

Watershed Monitoring, Training  
and Educational Programs in the  
Andes-Amazon Basin of Peru  
and How to Make this a  
Sustainable Effort

Dina L. DiSantis

West Chester University

Amazon Center for Environmental Education and  
Research (ACEER) Foundation's Institute for  
Emerging Sustainability Leaders.

# Project Investigation

- ❖ Today I am presenting my findings on how watershed monitoring, training and educational programs are being implemented in the Andes-Amazon Basin and on the feasibility of international collaboration between schools involving watershed studies.
- ❖ This summer, I traveled to Peru as a participant in the ACEER Foundations Institute for Emerging Sustainability Leaders.
- ❖ I set out to answer questions concerning water quality studies and training in the region.

# Project Investigation Questions

1. How are watershed monitoring, training and educational programs being implemented in the Region?
2. Have past and current monitoring programs in Peru conducted by organizations in the United States resulted in implementation of local watershed programs by the Peruvian people?
3. Is there any interest among Peruvian Schools in entering into a collaborative monitoring program with schools in the United States?



# Why Water Quality Testing and Education is Important?

- ❖ Safeguarding water quality is critical for human health and the health of the natural ecosystem.
- ❖ Testing can identify current or potential issues.
- ❖ Testing can establish baseline data.
- ❖ Testing allows owners, users and managers to make informed decisions regarding management.

# Geographic Area of Interest

- ❖ Place: Madre de Dios Region of Peru
- ❖ Capital City: Puerto Maldonado – population 60,000





# Puerto Maldonado



# Amazon Basin Headwaters

- ❖ The headwaters originate in the regions of the Brazilian and Guiana Shields and from the Andes Mountains.
- ❖ Madre de Dios River is one of the headwater rivers of the Amazon Basin
- ❖ Amazon Basin covers 6 million km<sup>2</sup>
- ❖ 15% is located in Peru
- ❖ Lowland Amazon rainforest, 85-90 thousand km<sup>2</sup> in size

Goulding et al. (2003)



# Biodiversity

- ❖ One of the most biodiverse areas of the world for
  - ❖ Mammal species
  - ❖ Amphibians species
  - ❖ And avian species



International Union for Conservation of Nature, (2008)  
Ridgely, et al. (2007)



# Photographs of the Region



# Negative Impacts to the Area

- ❖ Climate Change
- ❖ Gold Mining: A world demand for gold and record high prices results in environmental and social problems.
  - ❖ Artisanal/illegal mining is conducted by the poorest of people who do not have permits, pay taxes or undergo mining education.
  - ❖ They are directly exposed to and air and water pollution from cyanide, arsenic and mercury. The process results in acid mine drainage.
  - ❖ It releases toxins into waterways, sediments and atmosphere.
- ❖ Deforestation: as a result of gold mining and unsustainable logging practices.
- ❖ Transoceanic Highway: may further open up areas to exploitation by mining, ranchers, farmers, and loggers, leading to deforestation.

Swenson, et al. (2012)



# Illegal Gold Mining along the Madre de Dios River





# Illegal Gold Mining











# Previous Watershed Studies

## Stroud 2006

- ❖ In August 2006, Stroud Water Research Center of Avondale, Pennsylvania conducted intense field and laboratory studies on 33 sites located along tributaries to the Made de Dios and Tambopata Rivers.
- ❖ Included 12 scientists and educators from the Stroud Center, Florida A&M and Peru.

Stroud Center Report, (2007)

# Madre de Dios and Tambopata Rivers



# Previous Watershed Studies

## Stroud 2006

- ❖ Two goals of the study:
  - ❖ 1). To create a baseline of scientific data on water quality, stream biodiversity, and stream health that would serve as the foundation for understanding and sustaining on-going conservation efforts in the region.
  - ❖ 2). To test and implement accessible, easy-to-use educational programs for the people of the region.



# Previous Watershed Studies

## Stroud 2006

- ❖ Physical, chemical and biological data.
- ❖ October 2006, Stroud conducted workshops geared towards specific participants in the community such as educators, conservation planners, and eco-tourism guides.
- ❖ The goal was to provide a foundation on which to build watershed educational programs and to enable those living in the region to assess and monitor their water resources.
- ❖ 80 people attended the workshops in Peru.

# Photographs of Stroud's 2006 study taken from their website





# Previous Watershed Studies

## ACEER 2010

- ❖ In 2010, Amazon Center for Environmental Education and Research (ACEER) Foundation and Stroud established water quality monitoring stations in both the Madre de Dios region and the Pucallpa region near Iquitos in northeastern Peru.
- ❖ Water quality protocol used leaf pack – designed by Stroud
  - ❖ Creates a micro-ecosystem out of leaves in a mesh bag.
  - ❖ The bag is placed into a stream for 3 to 5 weeks, then examined for different types of aquatic organisms.
  - ❖ Results can be calculated using a biodiversity index based on three orders of insects :Ephemeroptera, Plecoptera and Trichoptera.

Mustalish, (2012)

# Previous Watershed Studies

## ACEER 2010

- ❖ ACEER's 2010 study trained local citizens.
- ❖ By offering workshops to teachers, students, local officials, and villagers.



Photograph taken by ACEER  
Foundation



# Macoinvertebrates



Plecoptera



Ephemeroptera



Tricoptera

# Current Watershed Studies

## ACEER 2012

- ❖ ACEER and Stroud returned to the region and are currently conducting stream studies using leaf pack.
- ❖ Goal: To assess water quality impacts from the Transoceanic Highway and to conduct citizen workshops for locals.
- ❖ Study area stretches from Cusco to Puerto Maldonado.
- ❖ The transect reflects ecological zones associated with lowland rainforest, the Andean foothills, and cloud forests of the Andean highlands.

Mustalish, (2012)



# Cusco to Puerto Maldonado



# Current Watershed Studies

## ACEER 2012

- ❖ Ten streams are being studied.
- ❖ Streams were photo-documented, stream morphology recorded, formal macroinvertebrate communities recorded, DNA barcoding of certain species, mercury analysis, and leaf packs.
- ❖ A Peruvian staff member (Terany Gonzales) of ACEER is responsible for continuing the stream studies using leaf packs now that the formal scientific surveys are completed.
- ❖ Leaf pack studies will continue for 2 years from the start of the formal study.



# Current Watershed Studies

## ACEER 2012

- ❖ ACEER plans to promote the use of leaf pack and continued watershed education by training university faculty and students from San Marcos National University in Lima and San Antonio Abad in Cusco and Puerto Maldonado.
- ❖ Participants will receive enough leaf pack kits to conduct their own studies on their own chosen streams.
- ❖ University participants will conduct workshops in their regions.

# Current Watershed Studies

## ACEER 2012

- ❖ Additional methods of disseminating information and training will include local villagers.
- ❖ This will occur through the AMIGOS Partnership for Education Conservation Program.
- ❖ This program is aimed at rural and urban school children, teachers, and adult villagers in Amazonia.



# Photographs of ACEER 2012 Study





# My Project Findings

- ❖ The information for my investigation was gathered from:
  - ❖ Literature review
  - ❖ Personal communication and interviews
  - ❖ Observations while traveling to the region



# Project Findings

## Stroud 2006

- ❖ The Stroud 2006 study was a great baseline study centered on sound science.
- ❖ Stroud also offered training workshops on water monitoring.

# Project Findings

## Stroud 2006

- ❖ Although Stroud's workshops trained and made available resources to a broad group of local people, my investigations found that the local people trained did not continue watershed monitoring.
- ❖ As far as I could tell through my investigations, it was not part of Stroud's original grant funded project to conduct follow-up training workshops for local people.



# Project Findings

## ACEER 2010

- ❖ In an interview with Roger Mustalish, President of ACEER, the 2010 study resulted in some continual watershed testing by local individuals.
- ❖ Some individual teachers at local schools continued to do water quality testing for a short time after the initial training, but this to was eventually discontinued.

# Project Findings: ACEER 2010

- ❖ Many teachers in Peru, may have as few as 3 months teacher training after high school before being sent to an area of the country where their services are needed.
- ❖ In many cases, teachers in local schools are not from the regions they are teaching in and may lack the knowledge and/or concern about local environmental issues.
- ❖ It was also voiced by those trained, that they needed additional training and that a one-time session was not enough.
- ❖ More pressing issues were faced such as local flooding that occurred at some of the test sites.

Mustalish, (2012)



# Project Findings

## ACEER Post 2010 and Current 2012 Study

- ❖ As a result of past efforts, ACEER took a closer look at how educational programming could best be implemented in the region.
- ❖ ACEER hired individuals from the region with a vested interest in local issues. Who would be able to continue the promotion of watershed education and training.
- ❖ ACEER hired a leaf pack coordinator – Terany Gonzales and educator – Lisea Silva.
- ❖ To reinforce the training of local people and to expand educational programs into local schools.

# Project Findings

## ACEER Post 2010 and Current 2012 Study



Lisea and Terany with children from the Dos de Mayo School, Puerto Maldonado, Madre de Dios, Peru.



# Planting School Gardens



# Globe Program





# Project Findings

## ACEER Post 2010 and Current 2012 Study

- ❖ Currently, Terany is conducting all the leaf pack studies for the 2012 project; gathering and collating all of the data and results.
- ❖ While, Lisea works in 8 local schools, K-12 conducting a leaf pack education program, Globe Program and the AMIGOS Program.

# Project Findings

## ACEER Post 2010 and Current 2012 Study

- ❖ ACEER's current program's are having a positive influence and impact on educating and promoting young citizen scientists, who are developing an appreciation and understanding of what scientists do.
- ❖ The involvement of university faculty and students in the 2012 project will likely lead to more local interest by residents of those areas and can develop into collegial programs.
- ❖ In addition, the AMIGOS partnership in which Lisea is working with is going to be incorporated into more teacher training and into more schools in the region.



# Project Findings: Looking Forward, Towards Sustainable Watershed Education Programs

- ❖ To encourage broader awareness and discussion of the importance of watershed monitoring, all data will be uploaded into Stroud Water Research Center's Leaf Pack Network and National Geographic Society's FieldScope global database.
- ❖ Designed to put scientific data into the hands of citizen scientists worldwide.

# National Geographic's FieldScope Webpage



education  BETA



Teachers

Informal Educators

Families

Students

Kids

Teaching Resources

Reference & News

Mapping

Media

Collections

Get Involved

Geo-Literacy

Search

Program

## FieldScope

Online Mapping for Citizen Science Investigation

See other versions of this page:

[Informal Educators](#) 5

NATIONAL GEOGRAPHIC Biscayne National Park FieldScope

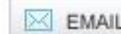
Thematic Data

- Park Boundary
- Bathymetry
- Marine Environments
- Terrestrial Environments
- Shoreline

Settings

- Boundaries & Places
- Species

Dear Map:



EMAIL



PRINT



SHARE

### Related Education Programs



#### Community Geography Initiative

Mapping connections between people and places.



#### BioBlitz Education

Collecting and mapping species data in our parks, neighborhoods, and schoolyards.



# Looking Forward, Towards Sustainable Watershed Education Programs

- ❖ Making Connections
- ❖ Partnership building
- ❖ Data sharing.



# Project Conclusions

- ❖ People need to be connected and vested in the region and be part of the training and monitoring process in order for them to continue the testing.
- ❖ Although the work of Stroud (2006) brought to light the importance of watershed monitoring and educational programs, it requires the presence of individual stake holders within the community that are willing to monitor and continue the training of local people.
- ❖ Protection relies on the participation of local people if change is to occur.



# Project Conclusions

- ❖ Individuals are more likely to understand the issues and develop responsible attitudes if trained by other local residents.
- ❖ Research shows that well-educated citizens become stewards of the environment.
- ❖ Ways to accomplish this task is to offer watershed education to students in local schools and build partnerships for international collaboration.

Thank You