# Sustainable Development Goals and Geospatial Education

*Yelena Ogneva-Himmelberger, Ph.D.*

*Clark University, USA*

GEOSPATIAL WORLD FORUM

CLARK UNIVERSITY

CHALLENGE CONVENTION. CHANGE OUR WORLD.

# Clark University

- Private research University located in Worcester, Massachusetts
- Offers Bachelors and Ph.D. degrees in Geography
- Offers Masters of Science degree in GIS

# Masters of Science in GIS

**Four Concentrations**

1. Geographic Information Science for Development and Environment
2. Conservation GIS
3. Environmental Remote Sensing
4. Global and Community Health

# Capstone course: GIS for International Development

- Prerequisite: Intro to GIS
- Duration: seven weeks
- Each week: two lectures + one lab session
- Enrollment: ~20 Master's students

How do you find the balance between technical GIS skills and the topical knowledge (i.e., "GIS&T Body of Knowledge" and "SDGs")?

# GIS&T Body of Knowledge

**FC-FOUNDATIONAL CONCEPTS**

The foundational concepts are the elementary building blocks and

**KE-KNOWLEDGE ECONOMY**

Knowledge Economy is the portion of the Body of Knowledge focused on

**CP-COMPUTING PLATFORMS**

Computing Platforms provide the computational capabilities to apply

**PD-PROGRAMMING AND DEVELOPMENT**

Computer programming and development are critical to the past,

**DC-DATA CAPTURE**

The capture of massive quantities of spatial data, able to be

**DM-DATA MANAGEMENT**

Data management involves the theories and techniques for managing the

**AM-ANALYTICS AND MODELING**

This knowledge area embodies a variety of data driven analytics,

**CV-CARTOGRAPHY AND VISUALIZATION**

The Cartography & Visualization section encapsulates competencies

**DA-DOMAIN APPLICATIONS**

The Domain Applications knowledge area focuses on the linkages

**GS-GIS&T AND SOCIETY**

The connections and interactions between GIS&T and society range

https://gistbok.ucgis.org/bok-basic-page/welcome-gist-body-knowledge


TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

# Weekly themes

- Poverty, hunger and food security (SDGs 1 and 2)
- Global public health (SDG 3)
- Access to safe drinking water & basic sanitation (SDG 6)
- Participatory mapping; Gender equality (SDG 5)
- Climate change vulnerability and adaptation (SDG 13)
- Conflicts, migration, and human rights (SDG 16)
- Disaster management and humanitarian assistance

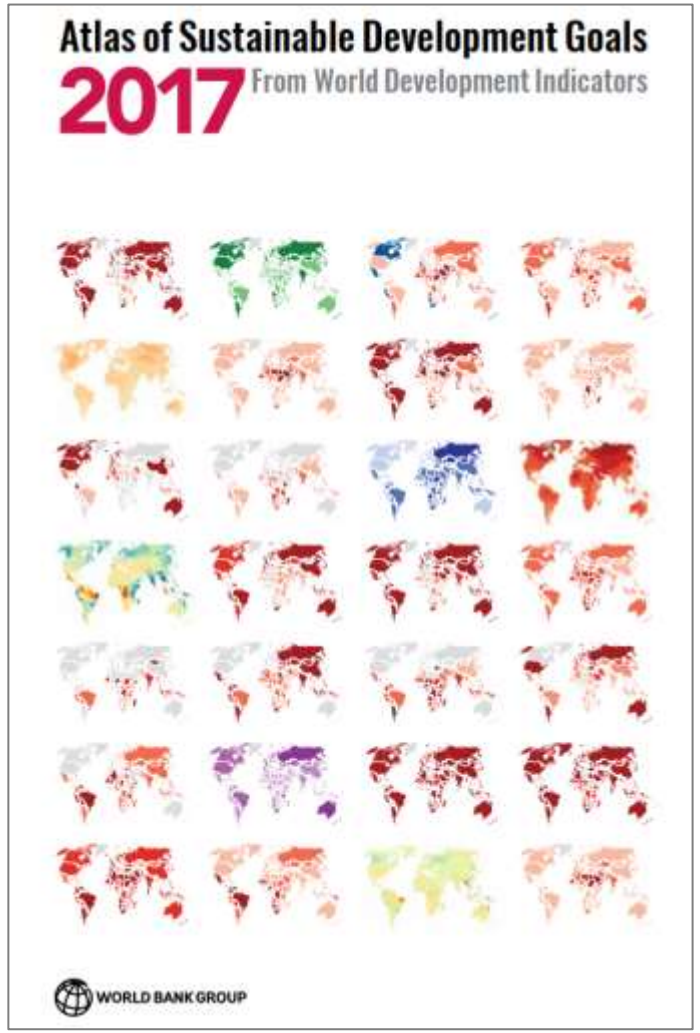
# Important course components

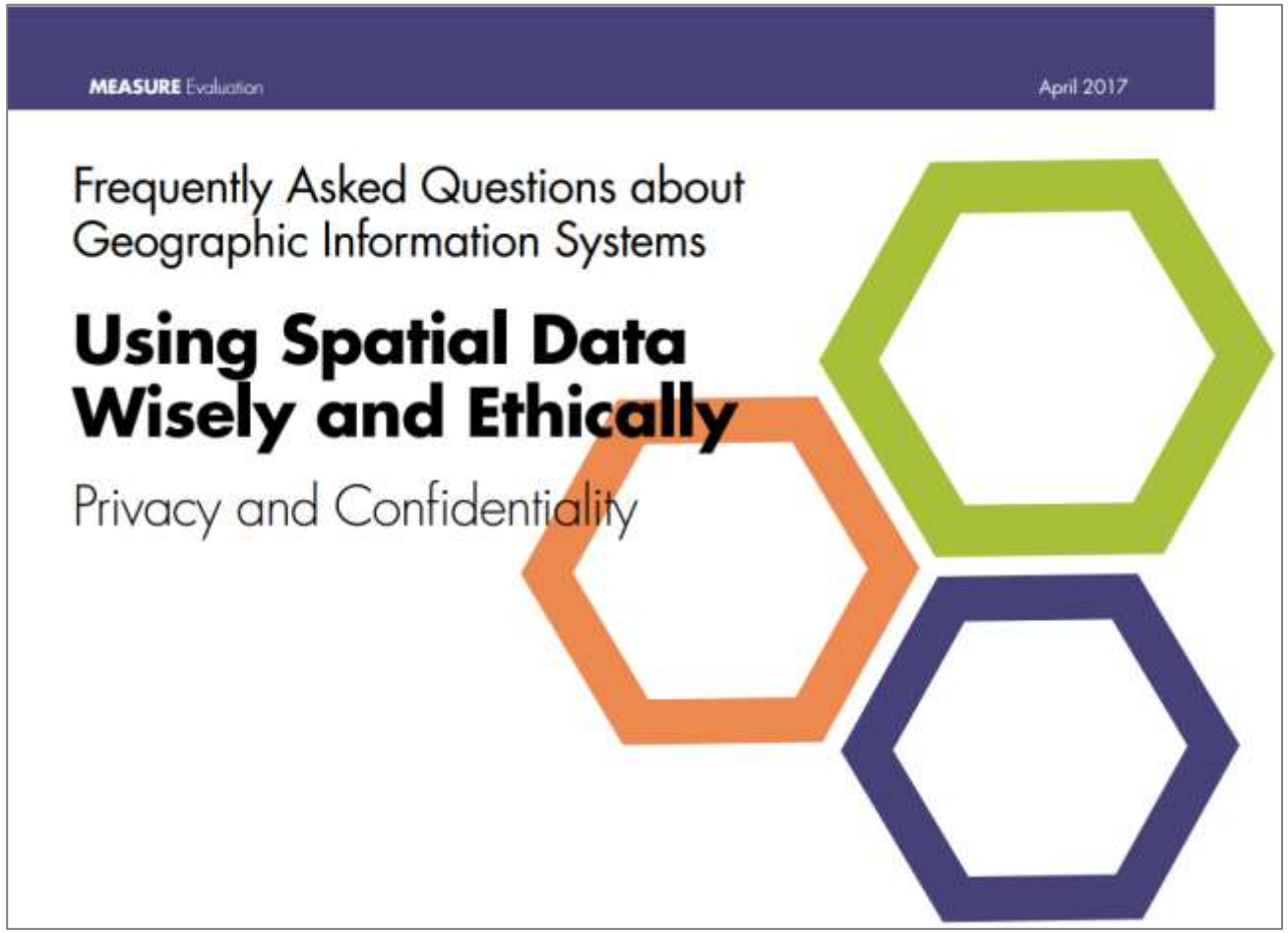
- Hands-on practice: during lectures and homework
- Weekly readings: online wiki responses and class discussions
- Final project

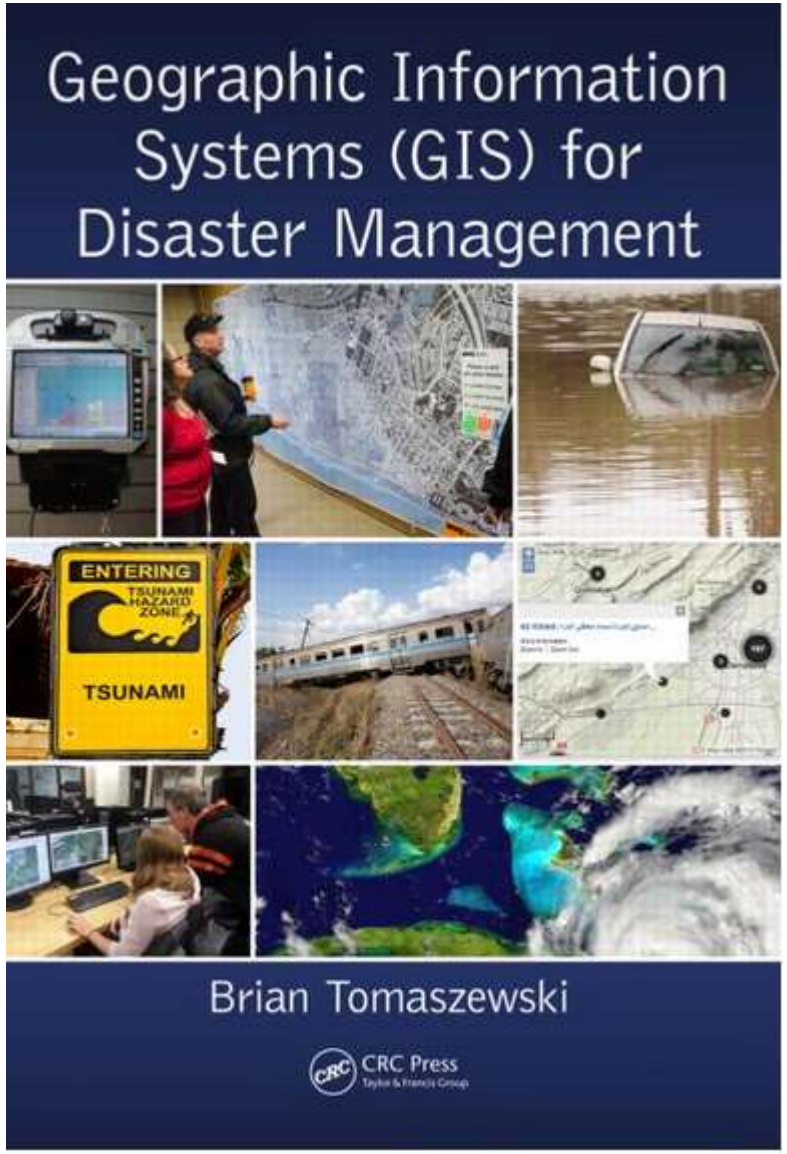
# By the end of the course students should be able to…

- understand what spatial data are required for monitoring a SDG target or indicator
- find relevant spatial data and evaluate its quality
- work with multiple formats of data
- create new data (field data collection)
- know what analytical tools to apply
- work with multiple GIS software programs (“software-agnostic”)
- communicate effectively – make maps that “tell the story”

# …understand what spatial data are needed for monitoring each SDG target  or indicator





MEASURE Evaluation
April 2017
Frequently Asked Questions about Geographic Information Systems
Using Spatial Data Wisely and Ethically
Privacy and Confidentiality


Geographic Information Systems (GIS) for Disaster Management
ENTERING
TSUNAMI HAZARD ZONE
TSUNAMI
Brian Tomaszewski
CRC Press

# Chapter 16
# Spatial Determinants of Poverty Using GIS-Based Mapping

**Brandon Manalo Vista and Yuji Murayama**

## 16.1 Introduction

In many countries, poverty has a geographic dimension (Bigman & Deichmann, 2000). Geography, particularly the physical environment, plays a significant role in the incidence of poverty in every local communities, especially in developing nations (Bigman & Fofack, 2000). Empirical evidences suggest a strong relationship between geography and poverty. Previous mapping studies in Vietnam (Minot, Bob, & Epprecht, 2006), in Uganda (Rogers, Emwanu, & Robinson, 2006), in Nigeria (Legg et al., 2005), in Bangladesh (Kam, Hossain, Bose, & Villano, 2005), in Kenya (Kristjanson, Radeny, Baltenweck, Ogutu, & Notenbaert, 2005), in Malawi (Benson, Chamberlin, & Rhinehart, 2005), in Sri Lanka (Amarasinghe, Samad, & Anputhas, 2005), among others, have shown that significant geographic variation in the incidence of poverty may be due to a variety of geographic factors. These include natural resource endowments and agro-climatic conditions, accessibility and proximity to markets, access to land, as well as aspects of public policy.

On this regard, geography cannot be regarded as a factor affecting the rate of poverty because it has a strong impact on the living standards of people living in the community. Poverty is not merely a socio-economic problem. Equally important, as Glasmeier (2002, p. 158), puts it "poverty is an inherently spatial problem ..." However, debates on poverty and its causes more often rest on the socio-economic realm, not until recently when the role of geography in understanding and analyzing poverty has been increasingly recognized by scholars and development practitioners (Hyman, Larrea, & Farrow, 2005). The passage of the Millennium Development Goals (MDGs) which advocates for poverty reduction triggered initiatives in the international arena to have greater interest in the geographic dimensions of poverty (Hyman et al., 2005). Correspondingly, the development of geographic information systems (GIS) together with advances in remote sensing has led to incorporate spatial data and satellite imageries as methods for poverty mapping and analysis

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Appl. Spatial Analysis
DOI 10.1007/s12061-011-9066-8

# Using GIS and Spatial Statistics to Target Poverty and Improve Poverty Alleviation Programs: A Case Study in Northeast Thailand

**Romanee Thongdara · Lal Samarakoon · Rajendra P. Shrestha · S. L. Ranamukhaarachchi**

Received: 7 June 2010 / Accepted: 24 March 2011


**Abstract** Various poverty alleviation programs have helped reduce poverty in Thailand, yet the poverty gap still remains, specifically in rural areas in the north and northeast of the country. The major barrier to poverty alleviation policies and strategies is the weakness of identifying where the poor are, thereby targeting poverty interventions. This paper investigates the potential of descriptive statistics, the geographic information system (GIS), and spatial autocorrelation in recognizing poverty association of a site selected in the northeast Thailand, including identifying factors that influence rural poverty, and investigating underlying factors and spatial associations of poverty at the rural household level. Results showed that 70% of the households sampled in the study area were poor, and nearly half of their income generated was from farming. Factors influencing farm income were examined by regression statistics and it was found that farm income is related to area cultivated, rice yield, livestock and learning experience of farmers. It was demonstrated that GIS is a useful tool to identify environmental factors that influence poverty and spatial autocorrelation is an effective method in revealing similarities and dissimilarities of poverty in household units. Use of these two technologies to identify factors underlying rural poverty was analyzed and

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*Article*

**Data Integration for Climate Vulnerability Mapping in West Africa**

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**Abstract:** Vulnerability mapping reveals areas that are likely to be at greater risk of climate-related disasters in the future. Through integration of climate, biophysical, and socioeconomic data in an overall vulnerability framework, so-called "hotspots" of vulnerability can be identified. These maps can be used as an aid to targeting adaptation and disaster risk management interventions. This paper reviews vulnerability mapping efforts in West Africa conducted under the USAID-funded African and Latin American Resilience to Climate Change (ARCC) project. The focus is on the integration of remotely sensed and socioeconomic data. Data inputs included a range of sensor data (e.g., MODIS NDVI, Landsat, SRTM elevation, DMSP-OLS night-time lights) as well as high-resolution poverty, conflict, and infrastructure data. Two basic methods were used, one in which each layer was transformed into standardized indicators in an additive approach, and another in which remote sensing data were used to contextualize the results of composite indicators. We assess the benefits and challenges of data integration, and the lessons learned from these mapping exercises.

# How to read critically

*Pay attention to how GIS was applied - what analytical tools were used? Were they the appropriate tools? Are there other tools the authors could have used?*

*Examine the issue of data - is the data source reliable? What format was the data in? Was the resolution of the data (spatial, and temporal, if applicable) adequate to answer the research question?*

*What are the limitations of the analysis? Are they data-related? Software tools related? Or are better analytical methods needed?*

*Pay attention to maps, graphs, charts, etc. - are they easy to understand? What about the quality of the maps? How can they be improved?*

…find relevant spatial data and evaluate its quality

…work with multiple formats of data

HDX
HUMANITARIAN DATA EXCHANGE v1.29.1
Find, share and use humanitarian data all in one place

AidData
Open Data for International Development

FEWS NET
FAMINE EARLY WARNING SYSTEMS NETWORK

OpenStreetMap

Spatial Data Repository
The DHS Program

world pop
UNIVERSITY OF Southampton

ACLED Armed Conflict Location & Event Data Project

# …work with various GIS software programs

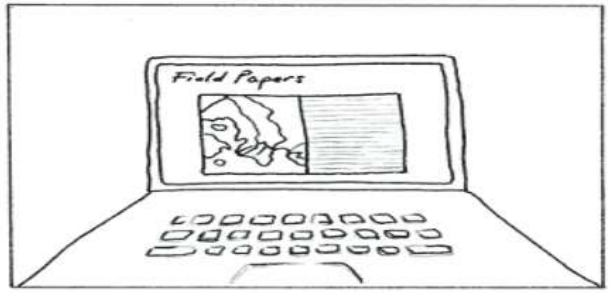


# … Create new data (field data collection)

Field Papers

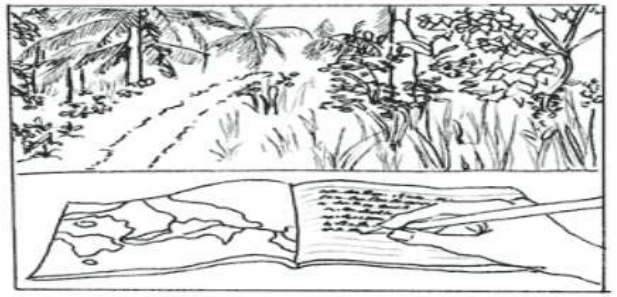
**MAKE** an atlas to print | **UPLOAD** pages you've marked | **WATCH** recent activity | **EXTEND** with advanced tools | **LOG IN** or create an account

## Welcome to Field Papers



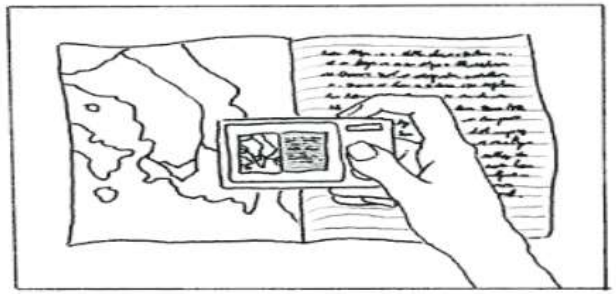

**Make yourself an atlas**

Print out anywhere in the world.



**Take it into the field**

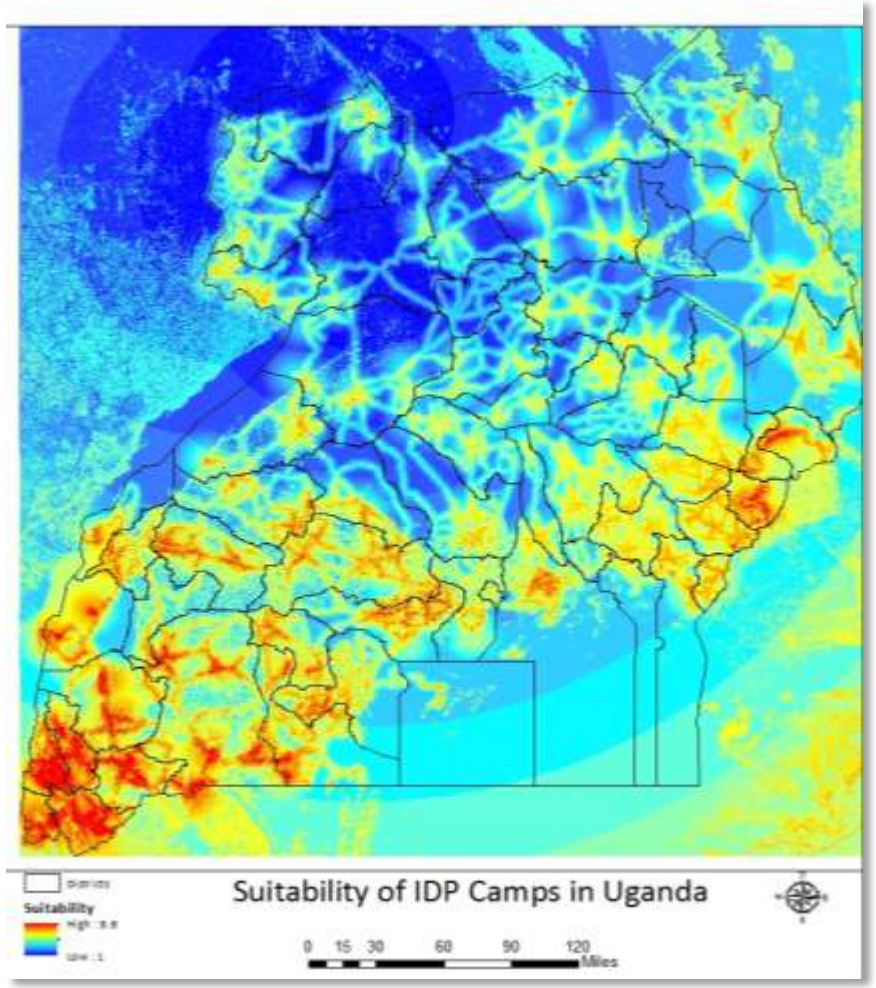
Make your notes and observations.

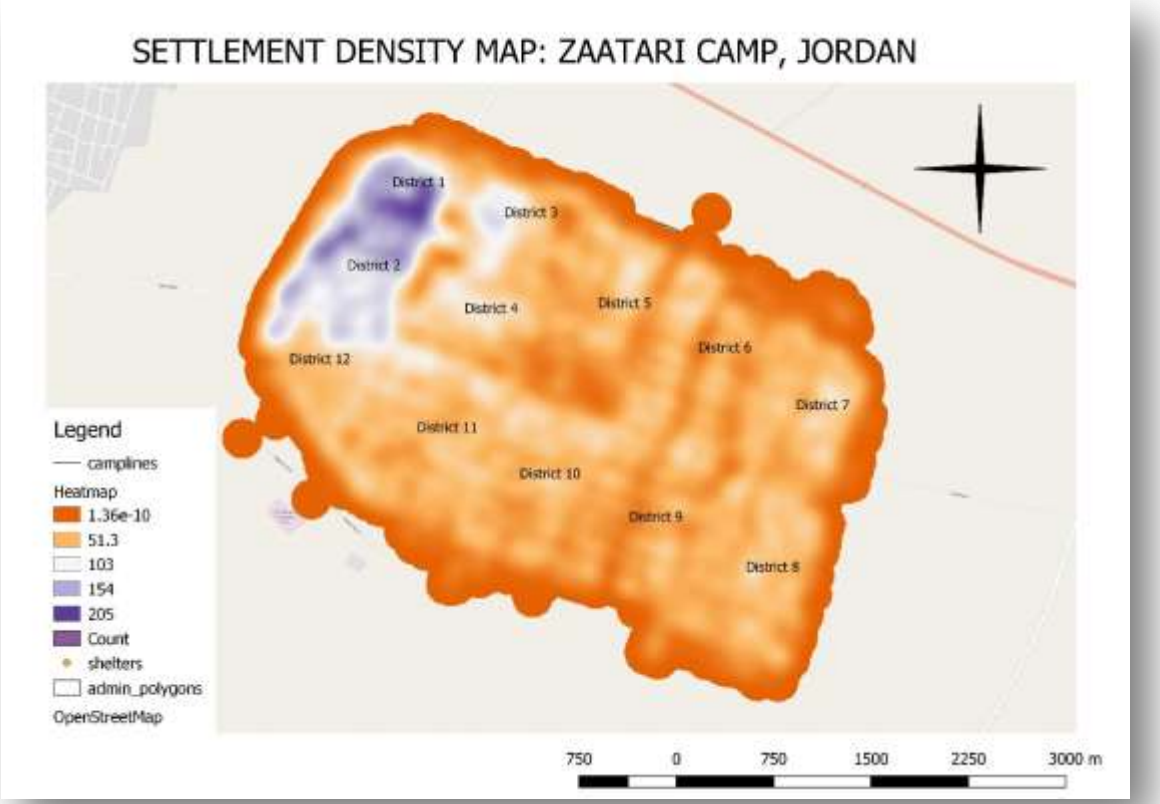


**Capture your notes**

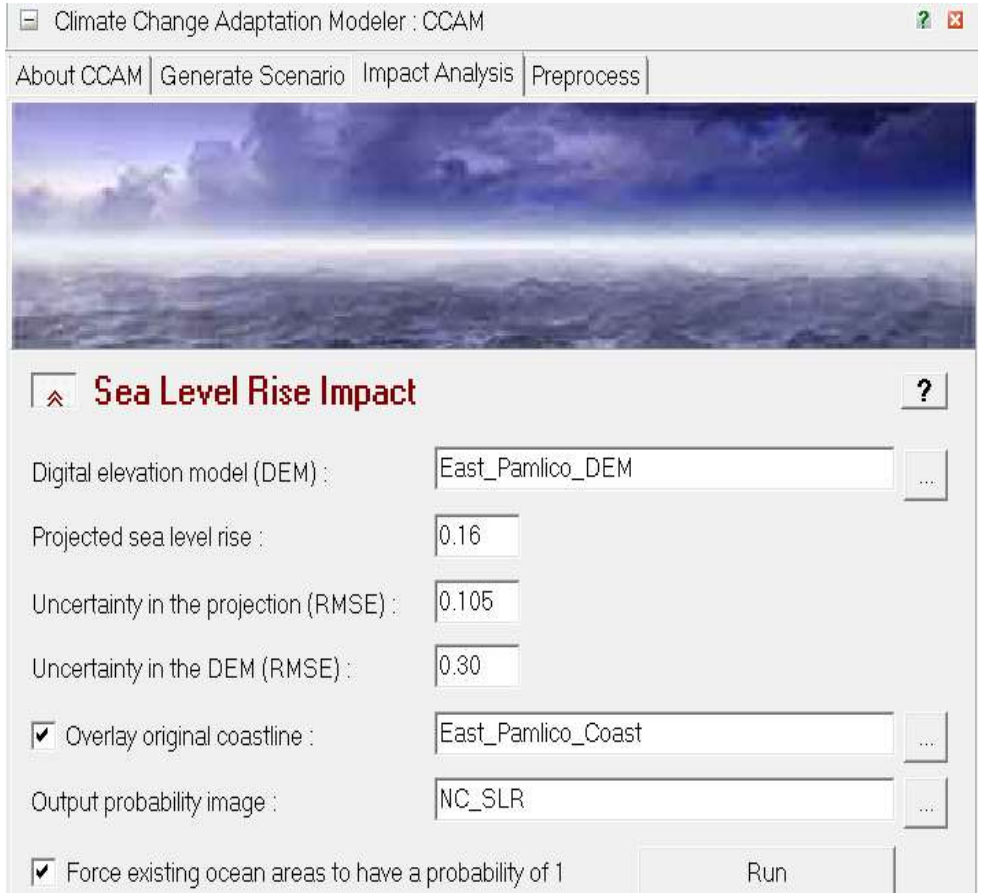
Upload pages you've photographed.

# …Know what analytical tools to apply

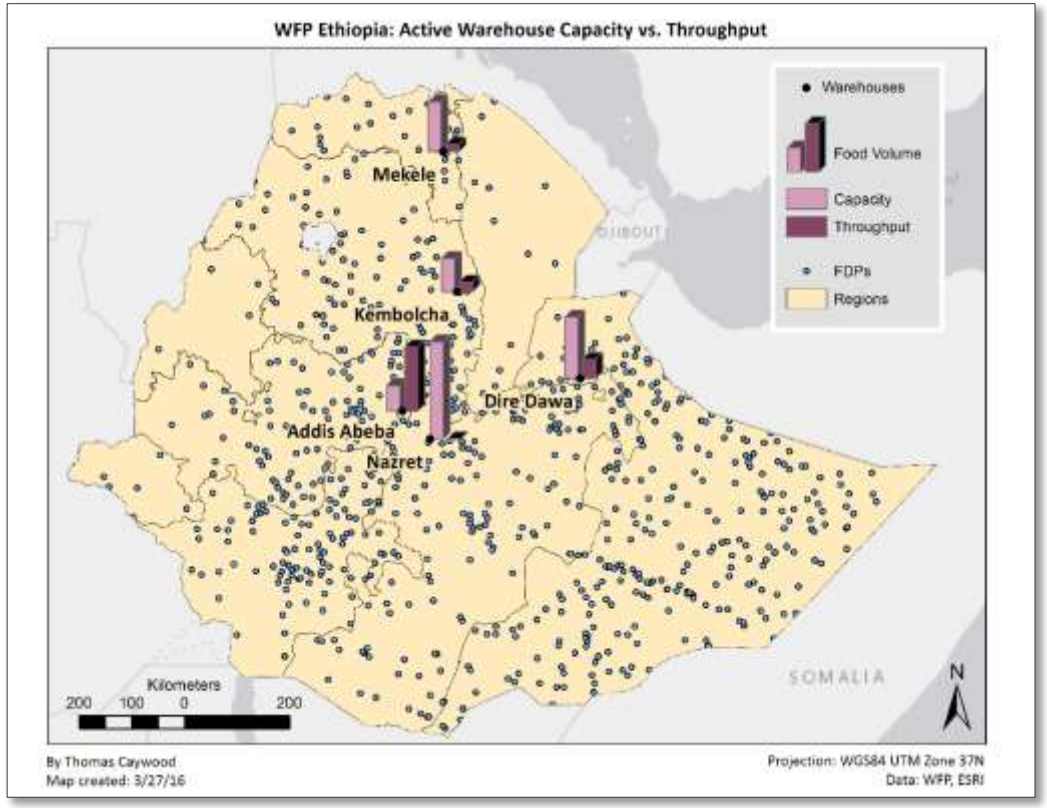


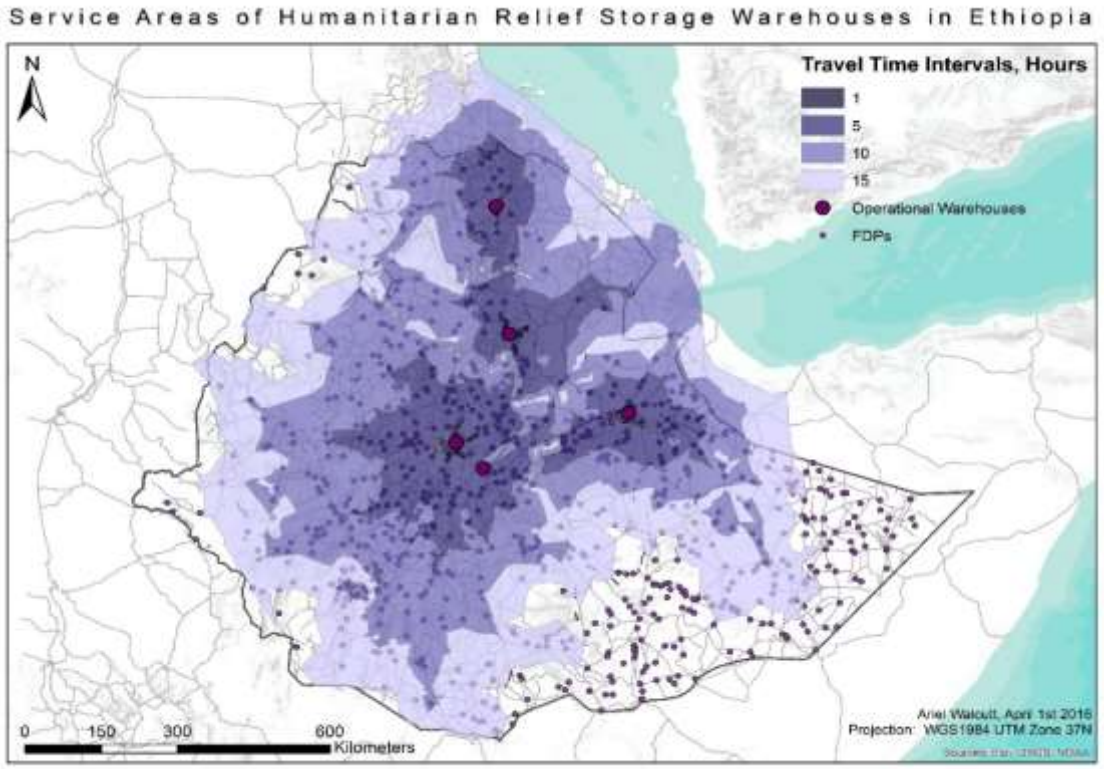




TerrSet
Geospatial Monitoring and Modeling System


Climate Change Adaptation Modeler : CCAM
About CCAM
Generate Scenario
Impact Analysis
Preprocess
Sea Level Rise Impact
?
Digital elevation model (DEM) :
East_Pamlico_DEM
...
Projected sea level rise :
0.16
Uncertainty in the projection (RMSE) :
0.105
Uncertainty in the DEM (RMSE) :
0.30
Overlay original coastline :
East_Pamlico_Coast
...
Output probability image :
NC_SLR
...
Force existing ocean areas to have a probability of 1
Run

# …Communicate effectively – make maps that “tell the story”




Lab assignment: Transportation network analysis for humanitarian assistance in Ethiopia

# Summary

- This course raised students' awareness of SDGs
- Designing a course around SDGs exposes students to a wide variety of international data sources
- SDGs provided useful framework for an applied GIS course

# Ideas for the future

- SDGs should have a more prominent role in the GIS curriculum in institutions of higher education worldwide
- SDGs could be used to design an entire GIS curriculum, allowing students to learn and apply technical skills in a meaningful context
- Creating an online platform where GIS educators can share their experiences and best practices  teaching with SDGs framework


# Thank you!

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