National Geospatial-Intelligence Agency

Incorporating Human Geography into GEOINT
STUDENT GUIDE (SG)

National Geospatial-Intelligence College

National Geospatial-Intelligence College
The School of Geospatial-Intelligence
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Change History Table

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1.0	Development and Dry Run are complete. This document is approved for classroom use.	24 August 2010
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IHGG Course Overview

Introduction

This course provides an overview of incorporating Human Geography into GEOINT at NGA, with the intention of providing a foundation of the knowledge, skills, and application capabilities for the NGA GEOINT analyst. By the end of the course, you will:

- Understand the relevance and need to incorporate Human Geography into GEOINT
- Be familiar with Human Geography concepts and data
- Be able to apply the NGA workflow process, including Human Geography data needs, acquisition, and challenges

Incorporating Human Geography into GEOINT

A blending of socio-cultural dynamics into traditional analyses is in high demand among NGA stakeholders.

- Peers and Partners with vested interest include:
  - DoD
    - USD (I)
    - Combatant Commands (CENTCOM, PACOM, AFRICOM, etc.)
    - Military Services (Army, Marines, etc.)
    - Service Intel Centers (MCIA, NGIC, etc.)
  - Intelligence Community
    - DNI
      - OSC
    - CIA, DIA, NSA, etc.
- Upper-level groups with vested interest include:
  - USG – Dept of State, Dept of Treasury, Dept of Commerce (Census Bureau), Dept of Justice (FBI)
  - Academia
  - Private Industry
  - US Allies (ASG)

Course Objectives

Upon completion of this course, you will be expected to:

- Describe Human Geography in the context of GEOINT.
- Describe how Human Geography concepts, perspectives, and data can assist in solving geospatial intelligence problems at NGA.
- Identify Human Geography data sources and types of information needed for GEOINT
- Demonstrate how Human Geography-based data can inform GEOINT analysis of an intelligence question.

Course Outline and Table of Contents

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Module One: Incorporating Human Geography into GEOINT

Lesson One: GEOINT and Human Geography

Version: 1.6
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Key Terminology

Critical Characteristics	Any attributes or features of a concept such as HTA that **MUST BE PRESENT** in order for something to be considered a valid example of that concept.
Human Terrain	The spatial differentiation and organization of human activity and its interrelationships with the physical environment.
Human Terrain Analysis	A multi-intelligence multidisciplinary scientific approach to describe and predict spatial and temporal patterns of human behavior by analyzing the attributes, actions, reactions, and interactions of groups and individuals in the context of their environment.
Operational Environment	The composite of the conditions, circumstances, and influences that affect the employment and capabilities and bear on the decisions of the commander. It encompasses physical areas and factors (of the air, land, maritime, and space domains) and the information environment. Including adversary, friendly, and neutral systems that are relevant to a specific joint operation.

Lesson One: GEOINT and Human Geography?

Introduction

This lesson provides a brief introduction into how Human Geography is incorporated into GEOINT, with a focus on the relevance of this analytical methodology in support of NGA mission requirements. This lesson will also briefly discuss the concept of Human Terrain as it is used by other agencies within the Intelligence Community (IC).

Objectives

Upon completion of this lesson, students will be able to:

- Identify how other organizations and agencies define and conceptualize the 'Human Terrain' and Human Terrain Analysis (HTA).
- Describe how NGA incorporates Human Geography into GEOINT
- Describe how incorporating HG themes support the broad spectrum of NGA GEOINT requirements.

21st Century GEOINT

21st Century GEOINT

As a key component of GEOINT, an understanding of Human Geography is critical to the 21st century's national security paradigm, helping to:

- Address challenges across the operational environment.
- Understand the cultural drivers of human behavior.
- Understand the attributes of culture.
- Interpret the world from a non-Western perspective.
- Force awareness and examination of our inherent cultural biases and perspectives.

The operating environment of the 21st Century poses a number of challenging mission sets to include:

- Overseas Contingency Operations
- Warfighters / Counterinsurgency / Asymmetrical Warfare
- Homeland Defense
- Humanitarian Assistance
- Disaster Relief
- Stability / Reconstruction
- Counter-WMD Proliferation
- Peacetime Engagement

- Epidemics / Medical
- Counternarcotics
- Human Smuggling

Human Terrain Defined

Incorporating Human Geography into GEOINT can be used to support efforts to understand the human terrain. But what is 'human terrain'?

One definition describes human terrain as "the social, ethnographic, cultural, economic, and political elements of the people among whom a force is operating."[1] General Petraeus noted that *"You have to understand not just what we call the military terrain… the high ground and low ground. It's about understanding the human terrain, really understanding it."*

Human terrain is not a new concept; the need for understanding the behavior of adversaries and their culture, as well as that of the local populations with whom our military forces, diplomats, and aid organizations work, has been identified before:

- World War II / Korea
  - JANIS: Joint Army Navy Intelligence Studies
- Vietnam
  - Hamlet Evaluation System
  - Attempt to measure the socio-economic, political, security conditions in a COIN environment

HT Analysis (HTA) is an evolving concept, and is often modified to meet specific organizational needs, requirements, and missions.

(U) Current efforts and challenges include creating a:

- Standardized doctrine
- Centralized database
- Shared lexicon
- Single HTA qualification course
- Product standardization
- Workflow methodology

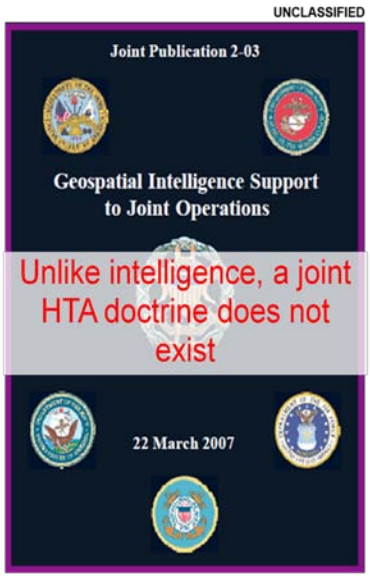

Figure 1.1.1 Joint Publication 2-03

[1] Kipp, Jacob, and Lester Grau. 2006. The Human Terrain System: A CORDS for the 21st Century. *Military Review* (September-October): 9

Efforts to develop and implement greater understanding of the 'human terrain' across the IC include:

- Defense Intelligence Agency
  - DISCCC: Defense Intelligence Socio-Cultural Capabilities Council
  - Human Factors Analysis Division
- US Combatant Commands
  - Human Terrain Analysis Team
  - Cultural and Human Environment Team
- US Special Operations Command
- National Air and Space Intelligence Center
- Service Intelligence Centers

Goal for NGA

"Create new value by broadening and deepening our analytic expertise. By *providing deeper, contextual analysis of places informed not only by the earth's physical features and imagery intelligence, but also by 'human geography'."*

GEOINT is synonymous with a deep contextual understanding of places…of *locations on the Earth.* This understanding is informed by:

- what we know about the Earth's physical features
- what structures people build
- how people use those structures – their activities
- human geography – data and information that can be understood spatially and depicted visually that further deepens and enriches our understanding of a "place."

Letitia A. Long, Director, NGA
Putting the Power of GEOINT in Your Hands
GEOINT Symposium
2 November 2010

Human Geography and GEOINT

Incorporating Human Geography into GEOINT

NGA incorporates Human Geography (HG) into traditional GEOINT in order to:

- establish a multi-intelligence, multidisciplinary scientific approach
- describe and predict spatial and temporal patterns of human behavior
- analyze the attributes, actions, reactions, and interactions of groups and individuals
- in the context of their environment.

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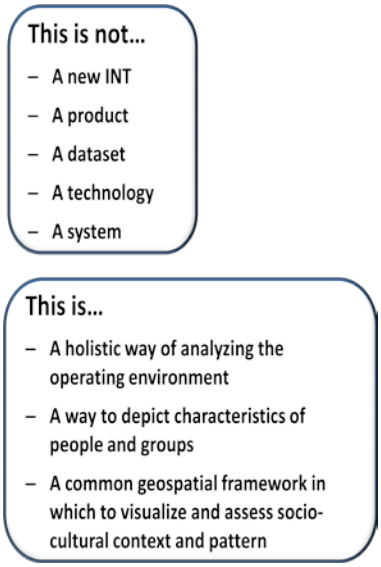


Figure 1.1.2 Incorporating HG into GEOINT

Incorporating Human Geography into GEOINT requires a multi-intelligence, multidisciplinary scientific approach

- Draws from and builds upon data and research from:
  - Government
  - Non-Government
  - Academia

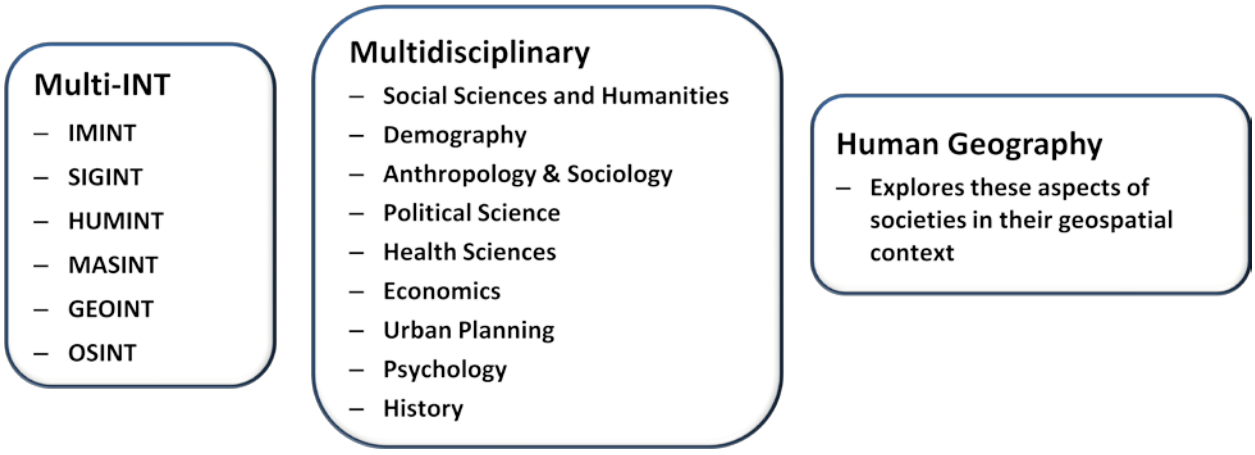


Figure 1.1.3 Incorporating HG into GEOINT – Multi-INT and Multidisciplinary

Incorporating Human Geography into GEOINT requires a scientific approach in order to describe, analyze, and predict spatial and temporal patterns of human behavior.

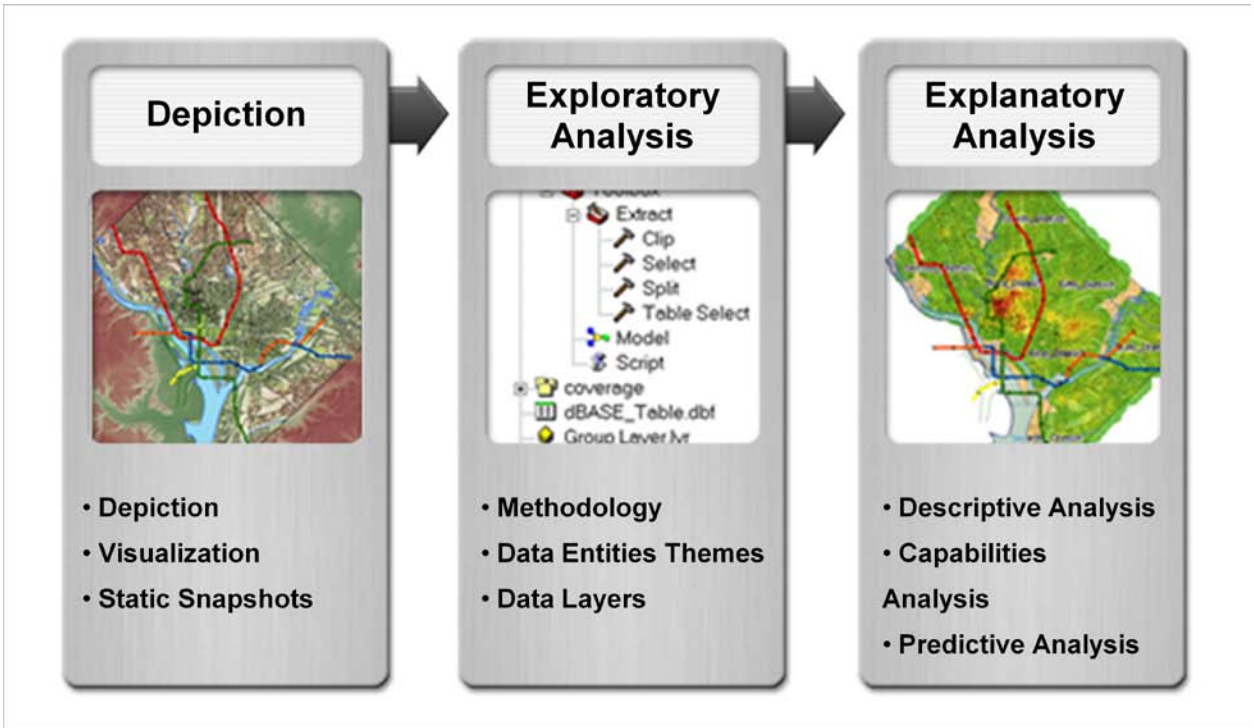


Figure 1.1.4 Incorporating HG into GEOINT – A scientific approach

GEOINT and Human Geography

Incorporating HG data for the identification, depiction, and interpretation of human patterns of behavior and cultural influences in a geospatial context.

- Predictive Analysis
- Capabilities Analysis
- Statistical Analysis
- Temporal Analysis
- Spatial Analysis
- Social Network Analysis
- Migration Analysis
- Resource Analysis

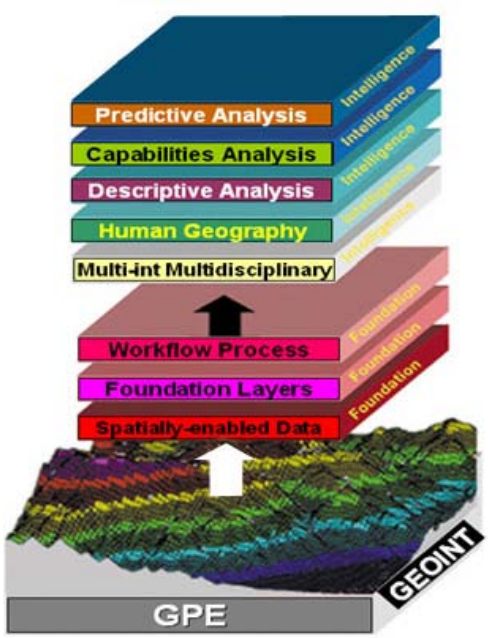


Figure 1.1.5 GPE: Geospatial-Intelligence Preparation of the Environment

HG in the GPE Framework

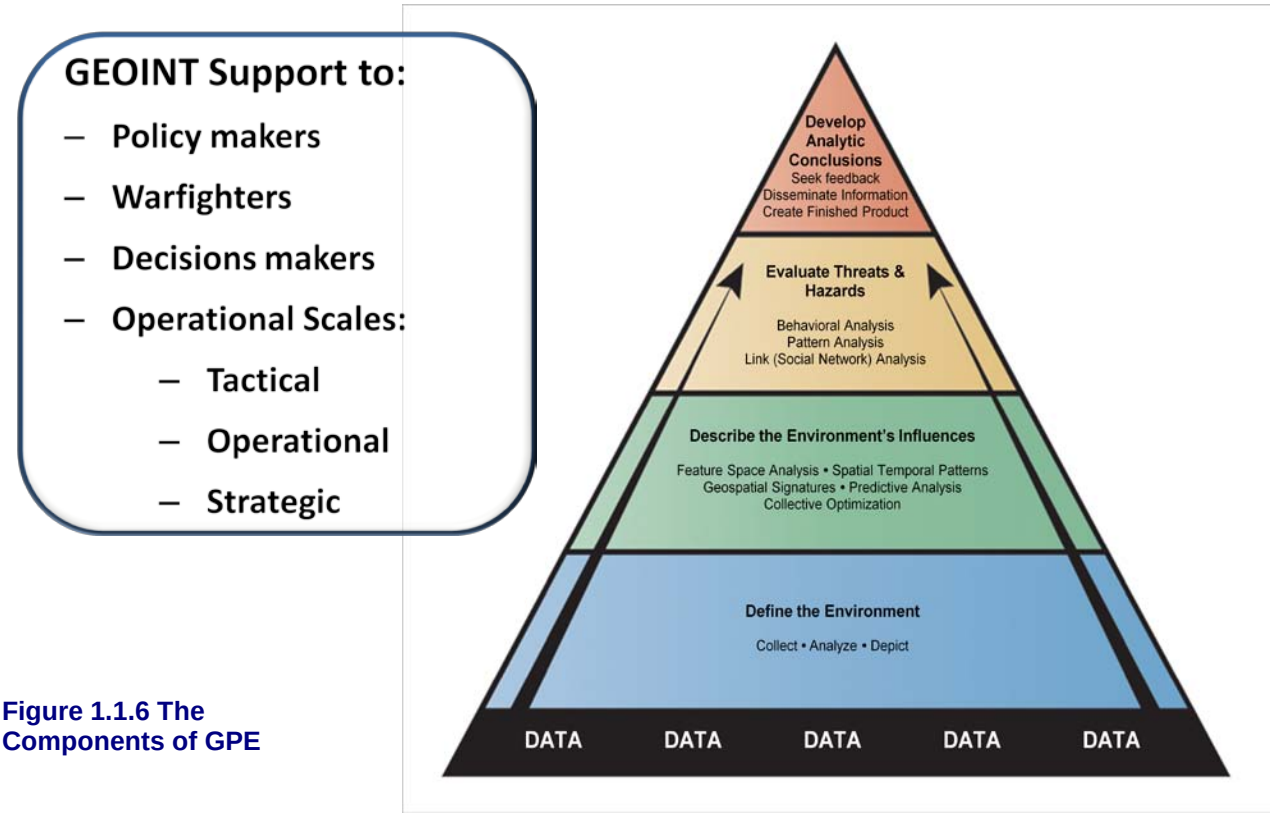


Figure 1.1.6 The Components of GPE

Analysis informed by human geography-based data is the progression of GEOINT

GEOINT analysis has historically incorporated a wide variety of physical science and sensors, metrics, and techniques to depict and assess geospatial terrain and infrastructure. Human Geography augments these traditional GEOINT approaches with the addition of data and models that describe the behavior, attitudes, perceptions, and relationships of people in the context of their environment.

Human Geography data will be expressed as a mix of vectors (e.g., maps and GIS) and words to visualize and describe beliefs, customs, political, and economic differentiations as they are manifested on the spatial and temporal landscape. In many instances, NGA tradecraft has settled for using only basic geospatial techniques for visualization and descriptive support. HG builds upon traditional GEOINT as traditional GEOINT does not include HG themes.

The Human Geography-based themes listed below provide a framework to establish a cultural baseline for a particular place or region. These themes were derived by the Pilot Study group, drawing from research in geography and the social sciences. These themes are not all inclusive and include subcategories that will be discussed in detail in Module 2, Lesson 1.

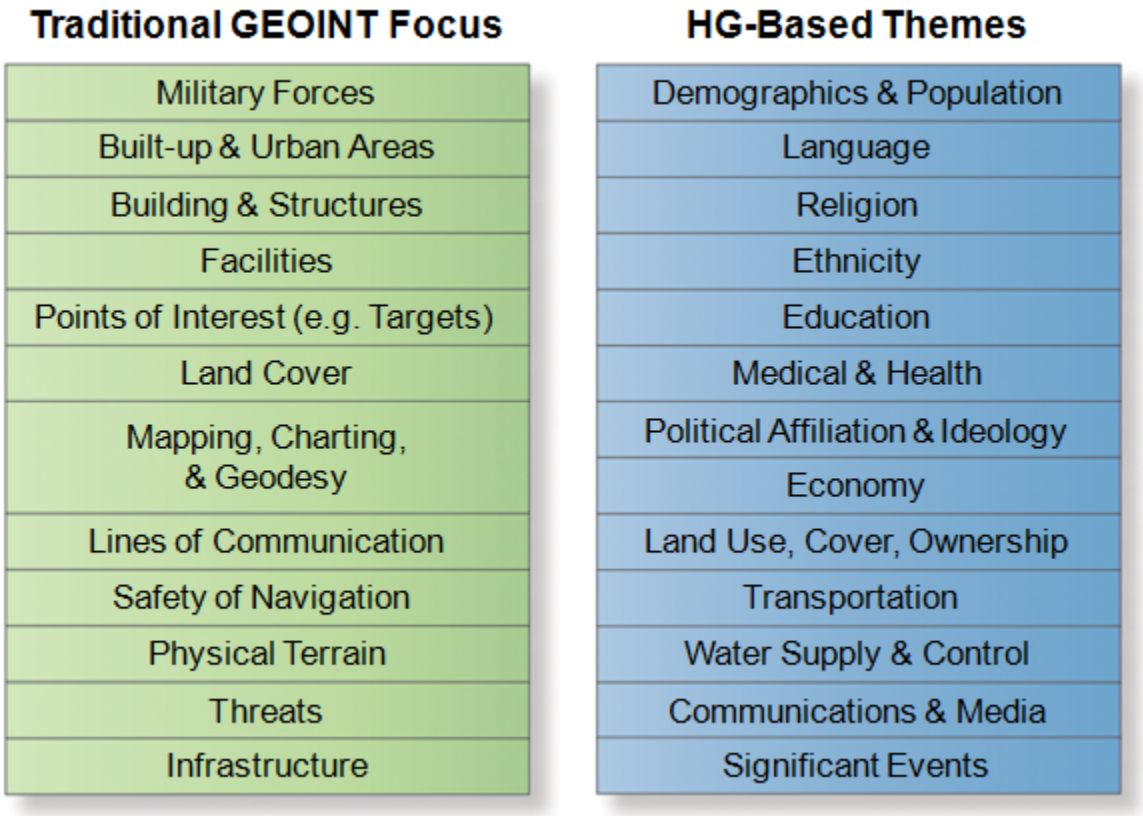


Figure 1.1.7 Traditional GEOINT Focus and Human Geography-Based Themes

Human Geography employs analysis across a range of scales. The scale of the analysis will often depend on the mission requiremetns as well as the available data.

UNCLASSIFIED

Strategic	G	Global	Worldwide	Administrative (ADM) Level Boundaries
Operational	R	Regional	National	ADM 0
Tactical	L	Local	District, Province, State	ADM 1
Tactical	S	Specialized	Village/Neighborhood	ADM 2 - 4

Figure 1.1.8 Scales of Analysis

Impact of Cultural Bias

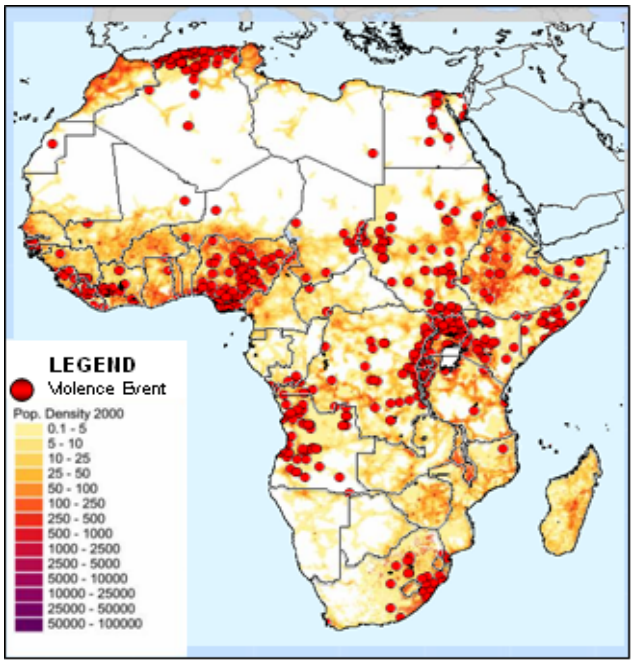
When incorporating HG-based data into GEOINT, analysts must be guarded against incorporating cultural bias into their analysis. This is especially important when those who have been raised in the Western world are examining non-western populations and their behaviors. Conflicts between Western and non-Western concepts can arise in many areas to include: Rationality, Justice, Fairness, Legitimacy, Morality, Religion, Nation-state, Jihad, History, Significant Events.

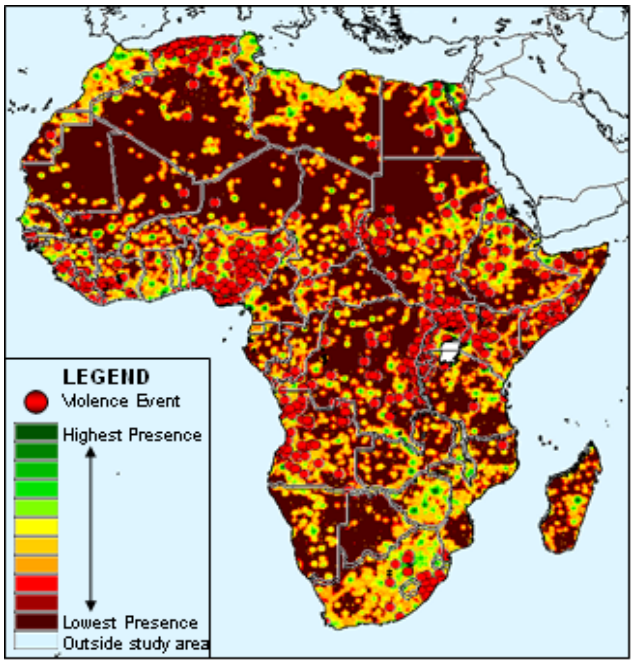
Figure 1.1.8 Mitigating Ethnocentrism

Integrating HG Themes

Integrating HTA Themes

History of civil and ethnic violence in comparison with government presence and population density can be demonstrated with integrated HTA products.


LEGEND
Violence Event
Pop. Density 2000
0.1 - 5
5 - 10
10 - 25
25 - 50
50 - 100
100 - 250
250 - 500
500 - 1000
1000 - 2500
2500 - 5000
5000 - 10000
10000 - 25000
25000 - 50000
50000 - 100000


LEGEND
Violence Event
Highest Presence
Lowest Presence
Outside study area

Lesson One Review

As you begin to incorporate HTA into your GEOINT tradecraft, keep in mind that Human Terrain Analysis must evolve as a collective effort. A collaborative approach will help ensure that this capability matures in alignment with NGA's strategic intent and in concert with the capabilities and expectations of NGA's partners.

In this lesson we covered the following topics:

- 21st Century GEOINT
    - The Operational Environment
    - The 'Human Terrain'
- Incorporating Human Geography Concepts into GEOINT
    - HG in the GPE Framework
    - Incorporating HG into GEOINT
    - Example Analysis

Lesson One References

References are as follows and can also be found on the *HTA Concepts* course Wikipedia page:

- NGA Pilot Group, *"Human Terrain Analysis Handbook and Reference Guide,"* (HTA HB), Version 1-0, November, 2009
- Fawcett, Grant S., *"Cultural Understanding in Counterinsurgency: Analysis of the Human Terrain System,"* United States Army Command and General Staff College, School of Advanced Military Studies, Ft. Leavenworth, KS, May 2009
- Gates, Robert M., *"A Balanced Strategy: Reprogramming the Pentagon for a New Age,"* Foreign Affairs, January/February 2009
- Joint Publication 2-01.3, *"Joint Intelligence Preparation of the Operational Environment*;*"* 16 June 2009
- Kipp, Jacob, and Lester Grau. 2006. The Human Terrain System: A CORDS for the 21st Century. *Military Review* (September-October): 8-15.
- Quadrennial Defense Review Report, United States Department of Defense, 06 February 2006

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Module One: Incorporating Human Geography into GEOINT

Lesson Two: Understanding Human Geography

Version: 1.6
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Key Terminology

Human Geography	Social Science. Human Geography studies people and places, and explore the imprint of human activity on Earth. It examines how people make places, how society is organized spatially, how people interact in places and across space and the processes that create these patterns.
Physical Geography	Natural Science. Physical Geography focuses on understanding the processes and patterns of the natural environment. The emphasis of this sub-discipline is the study of the variable character of the Earth's surface and atmosphere as the home for humanity.

Lesson Two: Understanding Human Terrain

Introduction

This lesson provides an introduction to the discipline of Geography and focuses on Human Geography as an academic perspective. Specifically, this lesson briefly explores the differences between Physical and Human Geography and introduces a variety of systematic Geography subjects, with emphasis on those which make the analysis of the cultural landscape possible. This lesson introduces concepts and topics within Human Geography and the various subfields to illustrate how these provide the foundation for incorporating Human Geography into GEOINT.

Objectives

Upon completion of this lesson, students will be able to:

- Differentiate between Physical and Human Geography
- Understand how basic concepts, theories, and approaches within Human Geography can inform GEOINT within NGA.
- Categorize the thirteen Human Geography foundation themes at NGA..

Geography Overview

Geography Overview

Geography is an academic discipline which is defined by a perspective—not a topic or subject matter—implying that every subject can be studied geographically or at least has some spatial extent that can be studied.

- The level of analysis can be varied by adjusting the scale of analysis.
- Geographers employ the spatial perspective, which explores:
  - The temporal and spatial distribution of phenomena on the Earth's surface
  - The processes that creates those distributions
  - The interaction between humans and the environment
- Geographers analyze the world seeking to answer the question, "What is where and why is it there?" by asking "How and why phenomena are distributed spatially on the surface of the Earth?"

Scale

One aspect that differentiates Geography from other disciplines is how geographers employ the concept of scale. Scale can be viewed as the level of representation, experience, and organization of events and processes.

Hierarchy of scales:

Body

Home

Community

Urban

Regional

National

Global

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Strategic	G	Global	Worldwide	Administrative (ADM) Level Boundaries
Operational	R	Regional	National	ADM 0
Tactical	L	Local	District, Province, State	ADM 1
Tactical	S	Specialized	Village/Neighborhood	ADM 2 - 4

Figure 1.2.1 GRLS application of scale.

Major Divisions of Geography

Overview

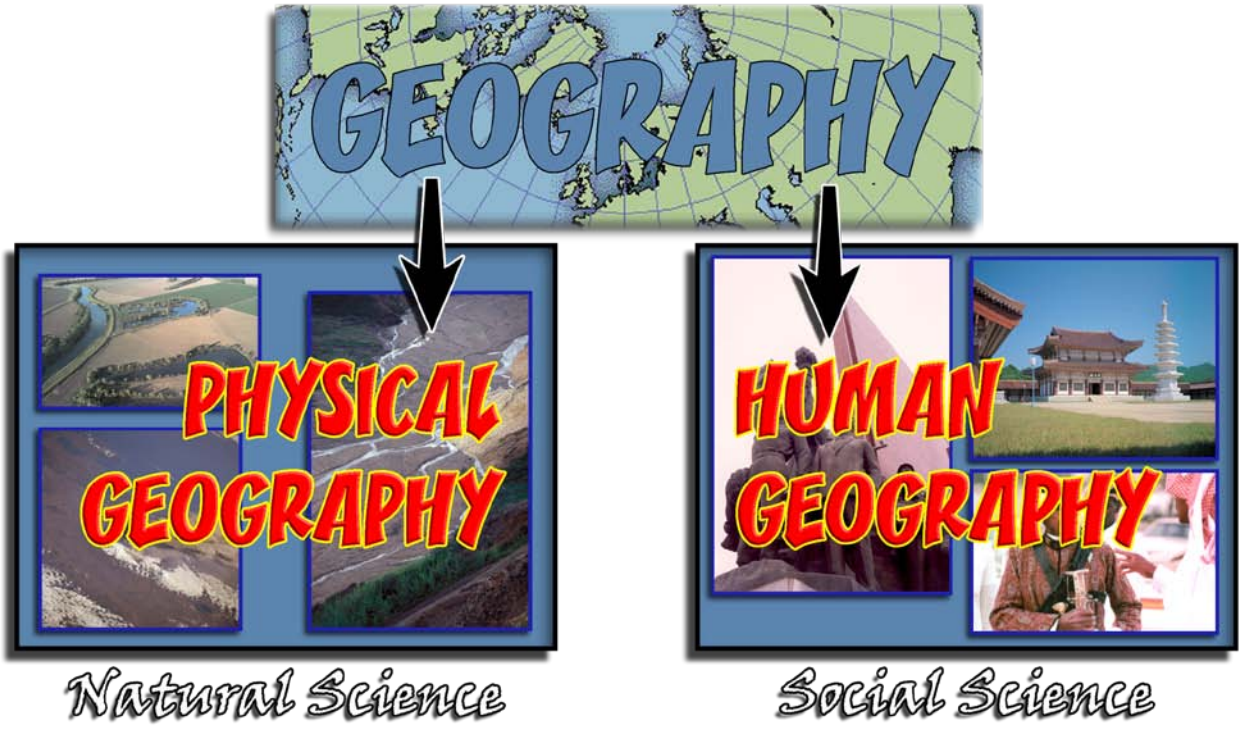


Figure 1.2.2 Major Divisions of Geography

The application of the geographic perspective and associated tools allows for the holistic analysis of peoples and places. During analysis, elements are often categorized as either Physical Geographic elements, which are most associated with the natural environment, or Human Geographic elements, which includes the environment as modified by humans.

Two Major Divisions of Geography

Geography is divided into two major divisions:

- **Physical Geography/Physical Science.** Focuses on understanding the processes and patterns of the natural environment. The emphasis of this sub-discipline is the study of the variable character of the Earth's surface and atmosphere as the home for humanity.
- **Human Geography/Social Science.** Human Geography studies people and places, and explores the imprint of human activity on Earth. It also examines how people make places, how society is organized spatially, how people interact in places and across space, and the processes that create these patterns.

Physical Geography

Physical Geography is primarily focused on elements of the physical terrain. Components that relate to the natural environment include:

- Landforms that are a result of the natural processes that occur at or near the surface of the Earth. This includes internal processes which build up the Earth and external process which weather, erode, and shape the Earth's surface.
- Vegetation includes any type of flora.
- Climate and weather contribute the hydrological systems which in turn, act as a major gradational agent when discussing the components of Physical Terrain in the natural environment.

Human Geography

Environment Modified by Humans

The environment as modified by human activity is a geographic concept known as the Cultural Landscape. The effects on the landscape are relatively easy to map or image through remote sensing. Examples of humans modifying the landscape include:

- Features built by humans on the natural landscape, such as cities, buildings, roads, bridges, power/utility lines, and airfields.
- Landscape as altered by human activity, such as farms, orchards, irrigation channels, deforestation, dams, and open-pit mining.

Attributes of human societies

Human Geography also explores the spatial patterns and distribution of human activities and societies as well as the processes which create these patterns.

- Socio-economic, cultural, political, demographic activates and patterns.
- Changes over time.

Systematic Fields of Human Geography

Systematic geographies represent topical approaches employed to understand human activities and patterns. As listed in ***Table 1.2.1*** below, they are integrative and a result of multidisciplinary approaches. The approach the geographer takes is to examine the spatial aspects and expressions of each topic in detail:

Table 1.2.1 Systematic Fields of Human Geography

Subfields of Geography	Related Disciplines
Population Geography	Demography
Cultural Geography	Anthropology & Sociology
Political Geography	Political Science
Medical Geography	Health Sciences
Economic Geography	Economics
Urban Geography	Urban Planning
Behavioral Geography	Psychology
Historical Geography	History

Bottom line: These are but a few of the systematic sub-fields of Geography. As you can imagine, since almost every phenomenon has a spatial component or can be mapped, just about any subject can be studied systematically by a geographer.

Population Geography

Focuses on the spatial aspects of demography. Examines the location, spatial distribution, and processes that create these patterns:

- The effect or influence of demographic changes in particular places

Topics considered/addressed:

- Population trends
- Population density
- Migration/mobility
- Composition of society
- Education levels/literacy

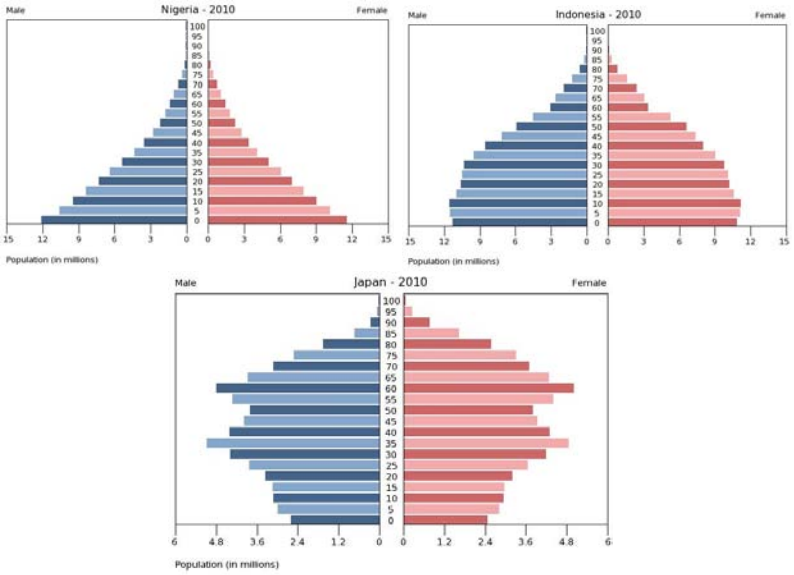


Figure 1.2.3: Population pyramids (or profiles) depict the age gender compositions of societies.

Population Trends

- Growth rates
- Birth/Death rates
- Fertility rates
- Infant mortality
- Life expectancy
- Age-sex compositions
- Doubling time
- Carrying capacity
- Demographic transitions
- Population pyramids & profiles
- Dependency ratios

Education, Migration / Mobility, and Composition

Cultural Geography

Examines the spatial aspects of human cultures.

Culture:

- Shared patterns of learned behavior
- Learned patterns of thought and behavior characteristics of a population
- Way of life

Components of Culture:

- **Ideological:** Ideas, beliefs, and knowledge
- **Sociological:** Patterns of interpersonal relations
- **Technological:** Materials, objects, and the techniques to use

Topics/Concepts:

- Religion
- Language
- Ethnicity/tribal
- Multiculturalism: Degree of homogeneity/heterogeneity
- Culture hearth
- Cultural traits, complexes, systems, regions
- Cultural diffusion

Cultural Diffusion

Cultural Diffusion is the spread of a phenomenon over space and through time. It is the process by which a concept, practice, or substance spreads from point of origin to new territories.

Types of Diffusion:

- Expansion:
    - Contagious: through direct contact
    - Hierarchical: through a hierarchical structure
    - Stimulus: modification of an idea, innovation
- Relocation: movement to new locations

Political Geography

Examines:

- Spatial expressions of political behavior
- Interaction of geographic space and political process
- Spatial patterns of political phenomena and processes

Topics/Concepts:

- Political systems, beliefs, and attitudes
- Electoral geography: voting patterns, districting
- Organization, administration, control of territory/territoriality
- Territorial morphology of states
- Boundaries and borders

Medical Geography

Examines:

- Spatial aspects of health and disease
- Sources, diffusion, and distribution of diseases and health related issues

Topics/Concepts:

- Geographic variables that contribute to the outbreak and spread of disease
- Types, causes and prevalence of diseases
- Health care: level of care, accessibility to that care
- Mortality rates
- Malnutrition, undernutrition indices
- Cultural practices that enable onset / diffusion of diseases

Economic Geography

Examines:

- The ways people earn a living
- How economic systems and the means of production vary from place to place
- The location of economic activity and the spatial organization and growth of economic systems
- Use and consumption of economic/natural resources
- How economic activities are interrelated and connected across space

Topics/Concepts:

- Sectors of the economy:
  - Primary: Mining, Agriculture
  - Secondary: Industry
  - Tertiary: Services
  - Quaternary: Information
- Agricultural production: subsistence, commercial
- Industrial production
- Extraction/use of natural resources
- Per capita incomes
- Commodity chain analysis

Urban Geography

Examines:

- Spatial evolution and structure of cities and urban systems

Topics/Concepts:

- Urban networks and hierarchies
- Communications patterns and networks
- Business districts
- Urbanization rates, urban growth
- Conurbation and urban sprawl
- Regional city models

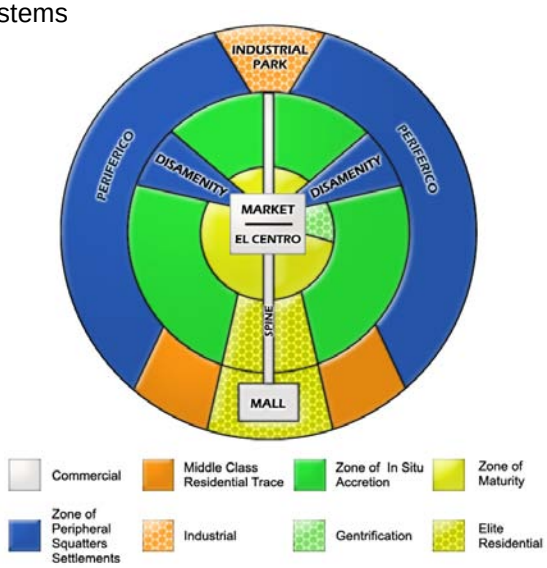


Figure 1.2.4: New and improved model of Latin American City Structure.

Historical Geography

Examines:

- Past geographies to provide understandings of the present
- How and why landscapes change over time

Topics/Concepts:

- Regional geography approach

Behavioral Geography

Examines:

- Psychology that underlies people's spatial behavior
- Locational / spatial decision-making of individuals, groups, and institutions

Topics/Concepts:

- Distance decay
- Mental maps
- Time-Space Geography

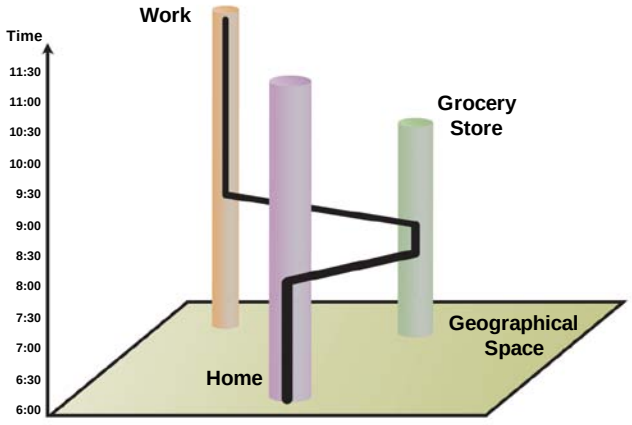


Figure 1.2.5: Time-space geography.

Human Geography as a Framework for Analyzing the Human Terrain

(Haiti Earthquake of 2010)

Human Geography can be used as a framework for analyzing the Human Terrain. Human Geography is a means of understanding the complexities of the real world. The recent earthquake in Haiti was devastating to its peoples. This residence (***Figure 1.2.4***) in the hills south of Port-au-Prince (Haiti's capital), like many others was destroyed during the earthquake of 12 January 2010.

But what factors of Human Geography played a role in the extreme devastation and suffering?

Figure 1.2.6 Devastation from the 2010 Haiti Earthquake

13 Foundation Themes of HTA

Although discussed throughout the lesson, by now you should be able to see that the 13 Human Geography-based foundational themes origins are well founded in Human Geography.

Figure 1.2.7 Thirteen Human Geography-based Foundation Themes

Generally speaking, these themes:

- Can be viewed as a “manageable number of layers” among a vast array of data
- Comprise the core foundation data needed to conduct HTA
- Themes will vary per Area of Interest (AOI)
- Can be difficult to map
- May be linked to other themes

Lesson Two Review

Geography is a blend of characteristics of the physical Earth, human structures, and human patterns on the Earth. Geography, as an academic discipline, examines the physical and human landscapes. The many systematic geographic subfields allow analysts to examine peoples and places through a set of lenses at varying scales. These lenses are represented by the Human Geography-based foundation themes.

In this lesson we covered the following topics:

- Human Geography as an academic discipline
  - Geography Overview
  - Two Major Divisions of Geography
  - Systematic Fields of Human Geography
  - Human Geography concepts, theories, and approaches
- 13 Foundation Themes

Lesson Two References

References are as follows and can also be found on the *HTA Concepts Course* Wikipedia page:

- NGA Pilot Group, *"Human Terrain Analysis Handbook and Reference Guide"* (HTA HB), Version 1-0, November, 2009

Module Two: Data Factors and Intelligence Issues

Lesson One: Human Geography-Based Foundation Data

Version: 1.6
Date: 12 July 2011

Change History Table

Version	Description of Change	Date
1.0	Development and Dry Run are complete. This document is approved for classroom use.	24 August 2010
1.5	Post-Dry Run conference is complete. Changes incorporated.	21 June 2011
1.6	Final edits. This document is approved for classroom use.	12 July 2011
1.6	Final edits from July course run. This document is approved for classroom use.	12 September 2011

Key Terminology

Consuetudinary	This term applies to law, where the rule of law is determined by long-standing custom as opposed to case law or statute.
Human Geography-Based Foundation Data	Human geography-based foundation data is the essential, slow-changing ethnic, social, cultural, economic, and demographic data describing the patterns and characteristics of human activities and communities of an Area of Interest (AOI), consolidated into human geography-based themes for building, maintaining, and sharing core human geography-based foundation data layers.

Lesson One: Foundation Data

Introduction

This lesson describes the components of the Human Geography-based foundation data and the 13 themes of foundation data needed for GEOINT. Additionally, it describes the 13 themes and accompanying subcategories, explains the Human Geography data process, and provides examples of how data makes it possible for GEOINT analysts to address geospatial intelligence issues at NGA.

Objectives

Upon completion of this lesson, you will be able to:

- Describe the factors and subcategories that make up the Human Geography-Based foundation data
- Identify how incorporating and analyzing foundation data can assist in addressing geospatial intelligence issues at NGA

What Is A Foundation Data?

Human Geography-Based Foundation Data Defined

Before we can talk about Human Geography-based foundation data, we need to first define and briefly explain what foundation data is and understand its relevance to GEOINT.

Critical Characteristics

In order to enhance your understanding of foundation data, take a closer look at its critical characteristics:

- Essential, relatively stable ethnic, social, cultural, and demographic data
- Can be used to analyze the patterns and characteristics of human activities and communities over space and time
- Consolidated into Human Geography-Based themes
- Build, maintain, and share core spatially enabled HG data layers

NGA's Intent

The NGA intent in incorporating Human Geography foundation data as the basis for data layers is twofold:

- Acquire and fuse existing data that spatially and temporally depict entities, attributes, and events relevant to the cultural baseline of an AOI.
- Acquire and integrate textual description of people, events, and relationships, and spatially enable these as data layers.

The IC expects the NGA to provide spatially enabled HG foundation data in support of a wide array of customers. Therefore, gathering HG-based foundation data—through both open and classified sources—is a key component in GEOINT success.

There are hundreds of potential data types and layers that could be included in any particular GEOINT effort. Accordingly, comprehensive HG-based foundation data efforts will likely build and investigate most of these in the course of producing descriptive analyses (for understanding), capability analyses (for knowledge), and predictive analyses (for decision making).

As you begin collecting the data, keep in mind that HG-based foundation data requires a broad and diverse collection of data types and layers; once constructed, these data layers can be used for analysis once the cultural descriptors of people, events, or beliefs are represented geospatially.

Open sources are the primary locations for foundation data, a business process to acquire semi-and unstructured data. NGA is developing this capability with several partners.

Human Geography-Based Foundation Data Elements

Foundation Data Overview

Successful HG-based foundation data is the amalgamation of three ongoing bedrock components, and all three are inextricably linked together:

- Foundation data
- Workflow process
- Data layers

Let's take a few minutes to examine and discuss what you're looking in the graphic below. In the top center is the workflow process, which we'll be discussing later in the lesson. For right now, just understand that the workflow process is the HG foundation data methodology that you will follow.

At the bottom are the 13 HG-based foundation data themes. The data themes are how the NGA has decided to codify, structure, and organize the enormous volume of data that you will be collecting.

Much of the information in those data themes will be used to produce layers that depict the human infrastructure and patterns of human activity—much in the same way that you already do for depicting the Earth, physical features, and structures.

The key take-away is for you to understand that the HG-based foundation data collected and stored in their respective categories are integrated into the workflow process to produce the necessary data layers that are essential to HG-based foundation data.

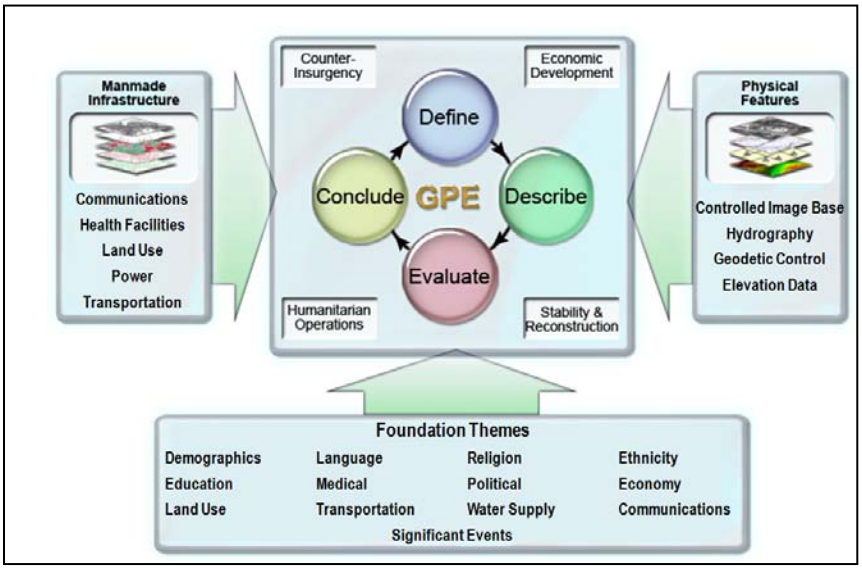


Figure 2.1.1 Foundation Data Themes and GPE

Human Geography-Based Foundation Data Process

This graphic depicts the major steps within the Human Geogrpahy-based data process, from data discovery to storage and maintenance of the acquired data. The data requirements will be identified during the planning phase of the workflow process,

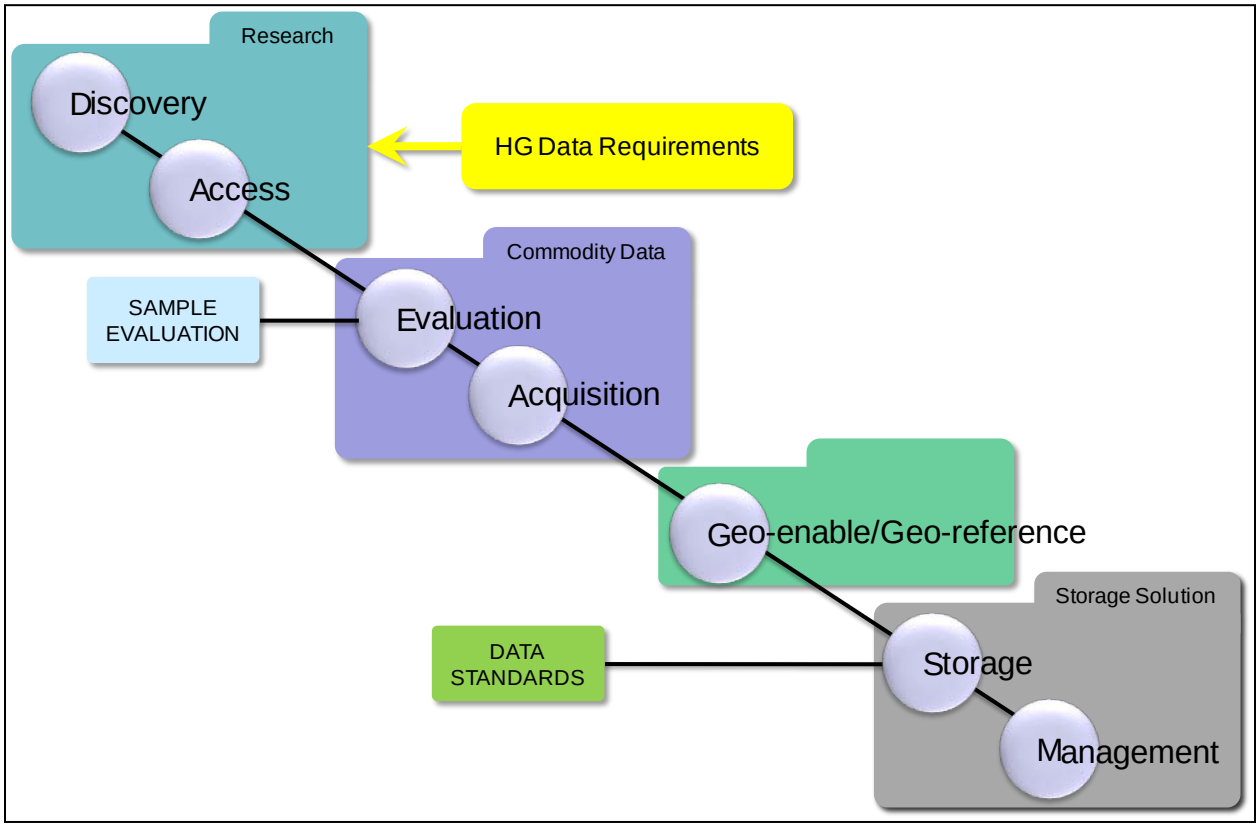


Figure 2.1.2 Human Geography-Based Foundation Data Process

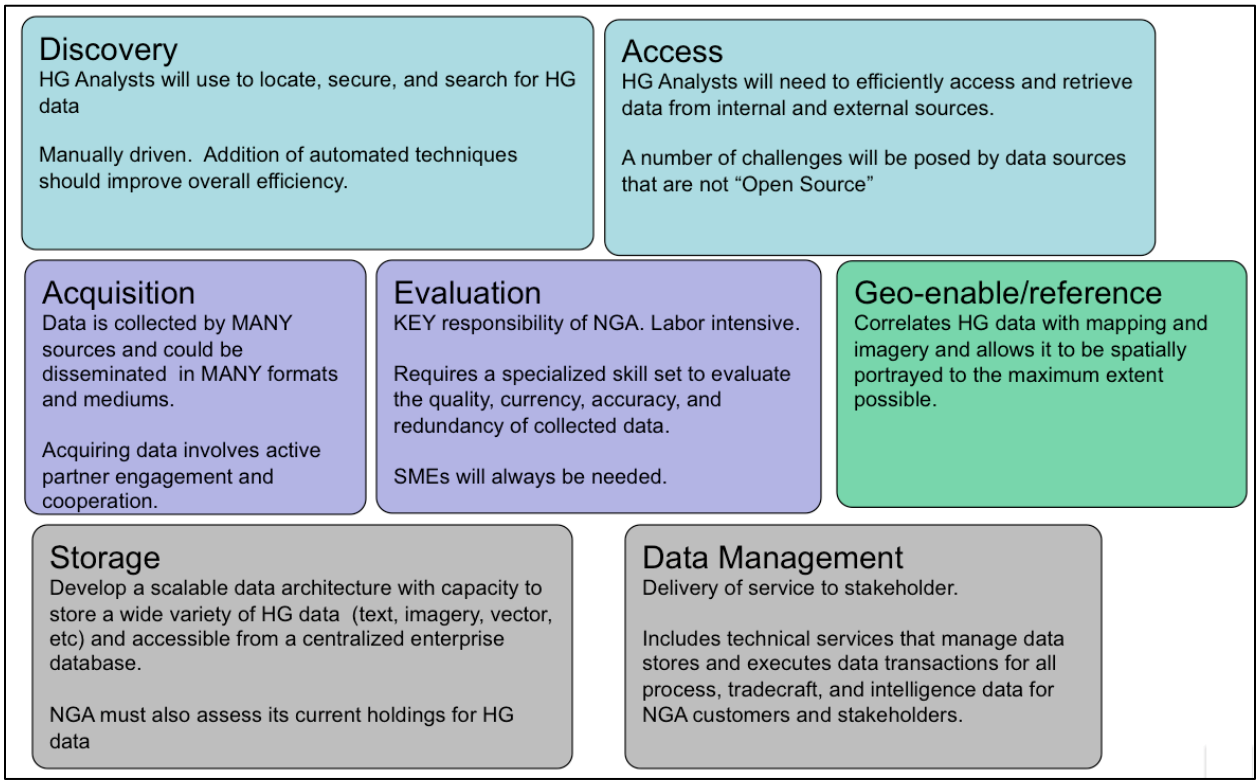


Figure 2.1.3 Human Geography-Based Foundation Data Process

Human Geography-Based Foundation Data Challenges

Building foundation data presents unique and unprecedented challenges to NGA analysts. To be successful, you will need to expand your tradecraft and get outside of your 'GEOINT comfort zone' to find the type and amount of data you will need.

Indeed, you can very easily find yourself overwhelmed by the massive volume of HG-based foundation data that is available from the broad range of open and classified sources. Therefore, planning your information and data collection efforts will be of paramount importance. Successful HG-based foundation data is the spatial and temporal fusion of this information into a reliable predictive analysis tool. A key feature is the use of GEOINT techniques to visualize, overlay, merge, and compare this foundation data in a common frame of reference (location).

Data challenges include (but are certainly not limited to):

- Determining what data is needed
- Discovering where that data is
- Acquiring the data
- Evaluating the data
- Geospatially enabling the data
- Storing the massive amount of data
- Provisioning the data
- Managing the data

The foundation data provides the cultural baseline to incorporate into GEOINT. Without data, there is nothing to punch into the workflow process, and consequently there would be no data layers.

13 Human Geography-Based Foundation Data Themes (Overview)

Before delving into the 13 foundation themes, it is important to remember that they are based in **Human Geography,** which constitutes the academic foundation of GEOINT.

When working with and compiling the data themes, keep in mind the following points:

- Data themes comprise the core foundation data needed to conduct HG-based foundation data analysis.
- Data themes are regarded as a manageable number of layers culled from a vast amount of volume.
- Data layers may be difficult to map.
- One theme may be linked to other themes.

Generally speaking, there are literally hundreds of potential Human Geography data sets that could be populated. This number must be reduced and the data types aligned with NGA mission requirements. A corresponding number of 'layers' must then be defined that NGA can build, maintain, and share as HG-based foundation data layers and cultural baselines.

The NGA has identified 13 data elements or themes, rooted in Human Geography, that best characterize the people and their culture within the context of their environment:

1. **Demographics and Population Measures**
2. **Language**
3. **Religion**
4. **Ethnicity**
5. **Education**
6. **Medical / Health**
7. **Political Affiliation & Ideology**
8. **Economy**
9. **Land Use, Cover and Ownership**
10. **Transportation**
11. **Water Supply & Control**
12. **Communications & Media**
13. **Significant Events**

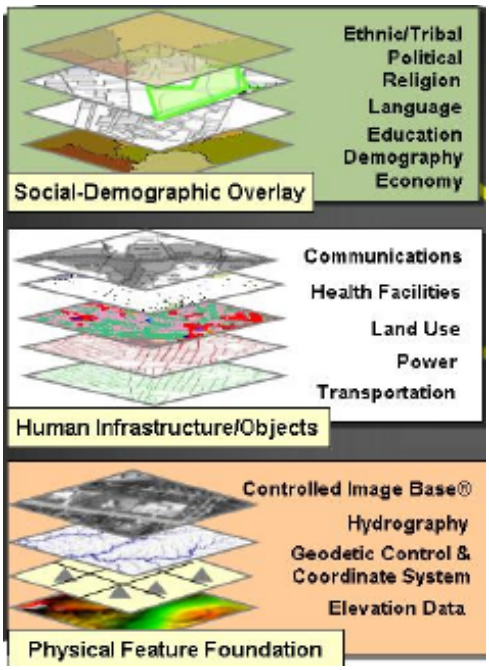


Figure 2.1.4 GEOINT Data Layers

In collecting HG-based foundation data, analysts should be guided by the need to collect and visualize the data elements that best characterize the people and their culture within the context of their environment. In other words, this HG-based foundation data must consist of factors that are fairly time-stable, are important enough to define key elements of the area, and can be spatially represented and organized. Accordingly, the NGA has identified 13 categories (or themes) of data that comprise the core HG-based foundation needed to support any GEOINT effort. HG-based foundation data cannot be collected and just stored in a data base—it must be turned into themes that subsequently become layers.

In collecting, processing, and incporporating these data inot GEOINT, analysts should remember that:

- Themes / topics derived from academic research in Human Geography and other social sciences
- Starting point for incorporating Human Geography into GEOINT
- Provides a cultural base line for understanding peoples and places
- Not a complete or exhaustive list
- Designed to prompt analysts about factors to consider in their analysis
- Themes and subcategories will evolve as needed to address lessons learned

Demographics and Population Measures

This theme describes the size, composition (e.g. age and gender), and trends of the population. Population growth (e.g. migration and births) or loss (e.g. mortality and emigration) factors and how these vary across the AOI among different groups (e.g racial composition) are important to understand. Much of these data may be gathered from census data, where available.

Topics and Subcategories include:

- Birth and mortality rates
- RNI/carrying capacity/demographic transition/ life expectancy
- Migration (emigration, immigration)
- Population density
- Racial composition
- Urban/rural composition
- Gender
- Birth control practices (low-level)
- Age distribution
- Census data
- Population movement (temporary, seasonal, refugee)

Language

A key concern for the cutltural baseline of an area depicts the linguistic groups present in the AOI, where the language or dialect is spoken, and how prevalent they are. Innovative tactical visualization or approximations may be needed to represent where language groups mix or overlap.

Topics and Subcategories include:

- Ethno-linguistic groups
- Linguistic groupings
- Number of speakers
- Languages used for education, broadcast, publications, business, religion, social activities, and politics
- Dialects, slang
- Dual languages (primary, secondary)

Religion

Analysts need to understand the religious affiliation of the area, including sects and subgroups. How these groups relate and how/ where they communicate and influence their members may be important to understand. The analyst needs to understand the formal and informal leadership structures and where / how these leaders are trained and influenced. Places of worship, support structures, and associated training areas should be plotted and related to the population and area of influence. The secular power of laders and groups, including their control or authority over organzed forces or miliaits are also important considerations.

Topics and Subcategories include:

- Religious composition
- Sacred/holy locations (including places of worship)
- Holidays, ceremonies, services, celebrations (timelines)
- Taboos and customs
- Religious history (including conflicts)
- Religious laws

Ethnicity

This theme depicts the ethnic groups in the AOI, their mutual associations and conflicts with other groups, their historic roles and influence, and their distribution within the area. Key concepts of this theme are to define, geo-locate, and characterize the community social structure and relationships across the area.

Topics and Subcategories include:

- Gender-based practices of ethnic groups
- Leadership, relationships, power structure, council of elders
- Religion of clan
- Youth-elder relationships and social norms for these relations
- Systems (patriarchal/matriarchal) for tracking lineage of leaders
- Property ownership and inheritance systems
- Influential personalities (storytellers and healers)
- Prejudices and characterizations of others (inferiority, outside actors, supervisors)
- Rivalries and alliances established over time
- Ethnic and tribal relationships
- Colonial legacy (historical alliances with external powers)
- Customs and traditions
- Laws, rules, and governance
- Livelihood, housing, and terrain characteristics where appropriate
- Racial or ethnic composition where appropriate
- Acculturation and assimilation

Education

This theme describes the educational and literacy characteristics of people and groups in the area. How do standards and proficiencies vary across gender, race, religion, ages, and ethnicities? What access do individuals and groups have to education facilities and services? Locations of schools and universities should be plotted and associated with political, religious, and ethnic groups.

Topics and Subcategories include:

- School levels (preschool, primary, secondary, university)
- Literacy
- School location, information, types (trade, religious, formal, informal)
- School curricula
- School-level attributes
- Education by gender
- Percentage illiterate (by province, district, state)
- School enrollment as a percentage of age group

Medical & Health

This theme depicts the health situation in the area based on medical resources present, how they are distributed, and the popu1ation's access to services. What diseases are present? Who is affected and how is it spread? What factors influence, improve, or diminish health in the area? What peoples and areas are most affected. Clinics and hospitals should be plotted and key attributes (e.g. beds, doctors, medical staff, etc.) associated with them.

Topics and Subcategories include:

- Disease conditions, incidence, and locations (endemic regions)
- Disease vectors and spread (human, animal, insect, and plant)
- Disease due to sanitation and/or malnutrition/under-nutrition

- Environmental hazards (pollution and industrial waste)
- Medical facility attributes (beds, operating rooms, doctors, staff, conditions)
- Doctors per capita, skill levels, and distribution
- Health workers and skills (including nurses)
- Access to healthcare
- Unmet Basic Needs Index (BNI)
- Health beliefs
- Diet and nutrition
- Medical facility locations
- Morbidity (Death as a result of disease)

PoliticalAffiliation & Ideology

This teme describes political entities, leadership, their support groups and allegiances. In addition to formal structures, it is also important to understand the presence and roles of secondary entities, such as unions, guilds, and other associations that lobby for selective policies.

Topics and Subcategories include:

- Voting patterns or behavior
- Civic and welfare organizations (NGOs, relief operations, religious-sponsored)
- Administrative boundaries and regions (political units, cities, populated places)
- Political groups
- Borders (actual, perceived, crossings)
- Government methods (elections, appointments, etc.)
- Government structures and facilities
- Type of nation-state
- Leadership
- Judicial system – rule of law
- Military/police
- Political/ideological perception and attitudes
- Political instability

Economy

This theme describes the standard of living in the area and how various peoples and groups support themselves? How are different areas and groups characterized by differing economic factors or livelihoods? What groups or organizations control or influence economic standards in the area? Major industries, key facilities, and markets should be plotted and associated with their supply and consumer nets.

Topics and Subcategories include:

- Financial base (banking, currency, GNP, GDP, inflation, remittances)
- Goods and services (tourism, imports, exports, prices)
- Energy/electricity
- Standards of living (distribution of wealth, poverty, and land ownership)
- Workforce characterization (wages, occupation, livelihood)
- Industrial base (raw materials, processing, and distribution)
- Markets (formal, black, informal, physical, and non-physical)

Land Use, Cover, and Ownership

This theme characterizes urban/rural areas, agricultural, forestry, pastoral and other general categories of human use of the land. Natural resources may be included here and linked as appropriate to the Economy layers.

Topics and Subcategories include:

- Vegetation
- Biomes
- Seasonal impacts
- Soils
- Climate
- Landforms
- Natural resources
- Hydrography/hydrology (floods, water security, irrigation)
- Agriculture and crops
- Terrain (elevation and line of sight)
- Fauna
- Land ownership / tenure

Transportation

This is a collection of data layers that describe the means by which goods, people, and ideas circulate within an AOI. Transportation capabilities will affect most other HG-based layers; for instance, they may reflect where people live and work and connect economic areas. NGA maintains a substantial collection of worldwide transportation features that can be used as the initial representation of transportation. Analysts will need to fill gaps (spatial and temporal) in this initial network and search for and add human-factor attributes that will relate the network to the people and groups that build, use, and maintain it.

Topics and Subcategories include:

- Transportation services available (air, bus, train, etc.)
  - How regular and reliable is the service?
  - How expensive?
  - Who uses the service?
- Companies in each form of transportation
  - Who owns them?
  - Profitability and legality of activities?
  - Where are shipping hubs, transshipment points and, rest/service stops?
- Economic value of internal and external transport of goods and services
- Are there roads, transport routes, or transportation services controlled by groups (government, insurgents, clans, political entities)?

Water Supply & Control

This theme depicts information about the supply of ground and surface water in a given area, including its ownership, access, and control. A potential database would include point, line, and polygon features of aqueducts, dams, wells, springs, cisterns, pipelines, canals, sluices, ditches, water treatment plants, tanks and reservoirs, catchment areas, watersheds. Such data would also include ownership and control of water supply features, as well as access to and maintenance of water supply features. These will affect most of other data theme layers.

Topics and Subcategories include:

- Main water sources in the area?
- Number / locations of wells?
- Water quality (potable, salinity) and impact on use / agriculture?
- Who controls / owns the water source?
- What irrigation systems are in use?
- Seasonality of use / availability?
- When is maximum / minimum supply available?
- How is the water treated?
- Who maintains the drainage / water system?
- Downstream impacts of sluices, dams on population?
- Disputes over water rights / use?
- Quantity of water available – capacity of reservoirs, springs?
- What / where are the catchment areas / basins for the AOI?

Communications & Media

This theme describe how information is distributed; who controls the content and spread of information; what access different groups and different regions have to the flow of information? The location and capabilities of broadcast media, print media, and internet access should be plotted along with key attributes, describing the ownership, control, range, and coverage of these resources.

Topics and Subcategories include:

- Media influence and control
- Press freedom
- Cellular communications
- Print media communications
- Communication coverage area (satellite, TV, cell, emergency, radio)
- Media type and distribution
- Oral traditions or word of mouth
- Social networks (groups, associations, impacts)
- Internet access and coverage
- Percent with access to radios
- Percent of households with at least one phone
- Percent of households with at least one radio

Significant Events

This theme describes historical events and incidents that have shaped the area and continue to do so. Major historical events of influence should be understood - especially those that endure in traditions and ceremonies. Current events that are deemed 'newsworthy' (reported in the press should be clustered into related groupings and tracked and temporally visualized.

Topics and Subcategories include:

- Conflicts (ethnic, religious, boundary, political)
- History/timeline of events
- Natural disasters
- Violent events
- Humanitarian disasters

Human Geography-Based Foundation Data Gathering and Spatially Enabling

Human Geography-Based Foundation Data Gathering

It is true that NGA analysts have experience reading reports and extracting relevant information relative to their GEOINT analysis. However, they typically manage such tasks as a one-off effort based on a relatively small list of sources. This current practice will not scale to the enterprise demands of the HG-based foundation data needs. In fact, general observations indicate that without automated assistance, analysts spend approximately 80 percent or more of their time and effort working to find and manage social, cultural, economic, and demographic data needed to support analysis. Obviously, this imbalance leaves little time for the analysis itself.

One of the reasons that HG-based foundation data requires a team-centric approach is the immense amount of data and information that must be identified, gathered, vetted, and assessed to conduct effective and meaningful HG-based foundation data analysis. Much of the required social, cultural, and demographic data does not exist in a finished state and must be extracted from multiple and disparate sources.

- HG data is based on less-defined characteristics that may often not be easily derived from images or depicted on maps.
- Determine proxies for hard to define / attain data
- Finding and organizing this data is a difficult, labor-intensive process.
- A mix of manual and automated discovery tools are required.
    - Manual geo-referencing is expected
    - Automated efforts are underway

Spatially Enabling Human Geography-Based Foundation Data

A key component of the HG data workflow is the process of geoparsing free and unstructured text. This time-intensive task occurs during both manual and automated extraction of physical feature, human/infrastructure, and socio-demographic data, and entity, incident, and event intelligence.

Geolocating content with machine assistance comprises two parts:

(1) Token identification

(2) Geographic disambiguation

Spatially enabling unstructured data manually requires greater reasoning (critical thinking) and geographic extract-transform-load (ETL) skills because data is combined from multiple sources into a single spatial layer for display and analysis in a GIS.

Spatially Enabling Foundation Data

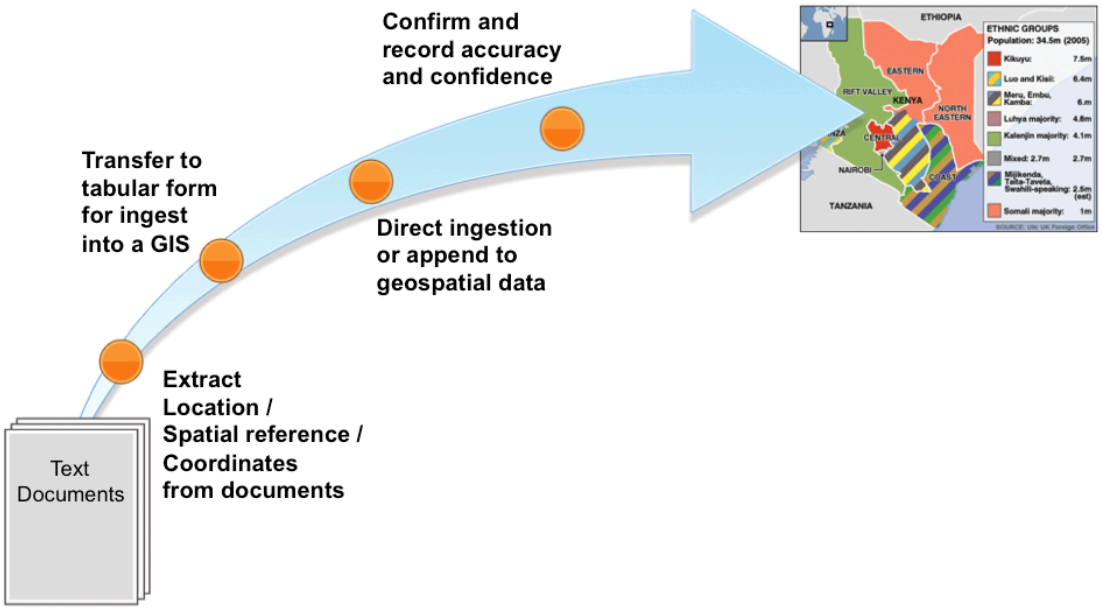


Figure 2.1.5 Spatially Enabling Data

The graphic above depicts the methods encountered for spatially enabling unstructured text and data for use in an HG-based foundation data product. They primarily include:

- Vectorization
- Geocoding
- Converting tabular data to shapefile

Foundation Data as GEOINT

This map plots, by month, incidents of violence against journalists in Somalia from January 2007 to September 2009. A histogram and color ramp for each month is used to show locations. While not exact, these locations could be geocoded to the nearest city or town in which they occurred.

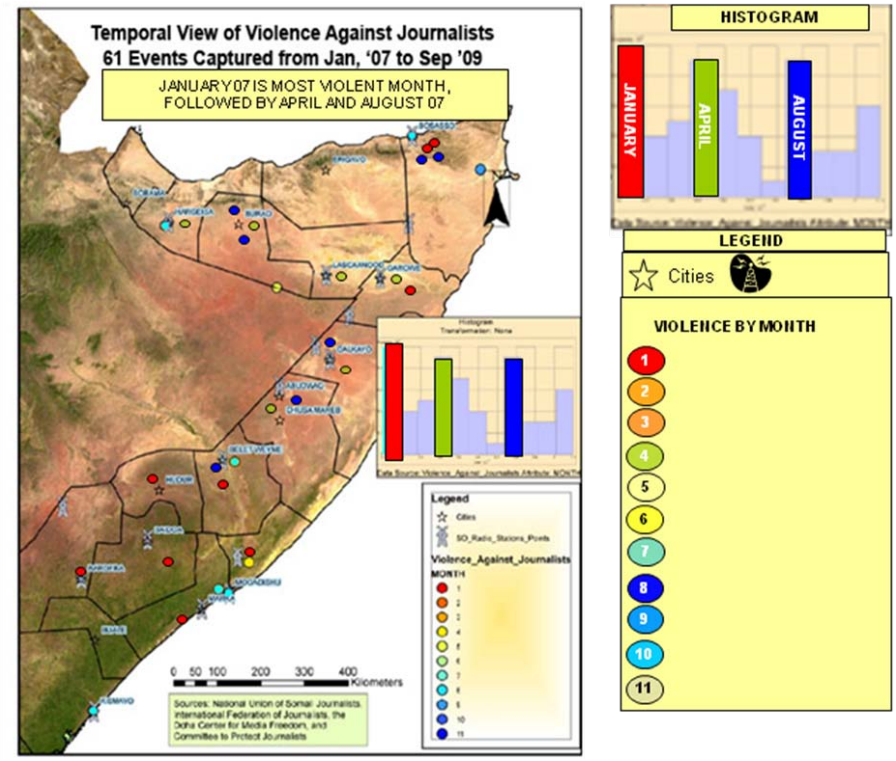


Figure 2.1.6 Foundation Data as GEOINT

Violence against journalists does not usually fall within the purview of traditional intelligence—GEOINT or otherwise. It is, however, an issue that can be addressed via HG-based foundation data.

- What are these violent attacks indicative of? What could these attacks mean?
- Could they be a surrogate for government oppression and control of free speech in the region?
- What foundation data theme does this example cover?

Lesson One Review

This lesson described the components of HG-based foundation data and the 13 themes of foundation data needed for HG-based data analysis. Additionally, it described the 13 themes and accompanying subcategories, explained the Human Geography data workflow process, and provided examples of how these data have enabled GEOINT analysts to address geospatial intelligence issues at NGA.

In this lesson we covered the following topics:

- What Is Foundation Data
  - Foundation Data Defined and Critical Characteristics
- Foundation Data Elements
  - Foundation Data Challenges
  - Pathways of Data Collection
  - 13 Human Geography Foundation Data Themes
  - Individual Data Themes
- Data Acquisition and Use
  - Foundation Data Sources
  - Foundation Data Gathering
  - Spatially Enabling Foundation Data

Lesson One References

References are as follows and can also be found on the *HTA Concepts Course* Wikipedia page:

- Random House. "Dictionary". 11 July 2010 http://dictionary.reference.com/browse/Consuetudinary
- NGA Pilot Group, *"Human Terrain Analysis Handbook and Reference Guide,"* (HTA HB), Version 1-0, November, 2009
- Gates, Robert M., *"A Balanced Strategy: Reprogramming the Pentagon for a New Age,"* Foreign Affairs, January/February 2009
- Joint Publication 2-01.3, *"Joint Intelligence Preparation of the Operational Environment*;*"* 16 June 2009
- Quadrennial Defense Review Report, United States Department of Defense, 06 February 2006

Module Two: Data Factors and Intelligence Issues

Lesson Two: Human Geography-Based Mission-Specific Data

Version: 1.6
Date: 12 September 2011

Change History Table

Version	Description of Change	Date
1.0	Development and Dry Run are complete. This document is approved for classroom use.	24 August 2010
1.5	Post-Dry Run conference is complete. Changes incorporated.	21 June 2011
1.6	Final edits. This document is approved for classroom use.	12 July 2011
1.6	Final edits after July 2011 course run. This document is approved for classroom use.	12 September 2011

Key Terminology

Data Fusion	Combining data from multiple sources or platforms to form one composite theme or layer depicting the environment.
Human Geography-Based Mission-Specific Data	Data that supports intelligence or operational customers who need to understand local individuals or groups in order to influence or affect them.

Lesson Two: Human Geography-Based Mission-Specific Data

Introduction

While the foundation data themes discussed in the previous lesson provide the cultural baseline for incorporating Human Geography into GEOINT, this lesson describes mission-specific data and the mission-specific workflow process. The lesson also provides examples of how these data have helped GEOINT analysts to address specific geospatial intelligence issues at NGA.

Objectives

Upon completion of this lesson, students will be able to:

- Describe the factors and subcategories that make up the Human Geography-based mission-specific data.
- Describe the mission-specific workflow process.
- Explain how analysis of mission-specific data can assist in addressing geospatial intelligence issues at NGA.

Factors and Subcategories of HG-Based Mission-Specific Data

Mission-Specific Data Overview

Mission-specific data varies from foundation data in a number of ways. It is data that supports intelligence or operational customers who need to understand local individuals or groups in order to influence or affect them.

- It often targets a specific socio-cultural aspect.
- It supports mission needs that are specific or tactical.
- It ideally builds upon existing foundation data.
- May originate / derive from a gap in foundation data.

Foundation Data

- A core set of Human Geography-based data that comprise a cultural baseline shared across multiple peoples.
- Stable data sets that change slowly over time.
- Reduces duplicative efforts.
- Should be incrementally improved over time.

Student-Provided Examples

What mission-specific intelligence questions and data would you need to support:

- Counter-insurgency operations?
- Humanitarian assistance?
- Response to a deadly epidemic?
- Counterterrorism support to the FIFA World Cup if held in Los Angeles, CA?

Mission-Specific Workflow Process

Data fusion

- Creates new themes and new understandings
- Combines data from multiple sources or platforms to form one composite theme or layer depicting the environment.
- This may be essential to successfully address mission questions and needs.
- Fused data can be more accurate than data taken from a single source.
- Introduces a number of data challenges, as individual data sets will have varying accuracies, scale, collection methods, formats, and duplicate entities.
- Occurs during each phase of the workflow process.

Planning Phase

- The first phase in the workflow process.
- Triggers to begin will likely come from an external / internal request, or an existing gap in data.
- Formulate research question.
- May need to form diverse internal teams.
- Begin to identify data requirements, types, sources.

Figure 2.2.1 Workflow Process

Research Phase

- Data gathering.
- Search for foundation data.
- If no foundation exists, then searching and retrieving this core data will be a simultaneous part of the project's Research Phase.
- Data queries and ingestion processes will use the same tools and visit many of the same sources.
- May need to revisit this step during the workflow process.

Analysis Phase

- Provides innovative analysis of HG-based data.
- Should consider a variety of advanced geospatial analysis methods.
- Rigor and effort will result in spatially and statistically rich data.
- Analysts may need awareness and training to apply advanced geospatial analysis methods.
- Academic and commercial techniques will help NGA evolve GEOINT capabilities.

Production Phase

- Communicates observations and conclusions.
- Uses text and GEOINT graphics to convey results.
- Documents:
    - Specific methods used
    - Lessons learned
    - Location of key source of data
    - Other information for future efforts
    - Includes metadata in spatial-temporal files

Mission-Specific GEOINT Products are:

- The result of analysis
- A recommendation
- Visualizations (flash or other presentation media)
- Map Animations (e.g., GEOPDF, JPEG, or ArcView map document)
- Written Reports

Note: See **Appendix B: Mission-Specific Workflow** for detailed steps and information.

Mission-Specific Data Addressing Geospatial Intelligence Issues at NGA

Overview

Collaboration during the mission-specific workflow process:

- Collaboration and dialogue with other partners to provide significant opportunities for initial population of any Human Geography-based database NGA might build.
- Collaboration occurs at the team level.
- Collaboration occurs with other government organizations.
- Collaboration with organizations may involve having the Open Source Center (OSC) find and extract the data while NGA takes the responsibility for spatially enabling, organizing, and managing the Human Geography-based data.

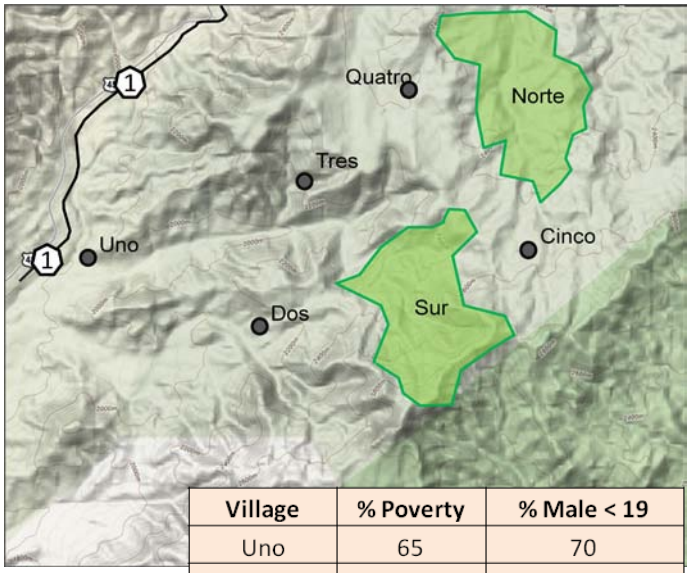
Example

Overview

A request has been made to NGA to develop a geospatial intelligence product that will help a US Government agency identify villages in a Latin American country for development. These development projects will offer jobless young men in the area an alternative to working for cocaine cartels.

There are some foundation data available for the area, but you suspect you will have to develop some mission-specific data to support this GEOINT request.

You form your team. You are in the Planning Phase of the workflow process.



Village	% Poverty	% Male < 19
Uno	65	70
Dos	35	25
Tres	70	65
Quatro	30	30
Cinco	70	80
Seis	25	15
Siete	40	25

Figure 2.2.2 Example data

Background

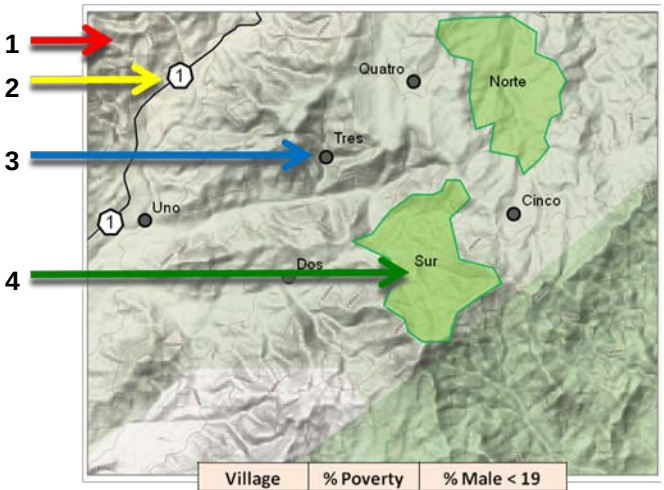
- Coca is processed in areas Norte and Sur.
- Cartel is labor-poor.
- Local young men move product from Norte and Sur to Hwy 1.
- Host nation government wants to deny labor to cartels.

Customer Input

- The government needs a map showing where to create jobs and development projects.
- Customer notes that all tribal affiliations in the AOI are willing to work with cartel if no other source of income exists
- Most likely source of labor is young men < 19 years of age.
- Customer believes villages with very high poverty rates (> 55%) and high rates of unemployed 19-year-old males (> 55%) are most vulnerable.

Data Available

1. DTED (relevant internal data)
2. Transportation (foundation)
3. Villages (foundation)
4. Coca regions (structured, mission-specific theme from a legacy NGA project)
5. University anthropology study (unstructured, demographic, found in Google search - unstructured data discovery)



Village	% Poverty	% Male < 19
Uno	65	70
Dos	35	25
Tres	70	65
Quatro	30	30
Cinco	70	80
Seis	25	15
Siete	40	25

Figure 2.2.3 Data Available

Mission-Specific GEOINT Product

- Analysis leads to a product that describes or visualizes findings.
- Analyst develops data layer based on customer criteria.
- Only three villages in the AOI meet criteria.

Village	% Poverty	% Male < 19
Uno	65	70
Dos	35	25
Tres	70	65
Quatro	30	30
Cinco	70	80
Seis	25	15
Siete	40	25

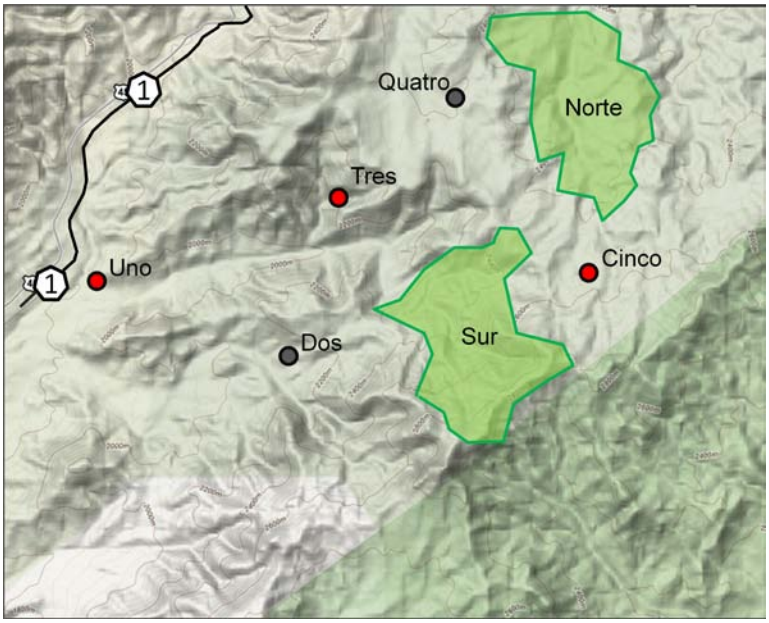


Figure 2.2.4 Mission Specific GEOINT Product

Lesson Review

Mission-specific data may be very unique to places and may change from mission to mission as the AOI or questions asked differ. While these processes may seem complicated now, you will become much more familiar with them as you progress through the workflow. The workflow provides a common framework you can use again and again.

In this lesson we covered the following topics:

- Factors and Subcategories of Human Geography-based Mission-Specific Data
  - Mission-Specific Data Overview
  - Comparison to Foundation Data
  - Mission-Specific Data Examples
- Mission-Specific Workflow Process
  - Planning Phase
  - Research Phase
  - Analysis Phase
  - Production Phase
- Mission-Specific Data Addressing Geospatial Intelligence Issues at NGA

Lesson Two References

References are as follows and can also be found on the *HTA Concepts* course Wikipedia page:

- NGA Pilot Group, *Human Terrain Analysis Handbook and Reference Guide* (HTA HB), Version 1-0, November, 2009

Module Three: Discovering, Evaluating, and Integrating Data

Lesson One: Human Geography-Based Data Sources

Version: 1.6
Date: 12 September 2011

Change History Table

Version	Description of Change	Date
1.0	Development and Dry Run are complete. This document is approved for classroom use.	24 August 2010
1.5	Post-Dry Run conference is complete. Changes incorporated.	21 June 2010
1.6	Final edits. This document is approved for classroom use.	12 September 2011

Key Terminology

DTED	Digital Terrain Elevation Data
GIDI	Geospatial-Intelligence Database Integration
GIFD	Geospatial Intelligence Feature Database
GOS	GEOINT Open-Source Seminar
NES	National Exploitation System
NGO	Non-Governmental Organization
TMS	Target Management System

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Lesson One: Human Geography-Based Data Sources

Introduction

In this lesson students identify potential data—from a wide range of sources—to incorporate Human Geography-Based data into GEOINT. In addition to identifying data and sources, this lesson describes the necessity of leveraging data from multiple sources. This lesson also demonstrates several methods for acquiring data.

Objectives

Upon completion of this lesson, students will be able to:

- Identify data sources within NGA, academia, government, and non-governmental agencies for acquiring human geography-based data.
- Describe the various methods of acquiring data.
- Recognize the importance of leveraging data from multiple sources.

Workflow Process Review

Workflow Key Activities

Before proceeding to the potential sources and data that may be used when incorporating HG-based data into GEOINT, let's review the key concepts of starting the Workflow process. Three key activities at the beginning of this process are:

- Deliberate planning to address the intelligence issue at hand.
- Forming the team.
- Gaining cultural and historical context that will assist analysts in their analysis.

Before looking for data, the team must identify what types of data are needed to complete this analysis.

Workflow Planning

Once the mission is received, the analysts must conduct an initial task assessment and determine if there are any previous analyses or bodies of work (including readily available data) that may assist their current analysis. In this process, analysts are determining the data requirements, which will also indicate whether the requested analysis is feasible.

Planning Phase

During the initial planning phase, the analysis team will determine mission requirements and whether foundation data exists for the particular country, region, or place. If foundation data does exist, the team tries to answer the following questions:

- Where is it?
- Is it complete, current, and accurate?

If the team does not possess the knowledge and experience to answer these questions, they consult SMEs, Human Geographers, and Regional Experts. Also, analysts must determine if this data will meet the mission needs. If it does not, the team must identify the types of data and potential sources from which the relevant data may be drawn.

Identifying Sources and Data

Foundation Data Themes

There are 13 foundation themes that characterize people and their cultures within the context of their environment, and serve as cultural baseline for incorporating Human Geography into GEOINT. (See Appendix C: HG-based Foundation Data Themes Guide)

1. Communications
2. Demographics & Population Measures
3. Economy
4. Education
5. Ethnicity
6. Political
7. Land Use, Cover & Ownership
8. Language
9. Medical
10. Religion
11. Significant Events
12. Transportation
13. Water Supply & Control

In assessing data needed for the analysis, consider data elements from all thirteen themes to determine if these will support the mission requirement.

Data Sources

Regardless of whether the mission is to build foundation themes or a mission-specific request, analysts should assess all available foundation data for its relevance to the requested mission and determine its currency and completeness, again collaborating with or seeking assistance from SMEs, Human Geographers, or Regional Experts through the GEOINT Research Center.

If foundation data does not exist, analysts should look to build these themes as they progress through the workflow process, as the 13 themes and sub-categories within each theme will significantly enhance the analysis and provide the foundation that can be used for future mission requirements. Finding and gathering data, though, is often the most difficult and challenging part of the project.

Because a large pool of potential sources of data exists, analysts have several avenues through which they can narrow their searches. Once they have identified the data needed to enable the analysis in the planning phase of the workflow process, the team should consult the following sources:

Within NGA:

- Foundation-Based Operations
  - Data Steward
  - Human Geographers/ Regional Experts
- GEOINT Research Center
  - Research Analysts
- Subject Matter Experts (SMEs)

External to NGA:

- Analysts/organizations across government and the Intelligence Community (IC)
- Open source research for existing databases, files, and reports

If the required data is not housed within NGA, or if sources within NGA cannot point the analysts to potentially useable data, analysts and organizations outside NGA may need to be consulted.	Often, these experts and analysts are able to direct the team to search specific sources or datasets that support the mission. If the desired data is not readily available or identifiable, analysts will have to conduct a broad spectrum search of existing databases, files, and reports from various sources.

Foundation-Based Operations (FBO)

FBO produces, integrates, and provides: imagery foundation and geospatial feature data, services, and guidance to the National System for Geospatial Intelligence (NSG). The office programs and coordinates data production operations with in-house production, commercial vendors, and co-production activities; and it builds and maintains all GEOINT data. Recently, FBO is including urban and cultural features, and is currently building a system that will accommodate Human Geography-based data. Human Geographers / Regional Experts and Data Stewards are housed within Foundation Based Operations

Data Steward

The Data Steward is a function currently managed by the Source Directorate for other types of foundation data. The Data Steward manages the collection and acquisition of existing Human Geography-based datasets using a strong network of enterprise-level and other contacts.

Human Geographers / Regional Experts

Human geographers and regional experts primarily deal with data. They have an understanding of the cultural and historical background and context of the Area of Interest (AOI). They can assist with the assessment of currency and completeness of foundation data. They can identify additional data sources and relevant data for incorporating Human Geography-bsed data into GEOINT. Human geographers and regional experts may provide contacts to other subject matter experts located throughout NGA and the IC.

GEOINT Research Center (GRC)

The GEOINT Research Center is an important tool in acquiring data for specialized collection requests. The GRC provides valuable data and sources for HG requirements. GEOINT Research Analysts fulfill Requests For Information (RFI) through the GEOINT Research Center. The GRC can be accessed on the high and low side.

- Contacting the GEOINT Research Center is the first step for data sources: **https://chimera.nga.mil/grc/**

Subject Matter Experts

If regional expertise is not available on the team, analysts may draw upon the knowledge and experience of SMEs, Human Geographers, and Regional Experts. These individuals can provide cultural and historical background and context for the country, region, and place under consideration for the analysis.

They can also help to assess currency, completeness, and accuracy of any available data (including foundation data), and can point the analysts to potentially useable data that is relevant to their analysis. These experts may also, through their network connections, put the analysts in touch with others who may be of assistance in identifying and acquiring needed data.

Gathering Human Geography-Based Data

Analysts will seek Human Geography-based data via several pathways. These can be pursued sequentially or in parallel, depending upon the team composition and resources available, the project requirements, and the time available. Specifically, these pathways are Aggregated Internal Data, Legacy Internal, Focused External Data Stores, and Data Discovery from a broad external search. Please note, however, that the figure that depicts this process (***Figure 3.1.1***), should not be viewed as a prescriptive manner in which to collect data.

Aggregated Internal Data

NGA holds significant quantities of Human Geography-based data held across its various legacy data stores and individual files. Some of this data, such as DTED and imagery, is in ready-to-go condition. It could be pulled and used for Human Geography-based data or background needs. Other existing NGA data is in differing states of readiness and will require considerably more effort to find and compile. Aggregated internal data is contained in geodatabases and search engines. It can be linked from Intellipedia, Web Map Services and Web Feature Services, and Google Earth.

Data may be found as individual files in working folders, and branch shared storage areas. NGA has some legacy systems in which useful data could be found. These systems include:

- Geospatial Intelligence Feature Database (GIFD)
- National Exploitation System (NES)
- Target Management System (TMS)
- Consolidated Analytical Spatial Initiative (CASI)
- Standard Metadata Tagging System (SMTS)

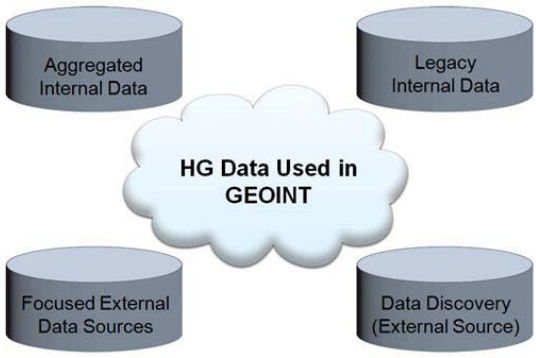

Figure 3.1.1 Gathering Human Geography-Based Data

Internal Data Systems

GIFD, a legacy system, contains data as points, lines, and polygons (ex. buildings, roads, crops). These will be valuable baseline HG-based data when used in GEOINT. If the existing data is assessed to be complete and current, then additional road and rail data searches may not be needed. If the existing data has gaps or are not current, then the team will need to search for or build data to meet the project needs. Feature data has some attributes populated. (i.e. place of worship and type of religion for a religious building), however one must examine the associated metadata as vector data may or may not be complete and/or current

Existing systems (e.g., TMS, NES) may contain a variety of data and reporting such as Religion, Economy, Education, and Health. As a whole, the aggregation of existing NGA data constitutes valuable entities and attributes for HG-based data layers. Likewise, GIFD, NES, and other systems store data related to economy, education, and health.

Compiling and integrating this collection will build valuable HG-based foundation data layers that can be enhanced through additional data collection.

Focused Data Discovery

Searching for and acquiring specific HG-based data relevant to your intelligence question will invariably lead to sources outside of NGA. Because these sources are outside NGA, Non-Attributable accounts are required and relate directly to operational security (OPSEC).

These data discovery efforts are 'surgical' in that the analyst looks for relevant/specific types of data identified in the planning process. Because this is a focused search, the analyst searches for data in places where it is expected to be found. A number of sources (organizations and agencies) compile many types of data that may meet or support the requested analysis. These may represent places previously known to analysts, sources they have used in the past, or sources that have been recommended by other analysts or team members.

These searches will involve looking for data that is already somewhat structured and aggregated so as to expedite reuse. Even though this data may be structured and aggregated, it must be evaluated for accuracy, currency, bias, and confidence.

Specific data is found by searching many avenues. Agencies and organizations both within and outside of NGA and the IC may have data that will enable analysts to answer the specific intelligence question posed. Analysts should consider both classified and unclassified data sources. The examples provided within this lesson identify potential data stores analysts may consider. This list is not all-inclusive, but offers some broad categories of sources from which data may be drawn.

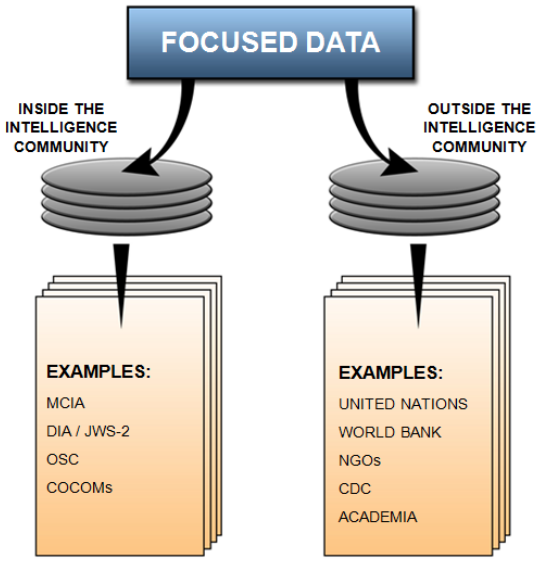

Figure 3.1.2 Focused Data Discovery

Intelligence Community Data

In focused data discovery, analysts may be looking for data about particular places or peoples. This data may have been collected through a wide variety of means. Sources of data that one should consider are Open Source Intelligence (OSINT), Human Intelligence (HUMINT), Signals Intelligence (SIGINT), Imagery Intelligence (IMINT), and Electronics Intelligence (ELINT). In searching for data that will enable the analysis, analysts should consider looking for or requesting data that may exist in these channels within the Intelligence Community.

Data from these sources may be used to add content and specificity to additional data gained through open sources. In this way, data from these sources within the IC allow analysts to corroborate, validate, update, and add fidelity to existing open-source data. The classification of data must be obtained and considered when using IC data

Open Source Searches (OSS) /Non-Intelligence Community Data

If the specific data needed is not readily known to exist in one location, analysts will need to conduct a broad search for relevant data. An OSS is a focused data discovery activity and allows an analyst to avail a tremendous amount of data. These searches may be subject to regulations and policies and require non-attributable accounts; disclosure and release policies should be reviewed prior to doing a search. Analysts should also consider searching in native languages for relevant data and perspectives. If doing so, consider using language translation resources within NGA or the intelligence community.

An OSS has the potential to be the largest source of HG-based data. These data may be structured and usable but much of the relevant HG-based data will be unstructured (in textual formats).
While offering a large pool of potentially usable data, the sheer amount of potential data from a broad search may require tools to filter, evaluate, and organize the specific data that may be of use during the analysis.

Leveraging Multiple Data Sources

Overview

There are three key factors and a number of concerns that should be emphasized in using data from multiple sources, specifically in regard to the following:

- Significant amount of data available
- No central repository
- Data assessment & validation

The bottom line is that the more options you have in your GEOINT "filing cabinet," the more you will be able to accomplish with your analysis.

Figure 3.1.3 Conceptual GEOINT File Cabinet

Key Factors for Leveraging Multiple Sources

There are **significant amounts of HG-based data available** to support GEOINT. While many of the sources contain substantial amounts of data that may be of use, analysts need to consult multiple sources. It is unlikely that a single source will produce the exact or complete data needed for analysis, so analysts must draw from a variety of sources.

Data discovery is difficult because the required data is scattered across a wide range of locations. It may be embedded in documents, e-mails, historical reports, news broadcasts, intelligence messages, or myriad other sources. Analysts may need to search millions of records to discover the most useful and valid data sets.

Currently there is **no central repository** of Human Geography-based data within the US Intelligence Community.

This means that analysts may have to look in a number of locations, both within and outside of the IC. Consequently, other agencies and organizations have collected, managed, and maintained relevant HG-based data. This data was collected for their own needs in support of requests from their customers.

NGA is taking a leading role to discover, evaluate, geospatially enable, consolidate, build, and maintain Human Geography-based data that can be used and reused for analysis and production. As this is accomplished, future support requests can be filled more quickly and with greater accuracy and completeness.

Analysts must also consider that existing datasets and reports were compiled for specific purposes, especially open-source data. Therefore, the data may be biased, incomplete, or contradictory when compared to data from other sources. By searching for data from multiple sources, analysts will be able to **verify, corroborate, and validate the data** they have collected. Evaluating data for bias and completeness will be discussed in the next lesson.

Considerations

Considering the range of potential data sources available, acquiring the necessary data can be a labor- and time-intensive aspect of the workflow process as it relates to the following:

- Internal NGA Data
- External NGA Data
- Intelligence Community Data
- External Intelligence Community Data / Open Source
- Classified or Unclassified

Because Human Geography-based data is not located in one location, some estimates suggest that as much as 80 percent of the analysts' time will be spent searching, acquiring, and preparing the data to enable their analysis.

- Discovery and extraction of key elements can be labor-intensive.
- Data may need to be spatially enabled.

Search time may limit the amount of time you have to provide the most comprehensive analysis possible as you work to meet customer delivery timelines. But the time spent is not completely devoid of benefit. With all the research and data collection, as well as its spatial enablement, you are creating a database for future use.

Data Acquisition

Overview

Open Source Searches and the **GEOINT Open-Source Seminar (GOS)**

There is a tremendous amount of potentially useable data in open sources. Searching for this data will often require a non-attributable (NA) account and analysts should consult all regulations and policies (including Disclosure and Release policies) prior to conducting any open-source searches. To understand how to conduct open-source searches, analysts should consider the GEOINT Open-Source Seminar (GOS), a two-day course designed to provide students with the basic understanding of geospatial and open-source (OS) concepts, terms, and tools. As well, you should also consider searching in the local language for relevant data and perspectives.

Acquiring Data

While we have already discussed some examples and potential sources within and outside of NGA and the IC in focused data discovery, general schematics show several "new" categories of potential sources to consider during broad-spectrum searches for Human Geography-based data.

Because much of the HG-based data that enables GEOINT is available from open sources, analysts may find these categories useful to consider when planning their data searches. There are many sources that offer a tremendous pool of potentially usable data from which analysts may draw:

- Governments
    - Both the US and foreign governments
    - Organizations (such as the UN and World Bank, with their various sub-agencies)
- A wide variety of Non-Governmental Organizations
- Scholars and research centers within academia

This lesson illuminates only a small sample of relevant data that may be obtained from a variety of potential sources. As with focused data discovery, each of these sources may offer valuable data. Leveraging data from these or other sources will substantially increase the accuracy of the data and the analysis.

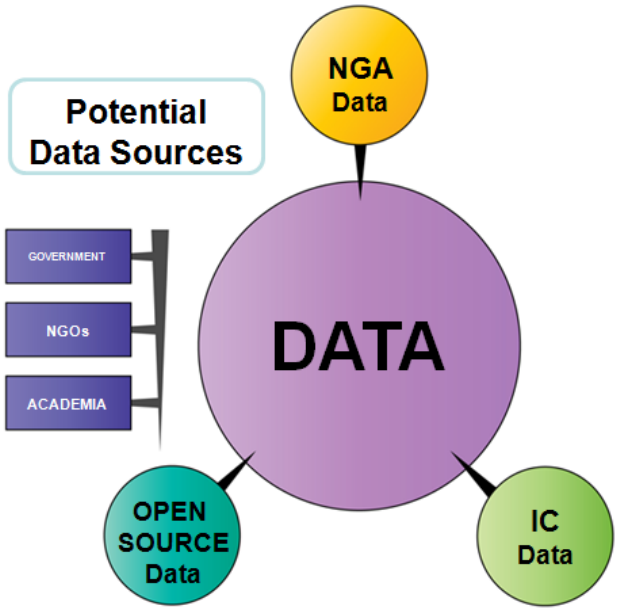

Figure 3.1.4 Human Geography-Based Data Sources

Government

Government Agencies

There are a lot of US Government agencies and organizations from which analysts may search for data relevant to their analysis. The USGS is one example. This slide illustrates the USAID's Famine Early Warning System, which is a multi-disciplinary project that collects and analyzes data about food insecurity in a number of countries and regions of the world.

Foreign Government

The US Government is not the only government that conducts a periodic census to gather data on its population. This example shows a map generated from the 2001 census in India; the map depicts the gender gap in literacy rates by districts. There are only certain countries that have conducted a recent census. Analysts should be wary of the quality of that data. A search of news reports or consultation with regional experts may shed light on the validity and completeness of such data.

Government Organizations

While the United Nations may also be used for external focused data discovery, this organization and others like it may also be searched in a broad-spectrum search for reports, files, and databases relevant to the analysis. Analysts may search the Maps and Databases Resources and Services or conduct a search of the UN website for potentially useable data.

The UN maintains a wide array of data and statistics on issues around the world and in particular countries. Although this may provide some background information and references to other sources of data, much of this data is focused at the state or country level. In some places where the UN has a significant presence or peacekeeping operation, usable Human Geography-based data may be available.

Non-Governmental Organizations (NGOs)

Almost every region will have a number of non-governmental organizations (NGOs) working on the ground. The International Crisis Group (ICG), for example, is an NGO committed to preventing and resolving deadly conflicts. They currently cover over 60 conflicts and potential conflict situations and publish 90 reports annually. This would certainly be a potential source of unstructured data for the analyst.

Academia

Scholars and research centers within academia offer a tremendous pool of potential Human Geography-based data. Researchers from various fields and disciplines have undertaken a great deal of research on wide array of topics. Much of this research has produced data on socio-economic, cultural, and political conditions around the world. Some of these data are publically available and downloadable from various sites. Keyword searches using search engines (like Google) may reveal some of these datasets. Searching journal articles or reference databanks may also lead to discovery of valuable, usable data. Some scholars, however, may be hesitant to share this data, especially with government or intelligence agencies. Analysts should be familiar with the regulations and policies that govern contact with scholars and researchers.

Lesson Review

This lesson identified potential data from a wide range of sources that enable HTA. In addition to identifying these data and sources, this lesson described the necessity of leveraging data from multiple sources and demonstrated several methods for acquiring these data.

During this lesson, we discussed the following topics:

- Identifying Data and Sources
  - Foundation Themes
  - Data Sources
  - Gathering Human Geography-Based Data
- Leveraging Multiple Data Sources
  - Key Factors
  - Considerations
- Data Acquisition
  - Government
  - Non-Governmental Organizations (NGOs)
  - Academia

Module Three: Discovering, Evaluating, and Integrating Data

Lesson Two: Evaluating Data Sources

Version: 1.6
Date: 12 September 2011

Change History Table

Version	Description of Change	Date
1.0	Development and Dry Run are complete. This document is approved for classroom use.	24 August 2010
1.5	Post-Dry Run conference is complete. Changes incorporated.	21 June 2011
1.6	Final edits from July 2011 course run. This document is approved for classroom use.	12 September 2011

Key Terminology

Attribute Accuracy	The measures of closeness of the descriptive data to the actual measure. Also expressed as how much the spatial object differs from the actual object on the ground.
Data Accuracy	How close the data comes to the true measure, or real-world measure, if it were known absolutely.
Data Completeness	Data completeness describes the extent to which the data used accounts for a complete description of all attributes associated with the feature being mapped.
Data Currency	In basic terms, data currency refers to the date/time that the data was collected, organized, and/or published.
Data Lineage (Genealogy)	The record of the data sources and of the operations that created the spatial database.
Institutional Bias	Also known as systematic or systemic bias; the inherent tendency of a process to favor a particular outcome.
Logical Consistency	A measure of the internal consistency of the data structure.
Positional Accuracy	The closeness of the location information of spatial data to its true position.
Psychological Bias	Biases in collecting and reporting data based upon an individual's background, personality, behavior, personality, cognition, or personal relationships.
Semantic Accuracy	A measure of whether or not the object, as depicted, is labeled or annotated correctly.
Spatial Completeness	The data covers the entire area of interest.
Temporal Accuracy	A measure of the closeness of the data at a given time to properties of the actual object on the ground at the same time.
Thematic Completeness	The data set includes all the necessary layers.

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Lesson Two: Evaluating Data Sources

Introduction

This lesson will provide students with a base of knowledge to evaluate the reliability and validity of human geography-based data from these multiple sources. The lesson also discusses the challenges to visualization and interpretation of the data.

Objectives

Upon completion of this lesson, students will be able to:

- Determine and evaluate the quality and accuracy of human geography-based data.

Human Geography-Based Data

Introduction

Human Geography-based data draws from disciplines based in the social sciences. The data form the foundation of GEOINT. As the social sciences are not traditionally "hard sciences," their data can be subjective. Consequently, the source reliability may be questionable. When supporting customer requests, analysts must consider potential quality and usefulness of data to use. Analysts must also consider how topics that are subjective by nature can affect the visualization and interpretation of data.

Types of Quality in GEOINT

Quality is of two distinct types in GEOINT analysis: **data quality** and **source quality.** Data quality refers to the data that is used, while source quality refers to the origin or creator of the data.

Table 3.2.1 Assessing Quality (HTA Handbook)

DATA / SOURCE	DESCRIPTOR	EVALUATION
Data	Accuracy	Is the data itself accurate?
Data	Repeatability	Can data be re-published in the future, at a later date, to incorporate changed values over time?
Data	Reproducibility	Can data be reproduced?
Data	Temporality	Is the data temporally accurate?
Source	Reliability	Is the human producer reliable?

Data Quality

Quality can be affected during the collection and processing of data and product development. Components that allow the quality of spatial data to be measured are:

- Topological Consistency
- Data Completeness
- Data Bias
- Data Lineage

Topological Consistency

Topological consistency ensures that feature data are correctly represented, fit together spatially, and have proper geometry. In a GIS, topological consistency can be checked through the topology model. Topological errors can influence positional or attribute accuracy.

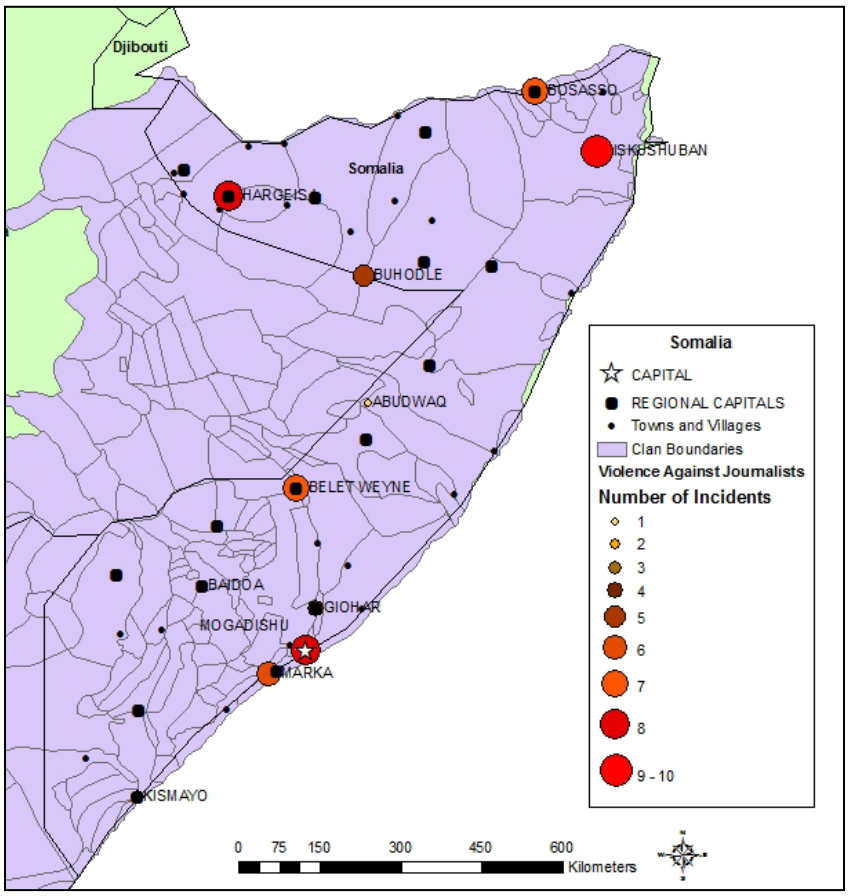


Figure 3.2.2 By using political boundaries generated by different sources, country, provincial and district boundaries may not have the proper fit.

Data Completeness

Data completeness describes the extent to which the data used accounts for a complete description of all attributes associated with the feature being mapped. Incomplete data can impact the quality of analysis and the end product. Data completeness refers to both spatial and thematic completeness. Spatial completeness means the data covers the entire area of interest, and thematic completeness seeks to secure whether the data set includes all the necessary layers.

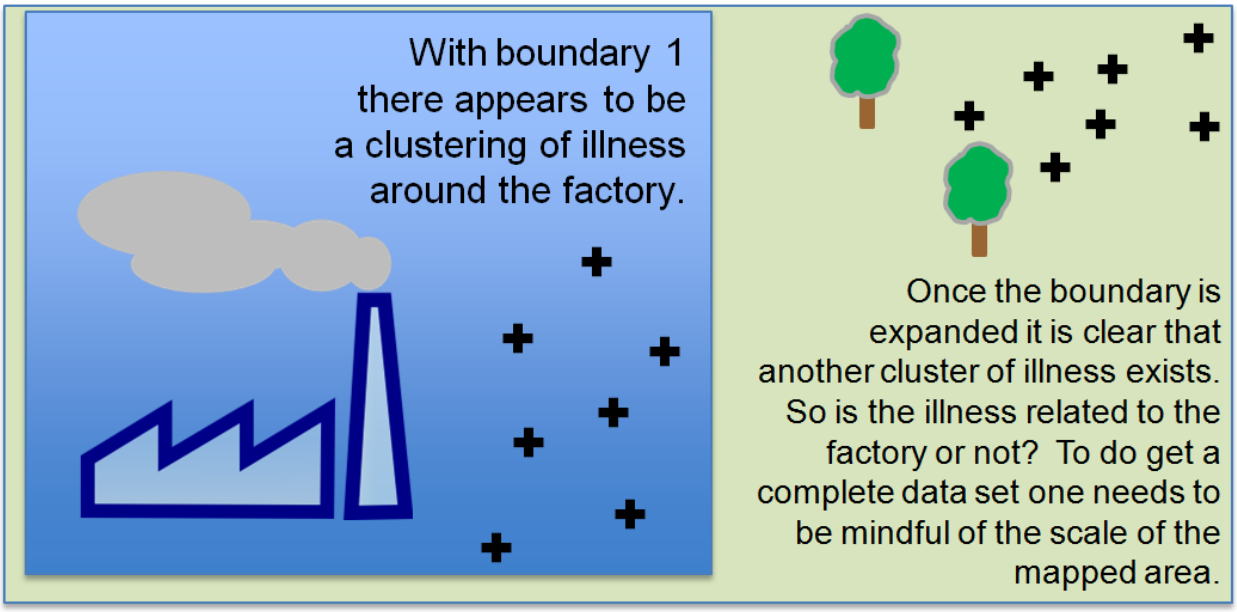


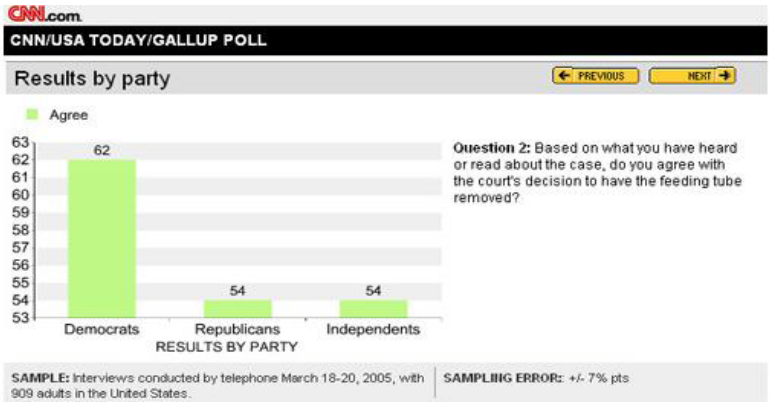
Figure 3.2.3 Notionally mapped area depicting the spatial extent of illness. Without mapping the complete set of illness data, improper correlations can be made.

Data Bias

Data bias includes both institutional bias and psycho-social bias. Bias influences how we collect and report data and can favor a particular outcome.

Institutional bias, also known as systematic or systemic bias, is the inherent tendency of a process to favor a particular outcome. **Psycho-social biases** are biases in collecting and reporting data based upon an individual's background (culture), personality, behavior, cognition, or personal relationships. We want to eliminate, as much as possible, bias in our data selection. We should be aware that bias in data selection can be made worse when working with a non-random subset of the population.

Accepting that the workflow process is a 'team sport', diverse backgrounds of analysts and experts provide the best mix for a more robust outcome; efforts should be made to minimize psychological bias. The varied members of a team are equipped with some degree of bias, whether from attitudes or beliefs entrenched in their background and training, or from cultural or religious heritage. This tendency toward bias, which may force a team to omit or overlook certain important entities and attributes needed for the analysis, can be minimized by ensuring a diverse team. Institutional bias may also exist and should be acknowledged in the production of certain types of geospatial data. We also have to look at bias in the data we are using. For example, data published by an organization whose goal is to increase funding to fight childhood diseases in developing nations may give preference to data which best strengthens their argument.



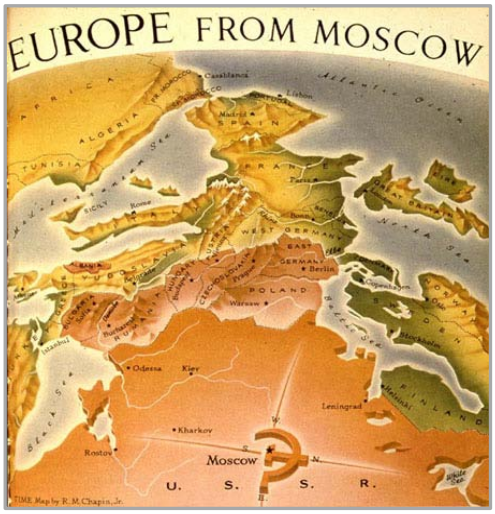


Figure 3.2.4 Examples of Institutional (left) and Psycho-social bias (right). Sources - CNN 2005 and *Time* 1952.

Data Lineage (Genealogy)

The concept of **data genealogy** or **lineage** refers to the history of the origins and changes of data over time as it has been manipulated to create new data. Much of what we discuss today can be found in Panigrahi's book on Geoinformation Science[1]. His is but one of the texts available that examine the quality of spatial data. Panigrahi describes lineage as "the record of the data sources and of the operations which created the spatial database." Another way to put it is, "Can we trace who collected and created the data, conversion that may have occurred, precision, and method of data collection?"

Data lineage is often missing from the metadata but could be captured simply as a description entered by the analyst. When lineage cannot be determined, additional work is then required to recreate a spatial product for re-use in the same area of interest for a different mission question.

Panigrahi suggests that when assessing lineage we try to answer fundamental questions (shown below) that effect spatial data accuracy. However, the answers to these questions may not come easy, if they come at all.

- How was it digitized, and from what documents?
- When was the data collected? (Currency)
- Who collected the data?
- What steps were used to process the data?
- What is the precision of the computational results?

[1]Panigrahi, N. 2009. *Geographical Information Science.* Hyderabad, India: Universities Press (India) Private Limited

Data Accuracy

Data Accuracy

Accuracy refers in the strict sense to how close the data comes to the true measure, or real-world measure, if it were known absolutely.

Performance measures that rate accuracy mainly involve ranking, rating, or quantifying the 'true-ness' of measure for the underlying data acquired. Such measures can be assigned by the analyst, by the data producer (such as positional or radiometric accuracy of the sensor used to generate the image, for example), or by the publisher.

Error reports the deviation between the measured values and the real-world or true values. Error refers to lack of accuracy and precision of the data. Uncertainty in data refers to lack of confidence in the use of the data due to incomplete knowledge or due to the sheer fact of estimation. For our purposes here, we will focus on four types of accuracy:

1. Positional Accuracy
2. Attribute Accuracy
3. Temporal Accuracy
4. Semantic Accuracy

When working with HG-based data, human error, however unintentional, is the most likely error that can be inducted into the process. These errors can occur while collecting, transcribing, calculating, processing, or analyzing data or developing products.

Positional Accuracy

As defined by Panigrahi, positional accuracy can be expressed “as the closeness of the location information of spatial data to its true position.” While positional accuracy is often not as critical in developing products outside of lethal targeting, the best positional accuracy will result in a better product for the customer. Positional accuracy is most important for targeting. This is the reason why maps often state “not to be used for targeting purposes.”

Panigrahi offers five methods to test positional accuracy in a spatial data set:

1. Using an independent source of higher accuracy for verification.
2. Using maps of larger scale to verify the positions of objects in lower scale.
3. Using a form of ground truth validation (GPS).
4. Using raw survey data as a supplement.
5. Using internal evidence generated by the GIS system to supplement and validate the data.

Attribute Accuracy

Attribute accuracy measures the accuracy or closeness of the descriptive data to the actual measure. Attribute accuracy can also be expressed as how much the spatial object differs from the actual object on the ground. While the location of objects on the ground may not change with time, their attributes may differ over time. An example of this may be the change in ethnic or religious composition of a neighborhood. Right here in the United States, we have seen old brownstone buildings in formerly economically depressed downtown areas go from unoccupied, dilapidated dwellings to upscale housing. Same spatial footprint, but a vastly different set of social attribute values. Attribute accuracy should describe the magnitude of gross errors—or misidentification during data collection. We should note that attribute accuracy testing is seldom carried out, but should be acknowledged. This is mostly due to the fact that ground truth is expensive and time-consuming.

Temporal Accuracy

Simply put, temporal accuracy (or Currency) measures the accuracy or closeness of the data at a given time to properties of the actual object on the ground at the same time. The analyst should be concerned that combining samples from widely varying temporal resolutions may negatively impact accuracy and yield suspicious results.

Figure 3.2.5 Aral Sea Changes, 1973 and 2011

Semantic Accuracy

Semantic accuracy refers to correct labeling or annotation.

Example: Labeling methods must be checked to ensure lines point to the correct polygon, that color ramps are accurately used to reflect the underlying data (e.g., darker colors to indicate higher numbers or greater severity of the attribute being modeled). Following sound cartographic principles helps ensure semantic accuracy, and performing quality control of a subset of map labels or annotation before publication is always good practice.

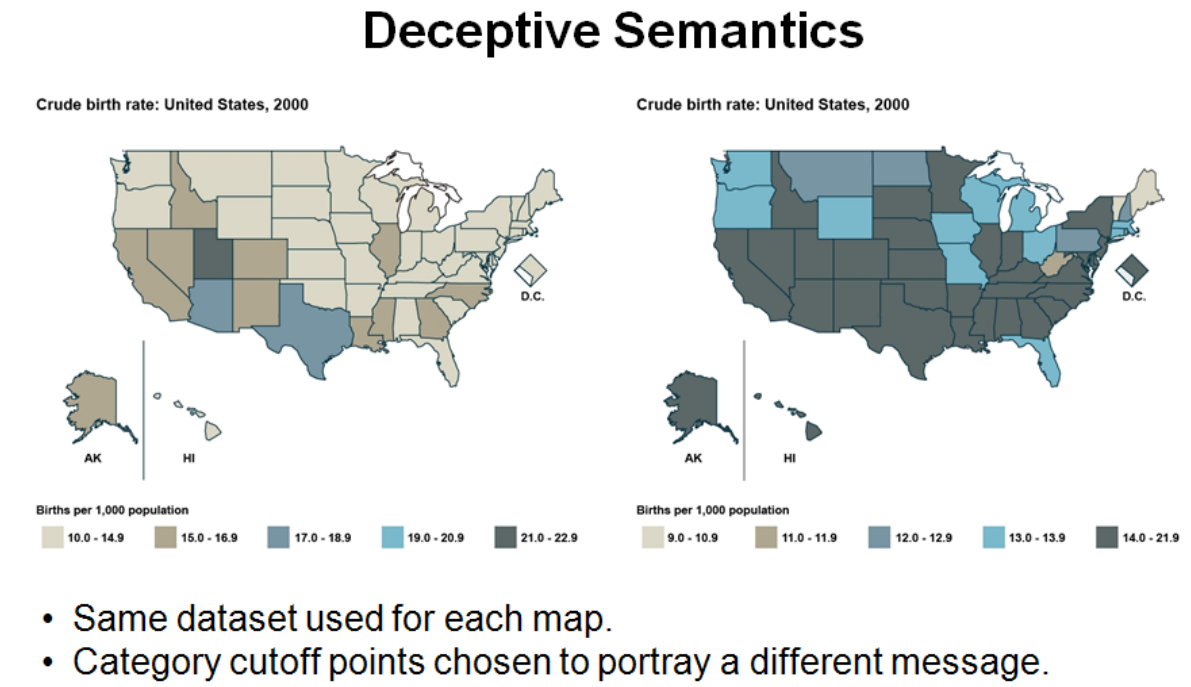


Figure 3.2.6 In these maps the same data set is used but a different category cutoff is chosen. This results in the same data portraying a different message. Source: Monmonier, M. 2005. Lying With Maps. *Statistical Science* 20(3):215-222

Data Source and Information Quality Scales

Overview

Part of understanding the quality of the data in GEOINT products analysts will generate resides in understanding and evaluating the quality of the raw data used in developing the product. The Army Field Manual for Human Intelligence Collector Operations, FM2-22.3, contains a suitable rating scale to be applied to data and their source(s). This rating scale measures 'Source' and 'Information' reliability. In other words, the source of the data has an associated reliability, and the data/information itself also has an associated reliability value. The pilot team recommends this same scale for human geography-based data. Source reliability can be rated from A to F, where A is most reliable and F 'cannot be judged.'

Data Source Reliability

Data Reliability - Data reliability could be determined simply by asking if the data comes from a reliable source or if there is any doubt about—or reason to doubt—the truth of the information. Reliability is also linked to confidence in the reported information.

The table below depicts reliability ratings, which range from "Reliable" (A) to "Unreliable" (E). In every instance the rating is based on previous reporting from that source. If there has been no previous reporting, the source must be rated as "F." One should note that an "F" rating does not necessarily mean that the source cannot be trusted, only that there is no reporting history and therefore no basis for making a determination.

Most Reliable

Least Reliable

A	**Reliable**	**<u>No doubt</u> of authenticity, trustworthiness, or competency; has a history of complete reliability.**
B	**Usually Reliable**	**<u>Minor doubt</u> about authenticity, trustworthiness, or competency; has a history of valid information most of the time.**
C	**Fairly Reliable**	**<u>Doubt</u> of authenticity, trustworthiness, of competency.**
D	**Not Usually Reliable**	**<u>Significant doubt</u> about authenticity, trustworthiness, or competency but has provided valid information in the past.**
E	**Unreliable**	**<u>Lacking</u> in authenticity, trustworthiness, and competency; history of invalid information.**
F	**Cannot Be Judged**	**<u>No basis</u> exists for evaluating the reliability of the source.**

Table 3.2.2 Evaluation of Source Reliability, FM 2-22.3

Information Content Evaluation

The table below provides a rubric for evaluating information content. The highest degree of confidence in reported information is given to that which has been confirmed by outside sources, "1." The degree of confidence decreases if the information is not confirmed, and/or does not seem to make sense. The lowest evaluated rating of "5" means that the information is considered to be false. Similar to the source evaluation, we should again note that a rating of "6" (cannot be judged) does not necessarily mean false information, but is generally used to indicate that no determination can be made since the information is completely new.

Highest Confidence

Lowest Confidence

1	**Confirmed**	**Confirmed by other independent sources; Logical in itself; Consistent with other information on the subject.**
2	**Probably True**	**Not confirmed; Logical in itself; Consistent with other information on the subject.**
3	**Possibly True**	**Not confirmed; Reasonably logical in itself; Agrees with some other information on the subject.**
4	**Doubtfully True**	**Not confirmed; Possible but not logical; No other information on the subject.**
5	**Improbable**	**Not confirmed; Not logical in itself; Contradicted by other information on the subject.**
6	**Cannot Be Judged**	**No basis exists for evaluating the validity of the information.**

Table 3.2.3 Evaluation of Information Content, FM 2-22.3

Lesson Two Review

Whether the data exists within NGA or has to be developed from unstructured, open-source information by the team of analysts, knowing the factors that impact data quality and knowing how to assess those factors are critical to the team's ability to develop quality products.

In this lesson, we discussed the following:

- Introduction
  - Human Geography-Based Data
- Types of Quality in GEOINT
  - Data Quality
  - Data Accuracy
- Measures of Quality
  - Logical Consistency
  - Data Completeness
  - Data Bias
  - Data Lineage (Genealogy)
- Types of Data Accuracy
  - Positional
  - Attribute
  - Temporal
  - Semantic
- Data Reliability and Evaluation

Module Three: Discovering, Evaluating, and Integrating Data

Lesson Three: Integrating Multiple Data Sources

Version: 1.6
Date: 12 September 2011

Change History Table

Version	Description of Change	Date
1.0	Development and Dry Run are complete. This document is approved for classroom use.	24 August 2010
1.5	Post-Dry Run conference is complete. Changes incorporated.	21 June 2011
1.6	Final edits from July 2011 course run. This document is approved for classroom use.	12 September 2011

Key Terminology

Geocoding	Process of assigning point data to event or described locations in a table with the use of a geospatial gazetteer or a list of populated places.
Georectify	In simplistic terms, georectify is the process of correcting the geospatial reference of a geospatial dataset.
Georeference	The process of establishing a geospatial coordinate and/ or projection system upon a spatial dataset.
Geospatial	Adjective used to describe data with reference to location in the form of an established geographic coordinate system and/ or projection.
Geospatially-Enable	Applying a geospatial reference to data through either georeferencing or geocoding.
Ingest	In terms of geospatial processes, *ingest* refers to the processes of setting the X,Y coordinate features of a table to their location as point features.
Spatial	Adjective used to describe data with a reference to location other than an established geographic coordinate system and/ or projection.
Structured Data	Any data with a repetitive and recognizable format. Data that is formatted into vector datasets or spreadsheets, tables and databases.
Unstructured Data	Graphical or Textual data available in reports and other published documents that are not formatted for immediate ingestion into a Geographic Information System.

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Lesson Three: Integrating Multiple Data Sources

Introduction

This lesson investigates the facets of integrating multiple sources of human geography-based data into GEOINT. This lesson provides students with an understanding of the challenges GEOINT analysts will face in leveraging data from multiple sources, and explains the importance of collaboration during the workflow process to overcome and mitigate these data challenges.

Objectives

Upon completion of this lesson, students will be able to:

- Understand the challenges of utilizing data from multiple sources and data formats.
- Recognize the importance of collaboration during the integration process.

Integrating Multiple Data Sources

Overview

Human geography-based data may be drawn from a variety of sources and locations and these data will come in a wide range of formats and structures.

Data may be structured or unstructured and each type of data has its own difficulties and challenges in preparing the data.

- Structured:
  - Tabular Data
  - Vector Data
- Unstructured:
  - Graphical data
  - Raw text data
- Semi-structured
  - Partially structured (similar general format)
  - SITREPs, other types of reports

In addition, analysts may face further challenges when integrating multiple types of data into geospatially-enabled data.

Structured Data

Includes:

- Any data with a repetitive and recognizable format
- Tabular: Spreadsheets, tables, databases
  - Variety of file types, formats, and structures
    - csv, xml, dbf
  - May lack geospatial reference

Challenges in using structured data

- Merging or joining data in differing formats.
- Transforming and/or restructuring data.
  - If there is a structure, a script can be written to handle it.
  - Consultation and collaboration with programming and GIS experts may be required.

Vector Data:

Generally speaking, for all established (GIS ready) vector data formats, these datasets consist of two major components, features and attributes. It's also important to understand that there is a geo-relational link that spatially ties the tabular attributes to the geospatial features that they describe.

- Geospatial **points**, **lines**, and **polygons**
  - Places, roads, administrative boundaries
- Geo-relationally linked tabular **attributes** to describe, characterize, and categorize features
  - Nominal, Ordinal, Ratio, Integer/Interval
- Various file formats
  - Feature Classes, Shapefiles, Google Earth (.kml), and etc.

Challenges in using vector data include:

- Data may not meet accuracy standards.
  - Positional, Attribute, Temporal, Semantic
- Transformation of data properties, features, and formats may be required.
  - Coordinate systems, projections, or scale of derivation
  - Documenting changes (metadata)
- Consultation and collaboration with experts or data producer may be required.

Unstructured Data

Graphical Data – images or picture files without geospatial reference:

- Raster-Based (Scanned images and raster-based graphics)
- Vector-Based (Digital point, line, polygon)

Challenges in using unstructured raster and vector data

- Scanning or digitizing hardcopy products
- Georeferencing
- Attributing features

Text Data – raw textual information:

- Much of the data analysts will work with may be derived from textual data
- A key component of workflow process
  - Parsing spatial and temporal data
  - Establish cultural and historical context

Challenges in using unstructured text data:

- Extracting and geospatially enabling unstructured textual data is a time-consuming process.

Geospatially-Enabled, Structured Data

On the right is a sample view of vector data of Somalia that is both geospatially-enabled and structured in Shapefile format**.**

- Places, facilities, roads, rails, areas, regions, boundaries
- Country
- Regions
- Clans

Challenge:

- Topological inconsistency in the data
  - o Boundaries do not match
  - o "Fuzzy" boundaries

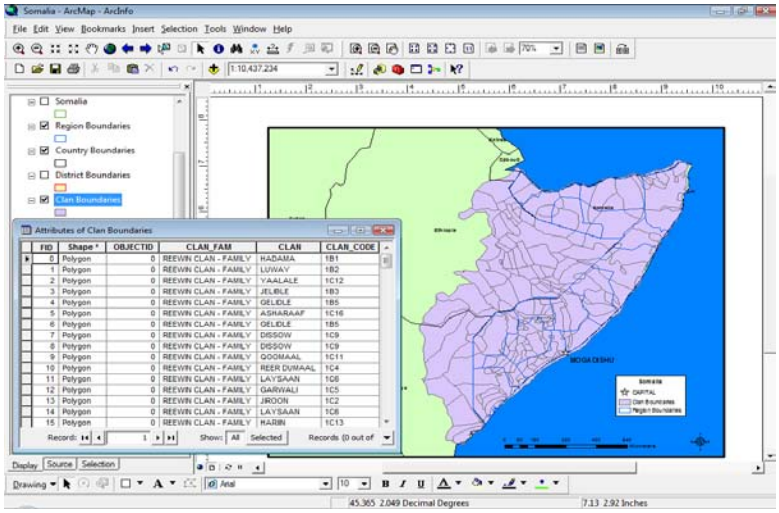


Figure 3.3.1 Shapefile and Attribute Table of Somali Clans. Source of shapefiles: Data Exchange Program for the Horn of Africa (DEPHA) for the UN High Commissioner for Refugees (UNHCR).

Geospatially Enabling Data

Enabling Graphical Data: Geospatially-enabling unstructured graphical data is a three-phase process:

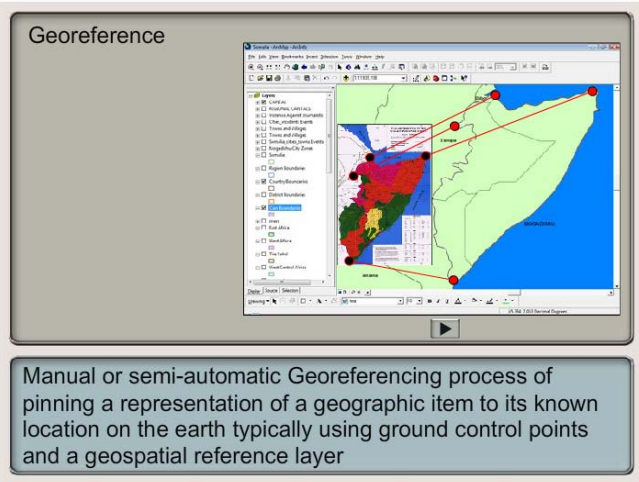


Figure 3.3.2 Step A. Georeference

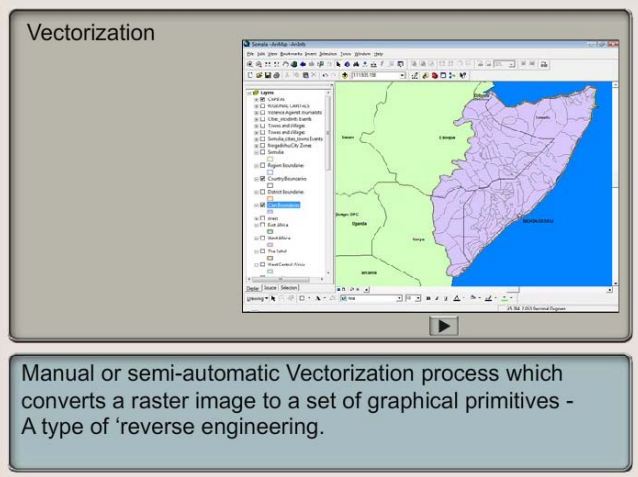


Figure 3.3.3 Step B. Vectorization

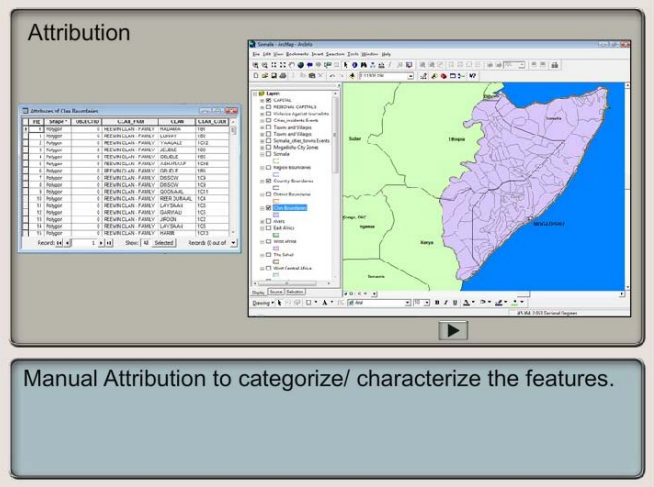


Figure 3.3.4 Step C. Attribution

Challenges of Integrating Data

Overview

- Differing scales/resolutions of data (Spatial, Temporal)
- Geocoding data
  - Different coordinate systems
  - Variations in place name spellings
  - Ambiguous, non-specific location references to places or areas
  - Merging/joining data in varying formats (text, tables, vectors, raster)

Spatial Scale

Overview:

- At what scale is the data available and the analysis required?
- Selection and comparison of variables will depend on the scale of the activity
- Populate human geography-based data along the NGA GLRS framework:
- HG-based data may be at any scale
- Scale for different types of data varies with mission needs and data availability
- Focus analysis at the largest, most practical scale:
  - Province, district
  - City, town, village
  - Neighborhood
  - Point data for specific events

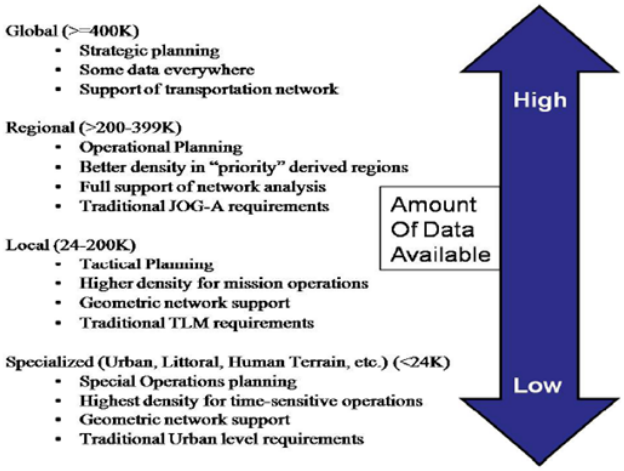


Figure 3.3.5 GRLS Scale

Challenges:

- Discovering and geocoding the data
- Integrating data constructed at different scales

Temporal Analysis and Scale

Overview:

- Provides insights into how human behavior and spatial patterns:
  - Changes over time in response to specific / significant events
- Precision of temporal data:
  - Year 2007
  - Month June 2007
  - Day 13 June 2007
  - Time of day 14:28 on 13 June 2007
  - Day of the Week Wednesday
  - Season Spring, summer, fall, winter, planting, harvesting, migratory patterns
  - Range of Dates Any Span of time

Challenges:

- Raw data will provide varying degrees of temporal resolution
- Makes detailed temporal trend analysis difficult if data is lacking or insufficient
  - Required precision will depend on the needs of the mission / intelligence request.
  - Temporal scale used should adequately capture the pattern periodicity of the human data
  - Time zone difference calculations to one particular zone
- Collecting and structuring data into a consistent format

Geocoding

Overview:

- Process of assigning point (coordinate) data to an event or described locations with the use of a gazetteer or a list of populated places.
- Potential Sources:
  - NGA Geonames
  - Open Source
  - Hardcopy sources
  - Local gazetteers in local languages
- Can be a time consuming process that requires:
  - Analytical judgment
  - Geocoding methods need to be captured in the metadata

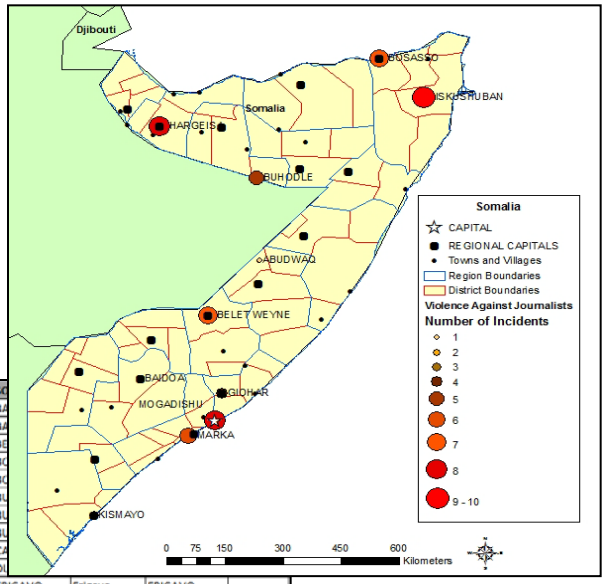
Challenges:

- Varying degrees of precision in the data:
  - Are specific coordinates for the data provided in the report?
    - If so, in what coordinate system?
      - MGRS
      - Lat/long: DMS, Decimal degrees
- If a specific place or feature is mentioned, are coordinates available in a gazetteer or other reference?
- If not, can coordinates be determined through other means?
  - Google Earth?
  - Collaboration/consultation with regional experts?
- If specific location or coordinates cannot be determined, then how can the data be enabled spatially?
- Decisions to assign location attributes to the data:
  - Point or polygon?
  - To the centroid of the administrative unit in which it occurred?
- Method will depend on knowledge of the source and the details available in the unstructured text
- Collaboration/consultation with subject matter and regional experts may be required

Example of Integrating Multiple Data Sources

The example surrounding *Violence Against Journalists* will cover data integration in the following manner:

- **13 Foundation Data Themes**
- **Potential for Unstructured Data**
- **Extracting Data**
- **Tabulating the Data**
- **Geocoding the Data**
- **Visualizing the Data**
- **Explaining the Patterns**
- **Temporal Analysis**



LAT	LONG	DMS_LAT	DMS_LONG	SC			
3.116667	43.650000	30700	433900	BA			
2.338564	42.285637	22019	421708	BA			
4.735833	45.203611	44409	451213	BE			
9.936111	43.182778	95610	431058	BO			
11.284722	49.182500	111705	491057	BO			
1.083333	42.583333	10500	423500	BU			
8.230556	46.326667	81350	461936	BU			
9.524167	45.536944	93127	453213	BU			
6.147778	46.396389	60852	462347	CA			
5.535000	46.386111	53206	462310	DU			
10.618056	47.370000	103705	472212	ERIGAVO	Erigavo	ERIGAVO	
6.769722	47.430833	64611	472551	GALKAYO	Galka?yo?	GALKAYO	
8.406389	48.483056	82423	482859	GAROWE	Garowe	GAROWE	
2.766667	45.516667	24600	453100	GIOHAR	Giohar	GIOHAR	4
9.560000	44.065000	93336	440354	HARGEISA	Hargeisa	HARGEISA	8
4.116667	43.900000	40700	435400	HUDDURHAD	Húddur Ha	HUDUR	
10.283333	50.233333	101700	501400	ISKUSHUBA	Iskushuba	ISKUSHUBAN	10
-0.358173	42.545365	-2129	423243	KISMAAYO	Kismaayo	KISMAYO	3
8.462778	47.361389	82746	472141	LASCAANOD	Las Caano	LASCAANOOD	
1.683333	44.750000	14100	444500	MARKA	Marka	MARKA	6
2.066667	45.366667	20400	452200	MOGADISHU	Mogadishu	MOGADISHU	8

Figure 3.3.6 Geospatially-Enabled Human Geography-Based Data

Collaboration During the Workflow Process

Although discussed throughout the lesson, the concepts regarding the importance of collaboration that you should be firmly aware of include:

- Analysts should have a firm understanding of the human geography of the region
  - Not always possible
- HG-based analysis requires:
  - Consideration and analysis of a wide variety of social attributes in different places
  - Skills and abilities in gathering, collecting, organizing, data
  - Technical abilities to transform and project those data spatially
- HG-based analysis is a collaborative effort
  - Draws upon expertise both within and outside of NGA
  - Collaboration takes places at every stage of the workflow process

Lesson Three Review

Integrating multiple sources of data into HTA certainly has its challenges. However, collaboration during the workflow process can help the analyst to overcome and mitigate these data challenges. As has been shown previously relying on multiple sources of data not only enhances the quality of the product an analyst can provide, it also results in a more holistic analysis and thus better supports the customer in the field.

In this lesson we covered the following topics:

- Integrating Multiple Data Sources and Data Formats
  - Structured Data
  - Unstructured Data
  - Geospatially Enabling Data
- Challenges of Integrating Data
  - Spatial Scale
  - Temporal Analysis and Scale
  - Geocoding
- Example of Integrating Multiple Data Sources
  - 13 Foundation Data Themes
  - Violence Against Journalists
  - Extracting Data
  - Tabulating the Data
  - Geocoding the Data
  - Visualizing the Data
  - Explaining the Patterns
  - Temporal Analysis
- Collaboration during the workflow process

Lesson Three References

The following references were used in this lesson:

- National Geospatial-Intelligence Agency. November 2009. *Human Terrain Analysis Handbook and Reference Guide*. Version 1-0.

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Module Four: Guided Exercise

Lesson One: Incorporating Human Geography into GEOINT

Version: 1.6
Date: 12 September 2011

Change History Table

Version	Description of Change	Date
1.0	Development and Dry Run are complete. This document is approved for classroom us.	24 August 2010
1.5	Post-Dry Run conference is complete. Changes incorporated.	21 June 2011
1.6	Final edits from July 2011 course run. This document is approved for classroom use.	12 September 2011

Guided Exercise – Administrative Details

Purpose

Provide the students an opportunity to examine non-IC derived, human geography-based data to solve an intelligence issue.

Objectives

Upon completion of this exercise, you will have demonstrated your ability to:

- Demonstrate how Human Geography-based data can inform GEOINT analysis of an intelligence question

Key Tasks

1. Understand your intelligence question
2. Become familiar with human and physical geography of the region of interest.
3. Identify what types of information, data, and data layers are needed to address the issues.
4. Identify which if the 13 Foundation Themes are relevant to your mission.
5. Identify which data in the given materials is relevant to your intelligence question.
6. Describe the research methods that you could employ to gather the necessary data.
7. Brief the resulting GEOINT product(s) and the specific process used to obtain it.

End State

Each student group will satisfactorily demonstrate the ability to derive HG-based data from a non-IC source, within the context of the Foundation Workflow Process, to address an intelligence issue. Each group will brief their findings to the other groups.

Guided Exercise Structure

- This is an open ended exercise where creativity and originality of thought are valued above the product.
- As you work through this exercise, draw upon Director Long's comments that GEOINT is informed by "data [human geography] and information that can be understood spatially and depicted visually that further deepens and enriches our understanding of a 'place' ".
- You will receive a broadly stated intelligence question.
- Your team must examine non-IC data from the Atlas of Ethiopian Livelihoods and extract information that will assist in answering a broadly stated intelligence question.
- Paying it Forward – as you examine the data, visualize where it would fit in the Human Geography-Based Foundation Themes.

This guided exercise will be conducted in student groups. Each student group will apply the knowledge acquired in the course to address a geospatial intelligence question. The student groups are provided with a scenario, a non-IC source of data and are then assigned the requirement of answering an intelligence question. The groups are encouraged to "think outside the box" in their efforts to understand how non-IC, HG-based data can be used to answer and intelligence question.

Guided Exercise Structure

1. Understand your intelligence question

2. Become familiar with human and physical geography of the region of interest.

3. Identify what types of information, data, and data layers are needed to address the issues.

4. Identify which if the 13 Foundation Themes are relevant to your mission.

5. Identify which data in the given materials is relevant to your intelligence question.

6. Describe the research methods that you could employ to gather the necessary data.

7. Brief the resulting GEOINT product(s) and the specific process used to obtain it.

Methodology

The workflow process will be used as a framework from within which the guided exercise is conducted. The instructor(s) will review each phase of the workflow process prior to beginning the exercise in order to facilitate student understanding and successful application of the process. The length and scope of this review is left to the instructor's discretion. Each student group will be given a copy of the scenario and allocated time to review the contents and ask questions.

During the exercise, the instructor spot-checks each student group during the exercise, providing guidance, feedback, and suggestions as required. Each student group will report to the instructor at selected "checkpoints". The exercise is not specifically tied to the phases of the workflow process, thus the instructor should encourage groups to think holistically about their question and spend additional time examining the provided data. Creative thinking is valued over the process or product in this exercise, however this is a good opportunity to reinforce a validated NGA process.

Administrative Instructions

- Depending upon location and circumstances, there may not be computers available to support this GE. Therefore, computer-generated products are not a requirement and the process and interaction within the exercise should be valued over the product produced.
- In briefing their findings, PowerPoint presentations are not required. Student groups may present their findings, conclusions, and methodologies via whiteboards or butcher block. Given the focus of this GE, the intent is for each group to explain the rationale for their chosen themes, how they used the data in the Atlas to inform their conclusions, and how it would be incorporated into the workflow.

- A hard copy reference source is provided, although its use is not mandatory. To supplement the classroom-provided material, students are free to use any additional open-source material they deem appropriate in compliance with Open Source guidelines.
- Students will be strongly encouraged to employ the questions applicable to the 13 Human Geography Themes as outlined in Student Guide Appendix C: HG-Based Theme Guide.
- This is a Human Geography–based GE. Rather than dictate specific themes to the students, the intent is for the students to select the Human Geography-based themes that they feel best correspond to the scenario. The student groups should select a minimum of six Human Geography-based themes.
- Regarding data, there is no requirement to physically produce references or sources. The intent is for each group to simply identify the types of data needed to support each chosen theme; each student group will subsequently brief their findings to the other groups.
- At a minimum, each student group will brief the following topics:
  - What Human Geography themes did the group chose to focus on and why?
  - What HG data did the group find in the Atlas to inform your decisions?
  - What types of data were needed for a more complete answer to the group's IQ? Where would an analyst expect to look for this data, what concerns should be examined regarding data quality, and how could this data be validated?
  - What GEOINT products would the group expect produced?

Exercise Scenario

Background

- US national interests remain focused on maintaining positive relationships across multiple channels with the government of Ethiopia.
- Effective assistance and aid across a diversity of sectors is key to maintain these relationships.
- Regional stability in the Horn of Africa is inextricably linked to internal stability in Ethiopia.
- A growing population of nearly 80 million puts tremendous pressure on the farmland, pasture, and natural resources that are the foundation of the country's economic growth.

USAID, Ethiopia and Agriculture

- USAID has worked to strengthen smallholder farms, providing access to credit and technical support.
- In 2009, USAID launched the Feed the Future Initiative in Ethiopia to enhance food security, increase agricultural productivity, and reduce the crippling impacts of famine.
- USAID also participates in Ethiopia's Productive Safety Net Program, a donor-government partnership to reduce the economic and environmental causes of chronic food insecurity that affects 7.5 million Ethiopians.
- In order to continue to support USG interests in the region, USAID needs to enhance its understanding of food security and agricultural productivity.

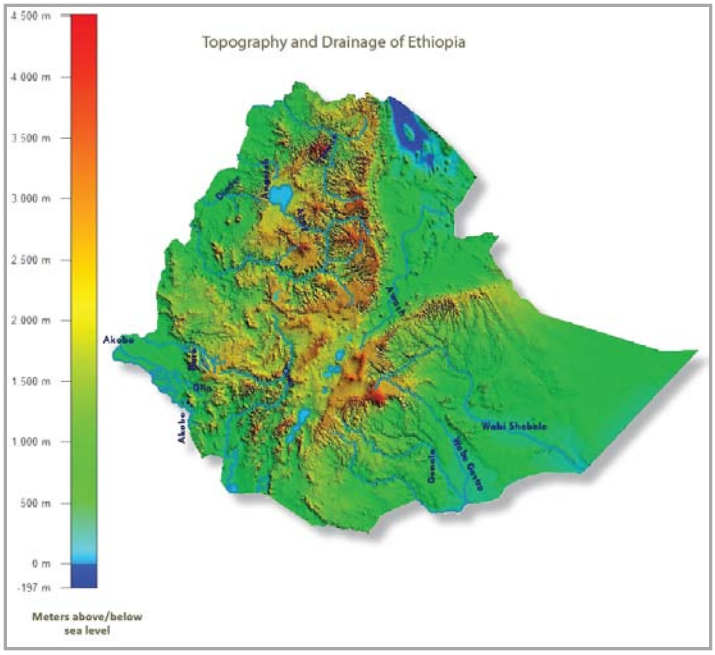
Farmers who diversify their crops decrease their risk of famine. USAID is working with Ethiopia's farmers to improve agricultural methods.

Ethiopia - History

- Unique among African countries, the ancient Ethiopian monarchy maintained its freedom from colonial rule with the exception of a short-lived Italian occupation from 1936-41.
- In 1974, a military junta deposed Emperor Selassie (who had ruled since 1930) and established a socialist state.
- Faced with many problems, the regime was finally toppled in 1991 by a coalition of rebel forces, the Ethiopian People's Revolutionary Democratic Front (EPRDF).
- A border war with Eritrea late in the 1990s ended with a peace treaty in December 2000.
- The 2007 Eritrea-Ethiopia border demarcation is on hold because of Ethiopian objections to an international commission's finding requiring it to surrender territory considered sensitive to Ethiopia.

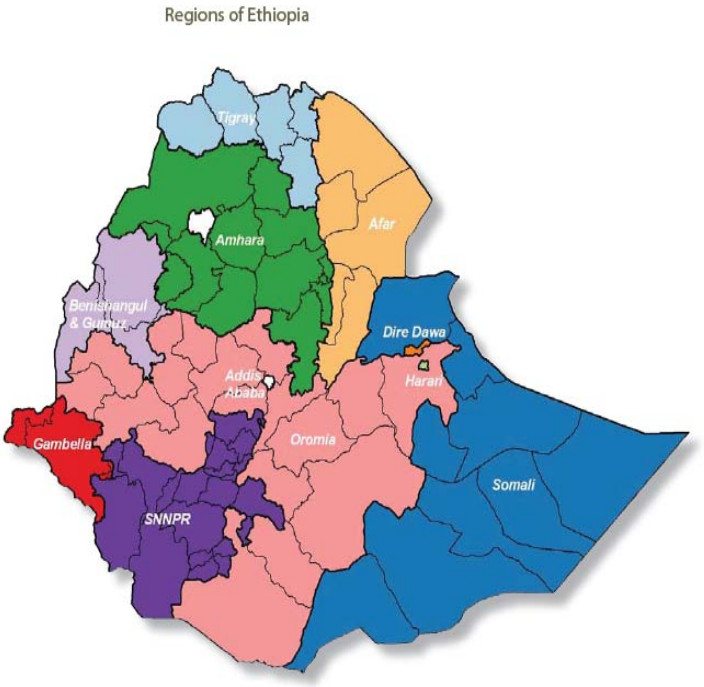
Ethiopia – Physical Geography

- 8 north of the equator
- The country is landlocked
- Climate is tropical monsoon with wide topographic-induced variation
- Terrain characterized by high plateau with central mountain range divided by Great Rift Valley



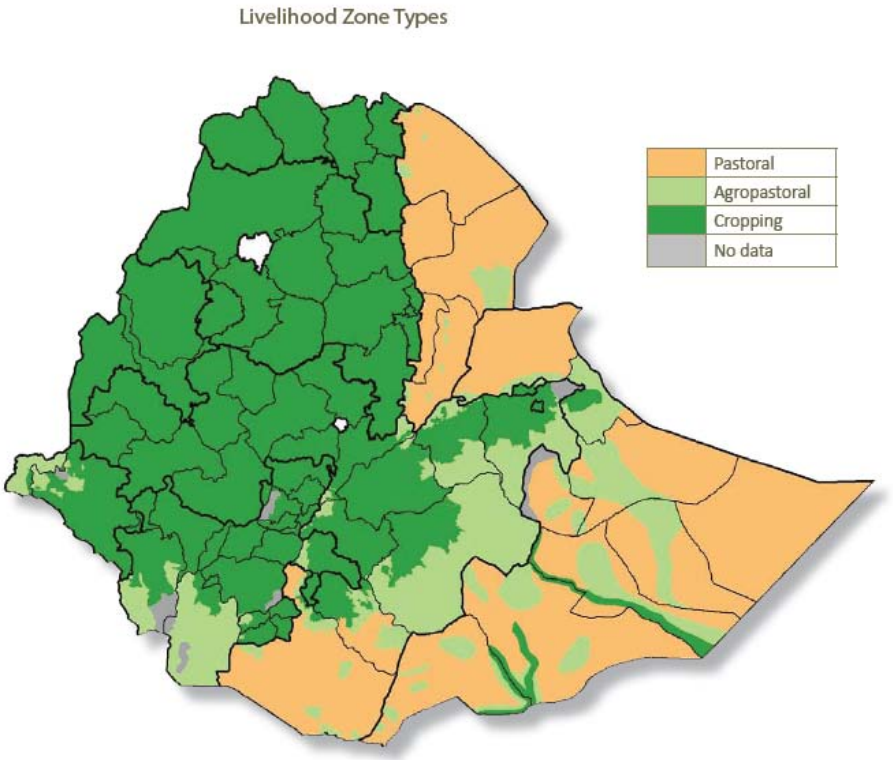
Ethiopia – Government and Political Divisions

- Government Type: federal republic
- Capital: Addis Ababa
- Chief executive is elected by the bi-cameral parliament
- 11 regions – 9 ethnically-based regions and 2 self-governing administrations
- Chartered cities are Addis Ababa and Dire Dawa
- Each region is further subdivided into an administrative units, known as a *woreda*

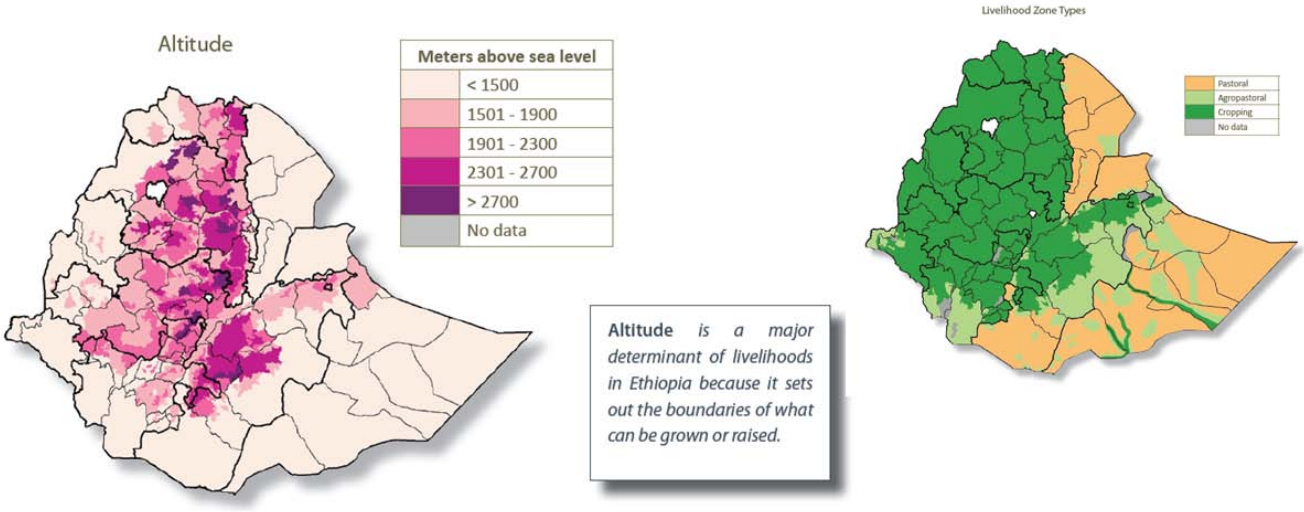


Ethiopia – Livelihoods

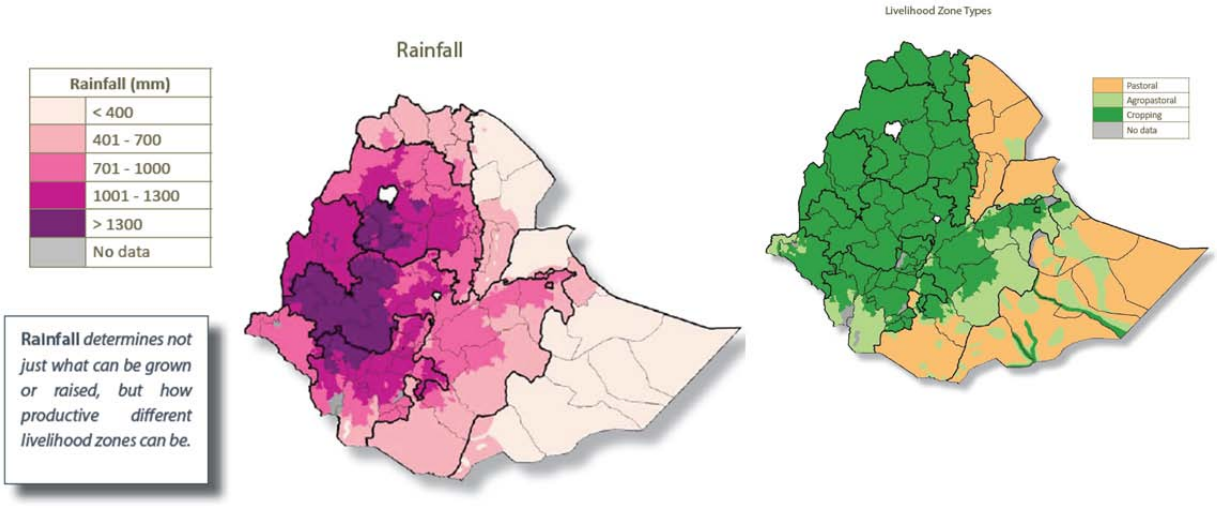
- Livelihood zones are based on economic pursuits and physical geography
- Pastoralists – depend primarily upon herding
- Agro-pastoralists – grow crops but mix the risk and the profit with a major dependence on herding



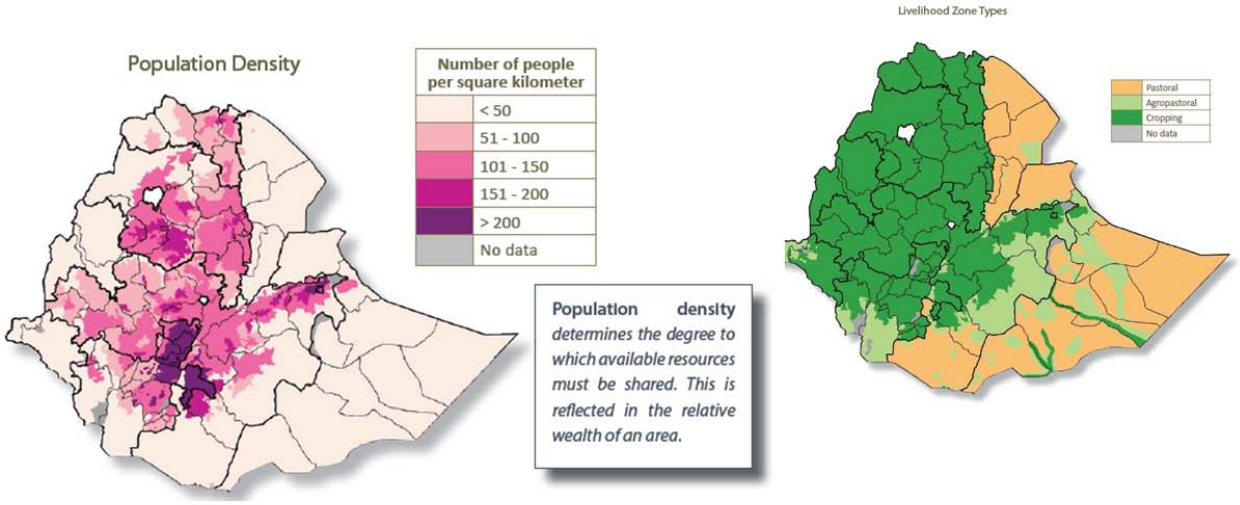
Ethiopia – Altitude



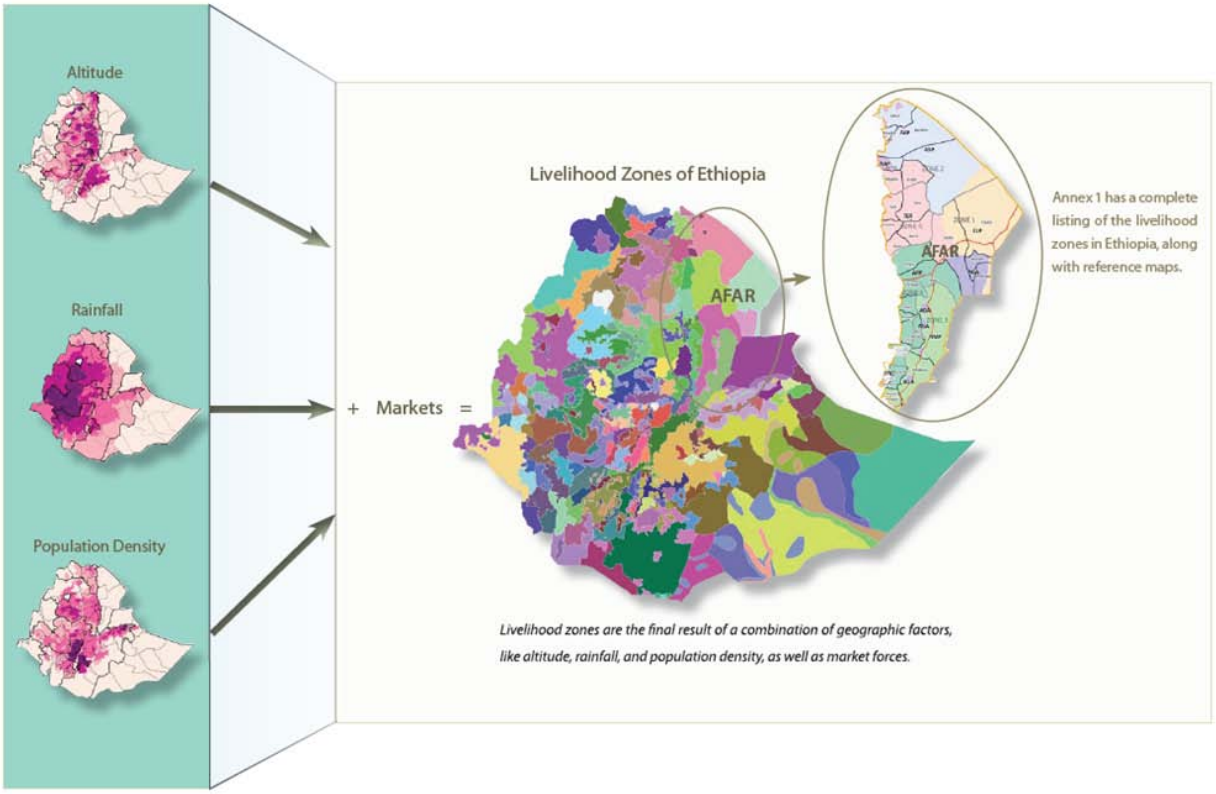
Ethiopia – Precipitation



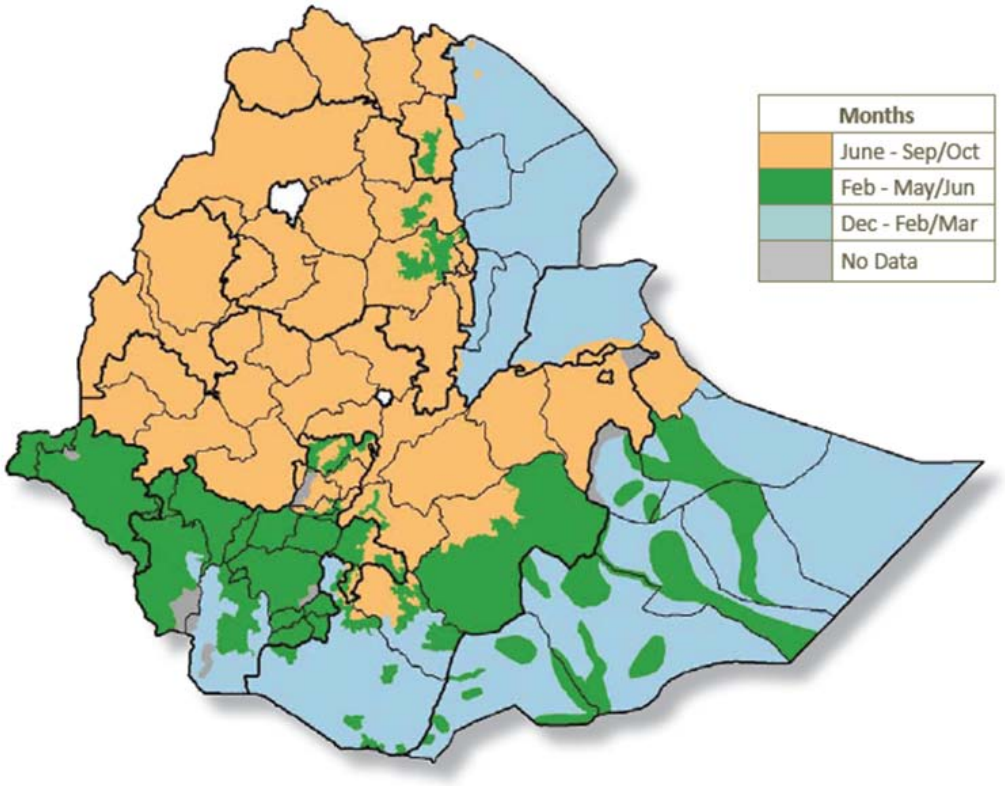
Ethiopia – Population



Development of Livelihood Zones



Timing of the Hungry Season



Your intelligence questions

1. **Livelihoods.** How are livelihoods distributed? On which livelihoods should USAID aid be most focused? Which HG-based foundation themes contain data that would best informs aid application decisions?

2. **Patterns.** How has precipitation patterns influenced settlement and livelihoods over time? Are there any demographic patterns that emerge? What information do policy makers need to better inform their understanding of these patterns?

3. **Food Security.** What variables impact food security in poor households? How could USAID mitigate the negative effects of these constraints? What might be the unintended effects of these actions?

4. **Stability.** What underlying factors could influence destabilization or violence in Ethiopia? Are there spatial patterns of violence? Which HG-based foundation themes could best be used to inform USG stabilization policies and how would this be done?

Your Results

- Please brief by group
- The creative thinking is valued over the product
- Provide insight into the approach your group employed
- Discuss what tools or data were you lacking
- Highlight the contributions your work would make to the HG-Based Foundation Data

Appendix A: Foundation Workflow Process

A. Planning Phase

1. Prioritize requirements and assign leads.
   - Receive request for cultural baseline data.
   - Prioritize requirements and resources.
   - Identify key team personnel.
2. Create project workspace.
   - Create a shared storage.
   - Determine where and on what network the working material should be initially stored.
   - If the team decides to file a geodatabase, decisions are made here with respect to such organization.
3. Clarify needs.
   - If there is any uncertainty regarding the nature of the project or request, then the requestor should be contacted in order to clarify the needs/final outcome.
   - The team is responsible for fully understanding requestor needs prior to planning and commencing work.
4. Determine whether or not the request is a standard product. THIS IS A DECISION POINT.
   - Is the outcome to be a standard descriptive analysis?
5. Identify additional skills and needs.
   - Determine how these needs can be achieved.
   - Conduct a data query to find out where NGA skills and resources are located.
6. Apply guidance.
   - Determine what essential entities and characteristics compose the core foundation themes.
   - Determine where to get relevant data and SMEs who can be contacted for assistance.
   - Capture lessons learned and store in a solutions repository.
7. Request analytical help.
   - Contact analysts or other staff who will be able to help with the additional data and analysis needed for the foundation request.
   - Clarify their role in the process and determine whether they will feed data back to the effort or conduct this as a separate project.
8. Validate and adapt guidance.
   - Adapt or expand the existing guidance in order to expand the plan to include what is necessary to satisfy the needs of this mission.

9. Check for prior foundation.
    - Check if a prior foundation exists for the Area of Interest (AOI).
10. Determine if there is prior foundation data available. THIS IS A DECISION POINT.
    - Query existing databases.
    - Check existing files and products.
11. Read context and history for the AOI/AO.
    - Ensure the team understands the basics involving the culture and society of interest.
    - If not, retrieve and ingest sufficient background information to ensure they have a contextually accurate frame of reference for the data.
12. Consult internal (NGA) SMEs.
    - Consult with NGA SMEs for assistance and contextual information.
    - Conduct data queries to learn where in NGA the required skills and resources are located.
13. Review external knowledge.
    - Determine if external knowledge is available that must be tapped, such as other IC members, academia, the Federal Government, or other experts.
14. Pull prior data.
    - If prior foundation layers exist, then the team will pull these directly into the shared workspace.
15. Identify update needs.
    - Identify currency and completeness gaps that will be needed in order to update the prior work.
16. Confirm whether or not to proceed. THIS IS A DECISION POINT.
    - Determine if the prior work and current level of team expertise is sufficient to solve the project needs.
    - If not, conduct additional study and review to learn about the mission question, parties involved, or the AOI itself.

B. Research Phase

17. Define AOI (determine spatial extent).
    - Make a specific determination what buffer, if any, outside the AOI, will be included in the analysis.
18. Initiate data gathering.
    - Begin the actual process of gathering new data for the project.
    - Assign team members with different responsibilities for data collection.
19. Look for existing structured data.
    - Conduct targeted searches of places where relevant data is likely to be found.
    - Seek high-value data already in some structured form.
    - Once found, examine, update, and improve this data.

20. Identify relevant internal data.
    - Check internal NGA sites such as GIFD, AMS, NES, etc.
    - Understand where this fragmented data might exist and develop a plan to pull and store it as an aggregated layer.
21. Compile vector baseline data.
    - Pull and gather internal vector data for project use.
    - Pull required raster information (e.g., DTED and images).
22. Compile related functional and attribute data.
    - Pull and organize data.
    - Check TMS, NES, AMS, and NSS for content scattered throughout their systems.
23. Identify external vector and feature data.
    - Query NGA sources to locate places to search in order to build the particular layers.
    - Check other relevant sites such as NGOs, UN, academic, etc.
24. Compile relevant external data.
    - Pull and gather the external vector data and other structured data types (e.g., spreadsheets, tables, etc.).
25. Correlate and extract data as needed.
    - Identify data sets requiring further extraction in order to isolate particular entities and objects of interest.
26. Initiate unstructured data discovery.
    - Search across diverse sources to see what data and information might be relevant and useful.
    - Locate sources of unstructured (textual) information scattered across reports, messages, documents, and web postings.
27. Check classified systems.
    - Gather entity, incident, and event data from intelligence sources, i.e., SIGINT, HUMINT, MASINT, and GEOINT sources.
28. Check open sources/gather socio-demographic data from open sources.
    - Check for data from published reports, individual messages, websites, libraries, and a variety of other sources.
    - Determine a collection strategy to disguise/hide the analyst's interests.
    - Formulate some type of anonymous collection strategy, or a search with extremely broad parameters.
29. Auto-extract relevant socio-demographic data and entity incident and event information.
    - Apply entity extractors, geotaggers, and event extractors to the unstructured data gathered from open and intelligence sources.
30. Tag/mark (geospatially enable) data.
    - Assign locations or boundaries in geographic space to the data.
    - Use automated tools as much as possible, especially as a first pass with the unstructured data.

31. Assemble data in appropriate workspace.
    - Identify the aggregate relevant data.
    - Merge the data found from the various sources and cluster it into similar categories.
32. Attach confidence value to data.
    - Attach a value of confidence to the data and its source.
    - Apply the same measures regardless of whether the data is structured (e.g., shapefiles) or unstructured (e.g., reports).
    - Score the data as to both the source of information and the quality of the information itself.
33. Assess for currency, completeness, and coverage.
    - Assess whether sufficient data has been collected to proceed with analysis.
34. Determine if there is sufficient content to proceed. THIS IS A DECISION POINT.
    - Determine if there is a sense that at least 75 percent of the needed detail has been collected to proceed with the analysis.
35. Fuse data by layer.
    - Ensure the geospatially-enabled data are organized correctly and packaged into the desired layers called forth in both the data plan and mission needs.
36. Compile layers of clustered themes/fuse data layers by theme.
    - Group data by needed display category within ArcGIS.
    - Build thematic layers.
    - Group data together into thematic maps.
    - Adjust labels and annotations so information in maps can be interpreted and discussed.
37. Clean and process data.
    - Begin projecting, merging, clipping activities, filetype conversion, and fixing topology errors.
    - Create metadata if the layers are considered foundational to an analysis (in other words, they don't need further geoprocessing in order to be used).
38. Store data for use.
    - Stored created data in shared locations that can be found, accessed, and used as needed.
    - Identify analysts or data steward for adding appropriate metadata to these files to promote subsequent discovery and reuse.

C. Analysis Phase

39. Identify information gaps and needs.
    - Evaluate where there may be incomplete coverage or determine where additional efforts could be applied to help fill out the overall perspective.
    - Identify which data are missing in order to build a more complete picture of the mission request.
    - Identify potential sources (perhaps suggesting these in the solutions record), telling subsequent users what additional types of data are needed and where they might be found.

40. Perform data extrapolation/interpolation.
    - Create geospatial data out of existing data through extrapolation or interpolation.
    - Fill in missing geospatial data using statistical tools.
    - Ensure metadata is created and populated after this result.
    - If required, create a surface out of discrete points, such as a kernel density using a single variable to weight unknown cells with values inversely (or otherwise) related to known point values. Krieging also falls into this category.
41. Determine if collection is required. THIS IS A DECISION POINT.
    - If additional data is still needed, then the alternatives are to initiate collection efforts (e.g., imagery, SIGINT, or HUMINT) or to notify data brokers to commence efforts to find, buy, or procure the needed data.

D. Production Phase Tasks

42. Package cultural baseline.
    - Determine whether or not to package this information into some from of cultural baseline that can be disseminated as its own product. This is, however, an optional step.
    - The final form of such a cultural baseline has not yet been determined. Regardless, analysts should always have the option of finishing their efforts this way.
    - Document lessons learned, the location of key sources of data, and other wrap-up information that will assist subsequent analysts.

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Appendix B: Mission-Specific Workflow

A. Planning Phase

1. Identify Mission Needs
   - Mission need is identified and transmitted.
   - May arrive via formal methods or more informal routes.
   - Division or Branch Chief will prioritize requests.

2. Decompose Mission Needs
   - Decompose the question to determine key elements and intent.
   - Improve results through some back-and-forth dialogue with the requestor.

3. Clarify Needs
   - Contact requestor if there is any uncertainty regarding the nature of the project or request.
   - Understand unique customer needs prior to planning and commencing work.

4. Create Project Workspace
   - Create a physical shared storage area for shared information (e.g., documents, contact lists, data, etc.).
   - Accumulate, refine, and integrate shared information.
   - Network storage can be informal (folders in the file system) but must be structured.
   - Grant and verify access for all parties involved in the project.
   - Reuse and share standard sub-directories and folders appropriate to HTA projects.

5. Identify Team Skills Needed
   - Responsibility for the project will be assigned to a team leader.
   - Mission needs dictate skills required for the team.
   - Regional expert who is already familiar with the area and its culture will assist team.
   - Team leader indentifies additional analyst and support resources.
   - Pre-existing team arrangements may include members of the team who built the HTA foundation layers for this region.

6. Develop Working Hypothes(es)
   - Make assumptions on outcome or cause of the mission question.
   - Hypothes(es) can be shaped around specific mission needs.
   - Hypothes(es) can be exploratory in order to uncover previously undetected relationships between variables or parties involved.
   - Revisite, re-work, or re-state the hypothes(es) if necessary.

7. Request Analytic Help
   - Team leader requests help if additional or specific skills are needed.
   - Help can come from existing contacts and relationships or from an analyst resource catalog or community of interest.

8. Visualize End Result
   - Involves some foresight among the team, their manager, and the requestor.
   - Must imagine what context, data, and presentation will best convey the final results.
   - Products include thematic maps, a written analysis, a PowerPoint, or other forms of visualization such as a geopdf or animation.

9. Identify Thematic (General) Data Requirements
   - Suggest type of data needed to solve the problem.
   - Data requirements include common foundational data and unique, mission-specific data.
   - Considered the 'whiteboard' session.
   - Explore which groups might be contacted for more information.

10. Check for Prior HTA Foundation
    - Check to see if prior HTA foundation layers exist for the area of interest (AOI).
    - Must query the HTA foundation database.

11. Prior HTA Foundation Available
    - Decision point.
    - Until NGA builds HTA foundation data, the answer may be no.
    - If no, initiate request to build foundation layers.
    - If no, team can commence building foundation.

12. Pull Prior Material
    - If prior HTA foundation layers exist, pull these directly into the shared workspace.

13. Assess Currency and Completeness
    - Review prior foundation data for currency and completeness gaps.
    - Update deficiencies prior to initiating work.

14. Is Cultural Expertise Available within the Analytical Team?
    - Decision point.
    - Determine team has expertise sufficient to solve the problem or answer the questions.
    - 'Yes' if the team is already deeply entrenched in studying/analyzing the AOI or AO.
    - 'No' if the team requires additional study and review to learn about the mission question, parties involved, or the AOI.

15. Read Context and History for the AOI/AO
    - Read about the cultural, political, economic, geographic, and historical context in the AOI.
    - Research to understand what is happening in order to ask logical questions of SMEs.

16. Consult Available Internal (NGA) SMEs
    - If internal experts are available, consult them for assistance, contextual information, and data.
    - Use listings or data query to find skills and resources within NGA.
    - Alternatively contact colleagues in order to find recommendations and leads.

17. Review available external knowledge
    - Determine if external knowledge is available that must be tapped.
    - Sources include academia, the Federal Government, or outside experts.
    - Individual experts may have direct experience with the mission set question or geographic or cultural knowledge of the AOI.

B. Research Phase

18. Define/Refine AOI (Determine Spatial Extent)
    - Determine what buffer outside of the AOI to include in the analysis.
    - May be determined by the data available or the activity occurring on the ground.
    - Example: A cultural grouping often does not stop at a country's borders.

19. Refine Hypothesis
    - Determine if hypothes(es) made in Step #6 should be altered.
    - Decision based on expert consultation and an initial knowledge base.

20. Define Specific Data Needs
    - Obtain more specific entity data.
    - Example: In a water-resource-challenged country, information on wells may be critical.

21. Identify Project Team Responsibilities
    - Leverage collaborative network and team environment.
    - Maximize contribution of diverse strengths and knowledge areas.
    - Teams can be either physical or virtual.
    - Proper HTA analysis is a 'team sport'.
    - Identify priorities and deadlines.

22. Initiate Data Gathering
    - Begin new data gathering;
    - Data collection may occur simultaneously and not in a sequential fashion;

23. Look for Existing Structured Data
    - Search of places where relevant HTA data is likely to be found;
    - Seek high-value data already in some structured form.

24. Identify Relevant Internal Data
    - Internal NGA sites include GIFD, AMS, or GNPS.
    - Check the OSC for leads and locations.

25. Compile Vector Baseline Data
    - Pull and gather of internal vector data.
    - Data includes rivers, roads, rails, buildings, facilities, power lines, water treatment plants, and communications tower.
    - Pull raster information (e.g., DTED and images).

26. Compile Related Functional and Attribute Data
    - Internal data will not be easily pulled in its current state.
    - Example: GIFD buildings have a function code for religious facilities and attributes that differentiate these as church/mosque/synagogue /temple/etc.
    - Pulling and organizing this data involves additional steps from the prior vector pull.
    - Check earlier foundation data build for new content and completeness.

27. Identify External Vector and Feature Data
    - Solicit team members for sources of external data.
    - Use OSC to assist in data search.
    - Relevant sites may include NGOs, UN, academic, etc.

28. Compile Relevant External Data
    - Pull and gather external vector data and other structured data types (e.g., spreadsheets, tables, etc.).

29. Correlate and Extract Data as Needed
    - Some data extraction has likely been done in earlier steps.
    - Earlier data sets may need further extraction to isolate particular entities and objects of interest.
    - Group and grow data layers for use in GIS.

30. Initiate Unstructured Data Discovery
    - Focus on data discovery.
    - Look across diverse sources for relevant and useful data and information.
    - Data may be unstructured (textual) information from reports, messages, documents, and web postings.
    - Effective search strategies utilize more advanced strategies and query broader sources.

31. Check Classified Systems
    - Gather entity, incident, and event data from intelligence sources.
    - Can occur concurrently with open-source check.
    - Classified system search queries can be more specific and need not try to hide the intent.
    - Sources include SIGINT, HUMINT, MASINT, and GEOINT.

32. Check Open Source
    - Gather socio-demographic data.
    - Data sources include published reports, individual messages, websites, and libraries.
    - Analysts must be concerned with disclosing interests.
    - Can occur concurrently with classified check.

33. Auto Extract Relevant Socio-Demographic Data and Entity Incident and Event Info
    - Apply entity extractors, geotaggers, and event extractors.
    - May have millions of potential results.
    - May use automated navigation assistance to quickly locate useful data.

34. Tag/Mark (Geospatially Enable) Data
    - Assign locations or boundaries in geographic space to the data.
    - Use automated tools as much as possible with unstructured data.
    - Could involve hand digitization or joining data against administrative units.
    - Prepare layers for use in a GIS.
    - May need to translate unstructured data into a spatially enabled structure.

35. Assemble data in appropriate workspace
    - Build on prior steps.
    - Merge data found from various sources and cluster it into similar categories.

36. Attach Confidence Value to Data
    - Attach a value of confidence to the data and its source.
    - Do same for structured (e.g., shapefiles) or unstructured (e.g., reports).
    - Score by source of information and the quality of the information itself.

37. Assess for Currency, Completeness, and Coverage
    - Assess whether sufficient data has been collected to proceed with analysis.

38. Sufficient Content to Proceed
    - Decision point.
    - May not be precise.
    - Should have at least three-quarters of the volume of detail originally sought.

39. Fuse Data by Layer
    - Ensure the geospatially-enabled data is organized correctly.
    - Package into the desired HTA data layers called for in the data plan and mission needs.

40. Compile Layers of Clustered Themes
    - Fuse data layers by theme.
    - Example: A hydrology theme might include rivers, wells, floods, and drought.
    - Group data by needed display category within ArcGIS.
    - Build thematic layers - group data together into thematic maps.

41. Clean and Process Data
    - Project, merge, clip, convert file types, fix topology errors.
    - Create metadata if layers are considered foundational to an analysis.
    - Data steward cleans, processes, and prepares data.

C. Analysis Phase

42. Perform Exploratory Data Analysis
    - Explore data to discover trends, outliers, anomalies, missing data and invalid.
    - Methods include histograms, box plots, and probability density.

43. Perform Data Extrapolation/Interpolation
    - Create geospatial data out of existing data through extrapolation or interpolation.
    - Fill in missing geospatial data using statistical tools.
    - Create and populate metadata.
    - Create surfaces to represent missing data (example: Krieging).

44. Evaluate Theme Completeness and Gaps
    - Check results against mission needs by asking:
        - Do the results address the needs and answer the questions?
        - Are there additional data layers or data content needed?
    - Identify missing data required to build a more complete picture of the mission request.

45. More Data Required
    - Decision point based on evaluation results from prior step.
    - Decide whether to initiate additional data collection or proceed onward.

46. Is Collection Required?
    - Decision point.
    - If more data is needed, must decide to use a collector or go back to data gathering (Step #22).
    - Collection is typically a lengthy process.
    - Additional data gathering may require additional guidance.

47. Revisit Mission Needs
    - Revisit mission needs to ensure map and theme information answer the mission question.
    - Normally requires a meeting or presentation of intermediate themes to determine gaps.

48. Refine Hypothes(es)
    - Results may alter hypothes(es).

49. Determine Additional Analysis
    - Explore methods that can be used based on data dimensionality.
    - Example: Explore point pattern, neighborhood, network, or time-series analyses.
    - Focus on correlations, linkages, and patterns among the data sets.

50. Is More Data Required?
    - Decision point.
    - Repeat data needs based on additional analysis.

51. Formulate Conclusions
    - Define the results, observations, and conclusions using annotated graphics, HTA data layers, and appropriate additional analysis (e.g., statistical evaluations).

D. Production Phase

52. Report Descriptive Analysis
    - Package the observations and conclusions using text and GEOINT graphics.
    - Document lessons learned, location of key sources of data, and other wrap-up information.

Appendix D: Acronym List

AMS – Aeronautical Management System

AOI – Area of Interest

ASG – Allied System for Geospatial-Intelligence

CASI – Consolidated Analytical Spatial Initiative

CDC – Center for Disease Control

CI – Counter-intelligence

COCOMs – Combatant Commands

COI – Community of Interest

COIN – Counter-Insurgency Operations

CSG – Consolidated Solutions Group

csv - Comma Separated Values

dbf - Database file

DDMS – Defense Discovery Metadata Specification

DIA – Defense Intelligence Agency

DISCCC – Defense Intelligence Socio-Cultural Capabilities Council

DNI – Director of National Intelligence

DoD – Department of Defense

DTED – Digital Terrain Elevation Data

EAV – Entity-Attribute-Value model

ELINT – Electronics Intelligence

ePODS – electronic Print on Demand System (NGA)

ETL – Extract, Transform, and Load (data ingest)

FBO – Foundation Based Operations

FMSO – Foreign Military Studies Office

GA – Geospatial Analyst

GEOINT – Geospatial Intelligence

GIFD – Geospatial Intelligence Feature Database

GIS – Geospatial Information System

GNPS – Geographic Names Processing System

GPE – Geospatial-Intelligence Preparation of the Environment

GRA – Geospatial Reference Architecture

GRC – GEOINT Research Center

GRLS – Global, Regional, Local and Specific scale
GSIP – GEOINT Structure Implementation Profile
GUI – Graphical User Interface
GWOT – Global War on Terrorism
HG – Human Geography
HT – Human Terrain
HTA – Human Terrain Analysis
HTAPP – Human Terrain Analysis Pilot Project
HTS – Human Terrain System
HUMINT – Human Intelligence
HVT – High Value Target
IA – Imagery Analyst
IC – Intelligence Community
IMINT – Imagery Intelligence
INSCOM – U.S. Army Intelligence and Security Command
JANIS – Joint Army Navy Intelligence Studies
kml – keyhole markup language (Google Earth)
kmz – zipped kml files (Google Earth)
KMM – Knowledge Management and Mining
MASINT – Measurement and Signature Intelligence
MAUP – Modifiable Areal Unit Problem
MCIA – Marine Corps Intelligence Activity
MGRS - Military Grid Reference System
NCGMP – National System for Geospatial-Intelligence (NSG) Geospatial Core Metadata Profile
NDVI – Normalized Difference Vegetation Indices
NEO – Non-Combatant Evacuation Operation
NES – NGA / National Exploitation System
NFDD – NSG Feature Data Dictionary
NGA – National Geospatial-Intelligence Agency
NGA/P – Analytical and Production Directorate of NGA
NGIC – National Ground Intelligence Center
NGO – Non-Governmental Agency
NIIB – NGA Imagery Intelligence Brief
NSA – National Security Agency
NSG – National System for Geospatial Intelligence

NSS – Nautical Safety System (NGA Maritime Data)

NST – NGA Support Team (deployed to customer or mission site)

OCO – Overseas Contingency Operations

OSEC – Operational Security

OSC – Open Source Center

OSINT – Open Source Intelligence

QDR – Quadrennial Defense Review

RFI – Request For Information

RMSE – Root Square Mean Error

SCDWG – Socio-Cultural Dynamics Working Group

SETA – Systems Engineering and Technical Assistance (contractors)

.shp – Shapefile format (ESRI)

SIGINT – Signals Intelligence

SME – Subject Matter Expert

SMTS – Standard Metadata Tagging System

SOCOM – Special Operations Command

SORSRE – Socio-Cultural Source Registry

TIN – Triangulated Irregular Network

TMS – Target Management System

.txt – Text file format

UN – United Nations

USAID – U.S. Agency for International Development

USD(I) – DoD Under Secretary of Defense for Intelligence

USG – U.S. Government

WMD – Weapons of Mass Destruction

.xls – Excel file format (Microsoft)

xml – Extensible markeup language