Chapter IV: Skill sets and needed capacities

To make fuller use of demographic data in spatial frameworks, and in applications that are non-demographic, greater engagement between demographers and other users of demographic data are needed. Towards that end, it will help if non-demographers have an appreciation for the types and limitations of demographic data. And, similarly, of course, it will help if demographers gain a better understanding of the disciplines in which they aim to do interdisciplinary work. Therefore, demographers, statisticians and planners who work in national statistical offices need to become equipped with the skills required to overcome challenges that arise when combining population data – whether from censuses or surveys – with environmental data useful for describing or predicting climate change hazards – whether derived from satellites or other spatial analysis.

While some of the skills necessary to integrate population data with environmental and climate change-related data are new, others are not. Even the new skills are increasingly becoming available to non-specialists. These skills and some resources on publicly available data and tools are identified below.

National skills and capacity to do necessary analyses

Those producing and analysing demographic data in national statistical offices must gain geographic information skills (GIS) to work with spatial data. The easiest entrée into GIS is to gain competency with vector-data, though climate-data may be raster-data and some statistical analysis will be enhanced by converting all data layers to raster-format.

There are some demands on infrastructure mostly in the form of computational capacity but these are relatively minor, and increasingly getting smaller as computers advance, compared to the human resources. Nevertheless, a national data infrastructure that has spatial data at its backbone needs to have servers and networked computers to share both data and software applications. GIS software ranges from costly to free open-source. Which data products are best depending on the needs of a particular agency. Adding GIS skills to an already well-trained work force is not a major commitment; however, if the NSO staff is already under-trained, adding these new skills may be a considerable strain.

Furthermore, the skills needed to link spatial data differ from those needed to create thematic maps, and these differ from those needed to generate zonal statistics. All of these skills are necessary. The first set of skills (joining data, and perhaps some geo-processing) is a prerequisite for linking two data sets, or even for linking non-spatial tables with spatial data with a set of codes or names that can be matched. The second (symbolizing data) is necessary to visual the data, make informative maps, and shade those maps with relevant thematic overlays. The third (spatial analysis, zonal statistics) is necessary to generate population at risk estimates by various geographically specified zones.

The implementation of new skills is influenced by local and national data cultures. For one, spatial data need to be shared within and between agencies or parts of agencies. Yet, spatial data, much more so that census tables, are often considered propriety data and tend to be severely restricted, even within a given country. This practice places severe limitations on analysis, informed policy making and participatory decision-making within different branches of government or civil society. Some countries overcome data restrictions by making data – even within agencies of NSOs – available through data enclaves (RDC REF) where census micro-data and any combinations of their spatial information may be used.

Sharing is not just limited by data restrictions. Lack of interaction between government agencies can prevent joint work, both in formal limits on cooperation and in lack of understanding of the substantive analyses that need to be conducted. As Chapter II suggests, doing the right analysis with the right outputs is critical in making the data work for policy. Particularly for NSOs, understanding what the Ministry of Environment or other Ministries need is critical. Having the flexibility to deliver results using varying geographic units is a very important skill in this regard. Setting up an institutional setting – like a data lab – in which exchanges can occur, data analysis can be conducted across government ministries, and specific results can be requested of the NSO is one possible option for greater integration.

Data delivery tools

Building sophisticated capacity for creating, managing and analysing spatial data may be more than many NSOs need or can accommodate. Fortunately, some NSOs create their own data delivery and analysis tools. For instance, Statistics South Africa has developed a mapping platform (http://mapserver2.statssa.gov.za/geographywebsite/) that

integrates their census data with a wide variety of other datasets. With World Bank support, Malawi has also created a similar visualization platform (website about to be launched).

Software for population data processing and data dissemination

REDATAM

*To estimate populations at risk, disaggregated data at lower geographical levels such as districts, counties or even enumeration areas is necessary. On the other hand, population and housing censuses seems to be the right data source to analyze statistically and spatially vulnerable population. Specifically for analyzing population structure, migration patterns, education level, indigenous people belonging, household conditions, Unmet Basic Needs, fuel for cooking, garbage disposal, among other characteristics. However, these data has always been sensible in nature, NSOs worlwide can't provide the micro data to third parties because of legal limitations. But, Redatam (**REtrieval of DATa for small Areas by Microcomputer Redatam+SP**) a free software developed by CELADE-Population Division of UNECLAC (www.cepal.org/reatam) can process and tabulate census micro data without providing the identification of individual or household records maintaining statistical confidentiality at all times.*

The software is particularly efficient for processing information for small areas as required by local-level planners and analysts in the public and private sectors. Among the most outstanding characteristics are: its simplicity to manage the system in a user-friendly way, even through the Internet, its speed (can process one million records per second for a frequency and almost 500,000 records per second for a tabulation); the facility for creating indicators and adding them permanently to the database within the program; the hierarchical structure in which the databases are organized in Redatam allows for the explicit processing of different data levels, that is, housing units, households and individual level characteristics, easily combined to derive indicators at the most disaggregated geographical levels, counties, blocks or enumeration areas (EAs) for further exportation to a GIS.

Furthermore, the Redatam+SP Web Server provides the general public with an interactive system that allows for the on-line processing of any census microdata database over the Internet (www.redatm.org). This is one of the major efforts of CELADE to provide technical support to the

national institutions all over the world that wants to re-engineer its information dissemination program to depend on the Internet as its basic delivery vehicle.

The Redatam+SP capabilities are built around a standard kernel identified as the Redatam+SP statistical engine. This highly efficient set of routines is used to create or import databases into a proprietary format —one of the security features of the system—, to produce required outputs and to generate new variables to be aggregated permanently to the database. External databases are generally converted to the proprietary format that compresses, encrypts and inverts the original data source in order to combine efficiency and confidentiality of information.

Therefore, the Redatam package permits in-depth population and demographic analysis based on census databases or other data sources. It is not a sophisticated statistical package neither a GIS and while it is a highly customizable tool for countries, and can produce statistical output tables and draw simple maps at a lower geographical levels, at present, it is not a fully-flexible tool for use with climate or other geographic data because it is not possible for users to upload and overlay geographic layers of interest to the system. It is better to use it as a population indicators producer that feeds a full fledge GIS or statistical package.

DEVINFO

DevInfo (www.devinfo.org) and the related CensusInfo tool are another means to map survey and census data. These tools show subnational detail of preset characteristics from the underlying micro-data (for surveys) or aggregated indicators (for the censuses). (Time series views are shown as well for the census data for a limited number of variables.) Some additional data layers are shown, but these are not supplied by the user. Furthermore, user supplied geographic data cannot be accommodated.

These tools offer much promise, but to be fully useful in the context of climate change these tools will need to preload climate zones. Some additional programming would be required to create summaries, if not zonal statistics of populations at risk, by these zones. Since REDATAM have micro-data on the backend, at least the creation of these summaries may be a fairly straightforward proposition on the part of

programmers. This would go a long way simplifying the arduous requirements of data integration and estimation of zonal statistics. It will not produce all the necessary output that every local or international user would want, but it would reduce substantial burdens on municipal and local agencies and help place demographic data for the purpose of climate adaptation in many of the agencies who need it in the short run.

Skill- and institution-building steps:

1. *Develop a national data infrastructure that integrated geographic information systems. While this may sound daunting, the hardware necessary to build these kinds of facilities is not substantially different than standard hardware, and software is readily available.*
2. *Ensure adequate human resources through a skills needs assessment and training programmes to supplement existing staff capabilities. Liaising with local and regional educational institutions would contribute to this step.*
3. *Consider developing a data lab that cuts across government ministries and departments for multi-sectoral analyses.*
4. *Focus on the ability to generate analytical results for different geographic units, including census units, administrative boundaries, catchment areas, climate exposed geographies, and others.*
5. *Explore the interests and needs of a range of potential users of the results, not only within government but also including academics, NGOs, local leaders, and organizations representing key populations at risk such as small-holder farmers and urban slum dwellers.*

SUGGESTED RESOURCES

SPATIAL SKILLS

Where to Start:

A basic introduction to geospatial information systems in an important part of making demographic data relevant in a spatial framework. The resources below contain tutorials basic "how-to" information.

What is GIS?: www.gis.com
Introducing GIS: http://linfiniti.com/dla/
Advice, lookups, and tutorials: http://www.csiss.org/GISPopSci/resources/cookbook/

The following resources contain on-line GIS – where reference maps and some additional layers – are available for visualization. These on-line applications are a good way to become familiar with some of the features of a GIS and to help users articulate their data requirements.

Google Earth: http://earth.google.com
Microsoft Virtual Earth: http://maps.live.com
NASA's World Wind: http://worldwind.arc.nasa.gov/

Software:

GIS software is a fast-growing area of software development. Software packages include a range of operations, with some specializing in visualization and geoprocessing while others specialize in spatial statistics. Statistical packages, such as STATA and SAS, include geostatistical add-ons and basic visualization features, but they are not primarily oriented towards spatial data and are not listed below. Additionally, software that primarily deals with raster data and image processing (ENVI, Erdas, and many others) is not included below.

ArcGIS (Largest commercial provider): http://www.esri.com/software/arcgis/index.html
MapInfo (An alternative commercial GIS software package): http://www.mapinfo.com/
Manifold (A simple, low cost GIS commercial package): http://www.manifold.net/
QGIS (A free, open source GIS package): http://www.qgis.org/

GeoDa (A free, geostatistical package): http://geodacenter.asu.edu/
R (A free statistical package with lots of spatial capabilities): http://www.r-project.org/
J-Earth ???

Other Helpful Tools and Links:

Often transformation of data and basic geo-reference of new spatial boundaries are needed to make population data relevant in a spatial framework. Those activities may require finding alternative geographic names, latitude and longitudes, converting map projections, or simply finding a more suitable color palette in use for a particular map. These miscellaneous resources are a good starting point:

Geographic name look-ups:
http://earth-info.nga.mil/gns/html/
http://www.getty.edu/research/tools/vocabularies/tgn/index.html
Spatial scales, resolutions, conventions, etc:
http://www.geog.ubc.ca/~brian/rules_of_thumb/index.html
Cartography tips:
http://soa.utexas.edu/crp/gis/tips/carto-tips.html
Geographic measurement converter:
http://www.beg.utexas.edu/GIS/tools/index.html
Map Projections:
http://erg.usgs.gov/isb/pubs/MapProjections/projections.html
Radical Cartography: http://www.radicalcartography.net/?projections
ColorBrewer: http://www.colorbrewer.org

Data access & downloads& Tools

Users may find themselves in need of spatial data. Even within different departments of national statistically offices, sometimes the easiest way to get data is from an on-line international data provider. This is usually not the case for very local information, for example, at the sub-city scale. The following list of examples includes global spatial data resources only.

AdministrativeBoundaries:
ESRI data collections: http://www.esri.com/data/index.html
Global Administrative Areas: http://www.gadm.org/

Environmental Data:
UN Environment Programme's Geospatial Data Portal: http://geodata.grid.unep.ch

UN Geographic Support Team: https://gist.itos.uga.edu/& http://www.un-spider.org/
Climate: portal.iri.columbia.edu/
Dartmouth Flood Observatory: http://floodobservatory.colorado.edu/
Low Elevation Coastal Zone: http://sedac.ciesin.columbia.edu/gpw/lecz.jsp
Emergency Disasters: http://www.em-dat.net/links/disasterdbs.html

Population Data:

Global Population & Urban Extents: http://sedac.ciesin.columbia.edu/gpw
Global Poverty and Mortality: http://www.ciesin.columbia.edu/povmap
Demographic Health Surveys: http://macroint.mapsherpa.com/statmapper/
IPUMS (historical census microdata): https://international.ipums.org/international/
The AfriPop Project: http://www.afripop.org/
The AsiaPop Project: http://www.asiapop.org/

On-line data tools and mapping applications:

Some users will find that there data needs may be met by on-line mapping applications. These tools tend to delivery data tables and maps images, but they do not allow for downloads of spatial data or tabular data with spatial identifiers. These resources similarly tend not to allow for uploading of geographic or tabular data to be used within the application.

Redatam http://www.eclac.org/redatam/
DevInfo http://devinfo.info
Demographic Health Surveys: http://macroint.mapsherpa.com/statmapper/
SEDAC's Population Estimation Service: http://sedac.ciesin.columbia.edu/gpw/wps.jsp
Population & Environment MapViewer: http://sedac.ciesin.columbia.edu/mapviewer/

BEST-PRACTICE GUIDELINES

While no set of best-practices exist for integrating population data with climate-change data, there are several sets of guidelines to inform

spatial data usage and climate-change and disaster vulnerability. Links to those guides are as follows.

Spatial Data Infrastructure:

Open GIS Consortium *http://www.opengeospatial.org/standards/bp*

ESRI's Spatial Data Infrastructure *http://www.esri.com/library/bestpractices/spatial-data-infrastructure.pdf*

Climate-change and Disaster Vulnerability:

*UNDP Adaptation to Climate Change*http://www.undp.org/climatechange/adapt/program.html

US-based post disaster planning *http://www.floridadisaster.org/Recovery/IndividualAssistance/pdredevelopmentplan/documents/Toolbox/GIS%20Vulnerability%20Analysis%20Methodology%20Appendix%203.31.10.pdf*

USAID Climate Change Best Practices: *http://pdf.usaid.gov/pdf_docs/PNADJ990.pdf*

User Communities

Technical User Groups & Blogs

User groups and blogs are effective for sharing information about software development, database development, and in some countries, meetings of spatial technologists and data users. Here are a few links as a starting place:

GITA: http://www.gita.org
URISA: http://www.urisa.org
ASRPS: http://www.asprs.org
ACSM: http://www.acsm.org
R: http://www.r-bloggers.com/
Geospatial Data Report: http://geospatial.edublogs.org/

Potential Partners: Regional Organization working on Climate Change

There are many regional networks working on climate adaptation. While many of these networks make little use of demographic data inputs, at the present-time. Nevertheless, these networks offer communities of users working to adapt to climate change and would be a good source of examples and projects currently being implemented.

Adapt Africa http://www.africa-adapt.net/aa/

African Agriculture & Climate Change Resilience
http://www.rockefellerfoundation.org/what-we-do/current-work/developing-climate-change-resilience/african-agriculture-climate-change

Africa Climate Change Resilience Alliance (ACCRA) http://www.ecbproject.org/ACCRA

Asian Cities Climate Change Resilience Network (ACCCRN) http://www.acccrn.org/

Learning for Sustainability http://learningforsustainability.net/susdev/resilience.php

Welcome Trust Teaching Resources on Climate Change and Health

http://www.wellcome.ac.uk/Education-resources/Teaching-and-education/Big-Picture/All-issues/Health-and-Climate-Change/index.htm