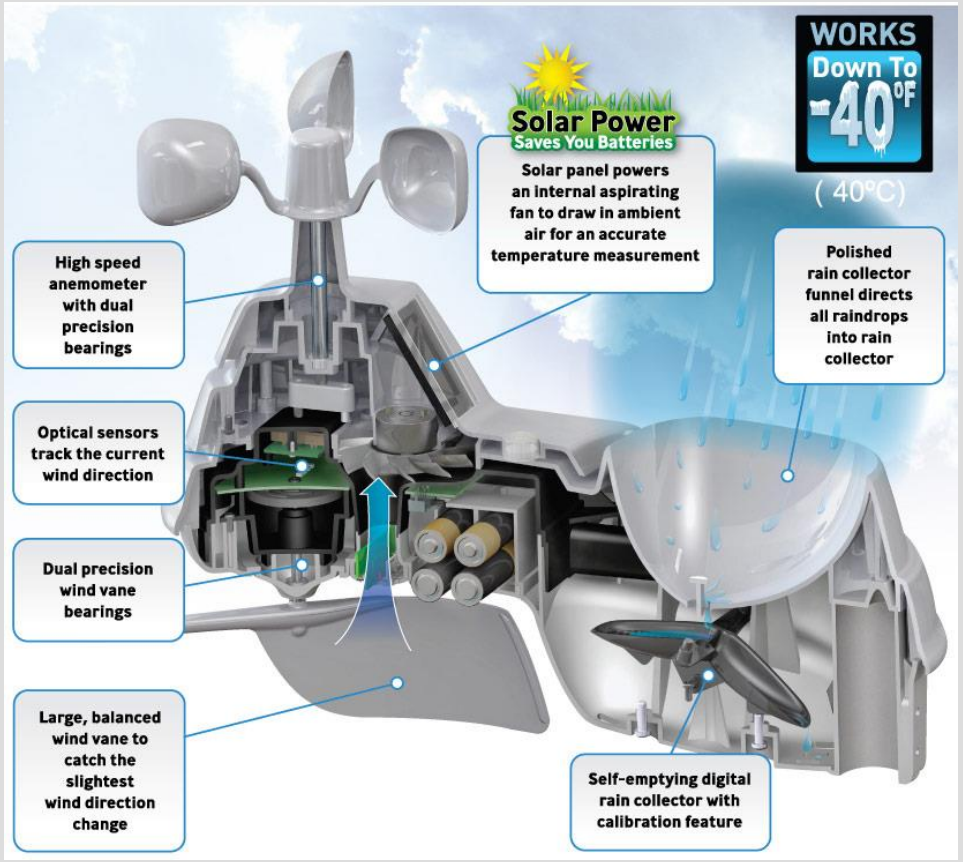
Baseline weather data can be used for analysis anticipating and understanding of the environment

Provides weather prediction in real-time

Works in conjunction with the Laser Egg and the Levelogger pressure transducer

5 IN 1 PRO WEATHER STATION

WEATHER STATION



APPLICATION (MY ACURITE)

INSTALLATION AND WORKSHEET

Weather Station Assessment Data Sheet

Understanding weather helps us know different climatic patterns in the region. In this excursive one will look at the weather station screen and fill in the measurements that are being collected by the Pro 1 and 5 Weather Station.

Look at the weather station monitor screen or the Acurite app and write down the corresponding numbers for each measurement in Table 3.

Table 3. Current weather conditions.

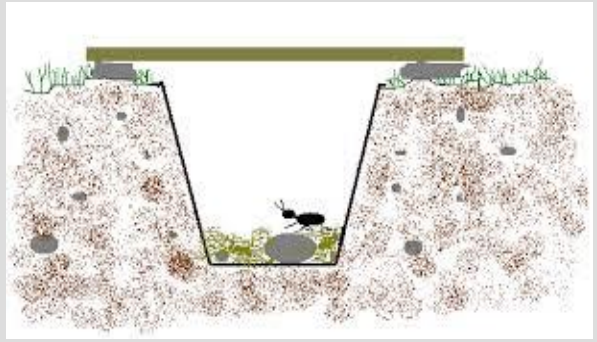
Weather Measurement	Weather Data
Temperature (°C)	
Humidity (%)	
Wind Speed (Km/hr)	
Precipitation (in)	
Barometric Pressure (Hg)	

FUTURE MONITORING

Biodiversity:

- Arthropod Trapping,
- Litter fall monitoring
- Vegetation monitoring

Importance: Monitor, maintain, and protect biological diversity, boost ecological productivity, and first responders and identifiers of environmental changes



CITIZEN SCIENCE

A survey was given after the installation and seminars to see if students understood the information received

CITIZEN SCIENCE SURVEY

Himalayan Study Abroad Program: Urban Health and Environment
Sustainable Development Action Lab (SDAL)
Nepal Study Center, University of New Mexico
Department of Economics

In collaboration with the
Lumbini Center for Sustainability (LCS), PNMF
Siddhacthanagar, Nepal

Namaste. Please help the University of New Mexico's SDAL Team understand how we can better collaborate with you in the future by answering the following questions. Please ask questions, if needed.

Name: _____

Gender: _____

Age: _____

Mention your grade level if you are a student: _____

Or mention your occupation and position if a professional: _____

How has your understanding of citizen science changed following this week's presentations and activities? Circle one option.
1—I understand much more about citizen science.
2—I understand a little more about citizen science
3—I have the same understanding about citizen science.

Was English a barrier to your understanding throughout the presentations and activities? Circle one option.
1—I understood everything.
2—I understood most of the information.
3—I partially understood the information.
4—I rarely understood the information.
5—I did not understand anything.

How has your awareness of the current environmental condition of the Danda River changed following this week's presentations and activities? Circle one option.
1—I am much more aware.
2—I am somewhat more aware.
3—I have the same awareness

To which of the following technological devices do you have access? Circle all that apply.
Feature Phone
Smart Phone
Landline
Personal Computer
School Computer
Other: _____

Which social media platforms do you use? Also, please indicate how often you use each one. Circle all that apply.
1—I use daily
2—I use sometimes
3—I rarely use.

Facebook (1 2 3)
Instagram (1 2 3)
Twitter (1 2 3)
Snapchat (1 2 3)
Tumblr (1 2 3)
YouTube (1 2 3)
Pinterest (1 2 3)
Reddit (1 2 3)
Other: _____

What computer programs do you know how to use? Circle all that apply.
Word (or other word processor)
Excel (or other spreadsheet software)
PowerPoint (or other presentation software)
Statistical Software (Such as SPSS or others)
Other: _____

What is the best way for the UNM SDAL to stay connected with you? Circle one option.
Email
Skype/Google Hangouts/FaceTime
Yogdan Website
Facebook
Other: _____

What resources and information could the UNM SDAL provide you to help you stay informed of our activities?

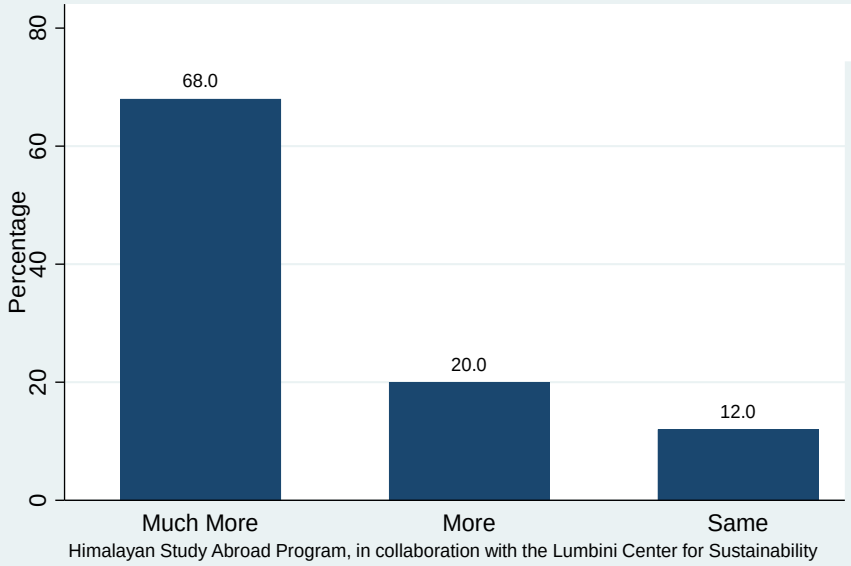
Do you have any suggestions/ideas that UNM SDAL can use in the future? Please explain.

What was your favorite and least favorite part of the activities and presentations? Please explain.

RESULTS

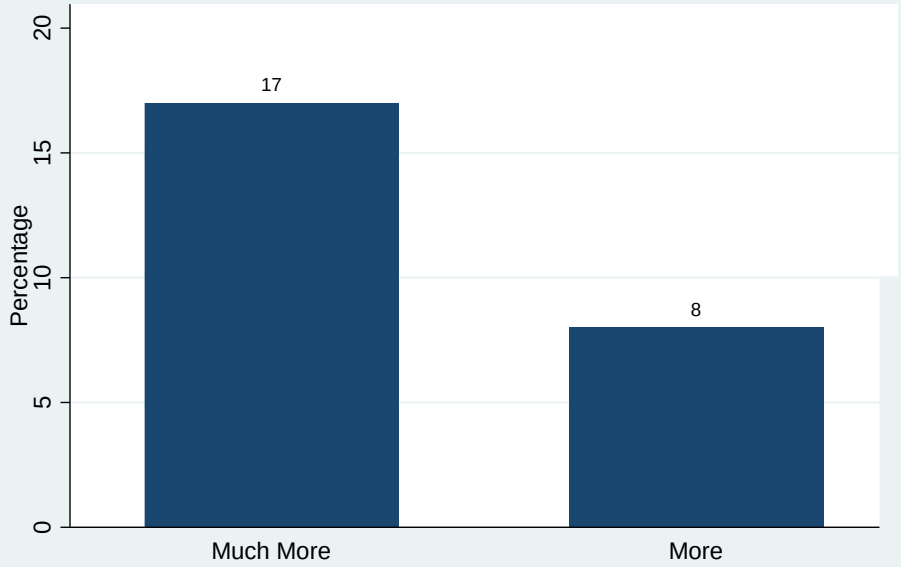
How Has Your Understanding of Citizen Science Changed

After this week's presentations and activities?



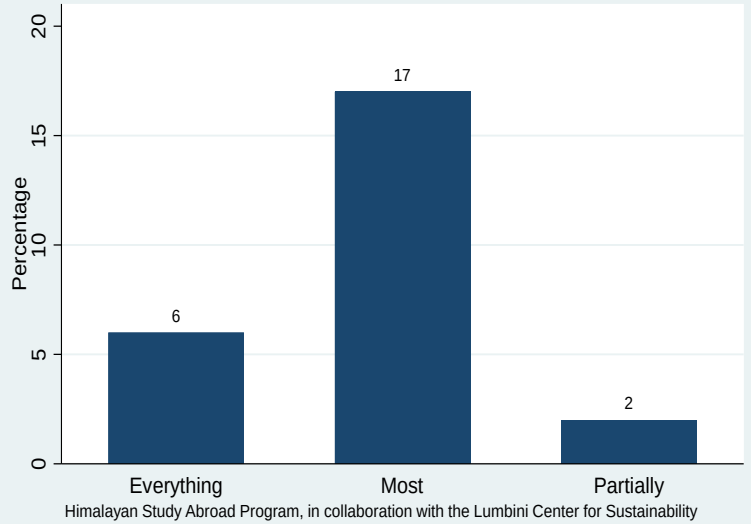
Change in Danda's Environmental Condition Awareness

Following this week's presentations and activities



Level of Understanding from Presenations and Activities

Presentations and Activities Given in English



FOR MORE INFORMATION

- Leve logger Info: https://www.solinst.com/products/data/3001.pdf
- Water Testing Kit: www.earthforce.org/green
- Weather Station: https://www.acurite.com/shop-all-acurite/environments/weather-stations/pro-5-in-1-weather-stations.html
- Biodiversity: http://www.epa.wa.gov.au/sites/default/files/Proponent_response_to_submissions/Attachment%205%20-%20Draft%20Biodiversity%20Management%20Plan_0.pdf
- Nepal Study Center: http://nepalstudycenter.unm.edu/
- Laser Egg: http://originstech.com/products/laser-egg/

THE YOGDAN BLOG

THANK YOU

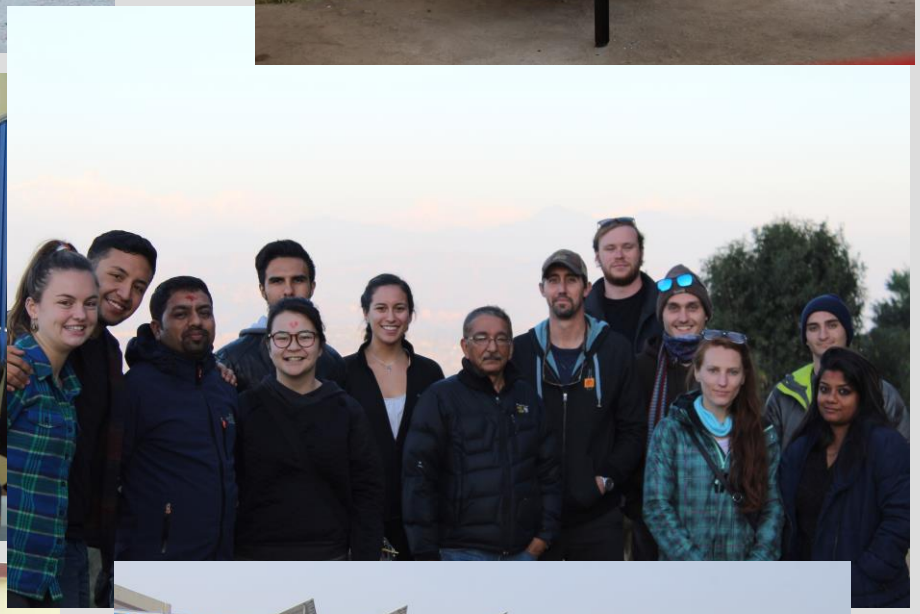
Follow up on Social Media

Instagram:
@yogdanunm

Facebook:
Lumbini Center of Sustainability

Blog:
Foxc01.wixsite.come/yogdan

Disposable Waste
DEMP(PNMF)
Yasodhara Eco-club
PNMHI
LOVE



ATIMAN-NEEMA MEMORIAL HEALTH INSTITUTE PNMHI