Field Guide for the Use of Geo-Codes

for
Office for the Coordination
Of
Humanitarian Affairs

In cooperation with and produced by the
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Introduction

Location management has been recognized as a key element for field command and control in military operations for centuries. Harnessing the elements of location management is also a key to safe field operations and effective management of resources for humanitarian activities by the United Nations. This guide is one of a series of "field guides" that provides field officers a reference for improving the use and control of location-based information technology and tools in addressing complex humanitarian field operations.

Field officers should be cognizant of the following major issues in the performance of field activities:

- Literacy of geo-spatial data and technology (GPS, GIS, remote sensing)
- Basic use of maps, reports, and database management software
- Access and review of metadata documentation
- Ability to check and correct geo-codes (P-codes) while on mission
- Procedure for reporting updates regarding field data and locations
- Location of reference sources and technical support contacts

Field officers should encourage sharing of datasets, and descriptions of datasets (i.e. metadata), for the purpose of assisting in coordination and planning activities. By sharing knowledge of datasets among agencies, many benefits follow, such as:

- Knowledge of the existence of a database can prevent duplication of efforts in developing new databases.
- Existing databases can serve as templates for designing compatible dataset for linking archival and new data.
- Standardization of data collection permits multiple datasets to be linked for analysis.
- Use of P-codes in datasets can allow data to be symbolized and mapped using GIS and computer mapping software.

This guide will provide the field officer with a basic introduction to the elements necessary for establishing an environment of coding and sharing with spatial data.

How to use this Guide

Information provided in this "field guide" is necessarily brief to provide a general reference for field officers tasked with performing humanitarian-oriented duties. The guide provides an overview of the use of geographic coding (known as geo-codes) or position codes (known as P-codes), which define unique identification numbers for areas and facilities in an operating theater. It also provides brief background on the valuable use of metadata to define the characteristics of database information, including P-codes, to determine the quality and appropriateness of any dataset and its use in the field. Field officers must be aware of the limitations as well as the usefulness of modern geo-based information systems as these systems can and will help to save lives and significantly improve the capacity to manage complex and chaotic information while in the field. The level of development for P-codes and county databases will range tremendously from country to country. Many areas have only received attention regarding location datasets due to recent crises that strike through famine, flood, or armed conflicts. Therefore, field

officers can expect to find a mosaic of schemes and data resources. A seamless and complete database will prove to be the exception in the field, although significant progress is being made by the United Nations (UN) agencies. Referral information and acronyms are listed at the end of this document.

What are Metadata and Geo-codes (P-codes)?

In the challenging environments associated with delivery of life sustaining support systems for humanitarian field operations, precise knowledge about the location of resources, facilities, administrative boundaries, and hazards is of paramount importance, and often critical. While significant advances have been made in providing regional databases for use by field staff, many information gaps will be encountered and data collection activities are best assumed by those most closely associated with the utilization of these data. Field officers must therefore be aware of the framework for using geo-coding and spatial (map based) data and develop competencies in handling spatial information resources, especially those of differentiated quality or completeness. Metadata and geo-codes (P-codes) represent two important resources for field officers information.

Across the globe there is a great need for a consistent set of geographic data that can be shared with the international community. Geographic data, in the form of maps and digital databases for location of points, features, natural and social phenomena, and logistic-oriented information, are vital for the execution of many United Nations operations. Standards for geographic data standards are being developed to provide a basic set of field tools for coordinating information among different organizations. However, the existence of a comprehensive and complete database of each country's geographic features will not be witnessed for many years in the future. There are many dedicated individuals and institutions that are focused on the creation and use of a consistent set of administration and feature coding schemes to form the basis for P-codes and provide the consistent approach to documentation of all database elements is the purpose of metadata. Although no universal standard exists, rapid advances in these development efforts can be expected.

Metadata is a term normally understood to mean structured data documentation about databases, especially those that can be used to help support a wide range of operations. Fields or sections within the metadata documentation file might include, for example, the creator and agency of the map or database, the mapping projection used, accuracy of the data in terms of horizontal or vertical accuracy, when the data was collected or verified, and other descriptions of the information resource that will enable a field officer to determine if a specific dataset can be used appropriately for his or her application. A good analogy for metadata is the library card-catalog system. Without the card catalog, knowledge of which books exist and where they are located in a library would be a seemingly impossible task. Metadata functions in much the same way as the card catalog by providing essential background information regarding mapping or other geo-locational database attributes.

In the context of digital resources, there exist a wide variety of metadata formats that have been developed over the past ten years. Viewed on a continuum of increasing complexity, these range from the basic records for automated Internet search services, through the highly specific formats like the FGDC (Federal Geographic Data Committee)

Content Standard for Digital Geospatial Metadata, and the GSDI (Global Spatial Data Infrastructure) Cookbook. Software vendors for GIS (geographic information systems) and computer mapping technologies, commonly provide easy-to-use metadata documentation guides and access programs. The issue for field officers is to become familiar with the existence of metadata and to inquire frequently as to the source and methods for the creation of the data that forms the basis for field decisions and planning. The old adage of "garbage in-garbage out" remains a truism even in these times of field automation and therefore the field officer must maintain vigilance over the information resources used in the performance of field operations; even if the data comes from a reputable UN source.

Geo-Codes or P-codes are unique geographic (geo) identification codes, represented by combinations of letters and/or numbers to identify a specific location or feature on a map or within a database. For specific place, point, or positional locations, the geo-codes have come into common usages as P-codes (abbreviated for Place-code). These terms can be essentially interchange as long as one recognizes the focus on "position or place" for P-codes. They are also used to provide unique reference codes to classify settlements or administrative boundaries. Experience has demonstrated that the use of P-codes can create a "common language" in countries or environments with different ethnic groups, agencies, and languages or whenever a unique way to translate the names from different alphabets does not exist. Access to a huge range of information on such items as population dynamics, housing damage, landmines, and agriculture and assistance distributions can be readily obtained and shared with common coding systems. Thus, a coding system should be used that will allow for future aggregation or disaggregating at various administrative levels and facilitate the dynamics as settlements grow and conditions change. As P-codes are introduced and applied, all the data referring to settlements or features belonging to a settlement will have a unique code to identify them, like schools and health clinics in a specific area. This common coding scheme can provide therefore, for any organization to use data generated by any other institutions, thereby avoiding repeating surveys and redundant data collection.

The P-code (or Geo-Code) System

By establishing an agreed upon list of places and administrative units and developing a simple code for the identification of each, the UN's Humanitarian Community Information Centres (HCIC) have discovered important benefits. Efforts have been initiated to ensuring a global, or universal, system of P-codes through the volunteer efforts of many UN agencies. The Second Administrative Level Boundaries (SALB) project represents a first attempt, proposed by the Administrative Boundaries Task Group of the United Nations Geographic Information Working Group (UNGIWG). The SALB project has built upon existing administrative boundary data sets to meet the general need for a consistent global coverage down to the second administrative level within the context of the United Nations Geographic Database project and UNGIWG. This guide will provide a brief overview for the coding system and describe the purpose of the adoption of this approach to development of a common set of P-codes.

Consensus has not been developed regarding the perfect model for geo-coding however; the communities of users that have been working towards this universal goal have been gaining common experience from the various hot spots over the past few

years. The example that follows has been reviewed by multiple UN agencies and non-governmental organizations (NGOs) and has proven to be an excellent test case, even though there remain concerns about the universal applicability.

Geo-codes Applications

By recording geo-codes (or P-codes), data collection can be immediately beneficial to all organizations by removing redundancy and wasteful replications and significantly extending the use of any individual or agency data. This will also promote sharing of data, even when using multiple vendor software based on different types of relational databases, like spreadsheets or word processors, because the P-code contains all the necessary information for locations and boundaries. The P-codes stored in a database are designed to be developed and shared among multiple agencies and a wide range of analysis undertaken based on the common framework of geographic locational attributes. P-codes represent an important component or field in the metadata used for humanitarian affairs.

Applications, based on geo-coding, include area inventories and status reports as defined for specific locations and administrative boundaries. Maps and reports can be generated in an hour or less those document and communicate the relationships between humanitarian basic demands (food, water, shelter, medicine, and security) and the availability of resources within various measures of distance. Maps and reports can be generated, if the data have been geo-coded, to define linear distances to assistance centres, or using radius measures to define the portion of the population that has potential access to such centres. The use of buffer zones, nearest neighbor, or overlay tools in GIS, allows for an array of analyses that can quickly identify the priorities for field actions. Today's technology for geo-coding combined with database management, using GIS management software, enables field officers to perform complex analytical planning processes in hours that would take weeks or months to perform using conventional methods. This capacity, in combination with the combinatorial benefits of sharing and exchanging datasets with multiple agencies provides an unparalleled environment for rapidly confronting and implementing humanitarian activities.

Data linkage, records, spatial analysis

The key to enabling multiple records within automated database management systems and GIS to interoperate is the definition of geo-coded fields. All records should use geographic locations, whether using latitude and longitude, grid coordinates from a map base, or geo-codes as defined from P-codes. Modern relational database software can use this link to geography as a basis for sorting and combining data from different sources. When captured in GIS or spatial data management systems, the geo-coding allows for a vast array of spatial analysis. It has been well documented that >80% of all information resources have spatial linkages. Spatial analysis capitalizes on this phenomenon and provides field officers with the capacity to ask questions about what is going on where. Field officers are encouraged to seek out GIS experts and to further investigate the range of analytical and visualization methods and tools available for humanitarian applications.

How to generate P-code (or Geo-Code) sets

UN agencies have begun to rely upon basic geographic data standards as prerequisites for creating coding schemes to ensure database compatibility. As multiple UN agencies coordinate with other UN agencies, international relief organizations, and country agencies, a common geographic language is essential. Office for the Coordination of Humanitarian Affairs (OCHA) field officers should consult with the New York Headquarters staff prior to embarking on missions to receive the latest information on the status and location of the P-Code reference standards or database. In country Humanitarian Information Centers (HIC) will be well versed in the conditions and existence of such coding standards. The following information is provided to better acquaint field officers with the differences and range of P-code activities, while recognizing that rarely will field officers be tasked with the creation of the coding schemes. Rather, it is envisioned that field officers will be literate users of the P-codes and be fully prepared to take full advantage of these automation and coding scheme advances for management of assets and implementation of field operations. **Remember, there are no universal standards in existence therefore, expect to encounter variations for all of the standards references presented in this guide.**

Field officers will discover that several countries and organizations may have already established a coding system for their administrative and feature datasets. Currently, the Second Administrative Level Boundaries (SALB) project has created a database with SALB codes and maps for 84 countries with the first and second level administrative units names. These lists are representative of the situation observed in January 2000 and have been validated by the National Mapping Agency (NMA) of the respective country and includes the SALB codes. The Democratic Republic of the Congo, Ethiopia, Senegal, and Swaziland are but a few of the countries listed, see (http://www3.who.int/whosis/gis/salb/)

Field Realities

Obviously all countries are not included in the SALB. However, it should be recognized that various national and international agencies are working with each country to develop Geo-Code/P-Code standards. For example, Kosovo has P-Codes developed by the Humanitarian Community Information Centre (HCIC) (http://www.reliefweb.int/hcic/maps/pcodes.htm). Somalia has developed P-codes by the Data and Information Management Unit (DIMU) of the United Nations Development Programme (UNDP) based on the Kosovo model. And recently UNHCR (RSL), WFP (VAM), and DEPHA have been working on the development of a regional P-code database for the seven African countries that comprise the Horn of Africa.

For those countries without a known coding scheme, the P-code generation is designed to avoid the frequent problems associated with searching and sharing place names. Computer-based sorting, merging and cross-referencing, in places with different place spellings or misspellings, can best be accomplished through established P-code standards to facilitate exchange of data between spatial data systems, and the retrieval of data as well as the creation and use of relational and object-oriented databases for reports and analysis.

Basic Steps Approach

In the absence of any P-code standards, or where significant gaps exist in the geographic coverage for an area, the basic steps involved for the creation of a common system are:

- Using a common base map, delineate the major administrative boundaries and develop a single set of P-codes and place names down to the Incremental Settlement Numbers. Format for both map and database display. Distribute in a widely accessible database format (i.e., Excel, Lotus 123, and MS Access) and map sheets.
- Create and publish procedures for documenting comments, field updates, and revisions.
- Using the National Mapping Agency and other primary coordination forums establish a small working group of experts in mapping, GIS, and Database (DB) to coordinate and schedule the development and implementation of the coding scheme.
- Prioritize the development of the coding scheme based on mission critical areas and shared database systems among agencies.
- Once a common protocol is in place for P-codes, coordination efforts should be continued among the small working group to ensure regular updating of the P-codes as well as addressing the coordination challenges for establishing a common digital database of compatible and cleanly intersecting boundary files.

Formula for Coding Scheme

When faced with the requirement to generate a coding scheme, the creation of P-codes requires two main datasets. These datasets can be obtained by locating and combining various data resources that may be obtained from various field organizations, national agencies, and UN Headquarters. This is not a trivial task, but the primary datasets are:

A) Polygon data on administrative divisions of the country. Polygon data on administrative divisions of the country could be provinces, districts, states, etc. Most available datasets on administrative units are available only to the third level, i.e., 1) country, 2) province, and, 3) district; and

B) Point data on settlement locations. US NIMA has a dataset of almost 26,000 places.

The following steps represent a generic approach. No UN or international standards currently exist. (See Figure 1)

Step1: Adminstration Level 1-International Boundary Verify that the country does not have a coding scheme. While this may appear straightforward, the reality is that field officers will often encounter resistance to sharing or acknowledgment that certain databases exist. Prior to mission deployment, a checklist should confirm the existence and status of P-codes by the UN agency responsible for deployment. If no scheme exits then determine the two (2) alphabetic digits, which define the country code which is expressed as the **Administrative international boundary** (**Administrative Level 1)** of

the country from either the SALB (http://www3.who.int/whosis/gis/salb/ or the US National Image and Mapping Agency (NIMA) (http://www.nima.mil/gns/html/).

Step 2: Administrative Level 2-Province/Municipalitities Determine the first level administrative boundary subdivisions; this is **Administrative Level 2 – Province/Municipalities**. This two digit (2) alphanumeric code should uniquely identify a primary administrative division of a country and can be obtained from either the SALB (http://www3.who.int/whosis/gis/salb/ or the US National Image and Mapping Agency (NIMA) (http://www.nima.mil/gns/html/fips10-4.html)

Step 3: Administrative Level 3 –District/ Zone- Using national or international sources, the two (2) digit numeric code will need to define the subdivision of a first-order administrative division (Step 2), such as a district in the Kenya. Keep in mind that these are politically defined boundaries that can and will be changed through legislative and political shifts in national affairs. Metadata is important as a method for recording why specific boundaries were selected.

Step 4: Administrative Level 4 – Territory/City- Using a two (2) numeric digits, the third level, administrative boundary that have been subdivided from District/Zone (Step 3) are identified. At this level of boundary delineation, there will be many discrepancies in specific boundaries. Field officers are recommended to record, using color-coded hard copy maps, the boundaries of controversy and make specific note of these disputed areas in the metadata documentation.

Step 5: Administrative Level 5- Village- Unique two (2) digit codes should be assigned to each village. Use of gazetteers and other mapping resources can help facilitate this coding assignment activity. Notations of different spellings should be included in the table listings of village names listed within each Administrative Level 4 area.

Step 6: Incremental Settlement Number- Each specific settlement, including all refugee camps and other temporary settlement zones, will be assigned a unique three (3) digits number to finalize the code of each area. The use of three digits provides for flexibility for including key features in an area, such as hospitals, schools, and food warehouses that may be located within each settlement. **Please note that with the advent of GPS field receivers, specific identification codes can be augmented for each settlement site and facility**. Field officers will need to generate an extra field in the locational tables to record the addition of longitude and latitude digits. While this may seem duplicative initially, the maintenance of tables with cross listings for P-codes and specific GPS coordinates for key features or facilities will prove of tremendous advantage for an array of field planning activities and can be readily imported to any GIS software for map and display purposes.

In all of the above steps, if no known data exists, then use zeros as “place holders”, until a coding value is established, or later assignment of a code number can be generated based on a logical sequence.

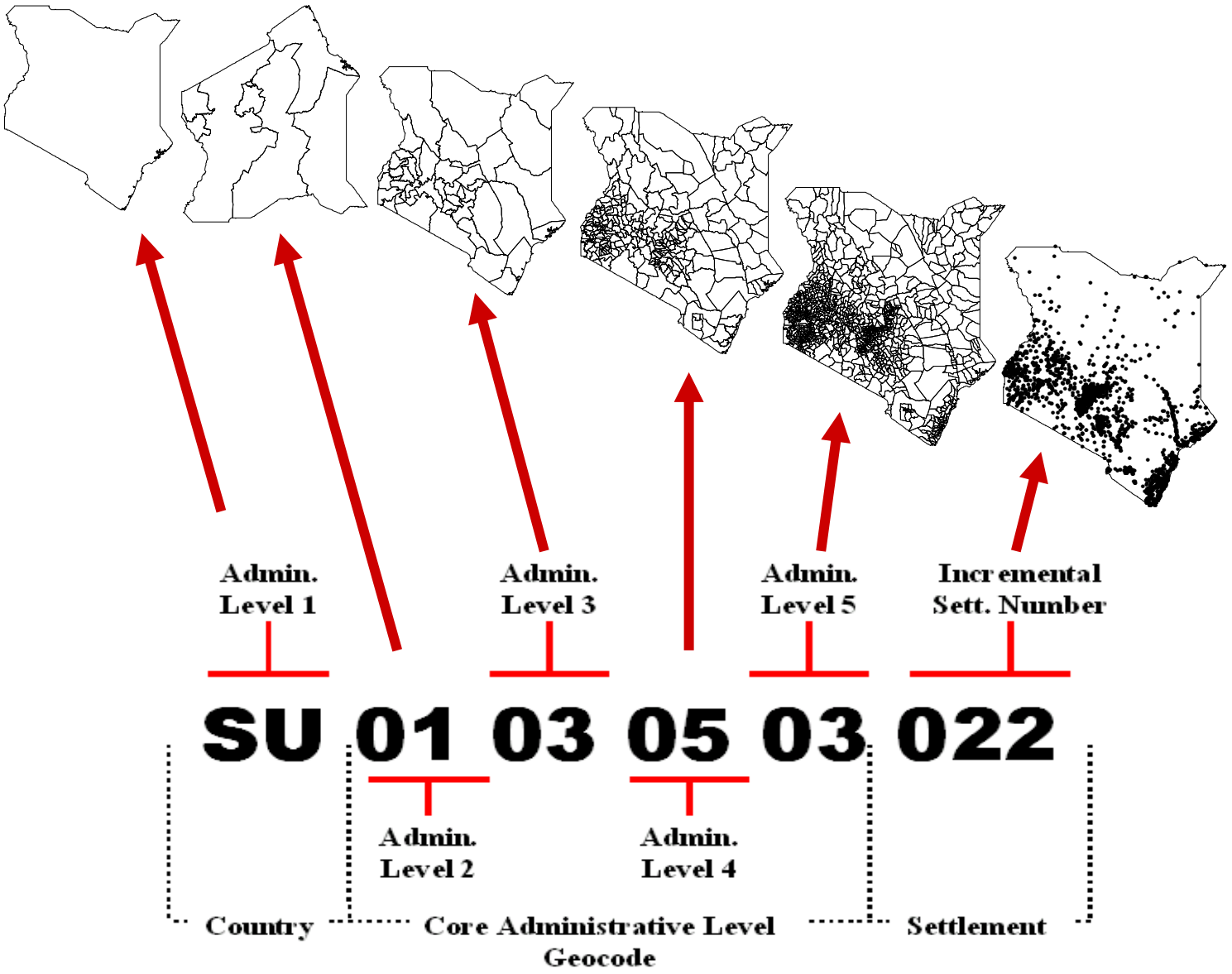

Figure 1. Example of P-code labeling strategy

UN Case Studies of Different Country Coding Schemes

P-Codes for Somalia

It is very common in Somalia to have one town with several names and ways to spell it. This inconvenience can be overcome by using relational databases that link the different names together. However, this is possible only if a central database is established and maintained. This situation is compounded whenever data should be shared and field-level data managers handle their own datasets.

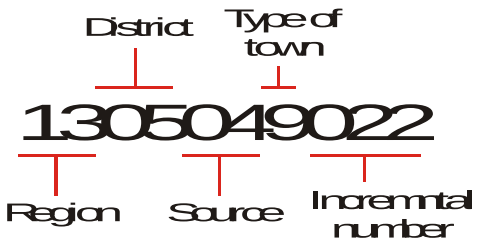

Figure 2 Somalia P-code Scheme

The P-codes created for Somalia are related at the administrative areas officially endorsed by the Government of Somalia in 1986 and are composed by a unique number of 10 digits, Figure 2. [Note the absence of the first two digit country code previously defined under Administrative Level 1] The 10 digits store data about the region and district where the settlement is located, the source, data on the type of settlement and a progressive subset. Therefore, not only do the codes offer a tool to link different sets of data but, most importantly, they make it possible to extract data related to different administrative areas or topics by querying subsets of the codes. This allows users who do not have GIS software and skills to extract and manipulate data according to spatial criteria. Although 10 digits could seem too long to be commonly used, the potential of desegregating data at any moment largely overcomes the annoying length of the codes. This peculiar way of storing data in a single code ensures the unique capacity to maintain a lot of information linked together to the settlement unique code. Since the P-codes contain geographical information, they can be translated in barcodes to be printed into labels. A hand bar code reader connected to a computer can detect the destination and support fast delivery.

Digit 1-2: Region code. The 18 regions have been numbered starting from the northwest down to the south. The numbers of this subset do not start with 1, as usual, but rather with 11. This thus always maintains the number of digits to 10. As a matter of fact, processing a number like 0245968870 (that has 10 digits) into a spreadsheet, results in 245968870, which is a number composed of 9 digits. The relation between codes and regions is depicted in Table 1. The following tables show the relations with the other subsets of digits.

Digit 3-4: District code. Each district has an incremental number that starts with the district having the regional town. The following are in alphabetical order.

Digit 5-6: Source code. These two digits provide information on the source used to capture the information of the settlements. At present only four sources have contributed to the database, but more will be available in the future. Since data has been acquired both from field surveys and bibliography, knowledge of the sources is a crucial element to evaluate data quality and accuracy. The sources that contribute to the database are the following:

SOURCE	YEAR OF DATA ACQUISITION	ESTIMATED SPATIAL ACCURACY	NUMBER OF RECORDS	MAIN WEAKNESS
Digital Chart of the Word	1980s	Maximum error encountered versus topographic maps 1.8 Km	6	Poor spatial accuracy
Gazetteer of Somalia	1987	Maximum error encountered versus topographic maps 0.75 Km	1121	Includes in the dataset small entities like farms or nomadic huts that sometimes do not exist anymore
Topographic maps	From aerial surveys 1978, revised 1986	Maximum estimated error 150 m	3041	The dataset does not include new settlements
Field surveys	Mainly 1996-97	100 m	350	

Table 1 Somalia Source Code

Digit 7: Type of settlement. This digit includes information on the type of settlement, which is often linked to its size. [Note that this is discussed as a two-digit code in generic descriptions previously discussed]

Digit 7-10: Incremental number. This subset identifies the unique code in a given Region and District. The number set starts with 000 for each regional or district town and proceeds in alphabetical order. To accommodate more settlements in the future and to maintain the alphabetical order the increment has been set to two.

P-Codes for Afghanistan

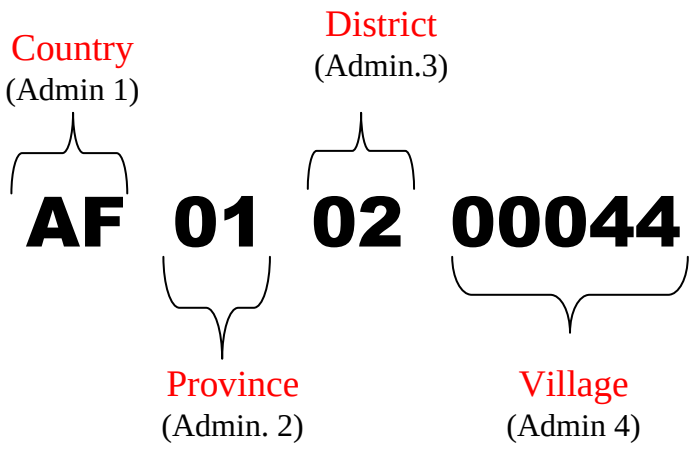

Figure 2 Afghanistan example of Geo-Code

The scheme was developed by a coalition of GIS experts and field officers from OCHA and other UN agencies to rapidly developing spatial data information for the Afghanistan humanitarian response activities of 2001.

County- (Administration Level 1) 2 Alphabetic Digits, Administrative international boundary of the country

Province- (Administration Level 2) 2 Numeric Digits, First level administrative boundary subdivisions.

District- (Administration Level 3) 2 Numeric Digits, Second level administrative boundary subdivided from Province.

Village- (Administration Level 4) 5 Numeric Digits, Unique number assigned to each village. Country, Province and District levels represent geographic regions and Village data are point locations thus the term Geo-code is used in place of P-Code, which implies "place code" or point locations only.

Horn of Africa

UNHCR Regional Spatial Analysis Lab (RSAL), WFP (VAM) and DEPHA are currently working on the development of a regional coding system for the Horn of Africa. This coding scheme was adopted from UNDP Somalia and Kenya, with slight modifications, in an effort to standardize coding across organizations. The spatial data used for the coding is adapted from USAID/FEWS.

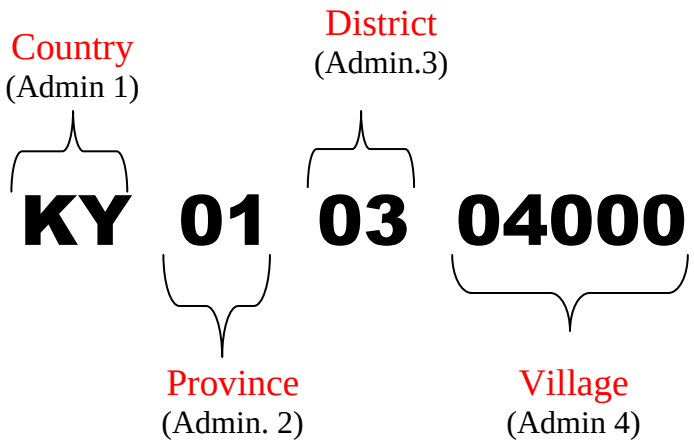

Figure 3 Horn of Africa example of Geo-code

Digits 1 & 2: Country- These first two digits are alphabetic and were derived by the National Image and Mapping Agency (NIMA) for all countries in the world.

Digits 2 & 3: Admin. Level 2- Regions have been numbered starting from the Northwest down to the South. See the "S" method depicted in Figure 4 that is used for assigning codes from North to South. This method allows users to know the approximate location of an administrative level just by the code. (Example: a code beginning with 01 would mean the administrative unit is in the northwest. If the next digits are 01 as well you would know that the next level administrative unit is situated in the northwest of the previous level). Two-digits are used because in some counties there are more than 9 unique administrative boundaries.

Digits 4 & 5: Administration. Level 4- Each county has an incremental number that like, Administration Level 3, begins from the northwest down to the south. Two-digits are used because in some counties there are more than 9 unique administrative boundaries.

Digits 6 & 7: Administration. Level 5- Each county has an incremental number that like, Administration Level 4, begins from the northwest down to the South. Two-digits are used because in some counties there are more than 9 unique administrative boundaries.

Digits 8, 9 & 10: Incremental Settlement Number- These last three digits are assigned slightly different from the previous administrative boundaries. Settlements are assigned unique numbers beginning from 001, but unlike the "S" method used for administration levels, they are sorted alphabetically by the highest resolution. Other fields may be added to settlement data objects/tables such as a field for settlement type (city, town, village, IDP camp etc.)

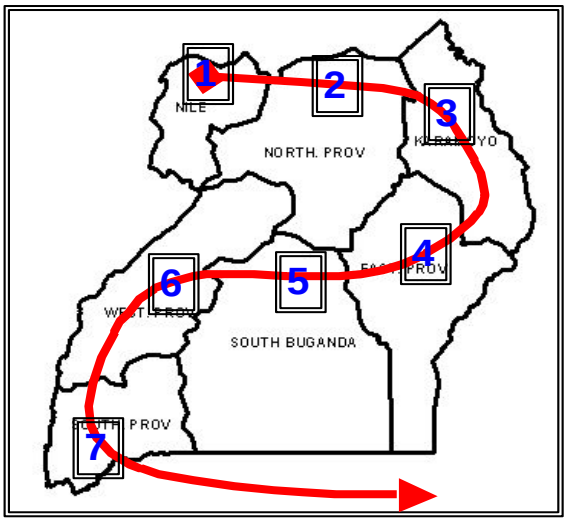

Figure 4 Horn of Africa scheme to determine administration Level 2

List of Figures and Tables

Acronyms

DB	Data Base
DEPH	Data Exchange Platform for the Horn of Africa
DIMU	Data and Information Management Unit (UNDP)
FGDC	Federal Geographic Data Committee (USA)
FIBS	Federal Information Processing Standards (USA)
GIS	Geographic Information Systems
GPS	Global Positioning Systems
GSDI	Global Spatial Data Infrastructure
HCIC	Humanitarian Community Information Centres- UN
HIC	Humanitarian Information Centres
NGO	Non-Governmental Organization
NIMA	National Image and Mapping Agency (USA)
OCHA	Office for the Coordination of Humanitarian Affairs
P-Code	Placement Codes
RSAL	Regional Spatial Analysis Lab
SALB	Second Administrative Level Boundaries
SEDC-CIESIN	Socioeconomic Data and Application Center-Center for International Earth Science Information Network
UN`	United Nations
UNDP	United Nations Development Programme
UNEP/GRID	United Nations Environmental Programme/Global Resource Information Database
UNHCR	United Nations High Commission for Refugees
UNWIG	United Nations Geographic Information Working Group
VAM	Vulnerability Analysis and Mapping
WFP	World Food Programme (UN)
WHO	World Health Organization (UN)

References

Standards

Standards for P-codes have been derived from a variety of international organizations. Sources for the development of these standards for reference have included the following:

FIPS PUB 10-4. (Federal Information Processing Standards) Issued by the National Institute of Standards and Technology (USA), at: http://164.214.59/gns/html/fips/fip10-4.html .

ISO 3166-2, Part 2: Country Subdivision Code. Codes for the representation of names of countries and their subdivision

SEDAC-CIESINS Girded Population of the World (GPW) data set, the distribution of human population is converted from national or subnational units to a series of georeferenced quadrilateral grids at: http://sedac.ciesin.columbia.edu/plue/gpw

UNEP/GRID. Population distribution database at http://grid2.cr.usgs.gov/datasets/datalist.php3

USGS International Program/FEWS NET A collection and processing of satellite data that provide the spatial coverage and temporal frequency necessary for monitoring both vegetation condition and rainfall occurrence throughout the entire African continent at: http://edcintl.cr.usgs.gov/fewsnet.html

WHO-World Health Organization. Coding scheme, need permission to access, at: http://www3.who.int/whosis/gis/salb

.

Contacts

AFGHANISTAN. Description of GeoCoding System. Humanitarian Information Center for Afghanistan (HICFA) http://info@hic.org.pk**)**

HORN OF AFRICA. Andrew Alspach. UNHCR Regional Spatial Analysis Lab (RSAL), P.O. Box 43801, Nairobi, Kenya

SOMALIA Ben Watkins email: haic.workshop@undp.org

SOMALIA. CD_ROM. DIMU/UNDP Somalia P.O. Box 61950 Nairobi, Kenya
Includes maps of all the settlements of Somalia and searching tools to identify settlement positions and P-codes.