where are the
poor ?

*Experiences with the
Development and Use
of Poverty Maps*

Norbert Henninger
Mathilde Snel

Where are the Poor?

Experiences with the Development
and Use of Poverty Maps

Norbert Henninger

Mathilde Snel

WRI   UNEP   **GRID** Arendal

CAROL ROSEN AND OTTO SIMONETT
PUBLICATION DIRECTORS

HYACINTH BILLINGS AND JANET FERNANDEZ SKAALVIK
PRODUCTION MANAGERS

MAGGIE POWELL
COVER DESIGN AND LAYOUT

KAREN HOLMES
EDITING

JOHNATHAN KOOL
MAP LAYOUT

Each World Resources Institute and UNEP/GRID-Arendal report represents a timely, scholarly treatment of a subject of public concern. We take responsibility for choosing the study topic and guaranteeing its authors and researchers freedom of inquiry. We also solicit and respond to the guidance of advisory panels and expert reviewers. Unless otherwise stated, however, all the interpretation and findings set forth in our publications are those of the authors.

The presentations and designations used in regard to the legal status of any country, territory, city, or area within its authority, or the delineation of its frontiers or boundaries, do not reflect the opinion of WRI or UNEP/GRID-Arendal or cooperating agencies.

Photo Credits

Tegucigalpa street girl eating in Honduras, photo by Paul Jeffrey, pablito@datum.hn.

Farm woman carrying heavy head load of fuelwood, Tagalla area, Sri Lanka, 1993, photo by G. Bizzarri, FAO MediaBase, photo-library@fao.org.

A view of Mathare (Nairobi) in the wake of the torrential El Niño rains (1997), Shootback: Photos by Kids from the Nairobi Slums, Booth-Clibborn Editions, London, 1999, lanawong@yahoo.com.

Contents

Foreword

The quest to eliminate poverty is one of the great human endeavors of our time. Never before has humankind had the economic resources and technological tools to end human deprivation. We do now.

One essential tool is *information*. In all countries and at all times, information is power. Information forms the basis of knowledge, which can be used to direct finite human and financial resources to projects with the greatest impact on improving the lot of poor people. Information is key to enable people to lift themselves out of poverty—a condition characterized not only by lack of income and material goods, but also by lack of *opportunity*. Foremost among these are the opportunity to learn and the opportunity to participate in decision-making.

In *Where are the Poor? Experiences with the Development and Use of Poverty Maps*, Norbert Henninger and Mathilde Snel examine a powerful new information analysis and communication tool that has come into prominence in recent years. They show how poverty maps can be used by international, national, and local decision-makers to direct investments in human development. They demonstrate the importance of the *spatial* dimensions of poverty. All too often, pockets of deprivation remain unrecognized alongside greater prosperity. Poverty mapping pinpoints places where development lags. It can highlight the location and condition of infrastructure and natural resource assets that are critical to poverty reduction. Armed with this knowledge, policymakers can deploy highly targeted antipoverty expenditures and interventions to reach the neediest people by the most effective and affordable means.

Drawing on case studies from 14 countries in Africa, Asia, and Latin America, the authors review how poverty maps were used and some of the factors constraining their use in a wide variety of geographic and institutional settings. Examples reveal how development decisions, investments in infrastructure, and targeting of assistance were shaped by poverty mapping in the countries studied. The report also points to the largely untapped potential for applications incorporating the risks and opportunities associated with environmental factors impacting poverty as well as applications to assist the planning and operations of private businesses and other non-traditional users. Especially intriguing is the role of poverty mapping in shedding light on antipoverty policy options, sparking fresh public debate, and strengthening civil society's call for increased transparency and accountability of government decision-making.

From such experiences come lessons that can guide future poverty mapping initiatives in other countries. Emerging as pivotal themes in the study's findings are the need for collaborative approaches and senior-level support as well as the importance of active dissemination of results. Recommendations aimed at national and international actors sketch a plan for sustaining poverty mapping in the countries studied and expanding its frontiers to all developed and developing countries. Particularly in the latter, poverty mapping must be viewed as an essential, long-term capacity development and institutional strengthening exercise. In all cases, early, continuing stakeholder involvement combined with data access for all those who want it are cornerstones of a successful poverty mapping effort.

This report is the product of a strong collaboration between the World Resources Institute (WRI), UNEP/GRID-Arendal, and dozens of country experts supplying information and insights for the cases studied. The Netherlands Ministry of Foreign Affairs, the Swedish International Development Cooperation Agency, and the FAO-CGIAR-UNEP Poverty Mapping Project funded by the Norwegian Ministry of Foreign Affairs provided critical support for this study. We are pleased to express our appreciation to all for their exceptional encouragement and generosity.

JONATHAN LASH
PRESIDENT
WORLD RESOURCES INSTITUTE

SVEIN TVEITDAL
MANAGING DIRECTOR
UNEP/GRID-ARENDAL

Acknowledgments

Executive Summary

Finding ways to reduce poverty and inequity is a daunting challenge for local, national, and international decision-makers. One important aspect of this challenge is the spatial heterogeneity of poverty: poor people tend to be clustered in specific places. Aggregated, national-level poverty data mask this subnational variation. For example, the figure below presents maps of poverty data from Ecuador at increasing levels of resolution, from national to regional, provincial, and municipal. These maps show that even the lowest-poverty region of the country (with a poverty rate of 30-45%) contains provinces with considerably greater incidence of poverty (45-60%) as well as municipalities with extremely high poverty rates (60-75%).

Poverty maps for Ecuador at various levels of spatial resolution

Sources: Boundary files from Centro Internacional de Agricultura (CIAT). Poverty estimates from Hentschel et al. 2000.

High-resolution maps can help uncover poor areas that might otherwise go undetected. Shown here are poverty maps for Ecuador at increasing levels of resolution, from national to regional, provincial, and *municipios* (districts). Higher-resolution maps reveal that the low-poverty region (the Andean region, shown in pale yellow, with a poverty rate of 30-45%) contains several provinces with a considerably higher incidence of poverty (45-60%, shown in dark yellow). One such province, shown at highest resolution, encompasses several *municipios* (districts) with extremely high poverty levels (60-75%, shown in orange) alongside areas of moderate and low poverty.

Poverty mapping—the spatial representation and analysis of indicators of human wellbeing and poverty—is becoming an increasingly important instrument for investigating and discussing social, economic, and environmental problems. Decision-makers need information tools such as poverty maps to help them identify areas where development lags and where

investments in infrastructure and services could have the greatest impact. Once largely the domain of economists and social scientists, poverty maps are now being used by policymakers and many non-governmental entities, including civil society groups, academic institutions, and private businesses. However, the new and diverse applications of poverty mapping emerging over the past five years have not been well documented.

The World Resources Institute (WRI) in collaboration with UNEP/GRID-Arendal has conducted a study examining the uses and impacts of poverty maps. Our interest in this topic grows out of extensive experience in mapping biophysical indicators, including those related to coral reefs, water resources, frontier forests, and drylands. We have found indicator maps to be a powerful tool for stimulating and advancing policy dialogue. In particular, poverty mapping provides a means for integrating biophysical information with socioeconomic indicators to provide a more systematic and analytical picture of human wellbeing and equity. Environmental factors represent one dimension of the complex physical, biological, and socioeconomic system that influences human welfare and poverty.

Poverty mapping—including methods for producing maps as well as ways of using them to influence policy and expenditures—is an evolving discipline. Specific objectives of this study are to:

- document the uses and impacts of poverty mapping;

- increase understanding of how national and subnational decision-making can benefit from incorporation of poverty maps;

- encourage innovative applications of poverty mapping in new areas such as environmental management;

- foster expansion of the community of poverty mapping users and stakeholders, including non-governmental and civil society organizations, universities, the media, and the private sector;

- support more widespread use of mapping in developing countries, including development of human and technical capacity to create and interpret poverty maps; and

- encourage greater coordination and collaboration between map producers and users.

The intended audience for this report is decision-makers in international and national development agencies with a poverty reduction mandate, along with the growing network of practitioners using various techniques to produce poverty maps. In addition, we hope it will be useful for a broader audience—including universities, non-governmental organizations, and the private sector—interested in learning more about experiences with and potential new applications of poverty mapping.

To conduct a systematic examination of the application and use of poverty maps, we used a country case study approach, featuring a series of telephone and in-person interviews with map producers and users in selected countries. The cases considered here encompass 14 countries from Africa (Burkina Faso, Madagascar, Malawi, Mozambique, and South Africa), Asia (Cambodia and Vietnam), and Latin America (Brazil, Ecuador, Guatemala, Jamaica, Nicaragua, Panama, and Peru). These examples reflect a variety of poverty mapping methodologies, in most cases focusing on more statistically rigorous methods, known as small area estimation. However, we also examined other approaches with a longer history of use, such as the Human Development Index pioneered by the United Nations Development Programme and various "unsatisfied basic needs" indexes used primarily in Latin America.

Highlights of the uses and impacts of poverty mapping include:

■ Poverty maps have become important tools in implementing poverty reduction programs, including international efforts (such as the World Bank-initiated poverty reduction strategies for Highly Indebted Poor Countries) as well as purely national initiatives. One such example comes from Nicaragua, whose poverty reduction strategy relies heavily on poverty maps to allocate US$1.1 billion in capital spending over five years (2001-5).

■ Poverty maps help improve targeting of public expenditures by identifying where the neediest populations are located. For instance, in Guatemala, poverty mapping is being used to restructure the National Public Investment System to improve geographic targeting of hundreds of millions of dollars (US$576 million in FY 2002) of annual expenditure.

■ Emergency response and food aid programs are beginning to make use of newer, more data-intensive mapping methods. In South Africa, information from a poverty mapping initiative was combined with data on sanitation and safe water supplies to create a geo-referenced strategy for containing a cholera outbreak in KwaZulu Natal province in early 2001. Implementation of this strategy effectively contained the disease in three months, with one of the lowest fatality rates (0.22%) ever recorded. Cambo-

dian poverty maps are being used to identify the poorest communities for distribution of US$50 million (2001-03) in World Food Program food aid, especially "food for work" interventions.

■ In several countries, high-resolution poverty maps are contributing to state- and local-level decision-making. Brazil's largest state, Minas Gerais, is using poverty maps to redistribute statewide tax revenues totaling US$1 billion annually toward poorer municipalities that are making an effort to invest in health, education, sanitation, and environmental conservation.

■ In the cases studied, the production and distribution of poverty maps resulted in increased transparency of public decision-making, by raising awareness of poverty, igniting policy debates at local and national levels, and encouraging broader civil society participation in decision-making. One such instance was reported from Panama, where officials of the Social Investment Fund indicated that the use of poverty maps in decision-making helped them resist pressure from politicians to alter funding allocations once they had been made.

Four central themes emerge from the case studies: issues related to user demand; methodological issues; the importance of dialogue, collaboration, and dissemination; and capacity development and long-term sustainability.

■ Our case studies indicate that, close linkage of map production with user demand promotes use and impact. While most cases address financial distribution issues, map producers and users point to untapped potential for environmental and other applications. Potential for private-sector use of poverty maps appears to be great, though relatively few such applications were documented.

■ With respect to methodology, the use of a credible, transparent method was identified as an important factor in the eventual acceptance and impact of a poverty map. We found that map producers often faced challenges regarding access to data, which some successfully addressed through collaborative arrangements with national statistics departments and other relevant agencies. Producing poverty maps at high levels of resolution using up-to-date information also promotes extensive use and impacts.

■ The cases we examined indicate that collaborative inter-agency approaches supported by senior officials greatly enhanced map production and use. We also found that active, strategic dissemination can have a powerful impact on awareness and use of poverty maps.

■ Among the most significant impacts of poverty mapping have been its effects on institutional strengthening in developing countries. In addition to the expected rise in the technical skills of participating researchers, case studies

contained numerous reports of increased institutional credibility and standing in policymaking circles in the wake of a poverty mapping exercise.

Based on these findings, we recommend that seven major steps be taken to ensure that poverty mapping is sustained in the countries studied and expanded to all developing and developed countries over the next 10 years.

1. RECOGNIZING THE NEED FOR UNIVERSAL APPLICATION. *Every country in the world should map the distribution of its poor.* Policies and programs to reduce poverty require that countries have solid, detailed information about where poor people live and the resources the poor can use to improve their lives.

2. INVOLVING STAKEHOLDERS FROM THE VERY START. *National governments*, through a multi-institutional, multi-stakeholder approach (and with the support of the international community, when needed), *should conduct a preliminary poverty mapping needs assessment* that identifies detailed steps to the development of a useful and accurate map of the poor. These steps should address: purposes and intended uses of poverty maps; agencies and universities to be involved in the mapping effort; methodological approaches and datasets to be used; technical support required; data quality and accuracy of maps required; budget and funding sources; target audiences and outreach strategies; and evaluation and monitoring of uses and user feedback.

3. SUSTAINING THE EFFORT. *It is essential that governments take steps to cultivate political support to sustain the technical effort over decades.* These actions typically involve: committing technical and financial resources; providing training to key staff; developing a cadre of broadly trained analysts; creating incentives to retain skilled analysts in the public sector; securing appropriate equipment; conducting a high quality census and periodic national household survey to generate essential data; developing data and map standards; providing support to universities and research centers that can assist with map development and rigorous evaluation of map uses and impacts; and committing to more transparent decision-making that takes into account both technical (i.e., poverty maps) and political considerations.

4. ENSURING ACCESS TO DATA. Most *countries will need to ensure that national legislation is in place to support the distribution of poverty information to all those who want it.* This means all potential users in: various levels of government, research institutes and universities, the private sector, nongovern-

mental organizations, media, and the poor themselves. Widespread access to poverty-relevant data will facilitate broad use of poverty maps and ensure strong demand for poverty information and more accountable decision-making. It will open the mapping process to independent organizations, helping to counterbalance any mistrust of official government information.

5. ENCOURAGING INNOVATIVE USES. This report identifies and documents numerous ways in which poverty maps can and are being used to make decisions; support social, economic, and environmental goals; and strengthen governance. Much more remains to be done, however, to ensure that poverty mapping is applied as broadly as possible. In the area of environmental quality and natural resource management, *there are numerous opportunities to integrate poverty mapping into natural resource management and pollution control.* For example, poverty mapping can be used to analyze the relationships between poverty and transportation, industrial hazards, exposure to air and water pollution, access to natural resources (wildlife, forests, grasslands, coastal and mineral resources), and natural hazards (flooding, storms, drought, and climate change). The interconnections between poverty and land and resource tenure, siting of protected areas, subsidies for food and agriculture, and a host of municipal services should also be assessed.

6. SUPPORTING RESEARCH ON METHODS. The World Bank has taken the lead in providing technical and statistical support to a number of countries; other donors should step forward to support poverty mapping research and applications as well. The international community should take up the challenge of creating *a new cadre of in-country experts who both understand the methodologies and can work with national and international colleagues to carry out studies and conduct research on new methods.*

7. DEVELOPING A POVERTY MAPPING STRATEGY. Enabling countries to develop and maintain poverty maps and make them widely available will take time, strong technical and institutional support, and leveraged funding. However, *it is essential that countries that have been successful in this endeavor*—along with international donors and interested nongovernmental organizations—*develop a long-term strategy to provide less developed countries with needed support.* WRI and UNEP/GRID-Arendal are ready to join with the World Bank, developing countries, and interested organizations to develop a strategy that brings the promise of poverty mapping to many countries through many different avenues. We welcome ideas and participation.

Introduction

Every day, 2.8 billion of the world's people face the challenge of eking out a living with fewer resources than the cost of a cup of coffee purchased in the capitals of Europe or North America. Finding ways to reduce such deep, widespread poverty and inequity is a daunting task for local, national, and international decision-makers. International development institutions increasingly emphasize poverty reduction in their program planning and operations. Representatives of 189 countries have endorsed eight *Millennium Development Goals*, committing themselves to specific poverty reduction targets, including halving the proportion of people living in extreme poverty from its 1990 level by 2015.

Individuals and institutions working to design and implement anti-poverty programs need tools to help them identify areas where development lags and where investments in infrastructure and services could have the greatest impact. Poverty is a spatially heterogeneous phenomenon; poor people tend to be clustered in specific places. Aggregated, national-level poverty data often obscure considerable subnational variation, including at the level of provinces, districts, and communities. This geographic variation in the incidence and magnitude of poverty may be partially due to factors with spatial dimensions, such as natural resource endowments as well as access to services including health care, education, and labor and product markets.

Poverty mapping—defined here as the spatial representation and analysis of indicators of human wellbeing and poverty (Davis 2002)—is becoming an increasingly important instrument for more integrated investigation and discussion of social, economic, and environmental problems. Maps are powerful tools for presenting information to non-specialists, who are able to examine mapped data to identify clusters, patterns, and trends. The past five years have witnessed the emergence of new and diverse applications of poverty mapping; consequently, the user community has become larger and more broad-based. Once largely the domain of economists and social scientists, poverty maps are now being used by policymakers and many non-governmental entities, including civil society groups, academic institutions, and private businesses.

Factors driving this trend toward greater and more widespread use of poverty maps are: increased availability of pertinent data; readily available mapping technologies, such as Geographic Information Systems (GIS) and mapping software;

recent strides in developing sophisticated statistical methods of mapping poverty based on econometric techniques (sometimes referred to as small area estimation); and increasing emphasis on poverty reduction in program and policy development at international and national development assistance organizations. The last factor is contributing to a more widely held view that development efforts must target the poor and is helping to overcome initial government concerns about the political sensitivity of poverty maps, especially when they expose policy failures. Altogether, these factors emerge against a backdrop of rising demands from civil society for transparency and accountability in government policymaking and operations, as well as a trend toward greater decentralization in provision of public services. Poverty mapping can be an important tool for empowering local groups as full participants in anti-poverty initiatives.

Besides visually representing geographic variation in human wellbeing, poverty mapping can highlight the distribution and condition of many assets that are key to poverty reduction, such as agroecological resources and ownership, and road networks providing access to markets, schools, and health clinics. Analyses can be conducted according by biophysically defined units (e.g., agroclimatic zone) and regions classified according to access (or lack thereof) to infrastructure and services as well as by administrative units (e.g., province, county, town, etc.).

Poverty maps, many created in the context of poverty reduction programs initiated by the World Bank and other development assistance organizations, are increasingly being used to target resources and interventions aimed at reducing poverty. However, to date, the use and impacts of poverty mapping have not been well documented.

The World Resources Institute (WRI) in collaboration with UNEP/GRID-Arendal has conducted a study documenting the uses and impacts of poverty maps. Our interest in this topic grows out of extensive experience in mapping biophysical indicators, including coral reefs, water resources, frontier forests, and drylands. We have found indicator maps to be a very useful tool for stimulating and advancing policy dialogue. In particular, poverty mapping provides a means for integrating biophysical information with socioeconomic indicators to provide a more systematic and analytical picture of human wellbeing and equity. Environmental factors represent one dimension of the complex physical,

biological, and socioeconomic system that influences human welfare and poverty.

WRI's interest in poverty mapping also is shaped by the realization that efforts to reduce poverty in developing countries often rely on a natural resource base that is becoming degraded. Combining natural resources maps with maps of poverty distribution and population density can show the location of vulnerable populations and suggest specific locations and resources of particular importance for policy action.

Poverty mapping, including methods for producing maps as well as ways of using them to influence policy and expenditures, is an evolving discipline. Specific objectives of this study of poverty mapping are to:

- document the uses and impacts of poverty mapping, including sectors of application, obstacles (data and methodological) encountered, best practices, lessons learned, and institutional aspects;

- increase understanding of how national and subnational decision-making can benefit from systematic incorporation of poverty maps and poverty mapping;

- encourage innovative applications of poverty mapping in arenas not strictly focused on poverty reduction, such as infrastructure development, tax reform, environmental management, technology policy, and many others;

- foster expansion of the community of poverty mapping users and stakeholders, including non-governmental and civil society organizations, universities, the private sector, microlending institutions, etc;

- support more widespread use of poverty mapping in developing countries, especially by increasing awareness of the need for financial and technical support to the poorest countries to build human and technical capacity to create and use poverty maps;

- promote greater access to data and software tools needed to conduct poverty mapping; and

- encourage coordination and collaboration between map producers and users, both in-country and internationally, including forging links between map producers using different methodologies.

This study *does not* aim to compare different mapping exercises conducted in different countries for differing purposes, nor does it seek to evaluate various poverty-mapping methodologies or otherwise draw conclusions about methodological issues.

The intended audience for this report is decision-makers in international and national development agencies with a poverty reduction mandate, along with the growing network of practitioners using various techniques to produce poverty maps. In addition, we hope it will be useful for a broader audience—including universities, non-governmental organizations, and the private sector—interested in learning more about experiences with and potential new applications of poverty mapping.

Background on Poverty Mapping

This paper focuses on experience with maps depicting indicators of poverty at a subnational scale, such as by district or community within a given country. Figure 1 provides an example of poverty maps for Ecuador at different levels of resolution, showing the percentage of individuals classified as poor (the so-called head count index).

Figure 1. Poverty maps for Ecuador at various levels of spatial resolution

Sources: Boundary files from Centro Internacional de Agricultura (CIAT). Poverty estimates from Hentschel et al. 2000.

High-resolution maps can help uncover poor areas that might otherwise go undetected. Shown here are poverty maps for Ecuador at increasing levels of resolution, from national to regional, provincial, and *municipios* (districts). Higher-resolution maps reveal that the low-poverty region (the Andean region, shown in pale yellow, with a poverty rate of 30-45%) contains several provinces with a considerably higher incidence of poverty (45-60%, shown in dark yellow). One such province, shown at highest resolution, encompasses several *municipios* (districts) with extremely high poverty levels (60-75%, shown in orange) alongside areas of moderate and low poverty.

Higher-resolution maps are useful to decision-makers and researchers in part because they powerfully illustrate the spatial heterogeneity of poverty within a country. They are of special interest to environmental scientists and other researchers working with spatial information on land cover change, ecosystem goods and services, infrastructure development, and market integration, and similar topics with locational aspects.

There is as yet no standard methodology for producing high-resolution poverty maps. Various methods have been used and refinements of technique continue to be developed. (See

Box 1 for a description of eight generic steps for producing poverty maps.) Each method has its own particular strengths and weaknesses. Data needs differ depending on the analytical methods chosen, and various methods have different implications for the timeframe and costs involved in conducting the analysis. Moreover, some methods require a higher level of statistical and econometric expertise than do others.

Some of the most commonly used methods of poverty mapping are outlined below (and described in more detail in Box 2). The choice of methods and data sources for poverty mapping should be determined according to the purpose for which the resulting map will be used, which often dictates the appropriate level of precision and resolution. In developing countries, it is also important to take into account the prevailing level of technical and human capacity development.

Preparation of a poverty map may be driven by demand (e.g., need for information and analysis for program design and/or implementation) or by supply (e.g., researcher interest in testing or refining a methodology). Ideally, a poverty mapping exercise will emerge from and be shaped by the process of policy dialogue between map producers and users. Through policy dialogue, map producers and users can work together to explore the specific purposes of a proposed poverty mapping effort. Technical experts can help increase decision-makers' awareness of the potential uses of poverty mapping as well as the inherent limitations of these techniques. Such discussions can help illuminate important issues, not only with respect to choice of method and data source(s), but also spark ideas concerning collaboration between various researchers and institutions, capacity development, dissemination of resulting data products, and long-term sustainability of the mapping effort.

Small area estimation. Poverty maps based on the small area-estimation method rely on sophisticated econometric techniques and a set of identical variables (e.g., household characteristics and educational background) in both a census and a surveyed representative sample of the overall population. By combining census and household survey data, researchers benefit from the strengths of each instrument: a census' complete coverage of a country and a survey's more detailed information. The survey provides the specific poverty indicator and the parameters, based on regression models, to predict the poverty measure for the census.

Box 1   Poverty mapping – generic steps

These eight generic steps involved in a poverty mapping effort highlight key decision points faced by researchers and map producers. Not every poverty-mapping exercise will include all eight steps or follow them sequentially.

1. Define purpose and expected use of mapping

In an ideal world, all poverty mapping would start here. Maps may be needed to show that certain regions are disadvantaged, to rapidly assess options for food emergency interventions, to target public investment to areas of greatest need, or to investigate specific causes of poverty. The purpose and intended use of poverty maps determine the scope and the required precision of the mapping exercise and should shape methodological choices described below.

2. Select measure(s) of poverty and human wellbeing

Choosing an indicator or indicators of poverty is a pivotal step in map production. Poverty is a multidimensional phenomenon, including economic, social, and other aspects of human wellbeing. The selected indicator may be a monetary or non-monetary variable—for example, the proportion of households below a certain income level or the proportion of households without access to sanitation. Researchers sometimes distinguish between status and outcome variables—e.g., access to safe drinking water (status) versus incidence of waterborne diseases (outcome)— but because indicators of poverty are interdependent, the distinction between status and outcome measures is not always clear. A poverty indicator may measure a single important dimension of human wellbeing, such as household expenditure compared to a minimum necessary level or poverty line. Alternatively, the indicator may be multidimensional, for instance, a composite

index that depicts deficits in basic human needs, such as education, health care, and sanitation. Each type of poverty indicator has its own strengths and weaknesses, and the choice of indicator will certainly influence who is classified as "poor."

3. Select input data

Data used to construct a poverty map typically are drawn from population or agricultural censuses, household surveys, or spatial (GIS) databases in which values are fixed to specific locations on a grid. Increasingly, poverty mapping relies on data from many sources. Data used in poverty mapping may vary in coverage, collection method, and level of resolution, all of which may have methodological implications. Data coverage may be comprehensive—such as a national census or a detailed map covering the entire geographic area under consideration—or it may be partial, for example, a survey of household expenditures covering a representative sample of the population. Researchers may face choices with respect to data collection methods, including qualitative versus quantitative approaches, or top-down versus participatory methods. The level of resolution of input data used in poverty mapping may be high (e.g., household level) or relatively coarse (e.g., averages for census tracts or administrative units).

4. Select method of estimating or calculating poverty indicator

Researchers may choose to estimate a single variable, such as per capita household expenditures compared to a specific standard of living (i.e., poverty line). Alternatively, they could use a composite index, which may be calculated by simple aggregation (i.e., equal weighting) of a few variables or by multivariate analysis, such as principal components or factor analysis.

Typically, the poverty indicator is an expenditure-based indicator of welfare, such as the proportion of households that falls below a certain expenditure level (i.e., poverty line). In recent years, researchers have relied on two principal methods for their small-area-based poverty maps. The first requires access to detailed household-unit-level data from a census. If such household-unit data are unavailable, unreliable, or incomplete—as is frequently the case in many developing countries—researchers have applied average values for a given indicator at the community level (see Box 2 for more detail).

Small area estimation-based household-level survey data generally are more accurate and reliable than those based on community-based averages. Indeed, the small-area estimation technique using household-unit data is the only poverty mapping method that generates an estimate of statistical error.

However, the technical and data requirements of this technique are relatively rigorous, and the approach works best in countries with regular and comprehensive national censuses and household surveys. Community-level averages are more readily available, but using the small-area estimation technique with such data generates an uncertain error, and the datasets used may not provide a good proxy for the poverty indicator that the researcher seeks to measure.

Other poverty mapping methods. Although the "newest" type of poverty maps are based on small-area estimation techniques, other methods have a longer history of application and important lessons have been learned in the course of their use. Many such methods feature the use of composite indexes, including the Human Development Index (HDI) originated by the United Nations Development Programme (UNDP), as well as various basic needs measures. The latter, sometimes

Box 1   continued

5. Select a method to calculate, estimate, or display poverty indicator for geographic area

Depending on the chosen poverty indicator, input data, and method of estimation/calculation, researchers will have different options for calculating or estimating the poverty indicator across a geographic area. For instance, if map producers are using census-level data made available at the household level, then simple aggregation of the data for the selected geographic unit may suffice. However, researchers often need techniques that are more sophisticated. Poverty maps often combine census data (featuring complete country coverage) with household survey data (encompassing a representative sample of the selected population). This is accomplished by means of advanced statistical methods based on econometric techniques, sometimes referred to as *small area estimation*. Combining data from these two sources enables a poverty mapping study to benefit from both the complete spatial coverage of the census and from a relevant poverty indicator in the household survey. Such statistical techniques help overcome the survey's insufficient sample size, which could not be aggregated to small administrative units, and the census' lack of an appropriate poverty measure.

6. Decide on number of units for final map (resolution) to present poverty data

For many poverty-mapping methods, this step is often combined with the previous one. In the case of small area estimation relying on household-unit data, researchers cannot map an individual household; they must aggregate household-level data to larger units to reduce the statistical error in their prediction model. Sensitivity tests conducted by researchers suggest that a minimum of 5,000 households is needed to reduce statistical error to

an acceptable level (Elbers et al. 2002). The number of households required may be significantly higher in other cases, especially if the statistical model is not as strong in its predictive power.

7. Produce and distribute maps

Mapping software is used to produce a spatial representation of the geographic distribution of calculated/estimated poverty indicators. Maps and supporting analyses are distributed to the targeted decision-makers. Increasingly, map producers are supplementing hardcopy maps with other products, such as interactive decision-support tools and/or datasets on compact discs (CDs), aimed at various audiences (technical, general, or mixed).

8. Monitor usage and feedback

Poverty maps are used for various purposes, ranging from identifying and understanding the causes of poverty, to assisting in program development and policy formulation, to guiding allocation of anti-poverty investments and expenditures. Map producers should monitor and evaluate the various ways in which their maps are being used by decision-makers and/or researchers, and users should provide feedback on the impact and limitations of poverty maps to map developers.

Sources: Adapted from Henninger (1998), Deichmann (1999), and Davis (2002)

referred to as "unsatisfied basic needs" indexes, have been used primarily in Latin America.

One advantage of composite indexes is that they are intuitive and easy for a general audience to understand. Moreover, this approach requires less advanced statistical expertise than small area estimation. Composite indicators are stronger on the social dimensions of poverty and, on first impression, they appear to better capture the multidimensional nature of human wellbeing.

The most serious criticism of composite indexes is that their weighting of variables can be arbitrary and theoretically unsound. Even a small change in the weighting scheme could easily lead to a change in the proportion of households classified as poor and overturn the ranking of geographic areas identified as poor.

Caveats. Although poverty mapping can be a powerful tool for analyzing poverty and communicating the results to technical and non-technical audiences, experts hasten to point out the limitations of these techniques. Poverty maps are not a panacea for understanding or solving poverty problems; they are only one tool among many for investigating the complex phenomenon of poverty. They should be used in conjunction with other information and analysis that provide context and groundtruthing within communities.

Poverty maps can be used to explore the spatial aspects of various components of human poverty. However, indirect estimation of poverty, as opposed to direct observation in the field, introduces some degree of uncertainty. Careful additional analyses are needed before conclusions are drawn on any meaningful correlation, much less causal relationships, between these variables.

Box 2   Methods of poverty mapping

Expenditure-based small area estimation using household-unit data

This approach was initiated by researchers at the World Bank in 1996 (Hentschel and Lanjouw 1996). The techniques have been further refined, mostly under the leadership of individuals at the World Bank, universities, and in-country partner institutions (e.g., Hentschel et al. 1998, Hentschel et al. 2000, Statistics SA 2000, Alderman et al. 2001, and Elbers et al. 2002). A group of these researchers is currently developing a handbook that describes this approach step by step (Lanjouw 2002).

Typically, this approach begins with a nationally representative household survey, such as the Living Standard Measurement Survey, to acquire a reliable estimate of household expenditure (y) and calculate more specific poverty measures linked to a poverty line. A common set of explanatory variables x (e.g., educational background, household characteristics, and quality of housing) at the household-unit level in both the survey and the census is then used to estimate the statistical relationship between y and x in the survey. Once a robust model has been identified for the survey, researchers apply the final model to the census data at household-unit level to predict per capita household expenditures (including an error estimate). These household-unit data can then be aggregated to small statistical areas, such as districts, to obtain more robust estimates of the percentage of households living below the poverty line. Finally, these poverty rates by administrative area are linked to a mapping program to produce a poverty map showing the spatial distribution of poverty. In most cases, the spatial resolution of this map, i.e., the number of administrative units, is significantly higher than would be possible using the household survey alone.

This small area approach using household-unit data has been applied in various countries, including Ecuador, Guatemala, Nicaragua, Panama, and South Africa. It is currently being considered for map development in a number of other countries, including China, Indonesia, Kazakhstan, Kenya, Kyrgyzstan, Madagascar, Malawi, Mexico, Mozambique, Pakistan, Thailand, and Uganda.

In all of the examples cited above, the outcome variable has been an estimate of household expenditure linked to a poverty line. In principle, this small-area estimation technique could be applied using a different outcome variable, for example, a non-monetary indicator; however, no example of such an approach has yet been published. As this report was going to press, a small area estimation of Demographic and Health Survey (DHS) indicators was initiated for Cambodia (Montana 2002). Similarly, researchers at the International Food Policy Research Institute (IFPRI) and Cornell University started on a small-area estimation that intends to use nutrition indicators as outcome variables for Tanzania and Ecuador, respectively (Minot 2002).

Davis (2002) lists the following strengths of this approach: It is relatively easy for national analysts familiar with econometric modeling to check the reliability of their estimates, because the data processing program provided by the World Bank is equipped with an error estimation module. It is the only method "where statistical properties have been—and continue to be—thoroughly investigated." In addition, the method has institutional support from the World Bank and a team of researchers is available to further refine the method and provide technical assistance.

One limitation of this approach may be that it is less feasible for individual researchers who would like to work independently. Without institutional support from the World Bank and a collaborative research agreement, an independent researcher may not be able to obtain access to household-unit data. A second important limitation is that census data in many developing countries may not provide a sufficient number of explanatory variables to build a robust statistical model. It is no surprise that most of the countries where this small area estimation has been used have a regular and comprehensive effort of national censuses and household surveys, with relatively strong statistical departments and relevant statistical expertise. Other obstacles—such as enormous input data files, literally millions of records to be processed, and the not-trivial econometric expertise required—are becoming less of an issue because of the growing processing power of personal computers as well as the technical support provided by the World Bank.

In addition, it is important that poverty mapping is always seen in the overall context of a country's decision-making processes. Technical tools like poverty maps run the risk of being abandoned once initial donor support has waned. To ensure a path of sustained use and support for poverty maps, fundamental questions need to be addressed, such as how to retain skilled analysts in the public sector, overcome limited or lacking demand and funding from policymakers, and convince decision-makers that continued investment in poverty maps is worthwhile in an environment that does not follow a purely technical approach to decision-making.

Box 2   continued

Expenditure-based small area estimation using community-level data

This approach has been pioneered by researchers at the World Bank and centers within the CGIAR system (Minot 1998, Bigman et al. 2000, Bigman and Fofack 2000, and Minot 2000). While different researchers may have varied their specific approaches—for example, by working at a regional versus a village level—all methods have a common element. The input data for the statistical model relies on average values—for example, for communities or regions—and not on household-unit data. For example, Bigman et al. (2000) combined such data from household surveys and a census, and also used variables generated by a GIS (i.e., distance to schools, water points, etc.) to overcome constraints on the quality and availability of household-level census data in Burkina Faso.

Besides this main difference, the small area estimation follows an approach similar to the one outlined above. First, researchers determine the statistical relationship between household expenditure and a set of explanatory variables within the survey data alone. Once they have determined a strong relationship between the two sets of variables, they can apply this relationship to the same variables in the census, but this time for a community or an administrative region, not an individual household.

This approach, using community-level averages, has been applied in Burkina Faso and Vietnam. Other examples, not examined here, have been reported for Kenya (Bigman and Loevinsohn 1999) and India (Bigman and Srinivasan 2001).

Davis (2002) mentions that more readily available data is a plus for this approach. Because of legitimate concerns about data confidentiality, government agencies are more willing to provide researchers with census data on community averages than on households. He also points out two limitations: In some cases, the averages calculated for the community or the region may not be a good proxy for the distribution of poverty. Second and most importantly, the error associated with such an estimation approach has not been thoroughly investigated yet. It is not clear how much statistical reliability is sacrificed for data access, and

what the most appropriate use for this approach is. Differences between the community-level and the household-unit approach need to be systematically investigated. A first paper examining how the levels of precision differ between the two approaches was presented in 2002 (Minot and Baulch 2002a).

Other methods not based on small area estimation

Some poverty mapping techniques use composite indexes as the poverty measure and rely on the direct aggregation of census data to display the poverty indicator for the chosen geographic area. Please refer to Davis (2002) or Henninger (1998) for detailed descriptions and examples of other poverty mapping approaches that do not rely on small area estimation.

Composite indexes used for poverty mapping studies include UNDP's well known Human Development Index and various basic needs measures, sometimes also referred to as "unsatisfied basic needs" index. Basic needs indexes have been applied primarily in Latin America. The Human Development Index is based on three variables: life expectancy, education (literacy), and income. All components are weighted equally. Basic needs indexes typically have included more than three variables—for example, literacy, access to water, access to sanitation, access to health services, and quality of housing. Many of the existing basic needs indexes have equal weighting schemes similar to the HDI. Others have relied on expert opinion or multivariate statistical techniques to provide weightings for each variable.

Sources: Adapted from Henninger (1998), Deichmann (1999), and Davis (2002).

Study Approach

To conduct a systematic examination of the application and use of poverty maps, we decided on a country case study approach. Such an approach, featuring a series of telephone and in-person interviews with map producers and technical and non-technical users in selected countries, was identified as a rapid, cost-effective way to document successful and appropriate uses of poverty maps.

Case selection. The case studies examined for this paper encompassed 14 countries from various regions, including Africa (Burkina Faso, Madagascar, Malawi, Mozambique, and South Africa), Asia (Cambodia and Vietnam), and Latin America (Brazil, Ecuador, Guatemala, Jamaica, Nicaragua, Panama, and Peru). In some cases, poverty maps had been completed, published, and used; in others, mapping was still underway and incomplete at the time of the interviews.

The cases reflect a variety of poverty mapping methodologies. Because the primary focus of this study is documenting uses of the "newest" type of poverty maps, most cases examined here apply small area estimation techniques combining survey and census data to produce expenditure-based poverty indicators. In some cases, survey data were collected at the household level; in others, input data described community- or district-level averages for expenditures or other poverty measures.

However, in addition to cases based on small area estimation, we also examined a few cases applying other poverty mapping approaches with a longer history of use. These cases feature application of composite indexes of human wellbeing, such as UNDP's Human Development Index or various "unsatisfied basic needs" indexes used primarily in Latin America. Many important lessons have been learned in the course of using these composite indicators for poverty mapping; thus, we believe that such cases should be represented in this study.

The 14 cases selected also reflect diversity with respect to the purpose for which poverty maps were developed. Some had a relatively narrow research focus (e.g., testing and refinement of a statistical method), while others aimed to reach a broad audience or to change public decision-making. In part due to these differences of purpose, cases differed significantly in the level of resources allocated to data outputs and dissemination of results. In some cases, distribution efforts consisted of publishing a technical paper and conducting a few briefings; in others, mapping efforts included the development and dissemination of various data products and decision-support tools and even mass media outreach.

Interview procedure. Interviews were conducted by telephone and in person between July and October 2001. Those interviewed included poverty mapping practitioners, task and project managers at the World Bank and other development organizations, and selected map users in the 14 country cases studied.

Technical experts—who could supply background information on the history and purpose of poverty mapping efforts as well as detailed explanation of the map production process (e.g., poverty measure mapped, whether and what kind of statistical estimation method(s) were used, scale of mapping, etc.)—were interviewed first. Following these interviews with map producers, we talked with map users—both technical and non-technical—about the applications and impacts of poverty mapping. A list of detailed interview questions is included in Appendix 2. Appendix 3 lists all interviewees and their contact information.

Interview questions were designed to generate information on such issues as: demand and supply factors influencing poverty mapping efforts; the relevance of certain analytical methods; poverty map products developed and how they were disseminated; and the significance of various institutional capacities and technical skills. Rather than using the questionnaire as a precise blueprint, we allowed for a more natural conversation and elicited rich stories on the process, use, and impact of mapping efforts. Respondents were specifically asked about:

- background of the poverty mapping initiative (e.g., types of poverty maps produced, data used, and origin of the mapping effort);
- process of poverty map production (e.g., how statistical estimations and poverty maps were produced and major constraints in the production process);
- use of poverty maps (e.g., how the poverty maps were disseminated, analyzed, and used in decision-making);
- impacts (e.g., influence of poverty maps on budgeting, programs, and human wellbeing); and
- long-term sustainability of the initiative (e.g., existence of sufficient in-country capacity to sustain the production and use of poverty maps).

■ Interviewees were also asked to provide pertinent documents about the poverty mapping effort.

Based on these interviews and review of submitted documents, case study summaries were drafted and distributed for review to all persons interviewed concerning a given case. In some instances, follow-up interviews were conducted. We asked respondents to edit and revise the draft summaries; however, sole responsibility for final revisions rests with the authors. These country case study notes are summarized in Snel and Henninger (2002) and can be downloaded from http://population.wri.org/ or http://www.povertymap.net/pub.htm.

This report represents a synthesis of the results of the 14 case studies examined. Draft versions of this report were sent for comments to those interviewed for the case studies. Other reviewers of the synthesis report include experts at the Consultative Group on International Agricultural Research (CGIAR), the Food and Agricultural Organization (FAO) of the United Nations, the United Kingdom's Department for International Development (DfID), the United Nations

Environment Programme's Global Resource Information Database Center at Arendal, Norway (UNEP/GRID-Arendal), United States Agency of International Development (USAID), the World Bank, and the World Resources Institute (WRI).

Readers of the case study notes and this synthesis report should bear in mind some selection biases inherent in the study methodology. Most of those interviewed were directly involved in map production and/or use; hence, a bias toward perception of use and impact seems likely. We tried to counter this bias with cross-checking of facts and assertions, for example, with other interviewees and/or published sources. In addition, most of those interviewed were technical users and producers of poverty maps; fewer were managers and decision-makers with only an indirect connection to poverty mapping.

This case study approach has enabled us to factually document the uses and applications of poverty mapping. Somewhat more subjectively, expert observers of and participants in the cases studied also have pointed to changes in expenditure and policy priorities plausibly resulting from poverty mapping.

Highlights of Use and Impact

The following section presents highlights of the uses and impacts of poverty mapping as revealed through the country case studies examined in this report. The information below is intended to be illustrative. For further details as well as more examples, readers should refer to the full text of the 14 country case study notes, which can be downloaded from http://population.wri.org/ or http://www.povertymap.net/pub.htm.
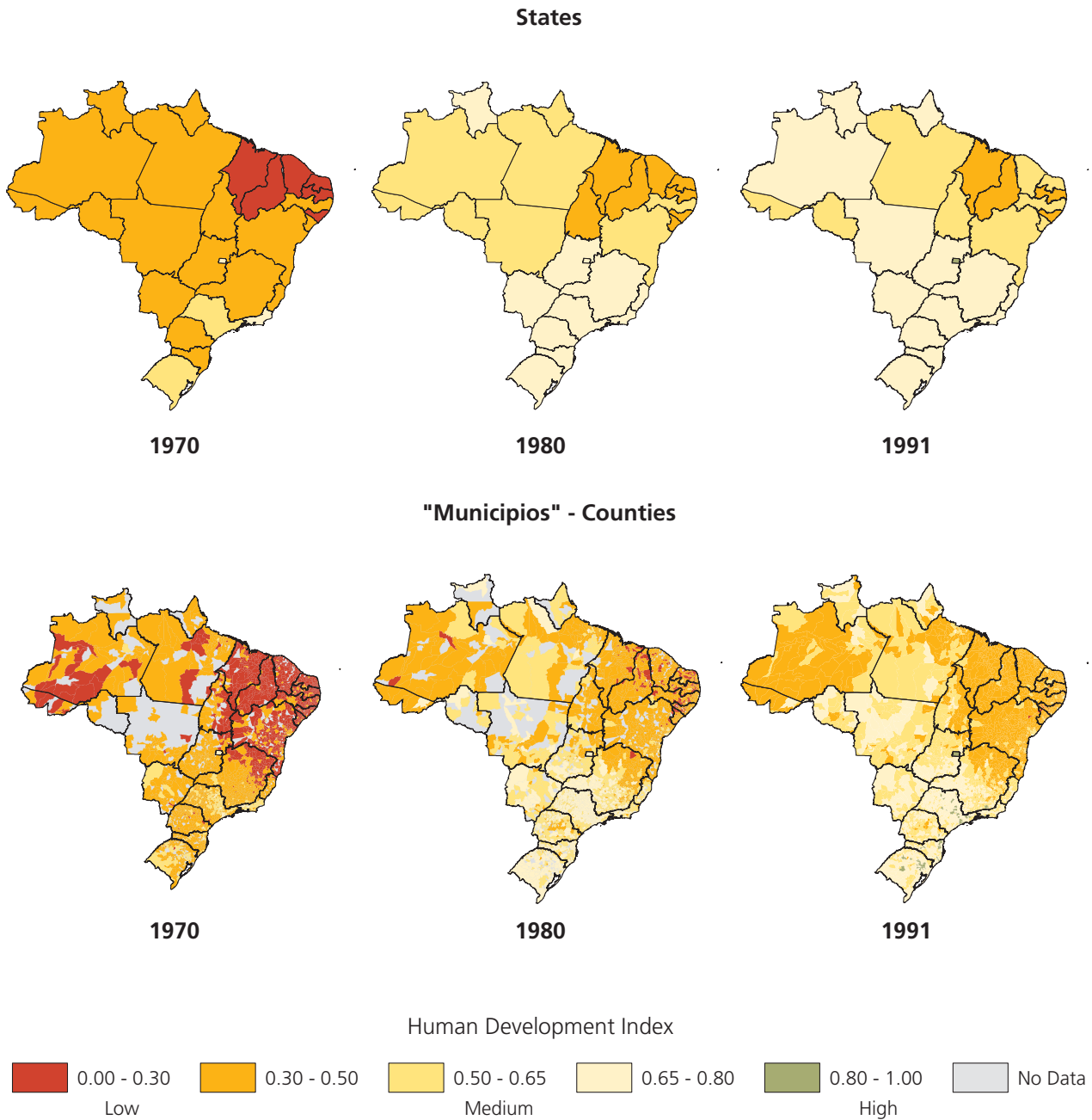
Highlights are reported in several categories: poverty reduction strategies and programs; targeting of national budgets and investment funds; emergency response and food aid; state- and local-level decision-making; and increased transparency of public decision-making.

Poverty reduction strategies and programs

Poverty maps have become important tools in implementing poverty reduction programs, including international efforts (such as the World Bank-initiated poverty reduction strategies for Highly Indebted Poor Countries) as well as purely national initiatives. Both small area estimation and straightforward mapping of census and survey data have been used as foundations for these maps.
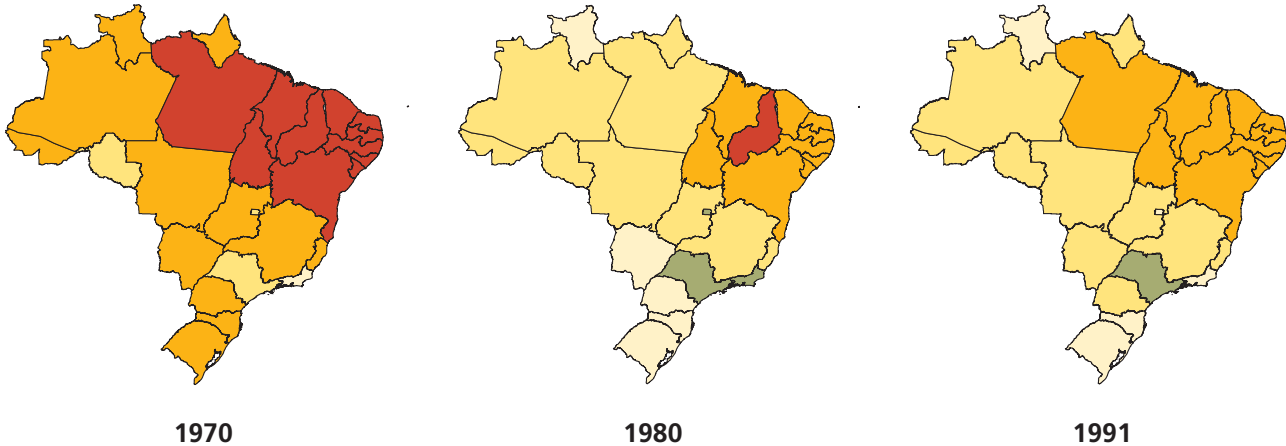
■ Nicaragua's Strengthened Growth and Poverty Reduction Strategy (SGPRS) relies heavily on poverty mapping to allocate US$1.1 billion in capital spending over five years (2001-05). Nicaragua has had a relatively long history of poverty mapping. Its first poverty map, based on indicators of unsatisfied basic needs (UBN), was developed in 1992 to guide expenditures of the Emergency Social Investment Fund (Fondo de Inversión Social de Emergencia, FISE). (See the following section for a discussion of FISE's use of poverty mapping). In 2000, an updated poverty map was produced using the World Bank's small-area estimation methodology to predict consumption at the regional, departmental, and municipal levels. Required by the World Bank and International Monetary Fund for Nicaraguan debt relief under the Highly Indebted Poor Countries (HPIC) Initiative, the SGPRS commits to the use of poverty mapping, noting that it is an "excellent tool" for achieving the "most efficient allocation of resources among competing targets." Improved targeting is influencing investment in several sectors, most notably health and education. A map of extreme poverty has been used to expand health services in especially poor areas, including the development

of new health clinics and upgrading of hospital services. Poverty mapping data are also being used to target direct educational support to 300,000 students in poor rural areas.

■ A South African grants program is using poverty maps to redistribute billions of rand annually (2.6 billion (US$305 million) in FY2001-02) toward poor municipalities. The equitable shares grant program is a system of intergovernmental transfers established under South Africa's 1998 Division of Revenue Act, which requires equitable distribution of nationally raised revenue to municipalities. Its distribution formula is based on the number and size of poor households and the costs associated with providing basic household-level services. Initially, census data on income were used to determine the number of poor households in each municipality. However, these data were quite limited and were found to seriously understate poverty in rural areas. In 1999, the World Bank approached Statistics-South Africa (Statistics SA) about possible interest in using the Bank's small area estimation methodology to produce a detailed poverty map for the municipal grants program. With technical assistance from the Bank, four researchers at Statistics SA developed a poverty map in about a year (March 1999-March 2000). Poverty rates were estimated at the province (9), district council (45), and magisterial district (354) levels. The poverty map was used for the first time in fiscal year 2001-02 to allocate municipal grants. In addition, thanks to the poverty mapping effort, the equitable shares program has, for the first time, reliable data on which to base a medium-term (three years out) budget, contributing substantially to better budgetary planning.

■ Brazil's so-called *Alvorada Program* depends fundamentally on municipal-level poverty maps to allocate funding for poverty reduction initiatives totaling 11.6 billion real (about US$4.2 billion) over three years (2000-02). Brazil has been engaged in poverty mapping based on UNDP's Human Development Index (HDI) since 1995, when UNDP initiated support for preparation of an *Atlas of Human Development for Brazil*. The first atlas was released in 1997, containing municipal-level HDI maps for Minas Gerais, the largest state in Brazil. A second version of the atlas was published the following year, with maps of about 4,500 municipalities in 27 states (see Figure 2). Five parameters—education (literacy, enrollment), health (life expectancy), housing (water and sanitation), income

Figure 2: Two indicators of human wellbeing at various spatial and temporal scales for Brazil

States

| 1970 | 1980 | 1991 |

"Municipios" - Counties

| 1970 | 1980 | 1991 |

Human Development Index

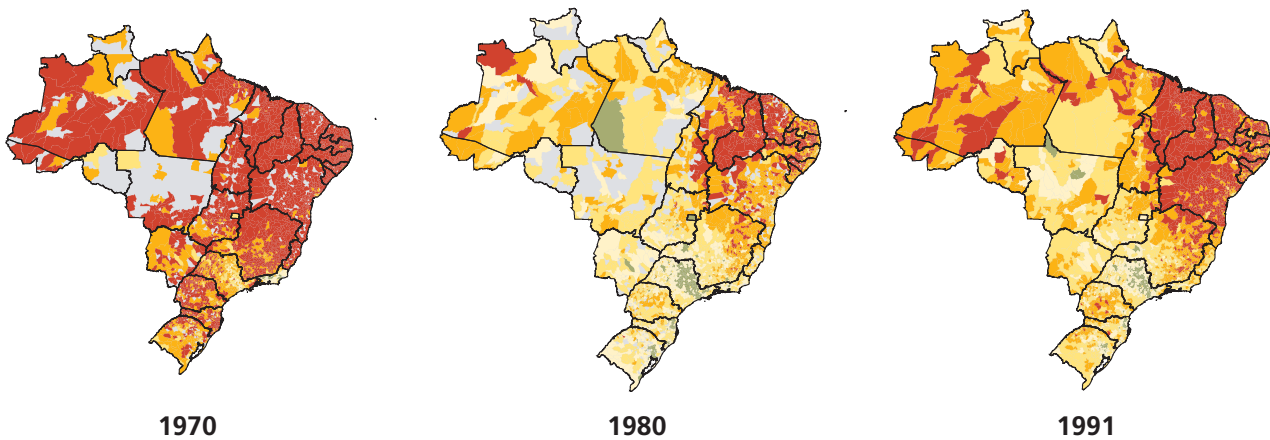| | 0.00 - 0.30 | | 0.30 - 0.50 | | 0.50 - 0.65 | | 0.65 - 0.80 | | 0.80 - 1.00 | | No Data |
| Low | | | | | Medium | | | | High | | |

Sources: Boundary files from Centro Internacional de Agricultura (CIAT). *HDI* estimates and *Percentage of Persons with Insufficient Income* from UNDP, Instituto de Pesquisa Econômica Aplicada, Fundação João Pinheiro, and Instituto Brasileiro de Geografia e Estatística, *Atlas do Desenvolvimento Humano no Brasil – CDROM* (1998).

States

1970   **1980**   **1991**

"Municipios" - Counties

1970   **1980**   **1991**

Persons with Insufficient Income (%)

80 - 100	60 - 80	40 - 60	20 - 40	Less than 20	No Data

This figure indicates the richness of information that can be conveyed by a time series of maps at various spatial scales. Shown here are two indicators of human wellbeing for Brazil at two levels (state and county – "municipio") over three decades (1970, 1980, and 1991). The first indicator used is the Human Development Index, which combines measures of life expectancy, education, and income—with equal weighting. HDI values range from zero to 1.00, based on achievement relative to minimum and maximum levels for the variables measured. The time series of maps show a dramatic decrease in the areas of extremely low (red) and low (orange) development: states depicted in red in 1970 are shown in orange in 1980 and some are dark yellow (medium HDI levels) by 1991. Comparing maps at different resolutions for the same period also is instructive. Although low-resolution maps indicate that the areas of lowest development were limited to Northeast Brazil (red in 1970, orange in 1980 and 1991), higher-resolution maps demonstrate that such areas are more widely dispersed with higher concentrations in the southwest. The second indicator presented is the percentage of persons whose income is below a minimum income line (defined at half of Brazil's official minimum wage per family member). Again, the maps indicate great spatial heterogeneity within all states and significant improvements over the past decades. A comparison of the HDI with the income measure clearly shows that areas with lowest HDI do not always have the highest percentage of persons with insufficient incomes, indicating that the two variables are measuring different dimensions of wellbeing.

(poverty line), and infant mortality—were mapped, along with a composite HDI encompassing income, education, and longevity. The *Alvorada Program* was developed in response to criticism of the government for focusing too intensely on economic conditions and not devoting sufficient attention to social issues. It provides various kinds of support to municipalities targeted using poverty mapping data. Examples of such support include: educational programs (adult literacy programs, remedial courses for students, scholarships for poor families); providing safe water and sanitation for 16,000 schools and more than 1.3 million families; establishing 6,000 new health care teams to serve an estimated 31 million people; and energy services programs (providing solar energy kits to 12,000 schools).

- **In Vietnam, poverty indicators and maps are being applied to geographic targeting of World Bank-funded poverty reduction initiatives totaling more than US$240 million over five years (2001-05).** Vietnamese experience with poverty mapping extends to 1997, when mapping was initiated with UNDP support. This effort examined rural areas only, mapping 543 of 545 rural districts. In 2000, an updated map was prepared using the World Bank methodology at the province level, encompassing 122 geographic areas, i.e., rural and urban areas of all 61 provinces. Overlaying this provincial poverty map with a map of ethnic minority populations showed a strong linkage between rural poverty and ethnic minorities, especially in the mountainous northwestern provinces and the central highlands (see Figure 3). In addition to these poverty maps, Vietnamese decision-makers make extensive use of local-level poverty indicators for the country's 10,000-plus communes. Commune-level indicators have been used since 1998 in two of the country's largest poverty reduction initiatives—MOLISA (Ministry of Labor, Invalids, and Social Assistance) Programme 133 and CEMMA (Committee for Ethnic Minorities in Mountainous Areas) Programme 135—under which poor households receive free or subsidized primary schooling, health care, and exemption from local taxes. Bureaucratic preference for these "home-grown" indicators (despite inconsistencies in how such indicators are defined and constructed nationwide) has thus far meant that use of poverty maps is frequently limited to cross-checking of results derived from commune-level indicators. World Bank-funded projects—including the Northern Mountains Poverty Reduction Project (US$120 million) and the Community-Based Rural Infrastructure Project (US$123 million)—have made use of both commune-level indicators and expenditure-based poverty maps to target poor areas.
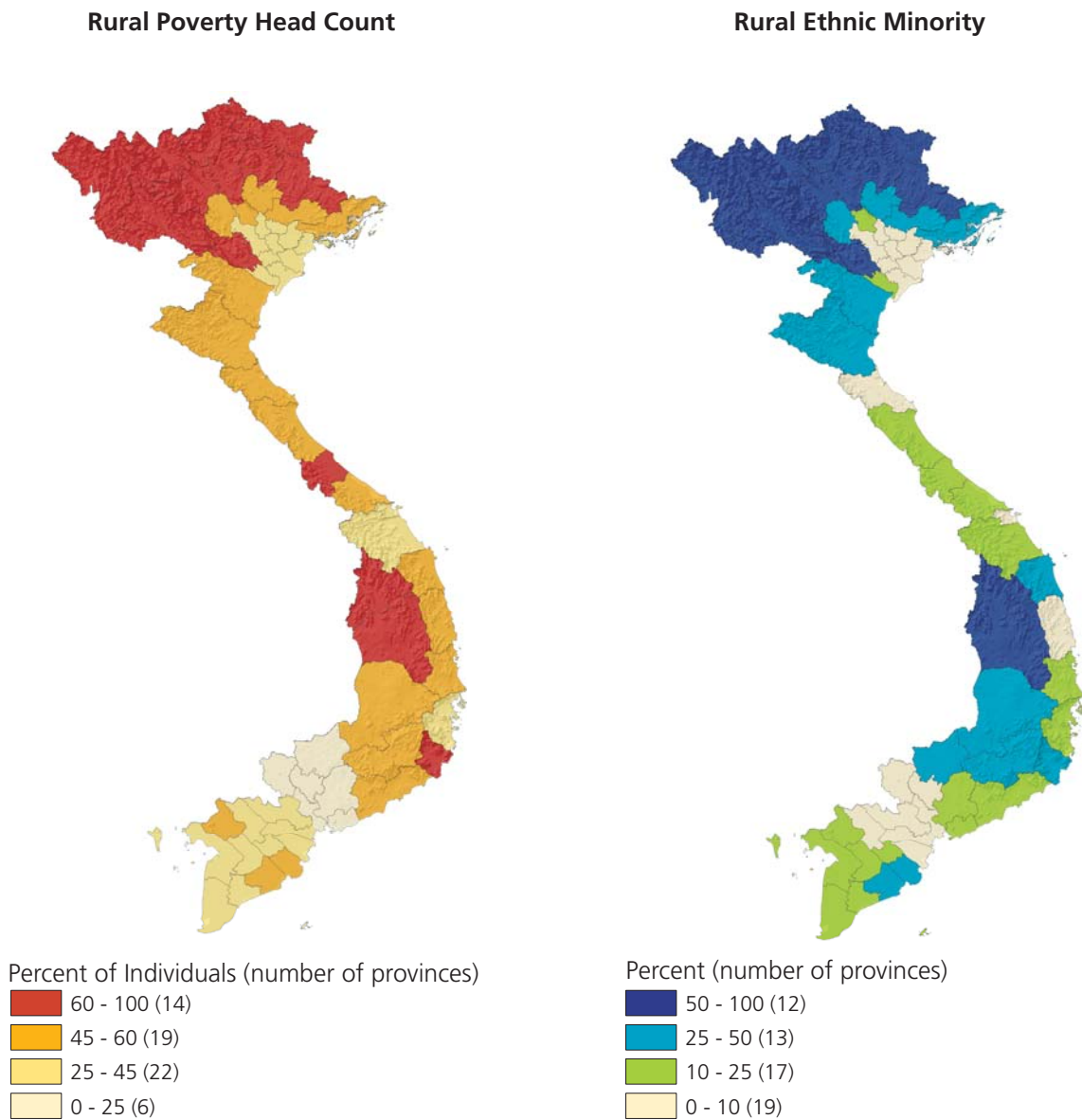
Targeting of national budgets and investment programs

Poverty maps are being used to help improve targeting of public expenditures by identifying where the neediest popula-

tions are located. Maps are focusing attention on poor areas and facilitating better integration of poverty as an issue in policy and program development.

- **In Guatemala, poverty mapping is helping to restructure the National Public Investment System (NPIS) and improve targeting of hundreds of millions of dollars (US$576 million in FY2002) of annual expenditures.** Although Guatemala is not a Highly Indebted Poor Country (HIPC) required by the World Bank and International Monetary Fund to institute a Poverty Reduction Strategy Program (PRSP), its president commissioned the development of such a strategy in 2000. Preparation of the strategy was led by SEGEPLAN (Secretariat for Planning and Programming), whose staff elected to use the World Bank's small-area estimation methodology for constructing a municipal-level poverty map (covering 330 municipalities in 22 departments). Developed under tight time constraints (November 2000-February 2001), the Guatemalan poverty map will provide SEGEPLAN with information for ranking projects proposed for NPIS funding according to geographic criteria. (Such criteria account for about 50 percent of a project's overall priority score; political and sustainability factors also are considered.) In addition to SEGEPLAN's use of the poverty maps, Guatemala's line ministries will in the future be asked to use similar geographic and other guidelines for prioritizing project selection. The World Bank is currently using the poverty maps to develop a road strategy for Guatemala, which will guide investment of about US$100 million. Overlaying poverty maps with roads data shows that poverty in Guatemala is highly correlated with lack of roads, resulting in significantly higher travel times and lack of access to basic services (see Figure 4).

- **Nicaragua will use poverty maps to guide the distribution of US$140 million (2002-04) under its Emergency Social Investment Fund (FISE).** As noted above, FISE first developed a poverty map to help allocate its investments in 1992. FISE was established during a period of political polarization shortly after the end of the Nicaraguan civil war, and the need for transparency in investment allocation quickly became apparent. Initially, poverty maps were based on unsatisfied basic needs (UBN) methodology, but this approach tended to overstate poverty (i.e., include non-poor households). In 1996, Nicaragua began using the small-area estimation technique to update its poverty maps. All told, the 1992 FISE poverty map helped allocate investment of about US$200 million (1992-7) and the 1996 map guided distribution of approximately US$160 million (1998-2001). The latest map, prepared in 2000, features the latest World Bank methodology to predict household consumption at the level of Nicaragua's 151 municipalities. FISE will rely heavily on the 2000 map (in conjunction with

Figure 3.   Linkage of rural poverty rates and ethnic minorities in Vietnam

Rural Poverty Head Count

Rural Ethnic Minority

Percent of Individuals (number of provinces)
- 🟥 60 - 100 (14)
- 🟧 45 - 60 (19)
- 🟨 25 - 45 (22)
- ⬜ 0 - 25 (6)

Percent (number of provinces)
- 🟦 50 - 100 (12)
- 🟦 25 - 50 (13)
- 🟩 10 - 25 (17)
- ⬜ 0 - 10 (19)

Sources: Boundary files from International Food Policy Research Institute (IFPRI). Rural poverty head count from Minot and Baulch (2002b). Rates of rural ethnic minorities computed from 3% Enumeration Sample of 1999 Population and Housing Census by Bob Baulch, Institute of Development Studies, University of Sussex, United Kingdom. Terrain based on United States Geological Survey (EROS Data Center) HYDRO1k.

The two maps depict the connection between incidence of rural poverty and proportion of ethnic minority population in Vietnam. A map of rural poverty by province (n=61) was juxtaposed with a map representing the proportion of the provincial population made up of ethnic minorities. The resulting maps show a strong association of rural poverty and ethnicity, especially in the mountainous northwestern provinces and in the Annamese highlands of the country's midsection. Of the 14 poorest provinces (headcount index of 60-100%, shown in red), the vast majority have extremely high proportions of their populations made up of ethnic minorities (50-100%, shown in dark blue). Conversely, the 19 provinces with the smallest ethnic minority population (0-10%, depicted in pale yellow) typically have low (0-25%) or medium (25-45%) rates of poverty.

Figure 4:   Overlay of Guatemalan poverty map and roads data
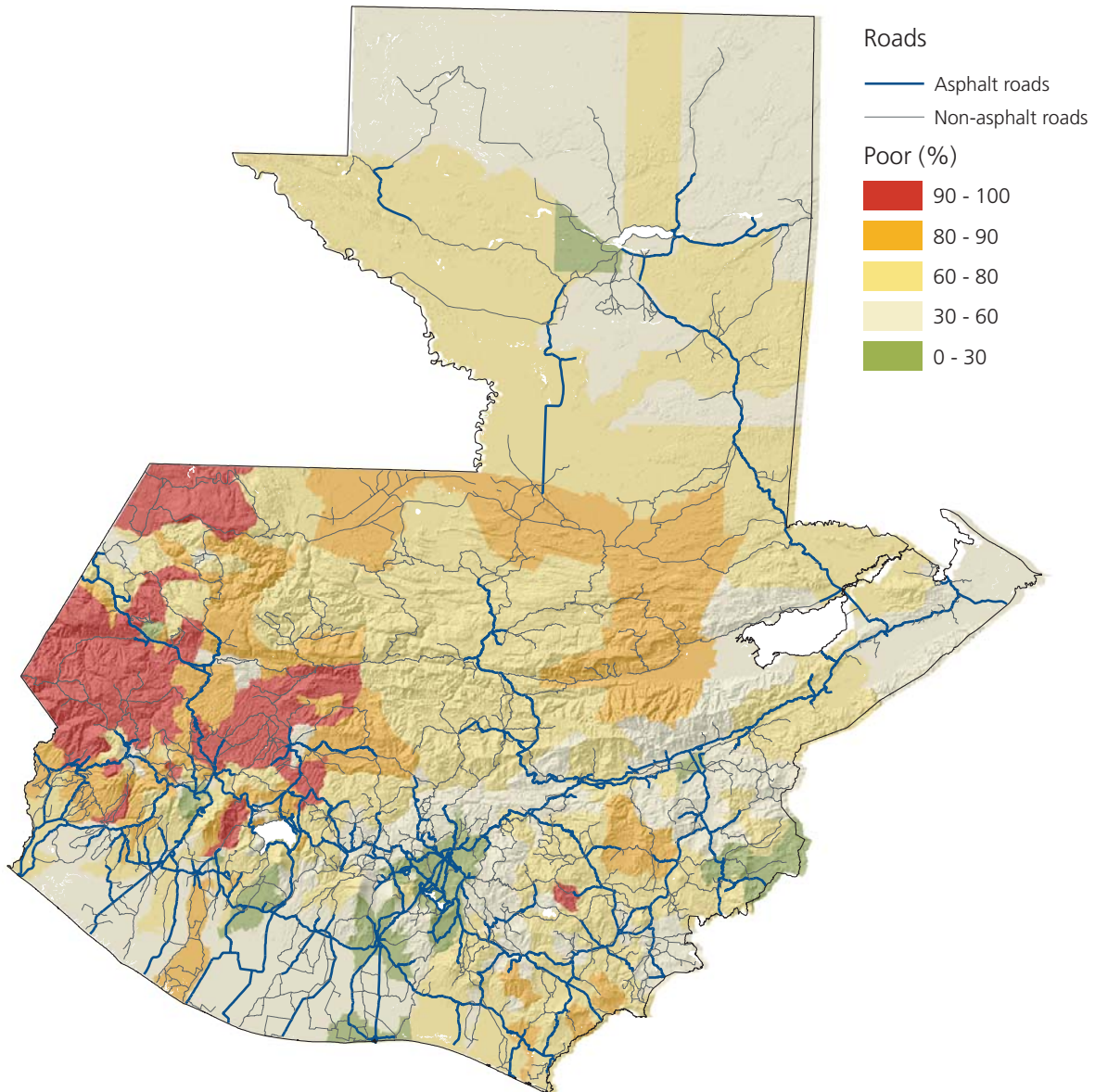
Sources: Roads, contours (terrain), and administrative boundaries from Instituto Geographico Nacional de Guatemala (1:250,000 topographic maps).
Poverty rates from the World Bank.

 This map shows the association of poverty and gaps in road infrastructure in Guatemala. It was produced by overlaying the country's poverty map with national roads data. Note that areas with a dense road network, such as the country's narrow Pacific coastal lowland, are mostly depicted in light colors, indicating a lower incidence of poverty. High-poverty areas (shown in red), many in the central highlands near the Mexican border, tend to have fewer asphalt roads. The absence of roads means longer travel times and lower access to markets, employment, health services, and education.

community and neighborhood consultations) to target investment in development of various social infrastructure (such as schools and health centers) in extremely poor areas. This map will also steer FISE's selection of poor municipalities to receive cash transfers under an Inter-American Development Bank (IDB)-funded social safety net program. Various line ministries also used the 2000 map in preparation of Nicaragua's 2001 national budget.

- Panama has applied poverty mapping to help target US$150 million (1997-2001) in expenditures by its Social Investment Fund (SIF). Poverty indicators based on basic needs have been used in the country since 1970. However, growing recognition that these indicators were crude and in need of updating led to a 1998-99 effort to develop a high-resolution poverty map based on small-area estimation methodology. With technical assistance from the World Bank, Panama's Ministry of Economy and Finance estimated household-level consumption for the country's 75 districts; for some districts, estimates were also produced at the county (*corregimiento*) level. SIF has used these poverty maps to target investment in schools, health centers, and roads toward the country's poorest districts. For example, a school lunch program (US$2 million) using poverty maps for geographic targeting has been quite successful in reaching an estimated 120,000 extremely poor students in 1,500 schools. A division of the Health Ministry is combining poverty maps with community-based surveys to monitor and assess nutrition programs. The IDB recently moved to require the use of poverty mapping as a condition of all loan requests in Panama. Planning is underway to develop an updated poverty map using the latest (2000) World Bank methodology.

- Peruvian poverty maps have guided allocation of more than US$560 million in social investment funds (1992-98). Aimed at reducing poverty through employment generation and improved access to basic services, Peru's FONCODES (Fondo Nacional de Compensación y Desarollo Social) has developed several district-level (n=1,812) poverty maps. Founded in 1991 as a specific response to the historic tendency of Peruvian social expenditures to favor the upper middle class, FONCODES has used poverty maps based on UBN methodology to redirect investment toward poor areas and households. FONCODES' most recent UBN poverty maps, prepared in 2000, incorporate eight indicators: chronic malnutrition, illiteracy, school-age children not in school, overcrowded housing, inadequate roofing, and share of population without access to water, sanitation, or electricity. The use of poverty mapping has resulted in better targeting of FONCODES initiatives; studies indicate that, by 1996, households in wealthiest quartile of districts were receiving virtually no FONCODES education funds. Better targeting of social investment has tremendous implications for the

Peruvian economy, with one study estimating that any targeting, regardless of which poverty maps was used, could reduce the costs of closing the country's poverty gap by an amount varying from US$80 million to US$100 million (Schady 2000a).

In 1999, the Peruvian Ministry of Economy and Finance (MEF) developed an updated poverty map based on household consumption indicators estimated using World Bank methodology. The ministry is using this map to improve targeting of its programs in urban areas.

- In addition to the many successful uses of poverty mapping for geographic targeting of national budgets and social investment funds, some decision-makers have occasionally shown resistance to this approach. In Ecuador, poverty maps have been developed but are not being used by the Ministry of Social Development in implementing its malnutrition programs. Maps were prepared in 1998 at the canton (n=400) and parish (n=1,000) levels that were clearly anchored but not identical to the World Bank methodology. These maps show that malnutrition is concentrated in the poor populations of the Ecuadorian highlands, while poverty along the coast is associated with poor infrastructure. However, the ministry has continued to distribute food aid to coastal communities, many of which are in areas of potential electoral gains for the government.

Malawi's poverty mapping effort is still underway (scheduled for completion in 2002); however, one anticipated use has already stimulated speculation about potential resistance. Poverty maps could be used to target the country's "starter pack" program, a poverty reduction effort initiated in 1998. This program provides universal distribution of fertilizer and seeds to rural households in Malawi. Between 1998 and 2000, the program successfully reached 2.8 million rural households, but at high cost—i.e., US$30 million, mostly from bilateral donors. These donors are generally supportive of the starter pack program, but balk at its lack of cost-effectiveness. Although poverty maps could increase cost-effectiveness through targeting, some believe that Malawi's decision-makers are likely to resist a shift away from universal distribution, as this approach provides greater electoral benefits.

A study of FONCODES, Peru's social investment fund, indicates that while poverty mapping has improved targeting of the fund's regular investment program toward poor communities, political considerations have also played a role in investment decisions. This is especially the case with so-called special project funding, which has fewer paperwork requirements and other restrictions. Analyses show spikes of special project funding coinciding with the election cycles of 1992, 1993, and 1995, as well as disproportionate benefits flowing to

areas of core support for the then government of President Alberto Fujimori (Schady 2000b).

Emergency response and food aid

Maps have always been important tools in emergency response and food security interventions. Institutions involved in food security and famine early warning programs have regularly produced vulnerability maps at a subnational level to guide food distribution and food-for-work programs. These maps typically have relied on a combination of quantitative and qualitative methods. With the availability of detailed census data, household surveys, and more refined statistical estima- tion techniques, emergency response programs are beginning to make use of newer, more data-intensive methods like small area estimation.

- **In South Africa, information from a poverty mapping initiative was combined with information on sanitation and safe water supplies to create a geo-referenced strategy for containing a cholera outbreak in KwaZulu Natal province in early 2001.** Implementation of this strategy effectively contained the outbreak within three months. The resulting fatality rate, 0.22%, was among the world's

lowest ever recorded. Three agencies worked collaboratively to compile necessary information for the strategy: the Department of Health provided disease data, Statistics SA provided the poverty map and information on sanitation, and the Department of Water Affairs provided information on safe water and combined datasets to produce maps of high-risk areas. Mapping showed that cholera was follow- ing the river floodplain, moving through and toward poor areas (see Figure 5). Data on illiteracy rates, dwelling types, lack of basic services, and poverty provided the basis for an effective, targeted health education campaign.

- **Cambodian poverty maps are being used to help allocate $50 million in World Food Program (WFP) food aid (2001-03).** WFP has used poverty maps in combination with qualitative assessments since 1995 to identify the poorest of Cambodia communes for food aid, especially the WFP "food for work" interventions (constituting 85 percent of WFP assistance to Cambodia). Based on identification of the country's 550 poorest communes (of a total of 1,619), WFP field staff are mobilized to further determine the poorest villages and households within these poor communes. During the late 1990s, WFP relied on poverty maps based on expert qualitative assessments of 27

Figure 5.   Mapping poverty and the spread of cholera in KwaZulu Natal, South Africa, January 2001

Sources: Boundary files from UNEP/GRID-Arendal. Household poverty rates (1996) from Statistics South Africa (based on Statistics SA, 2000). Cholera data from Depart- ment of Health, KwaZulu Natal.

This map depicts an overlay of poverty mapping data with information concerning an outbreak of cholera in the KwaZulu Natal province of South Africa in early 2001. It shows that the disease outbreak originated in areas of very high and high poverty and spread through and towards other poor areas. The map was produced through the cooperation of several government agencies, including Statistics-SA (developer of the national poverty map), the Department of Health (provided disease data), and the Department of Water Affairs (provided information on safe water supplies). It served as the basis for a disease control strategy and helped to target health education messages in affected and high-risk communities. Using this map, the outbreak was effectively contained within three months, with a resulting fatality rate of (0.22%) among the lowest ever observed.
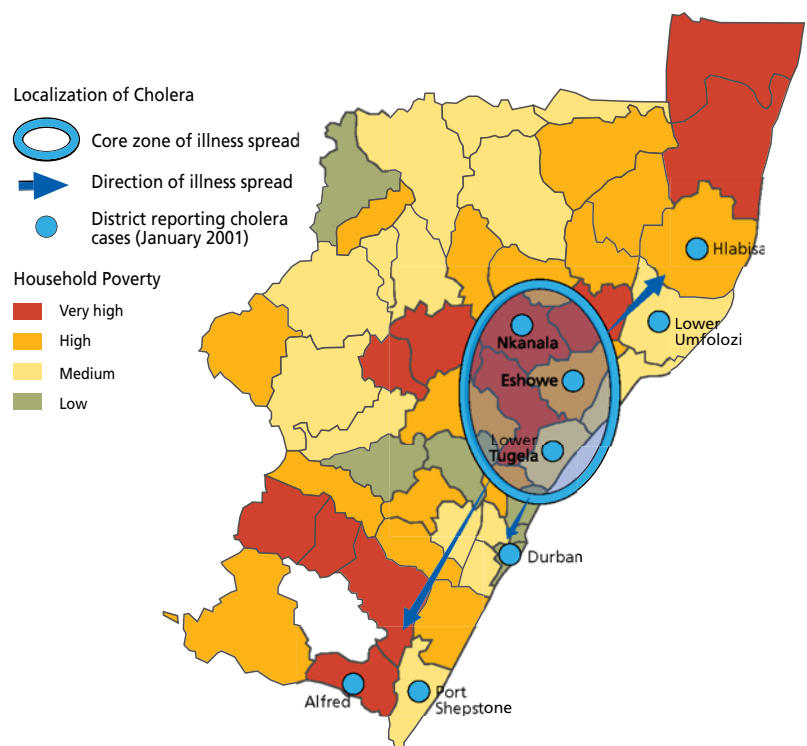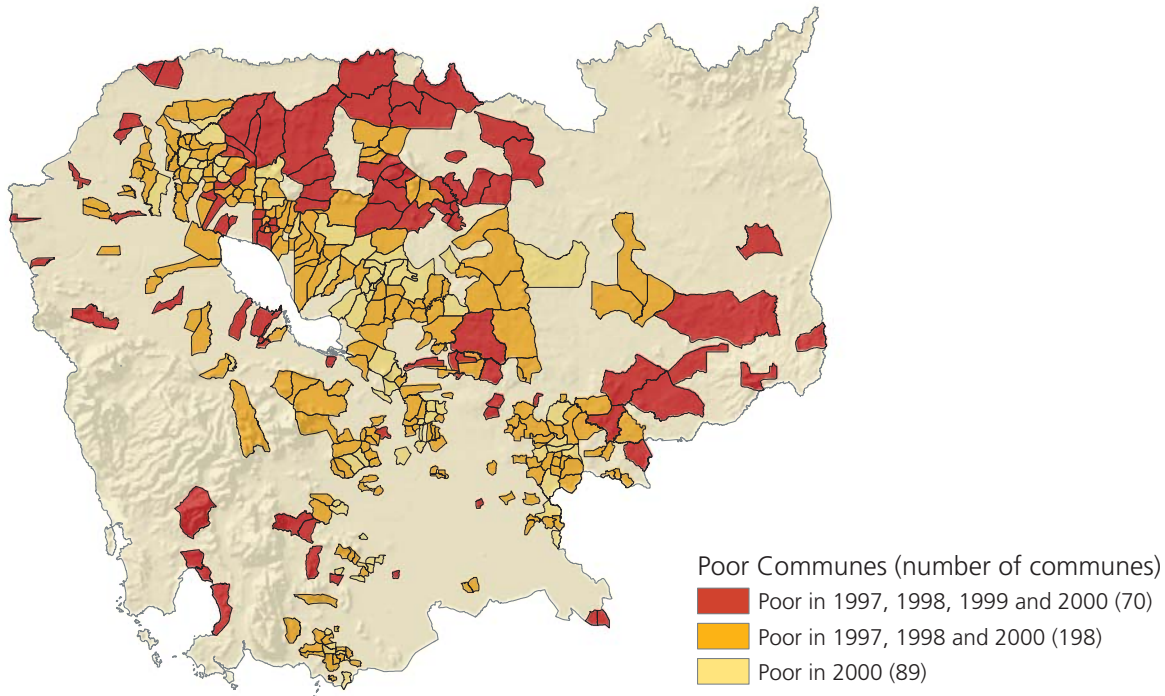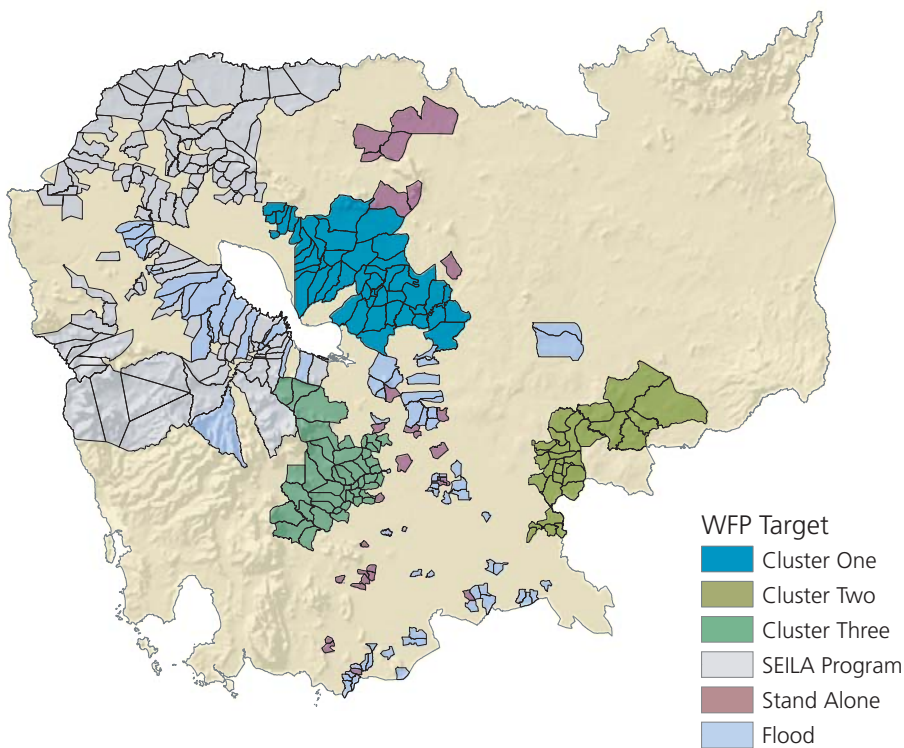
Figure 6.   Combining qualitative and quantitative poverty maps in Cambodia

Analysis of Poor Communes from 1997 to 2000

Poor Communes (number of communes)
- Poor in 1997, 1998, 1999 and 2000 (70)
- Poor in 1997, 1998 and 2000 (198)
- Poor in 2000 (89)

Poor Communes Targeted for 2001

WFP Target
- Cluster One
- Cluster Two
- Cluster Three
- SEILA Program
- Stand Alone
- Flood

Sources: Boundary files, qualitative commune-level poverty data, and poor communes targeted for 2001 (based on small area estimation) from World Food Program, Vulnerability and Mapping Unit (VAM). Terrain based on United States Geological Survey (EROS Data Center) HYDRO1k.

This figure depicts Cambodian poverty maps developed using different methodologies. From 1997-2000, the country's poverty mapping was based on qualitative assessments. Beginning in 2001, with increased availability of in-country data, a more quantitative analysis was undertaken, using a small-area estimation technique to predict household consumption. Previous poverty map results (1997-2000) and local-level field staff at the Ministry of Rural Development and the World Food Program were used to cross-check and verify the 2001 poverty map results.

socioeconomic indicators. With increased availability of in-country data, WFP used a small-area estimation methodology to produce a poverty map in 2001 (see Figure 6). Based on a prediction model of consumption, the map incorporated estimates of consumption for all 2.1 million households in Cambodia.

■ A poverty map in preparation in Madagascar will help target hotspots for risk and disaster management. The map is being developed jointly by the National Statistics Institute (INS) and the Ministry of Interior's Risk and Disaster Management Unit (CNS), in cooperation with an NGO (CARE) and with technical assistance from the World Bank. A technical advisor to CNS recognized that a poverty map could substantially contribute to a national analysis of the physical dangers of and socioeconomic vulnerability to natural disasters. The poverty map ultimately will be combined with physical data on natural hazards (e.g., maps of the extent and frequency cyclones, floods, droughts, etc.) and on socioeconomic vulnerability to natural disasters (e.g., maps of agricultural production, malnutrition, etc.). The poverty map will be produced at the level of the country's 111 districts (*fivondrona*) and 1,332 communes (*firaisana*). The Interior Ministry and CARE expect to use the poverty, natural hazard, and socioeconomic vulnerability maps to target disaster management programming. The poverty map is also slated for use in Madagascar's Poverty Reduction Strategy Program and a World Bank-funded Rural Transport Project.

State- and local-level decision-making

High-resolution poverty maps have been useful in decision-making and priority setting not only nationally, but also at the state and local levels.

■ Brazil's largest state, Minas Gerais, is using poverty maps to redistribute statewide tax revenues totaling US$1 billion annually toward poorer municipalities. The state government formulated a "Robin Hood Law," which changed the criteria for allocating statewide value-added tax revenues among municipalities. Previously, the distribution formula took into account only the size of municipality (providing an incentive for rapid population growth) and fiscal value added locally (promoting a tendency toward concentration of economic growth). Under the new law, allocation will be based on a comprehensive set of human development indicators. Revenues will be transferred from richer areas to poor municipalities that are making an effort to invest in health, education, sanitation, and environmental conservation. In addition, Minas Gerais, along with the state of São Paulo, recently passed legislation requiring the use of an Index of Social Responsibility (based on a Human Development Index, among other factors) to help set state development and investment priorities.

■ Ecuadorian poverty mapping has had a substantial impact on local-level decision-making. As noted above, poverty maps based on small-area estimation methodology were developed in 1998 at the canton and parish level. Maps and underlying data were published and widely disseminated in hardcopy and on CD. Besides consumption-based poverty maps, these publications also contained data on other poverty indicators, such as health, education, malnutrition, and employment. The Institute of Ecuadorian Studies used the data and a simple mapping program included on a CD to facilitate participatory development of 15- to 20-year local plans in various municipalities. This provided a tool for further informing community perceptions about development needs (e.g., building of health centers, strengthening education, etc.) and cross-checking perceived community needs with mapped data. The use of poverty mapping tools, in consultation with local communities, has helped to shift the allocation of expenditures to better meet rural needs.

Increased transparency of public decision-making

In the cases studied, producing and distributing poverty maps helped to raise awareness of poverty, ignited policy debates at local and national levels, encouraged broader civil society participation in decision-making, and increased the transparency of resource allocation.

■ Brazil's *Atlas of Human Development* and the poverty maps it contains have had a major impact on public debate about poverty and the transparency of public decision-making. Before the atlas was developed, it was uncommon for government expenditures to target poor areas geographically. Now, the release of updated human development indicators is regularly covered by Brazilian mass media (newspapers and television), often sparking heated policy debates. Civil society participation in discussion and decisions about poverty has been encouraged by the wide dissemination of user-friendly poverty mapping data and software, at no cost, to the country's libraries, state and federal agencies, and research institutes.

■ In Nicaragua, poverty mapping helped identify poor regions and communities previously neglected by the government. For example, mapping highlighted the Atlantic Coast department—populated by ethnic minorities and indigenous groups (e.g., *miskitos, mayagnas, ramas,* and Creoles—as one of the poorest in the country).

■ Officials of Panama's Social Investment Fund have reported that the transparent use of poverty maps in decision-making has enabled them to resist pressure from politicians to alter funding allocations once these had been made.

Discussion of Findings

In this section, we identify major patterns and themes emerging from the case studies, especially those pointing toward best practices and lessons learned. This discussion is influenced by the fact that the study focused primarily on one particular method of poverty map production— consumption-based small area estimation—and gave only cursory consideration to other methods (e.g., basic needs indexes). Cases featuring the latter method were included because we believe they offer valuable insights on uses and applications of poverty maps.

The discussion below is organized according to four major themes: demand issues; methodological issues; dialogue, collaboration, and dissemination; and capacity development and long-term sustainability.

Demand issues

Linkage between user demand and subsequent applications of poverty maps. Our case studies indicate that, not surprisingly, a strong linkage of map production with user demand promoted subsequent use of poverty maps. In Guatemala and Nicaragua, this demand took the form of requests for poverty mapping services from high-profile poverty reduction strategies. Demand prompted by a legal mandate, such as South Africa's municipal grants program for redistribution of tax revenues, provided a basis for effective and influential use of poverty mapping. Direct connection to a recurrent program, such as the WFP's food-for-work program in Cambodia, also tended to stimulate ongoing demand for and use of poverty maps.

One important observation is that, in cases where poverty mapping was driven by demand, users tended to be involved from the very start of the exercise. Hence, they were better able to influence critical decisions, such as the methodology and datasets to be used as well as the level of map resolution. Such early and extensive user participation meant that the maps were suitable for immediate application upon their release to help allocate public expenditures and target social investment. Examples of map users extensively involved with poverty mapping efforts include the social investment funds of Nicaragua, Panama, and Peru.

In some cases, strong user demand led not only to extensive use of poverty maps but also more fundamental changes in the processes of public decision-making. For example, Guatemala restructured its National Public Investment System

to rely heavily on geographic criteria for allocating public expenditures. Likewise, Nicaragua is integrating poverty rankings in the National Investment System database used to prepare the national budget.

Cases in which poverty maps have been in circulation for some time indicate a tendency for strong initial user demand to spark further demand among secondary users of poverty maps. For example, in Panama, the Social Investment Fund drove the creation of the national poverty map, but it has since been adopted by the Inter-American Development Bank as a requirement for use in all loan requests from that country. Similarly, Cambodia's poverty map was developed initially for use by the World Food Program, but since has been taken up and used by the Asian Development Bank in its Northwestern Rural Development Project. It has also been applied by the Cambodian Planning Ministry to select communes for a participatory poverty assessment. Other cases in which the use of poverty maps spread beyond initial users involved in their creation include Guatemala, Nicaragua, South Africa, and Vietnam.

Untapped potential for environmental and other applications. The case studies we examined reflected a concentration of applications to economic issues, partially because many of our cases featured mapping initiatives that were driven by national planning and budgetary entities. However, the interviews we conducted with map producers and users point to applications in other sectors. These additional applications could become reality as newer maps and data (based on small area estimation) are disseminated more widely and gain broader acceptance.

One of the few environmental applications uncovered during the case studies was the use of poverty mapping to assist in developing an environmental health strategy to contain a cholera outbreak in the KwaZulu Natal province of South Africa (described above). Another took place in Ecuador, where the government issued an urgent request for a map of poor households. It was considering eliminating a fuel subsidy program, a decision that could potentially improve the country's fiscal condition and environmental quality, but which would create a hardship for poor families. Poverty maps could help target a compensatory transfer to facilitate poor peoples' adjustment to fuel price increases. In this case, Ecuador ultimately decided not to remove the subsidy. However, other developing countries faced with similar

decisions could potentially find poverty maps a powerful tool for implementing policy measures with important overall economic and environmental benefits but painful short-term consequences for the poor. Subsequent Ecuadorian poverty maps have been successfully used in environmental applications: the NGO EcoCiencia overlaid poverty mapping data with maps of vegetative cover and biodiversity to highlight the role of human migration in land cover change.

Case study interviews brought to light some additional applications with significant spatial aspects. For instance, as described above, World Bank researchers in Guatemala compared poverty map results with road data to help develop a new road strategy. These researchers also mentioned plans to compare the poverty map with information on health centers, schools, earthquakes, floods, landslides, and conflicts to support future World Bank programs in Guatemala. In Madagascar, use of the forthcoming poverty map to target hotspots for risk and disaster management (also described above) is expected to be another significant spatial application.

Potential private-sector users. Although poverty mapping has great potential to contribute to the planning and operations of private- as well as public-sector entities, relatively few such uses were documented in our case studies. Interviews revealed that, once data became available and the limitations of these maps were well understood, NGOs such as Catholic Relief Services and Save the Children in Nicaragua and CARE in Madagascar have become interested in incorporating these poverty maps in their internal programming activities.

Documented instances of for-profit companies using poverty mapping came principally from Brazil, where maps of the national Human Development Index are extensively publicized via the mass media and more widely used than in other country cases. Among private-sector users, a leading insurer in Brazil has applied HDI maps in calculating life insurance premiums. Rio Grande do Sul, the state with the highest HDI rankings (and concomitant highly educated workforce), has used this information to attract business investment, including an automobile manufacturing plant. One of Brazil's largest telecommunications providers used the atlas to identify poor neighborhoods in Rio de Janeiro that would be good candidates for sales of prepaid mobile phone service (as an alternative to postpaid landline phone service requiring substantial infrastructure investment). A large industrial firm used poverty data for a corporate social responsibility project aimed at youth (aged 15-17) living in the poorest areas as identified by HDI maps.

Methodological issues

Importance of a credible, transparent method. Case study results indicate that small area estimation provides a consis-

tent and replicable method of poverty mapping. Countries that have tested and used this methodology include Ecuador, Guatemala, Nicaragua, Panama, and South Africa. In addition, China, Indonesia, Kazakhstan, Kenya, Kyrgyzstan, Madagascar, Malawi, Mexico, Mozambique, Pakistan, Thailand, and Uganda are in the process of developing poverty maps based on small area estimation. Acceptance and use of such maps has been significantly aided by the institutional clout of the World Bank, along with the commitment of the Bank's Research Group to providing technical assistance, refining statistical tools, and building developing-country poverty mapping capacity.

Maps based on techniques other than small area estimation have also gained acceptance and produced substantial impact. In Brazil, the solid international reputation of UNDP's Human Development Index (HDI) has proved more important than stringent methodological attributes. The HDI is computationally easy to construct: no statistical estimation for small areas is involved, just simple direct aggregation of census data to municipal level. Any methodological drawbacks perceived in some quarters have not prevented the HDI from attaining widespread national and local use in Brazil.

Nevertheless, other countries have struggled with the limitations of composite indicators lacking the HDI's international reputation. Jamaica experienced considerable difficulties with selection and weighting of indicators for a composite basic needs index developed and mapped in 1995-96. These problems have stimulated interest in using the statistically more rigorous small-area estimation technique to develop the next version of the Jamaican poverty map in 2002. Interviews with Vietnamese experts indicate growing interest in developing more consistent poverty measures, slowly overcoming bureaucratic inertia and reliance on commune-level indicators based on more subjective criteria and methods.

Despite the methodological rigor of the small area estimation technique, not all intended uses of poverty maps require detailed household survey data and sophisticated econometric analyses. In some countries, highly complex analytical methods are impractical and too expensive.

It is important to recognize that debating the use of many different, competing methodologies may discourage the use of poverty maps. In Peru, for example, discussion of poverty mapping is increasingly bogged down in debates about which mapping technique to use rather which programs would benefit most from the application of poverty maps. In some instances, methodological controversies are thought to have provided a means of sidestepping the development and use of poverty maps altogether.

Overcoming problems with data availability and access. Map producers typically face two major challenges: do the necessary data exist and can access to them be secured at a reasonable cost in an acceptable timeframe? These issues are most prominent for researchers using the small-area estimation methodology at a household-unit level, which requires comprehensive data from the national census as well as household surveys. Many governments are extremely reluctant to release highly disaggregated census data to independent parties, citing legitimate confidentiality concerns.

One means of addressing such constraints has been the forging of collaborative arrangements through which researchers at government institutions first manipulate the raw data directly and then work jointly with analysts from other institutions on model development and distribution of results. Such arrangements can be observed in the Cambodian case study (collaboration of the World Food Programme with the Ministry of Planning) and in Ecuador (close affiliation of the World Bank with the National Statistics Institute). Similarly, the direct involvement of the national statistics departments in poverty map production in Guatemala, Madagascar, Malawi, Nicaragua, Panama, and South Africa is thought to have helped map developers obtain full access to census data.

Another approach has been to make use of coarser data that governments *are* willing to release. Researchers in Burkina Faso did not have access to household-unit data; they instead used an econometric technique capable of using input data based on average values for communities, supplemented by additional data (village, county, and regional levels) generated by a GIS. In Vietnam, map producers negotiated access to a 3% sample (and more recently a 33% sample) of all households in the 1999 census, which produced a map that is coarser in scale than would have been possible with complete census data, but more detailed than a map incorporating *no* census data.

Issues of data quality. Case study results point to two general data-quality problems: quality of input data coming from household surveys or censuses, and quality of geographic attribution of input data. For example, in Malawi, researchers had to painstakingly remove half of the household sample, due to unreliable consumption information in the 1997 household survey. This operation consumed considerable analyst time, and the resulting reduction of the sample size diminished the analytical power of the underlying statistical model.

South African map producers faced geo-coding issues involving the time-consuming task of reconciling incompatible datasets from the apartheid and post-apartheid eras. Burkina Faso's reliance on GIS for additional information required the investment of significant resources to check spatial data for errors, reconcile boundary information, and integrate various data in a "seamless" GIS.

Commonly agreed-upon minimum data standards (e.g., phrasing of questions on household characteristics or locating boundaries of enumeration areas) for household surveys, national censuses, and geospatial information like administrative boundaries are one way to address these issues. High-quality, documented baseline data reduces costs and increases accuracy of poverty map results.

Significance of up-to-date information and high-resolution maps. The use and impact of poverty maps can be considerably reduced if the map is based on data (typically census) that are several years old. Recent data are especially important for applications requiring a great deal of accuracy, such as geographic targeting. Use of Jamaica's poverty map (based on a 1991 census) has steadily declined as the data have aged. In Peru, decision-makers are considering use of a different indicator based on more recent (1999) data than the poverty map (based on the 1993 census) for application in a nutrition program. Outdated information can also lead to serious misunderstandings; a Brazilian municipality attempted to sue UNDP over its HDI ranking, not realizing that the indicator was based on 1991 census data rather than more recent information.

Whether data are "current" is not an absolute, but rather depends on the context in which the information will be used. Such factors as the speed of change in a country or the sensitivity of poverty measure used greatly influence data requirements. In Nicaragua, a study was conducted to determine whether Hurricane Mitch (1999) had significantly altered the profile of poverty in the country as described by its poverty map, which is based on 1995 census and 1998 household survey data. Results showed only a small, statistically insignificant change, indicating that the Nicaragua poverty map is not obsolete.

Producing poverty maps at a high level of resolution seems to promote more extensive use. Conversely, the comparatively coarse scale of Vietnam's 2000 poverty map (depicting 122 rural and urban areas at the province level) is thought to have limited its use. Although based on a more consistent and rigorous approach, this map cannot compete with commune-level poverty data covering more than 10,000 individual areas.

Packaging data at various spatial and temporal scales also appears to encourage broad usage. In Brazil, the *Atlas of Human Development* was distributed at the municipal and state levels and included time-series data for 1970, 1980, and 1991 (see Figure 2, p. 16–17). Moreover, neighborhood-level atlases were prepared for three heavily populated cities (Belo Horizonte, Rio de Janeiro, and Recife).

Need for comparative analyses and more sophisticated spatial analyses. The case studies examined here encompass considerable diversity of approaches. With the proliferation of poverty maps, it will become even more imperative for mapping experts to encourage systematic, comparative analyses that highlight the strengths and weaknesses of different methods. Davis (2002) also takes note of this need, pointing out, for example, the lack of formal comparisons between the household-unit and community-levels methods of small area estimation.

Interviews with case study participants also revealed a need to incorporate additional spatial datasets in poverty analyses and make use of more sophisticated spatial analyses. For example, various decision-makers in Peru voiced concern that geographic targeting should identify zones of high economic potential as well as areas of high poverty. This suggests a need for additional spatial analysis, for example by overlaying mapped data related to regional economic potential and/or performance with poverty maps. Davis (2002) suggests that research on poverty and food security could be greatly improved with more sophisticated spatial analyses that move beyond simple spatial overlays. Similar advanced spatial analyses could be envisioned in the area of environment and poverty. Dimensions that could be explored by such analyses include basic environmental services (solid waste collection and disposal, drinking water supply, wastewater treatment and management, mass transit), identification and prevention of environmental health risks, rights of access to natural resource use and development, siting and management of protected areas, and fiscal expenditures and subsidies for environmental goods and services at municipal, county, or state levels.

Dialogue, collaboration, and dissemination

Importance of senior-level support. The support of senior-level officials is crucial to the success of poverty map production and use, especially when there are issues of data access and testing of new statistical methods. One example drawn from our case studies is that of South Africa, where the leadership of Statistics SA supported the idea of conducting a formal evaluation of data for income and poverty estimation. This evaluation demonstrated how census data underestimated income, especially for rural households with significant earnings in non-cash income (Alderman et al. 2000). Initial senior-level endorsement was subsequently extended to support for production of a poverty map using small area estimation to combine census income data with household expenditure data from a national survey. The involvement of senior management also helped researchers gain full access to census and survey data.

Need for collaborative approaches. The cases we examined indicate that collaborative interagency approaches greatly facilitate map production and use. In Nicaragua, interagency collaboration on poverty mapping featured the participation of both information producers and users. Among the former were the National Statistics and Census Institute and the Program for the Improvement of Living Standards Measurement Surveys. Key potential users involved in the collaboration were the Technical Secretariat of the President (SETEC) and the national Emergency Social Investment Fund (FISE). Developed in 2000, Nicaragua's poverty map has already been used by SETEC to improve geographic targeting of the national poverty reduction strategy and by FISE to support the development of schools, health centers, and other infrastructure.

Likewise, a diverse mix of information producers (such as the National Statistics Institute and the University of Rafael Landívar) and users (such as SEGEPLAN, the President's Secretariat for Planning and Programming) contributed to the development of the Guatemalan poverty map in 2000. Information users were directly involved in the map production process and are already using the resulting information outputs. SEGEPLAN, for example, is currently developing guidelines under which the poverty map will be used to improve targeting of expenditures by the national social investment fund (NPIS).

Importance of an active dissemination strategy. Extensive and strategic dissemination of poverty maps is crucial if poverty maps are to be widely used to influence decision-making in government and among other users in society. Our case studies illustrate the various ways in which an active dissemination strategy can affect awareness and use of poverty maps. Outreach vehicles employed in the cases we considered included such outputs as special briefings, technical and non-technical reports, specific products for mass media, CDs of data and simple, user-friendly mapping programs, websites, and publications of results in technical journals.

Briefings for senior policymakers helped raise awareness and build acceptance for poverty maps. In South Africa, numerous presentations to the President's office, various ministries, and provincial-level government agencies are thought to have greatly influenced use. In Guatemala, various ministries as well as the vice president were briefed, helping to generate substantial support for integrating geographic criteria in national budget procedures.

Distribution of data products, such as CDs containing data and user-friendly mapping and statistical software, has also been an effective way of promoting familiarity with and adoption of poverty maps by a broad spectrum of users. The *Human Development Atlas* CD in Brazil provides the largest publicly available database ever assembled at the municipal-level. Ecuador's INFOPLAN similarly relies on a simple

mapping program to facilitate the display and analysis of data. The INFOPLAN CD includes poverty data, as well as numerous disaggregated data on health, education, malnutrition, employment, and environmental risk.

The case of Brazil indicates the potential for mass media coverage to create a high public profile for poverty mapping. Brazil's HDI map was featured on the front pages of newspapers as well as on primetime television. Television coverage reached approximately 16 million viewers nationwide, while more than 50 newspapers from every region published extensive editorials on the HDI results.

Capacity development and long-term sustainability

Institutional strengthening. Among the most significant impacts of poverty mapping have been the effects—both planned and unanticipated—on institutional strengthening in developing countries. In addition to the expected rise in the technical skills of participating researchers, case studies contained several reports of increased institutional credibility and standing in senior policymaking circles in the wake of a poverty mapping exercise.

One of the most dramatic cases is that of Statistics South Africa. Previously regarded as an institution that collected data for selected urban areas, it is increasingly perceived as an entity committed to contributing to the development of South African society as a whole. Assuming the lead role in the country's poverty mapping exercise broadened and enhanced the capacity of Statistics SA for information analysis as well as data provision. Since publication of the poverty maps, the agency has been invited to participate in the country's top planning and strategy development. Organizations involved with poverty mapping in Guatemala and Nicaragua also reported increased credibility.

Experiences with poverty mapping has led to greater institutional awareness of the need for better coordination of efforts, especially with respect to survey and census design, data issues (collection, processing, analysis, data standards, and data sharing), and project development. Many of the institutions participating in poverty mapping had poor track records concerning interagency collaboration. In particular, poor coordination has led to the development of incompatible datasets. Long-term data standards development requires better coordination among institutions responsible for baseline data, such as surveys and statistics departments and mapping agencies.

Working knowledge of the collaborative process of map production and dissemination has made it much easier for such institutions to make a better case within their own governments for establishing a mechanism to facilitate

coordination. Interviewees from Guatemala, Malawi, Nicaragua, and South Africa reported such changes in attitude. In Nicaragua, use of essentially identical poverty maps is facilitating coordination between FISE, which is responsible for infrastructure development in extremely poor areas, and government agencies providing operational services (e.g., supporting teachers and health workers in the same areas where new educational and health infrastructure have been developed).

Strategy for building a cadre of skilled poverty map producers and analysts. Some of our case studies indicate that the production of poverty maps has been challenging in countries where staff was spread too thinly. For instance, this was a concern in Nicaragua, where two full-time consultants were hired to facilitate completion of the poverty maps. Progress on poverty mapping in Malawi has been slowed by other commitments of key staff. These and similar examples suggest a need for long-term strategies to build a cadre of trained poverty-map producers and analysts, particularly in countries with high poverty rates. (See Box 3 on how lessons learned from these case studies are being applied in East Africa to build the capacity of poverty map producers and analysts.)

Such a strategy would include developing training programs and guidelines for using poverty maps and incorporating poverty map techniques and results in university curricula. Interviewees in Brazil, Ecuador, Guatemala, and Nicaragua reported that specific training programs helped to raise awareness on the limitations and use of poverty data and maps. Researchers in Guatemala and Nicaragua developed guidelines for training sessions with decision-makers to describe how poverty maps can help to allocate public expenditures. Strengthening university-level curricula in the environmental sciences and economics, including econometric modeling and GIS, and incorporating the findings of poverty maps in curricula to communicate the issue of poverty more widely would be part of a long-term effort to increase the number of broadly-trained analysts. A first step in that direction was reported for Brazil, where information on the HDI was incorporated in secondary school curricula and in university entrance exams, thus helping to raise awareness of the HDI in civil society.

Strategy to help finance poverty map production. The case studies point toward opportunities for financial support of poverty maps outside government. In Madagascar, NGO (CARE) funds are supporting staff at Madagascar's statistical institute (INSTAT). Private companies will fund an update of Rio de Janeiro's neighborhood HDI. The Federation of Industries of Rio de Janeiro State recently decided to provide US$1 million for participatory research to further evaluate—at a fine resolution—poverty within Rio's 166 neighborhoods previously mapped at coarser resolution.

Tools and skills for sustainability. The case studies make it clear that equipment and tools used to develop and disseminate poverty maps need to account for local conditions. For instance, user-friendly mapping software available on Brazil's *Human Development Atlas* CD was intentionally developed with local conditions and uses in mind. The software runs on Brazil's most commonly available computers, requires little hard drive memory, and has easy-to-use import and export functions. It was developed in Brazil from scratch (i.e., in Delphi language) to avoid incurring obligations to pay expensive royalty fees to commercial GIS software companies.

Another potentially important tool is the customized poverty mapping software currently being developed by the World Bank in C++ (Lanjouw 2002). This software will not only facilitate complex econometric modeling, but will also obviate the need for expensive purchases and high maintenance fees associated with commercial statistical software (e.g., SAS).

Data comparisons are greatly facilitated by the use of GIS technology allowing for data overlays and comparisons. With anticipated rising demand for comparing poverty map results with other spatial data (e.g., in environmental applications), adequate support for developing and maintaining GIS skills and technologies in developing countries will become even more important. Likewise, support will be needed for the capacity to use GIS to generate additional variables for econometric models.

Box 3.   Applying the lessons learned to poverty mapping in East Africa

In early 2001, research and policy teams in Kenya and Uganda embarked, with support from the International Livestock Research Institute (ILRI), Rockefeller Foundation, World Bank, and World Resources Institute (WRI), on producing poverty maps based on small area estimation using household unit-level data. The Kenya teams are linking the 1997 Welfare Monitoring Survey (WMS) to the 1999 national household census. The Uganda teams are first applying the techniques to the 1992 WMS and the 1991 national census to gain experience and intend to base their final maps on the upcoming census (2002) and a more recent household survey. Initial results for both efforts are expected by the end of 2002.

This project approach builds on the experiences of poverty mapping efforts in other countries. The approach features: (i) three-person teams of highly motivated analysts from key institutions (e.g., census bureau, survey department, ministry of finance and planning, and university); (ii) small teams of senior advisors representing policymakers, major users, and major data producers (e.g., ministry of finance and planning, secretariat responsible for poverty reduction strategy paper, and heads of central bureau of statistics); (iii) hands-on training workshops to review progress; (iv) technical assistance from the World Bank's Research Group as well as countries with experience in small area estimation (e.g., Statistics South Africa), and (v) regular briefings for senior policymakers. A sixth element to this package is envisioned, which would encourage country teams to compile, in addition to the poverty maps, about two dozen maps showing household characteristics, educational background, access to sanitation and water, and other variables that are relevant for poverty analyses. These data can be taken directly from the census, an often-underused source of information, and would provide an important context for the poverty maps. (See for example Malawi's upcoming *Atlas of Social Statistics* as an excellent example how to communicate these census data.)

It is anticipated that the Kenya and Uganda maps will raise awareness about poverty, communicate its important spatial aspects, and facilitate policy dialogue and planning. In addition, Kenyan and Ugandan policymakers expect to improve the targeting and allocation of government expenditures, emergency response and food security planning, and poverty alleviation programs.

Lessons from the process in these two countries mirror the findings in this report, namely, the importance of senior-level support, the need for collaborative approaches, the importance of an active dissemination strategy, and the importance of viewing poverty mapping as critical long-term capacity-development and institutional-strengthening exercises. With an upcoming election in Kenya, it remains to be seen whether these maps will be released for further analyses and policymaking at various levels, or viewed by those in power as too politically sensitive to be made available for such uses.

A rich area for further research utilizing poverty maps relates to better understanding the problems of low productivity, natural resource degradation, and poverty in the intensifying rural sectors of both Kenya and Uganda. In some areas, it appears that land-use change has been part and parcel of a productive and sustainable pattern of agricultural development; in other areas the reverse is true, and tremendous population growth and land-use changes have led to severe land degradation. These new poverty maps may hold the key for determining agricultural land use and related technological options that lead to the former rather than the latter.

Sources: Presentations by T. Benson, P. Kristjanson, G. Ndeng'e, and P. Okwi, at IFPRI-ILRI "Poverty Mapping Methods and Policy Workshop," Nairobi, 19-21 June 2002.

Recommendations

The mapping of poverty is off to a good start in a number of developing countries, but it is just a start. Based on a review of case studies in 14 countries, we believe that seven major steps need to be taken to ensure that poverty mapping is sustained in these countries and expanded to all developing and developed countries over the next 10 years.

1. RECOGNIZING THE NEED FOR UNIVERSAL APPLICATION. *Every country in the world should map the distribution of its poor.* Policies and programs to reduce poverty require that countries have solid, detailed information about where poor people live and the resources the poor can use to improve their lives. Mapping poverty at the country and subnational level has become as important as mapping population and natural resources. Poverty maps should embody four characteristics if they are to be used and useful: the data must be timely; mapping should be done over time so that changes in poverty can be monitored and assessed; poverty maps should be based on high-resolution data so that citizens and authorities at all levels of government can assess their status and use the data for improvement; and the data should be of known quality.

2. INVOLVING STAKEHOLDERS FROM THE VERY START. *National governments*, through a multi-institutional, multi-stakeholder approach (and with the support of the international community, when needed), *should conduct a preliminary poverty mapping needs assessment* that identifies the following steps to the development of a useful and accurate map of the poor:

   - Definition of purposes and expected uses of mapping;
   - Statistical and mapping agencies and universities that should be involved in the development of data, mapping, and analyses;
   - Methodological approaches and datasets to be used;
   - Assessment of optimal level of map resolution and data quality for expected uses and whether this level is currently achievable technically;
   - Technical support required;
   - Budget and funding sources;
   - Outreach strategies to reach target audiences;
   - Evaluation of the process, including monitoring of how maps are used, by whom, and user feedback.

3. SUSTAINING THE EFFORT. Mapping the poor is a technical and political task. *It is essential that governments take steps to cultivate political support to sustain the technical effort over decades.* These actions typically involve: committing technical and financial resources; providing training to key staff; developing a cadre of broadly trained analysts; creating incentives to retain skilled analysts in the public sector; securing appropriate equipment; conducting a high quality census and periodic national household survey to generate essential data; developing data and map standards; providing support to universities and research centers that can assist with map development as well as rigorous analysis and evaluation of map uses and impacts; and committing to more transparent decision-making that takes into account both technical (i.e., poverty maps) and political considerations.

4. ENSURING ACCESS TO DATA. Most *countries will need to ensure that national legislation is in place to support the distribution of poverty information to all those who want it.* This means all potential users in: government at all levels, research institutes and universities, the private sector, nongovernmental organizations, media, and the poor themselves. Widespread access to poverty-relevant data will facilitate broad use of poverty maps and ensure strong demand for poverty information and more accountable decision-making. It will open the mapping process to independent organizations, helping to counterbalance any mistrust of official government information.

5. ENCOURAGING INNOVATIVE USES. Poverty maps are an important tool for developing poverty reduction strategies—a tool once missing but now available and ready to be used in many situations. We have identified and documented numerous ways in which these maps can and are being used to make decisions; support social, economic, and environmental goals; and strengthen governance. Much more remains to be done, however, to ensure that poverty mapping is applied as broadly as possible. In the area of environmental quality and natural resource management, *there are numerous opportunities to integrate poverty mapping into natural resource management and pollution control.* For example, poverty mapping can and should be used to analyze the relationships between poverty and: transportation, industrial hazards, exposure to air and water pollution, access to natural resources (wildlife, forests, grasslands, coastal and mineral resources), and natural hazards (flooding, storms, drought, and climate

change). The interconnections between poverty and land and resource tenure, siting of protected areas, subsidies for food and agriculture, and a host of municipal services should also be assessed.

6. SUPPORTING RESEARCH ON METHODS. As documented in this report, a number of methods can be used to map the poor. Some are more statistically sound than others; some, though less rigorous methodologically, are less costly and still valuable for selected applications. The World Bank has taken the lead in providing technical and statistical support to a number of countries; other donors should support poverty mapping research and applications as well. The international community should take up the challenge of creating *a new cadre of in-country experts who both understand the methodologies and can work with national and international colleagues to carry out studies and conduct research on new methods.*

7. DEVELOPING A POVERTY MAPPING STRATEGY. Enabling countries to develop and maintain poverty maps and make them widely available will take time, strong technical and institutional support, and leveraged funding. However, *it is essential that countries that have been successful in this endeavor*—along with international donors and interested nongovernmental organizations—*develop a long-term strategy to provide less developed countries with needed support.* WRI and UNEP/GRID-Arendal stand ready to join with the World Bank, developing countries, and interested organizations to develop a strategy that brings the promise of poverty mapping to many countries through many different avenues. We welcome ideas and participation.

Bibliography

Alderman, H., M. Babita, G. Demombynes, N. Makhatha, and B. Özler. 2001. "How Low Can You Go? Combining Census and Survey Data for Mapping Poverty in South Africa." Mimeo, The World Bank.

Bigman, D. and H. Fofack. 2000. *Geographical Targeting for Poverty Alleviation.* World Bank Regional and Sectoral Studies. Washington, DC: The World Bank.

Bigman, D. and M. Loevinsohn. 1999. "Targeting Agricultural R&D for Poverty Reduction: General Principles and an Illustration for Sub-Saharan Africa." Paper for presentation at the workshop "Assessing the Impact of Agricultural Research on Poverty Alleviation". San José, Costa Rica, September 14–16.

Bigman, D. and P. Srinivasan. 2001. "Geographical Targeting of Poverty Alleviation Programs: Methodology and Applications in Rural India." Mimeo, International Service for National Agricultural Research and Indira Gandhi Institute of Development Research.

Bigman, D., S. Dercon, D. Guillaume, and M. Lambotte. 2000. "Community Targeting for Poverty Reduction in Burkina Faso." *The World Bank Economic Review* 14(1): 167-94.

Davis, B. 2002. "Is it Possible to Avoid a Lemon? Reflections on Choosing a Poverty Mapping Method." Mimeo, Draft, January 30, 2002. Food and Agriculture Organization of the United Nations.

Deichmann, U. 1999. "Geographic Aspects of Inequality and Poverty." Text for the World Bank website on inequality, poverty, and socioeconomic performance, http://www.worldbank.org/poverty/inequal/index.htm.

Elbers, C., J. Lanjouw, and P. Lanjouw. 2002. "Micro-Level Estimation of Poverty and Inequality." *Econometrica*, forthcoming.

Henninger, N. 1998. "Mapping and Geographic Analysis of Poverty and Human Welfare: Review and Assessment." Report prepared for the UNEP-CGIAR Consortium for Spatial Information. Washington, DC: World Resources Institute. Available electronically at http://www.povertymap.net/pub.htm.

Hentschel, J. and P. Lanjouw. 1996. "Poverty Profile." Pp. 53–91 in *Ecuador Poverty Report.* Washington, DC: The World Bank.

Hentschel, J., J. Lanjouw, P. Lanjouw, and J. Poggi. 1998. *Combining Census and Survey Data to Study Spatial Dimensions of Poverty.* Policy Research Working Paper No. 1928. Washington, DC: The World Bank.

Hentschel, J., J. Lanjouw, P. Lanjouw, and J. Poggi. 2000. "Combining Census and Survey Data to Trace the Spatial Dimensions of Poverty: A Case Study of Ecuador." *The World Bank Economic Review* 14 (1): 147–65.

Lanjouw, P. 2002. Personal communication, June.

Montana, L. 2002. Personal communication, June.

Minot, N. 1998. *Generating Disaggregated Poverty Maps: An Application to Vietnam.* Markets and Structural Studies Division. Discussion Paper No. 25. Washington, DC: International Food Policy Research Institute.

Minot, N. 2000. "Generating Disaggregated Poverty Maps: An Application to Vietnam." *World Development.* Vol. 28, No. 2, pp. 319 – 331.

Minot, N. 2002. Personal communication, June.

Minot, N. and B. Baulch. 2002a. "Poverty Mapping with Aggregate Census Data: What is the Loss in Precision." Paper presented at the conference "Understanding Poverty and Growth in Sub-Saharan Africa," Centre for the Study of African Economies, St. Catherine's College, Oxford University, 18–19 March 2002.

Minot, N. and B. Baulch. 2002b. *The Spatial Distribution of Poverty in Vietnam and the Potential for Targeting.* Markets and Structural Studies Division. Discussion Paper 42. Washington, DC: International Food Policy Research Institute.

Schady, N. 2000a. "The Political Economy of Expenditures by the Peruvian Social Fund (FONCODES), 1991 – 1995." *American Political Science Review* 94(2): pp. 289–393.

Schady, N. 2000b. *Picking the Poor: Indicators for Geographic Targeting in Peru.* Policy Research Working Paper 2477. Washington, DC: The World Bank.

Statistics SA, 2000. *Measuring Poverty in South Africa.* Pretoria: Statistics South Africa.

Snel, M. and N. Henninger. 2002. "Review of the Development and Use of Poverty Maps: 14 Case Study Notes." World Resources Institute and UNEP/GRID-Arendal available electronically at http://www.population.wri.org/ and http://www.povertymap.net/pub.htm.

Appendix 1   List of Abbreviations and Acronyms[*]

ADB	Asian Development Bank
CEMMA	Committee for Ethnic Minorities in Mountainous Areas (Vietnam)
CEPAL	Economic Commission for Latin America and the Caribbean (Peru)
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency (Canada)
CNS	Ministry of Interior's Risk and Disaster Management Unit (Madagascar)
CONADE	Consejo National de Desarollo (National Council of Development) (Ecuador)
CSES	Cambodia Socio-Economic Survey
CRS	Catholic Relief Services
CSR	Center for Social Research (Malawi)
DANIDA	Danish International Development Assistance
DfID	Department for International Development (United Kingdom)
DOH	Department of Health (South Africa)
DOS	Department of Surveys (Malawi)
DWAF	Department of Water Affairs (South Africa)
EA	Enumeration Area (Malawi)
ECLAC	Economic Commission for Latin America and the Caribbean
EcoCiencia	La Fundación Ecuatoriana de Estudios Ecológicos (Ecuador)
ECV	Encuesta sobre las Condiciones de Vida (Ecuador)
EIS	Environmental Information System
ENV	Encuesta de Niveles de Vida (Panama)
ENIGFAM	Encuesta Nacional de Ingresos y Gastos Familiares (Guatemala)
ENCOVI	Encuesta Nacional sobre Condiciones de Vida (Guatemala)
EPA	Extension Planning Area (Malawi)
FAO	Food and Agricultural Organization of the United Nations
FEWS	Famine Early Warning System

FISE	Fondo de Inversión Social de Emergencia (Emergency Social Investment Fund) (Nicaragua)
FLACSO	Facultad Latinoamericana de Ciencias Sociales (Guatemala)
FONCODES	Fondo Nacional de Compensación y Desarrollo Social (Peruvian Social Fund)
FSS	Supplementary Social Fund (Nicaragua)
GIS	Geographic Information System
GRID	Global Resource Information Database (United Nations Environment Programme)
GSO	General Statistics Office (Vietnam)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (Germany)
HDI	Human Development Index
HIE	Household Income and Expenditure (Burkina Faso)
HIPC	Highly Indebted Poor Country
IDA	International Development Agency
IDB	Inter-American Development Bank
IES	Income and Expenditure Survey (South Africa)
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IHS	Integrated Household Survey (Malawi)
INE	National Statistical Institute (Guatemala, Mozambique)
INEC	Instituto Nacional de Estadistica y Censos (Ecuador, Nicaragua)
INEI	Instituto Nacional de Estadística e Informática (Peru)
INSTAT	Institut National de la Statistique (Madagascar)
IRD	Integrated Sustainable Rural Development (IRD)
ISR	Index of Social Responsibility (Brazil)
ISRDP	Integrated Sustainable Rural Development Programme (South Africa)
IPEA	Ministry of Planning's Institute of Applied Economic Research (Brazil)
JSIF	Jamaica Social Investment Fund
JICA	Japan International Cooperation Agency
KFW	Kreditanstalt für Wiederaufbau (Germany)

LCI	Life Condition Index		RPS	Red de Protección Social (Social Safety Net program - Nicaragua)
LSMS	Living Standards Measurement Survey		RTI	Research Triangle Institute (USA)
MARD	Ministry of Agriculture and Rural Development (Vietnam)		SADC	South African Development Community
MECOVI	Program for the Improvement of Living Standards Measurement Survey (Nicaragua)		SDC	Swiss Agency for Development and Cooperation
			SEGEPLAN	Secretariat of Planning and Programming for the Presidency (Guatemala)
MEF	Ministry of Economics and Finance (Peru)		SETEC	Technical Secretariat of the President (Nicaragua)
MOLISA	Ministry of Labor, Invalids, and Social Assistance (Vietnam)		SGPRS	Strengthened Growth and Poverty Reduction Strategy (Nicaragua)
MPF	Ministry of Planning and Finance (Mozambique)		Sida	Swedish International Development Cooperation Agency (Sweden)
MPI	Ministry of Planning and Investment (Vietnam)		SIF	Social Investment Fund (Panama)
NIAPP	National Institute for Agricultural Planning and Projection (Vietnam)		SILAIS	System of Local Health Care Center (Nicaragua)
NGO	Non-Governmental Organization		SNIP	National Investment System (Nicaragua)
NORAD	Norwegian Agency for Development Cooperation		Statistics SA	Statistics South Africa
NPIS	National Public Investment System (Guatemala)		TA	Traditional Authority (Malawi)
NSO	National Statistics Office (Malawi)		UBN	Unsatisfied/Unmet Basic Needs
ODEPLAN	Oficina de Planificación de la Presidencia de Ecuador (Ecuador's planning agency under the Office of the President)		UEM	Eduardo Mondlane University (Mozambique)
			UNDP	United Nations Development Programme
OHS	October Household Survey (South Africa)		UNEP	United Nations Environment Programme
PACE	University of Pennsylvania Pan African Census Explorer		UNPFA	United Nations Population Fund
			URL	University of Rafael Landívar (Guatemala)
PARPA	National Action Plan for the Reduction of Absolute Poverty (Mozambique)		USAID	United States Agency for International Development
PCA	Principal Components Analysis		VAM	Vulnerability Assessment and Mapping (Malawi)
PIOJ	Planning Institute of Jamaica (Jamaica)		VLSS	Vietnam Living Standard Survey
PPA	Participatory Poverty Assessment (Cambodia)		WHO	World Health Organization
PRSP	Poverty Reduction Strategy Program		WFP	World Food Programme
ROC	Receiver Operator Characteristics (Vietnam)		WRI	World Resources Institute

* Includes abbreviations used in the detailed case study notes.

Appendix 2   Questionnaire

1. Background information on the poverty mapping initiative

a. What types of poverty maps have been produced (e.g., scale or resolution and coverage)?

b. What data were used (e.g., census and survey at household unit level)?

c. Generally what methods were used to produce high-resolution estimates (e.g., small area estimation)?

d. How long did it take to develop the poverty maps (i.e., start and completion date)?

e. *Who* and *what* sparked the initial production of the poverty maps?

◆ donor (supply-driven – e.g., request from external consultants or in-country consultants?)

◆ in-country senior-level individuals (demand-driven – e.g., request from a high/senior-level individuals, due to awareness building, training, or in-country need?)

◆ personal/professional interest (e.g., interest from an analyst)

◆ specific uses like method development, better geographic targeting, etc.

f. Which other individuals should be contacted regarding the production and use of poverty maps?

2. Document the process of the poverty mapping production

Statistical estimation technique/ methods for aggregation

a. Describe in general terms the process of producing the statistical estimations?/ How did it work? What were challenges? Describe with regards to:

◆ institutions (who was involved? at what staff level? was staff time allocated? was there collaboration/dialogue within and between institutions?)

◆ skills/training(s) (how were skills developed – e.g., through formal training, training modules, handbooks, or manuals in poverty mapping? who was involved in this training?)

◆ funds (who provided funding – e.g., donors and/or in-country funds? over what time period?)

◆ equipment (was applicable equipment available?)

◆ approach/methodological issues (was there a willingness to use a new approach?)

◆ data issues (were data sets available, accessible, and compatible? has there been high investment in data collection and standards?)

Map production/cartography

a. Describe the process of mapping the poverty. How was it done? What were challenges? Describe with regards to the above noted issues (e.g., training, institutional, financial, equipment, methodological, and data issues – see #2).

Analysis/linking the poverty map with other data

a. Describe the process of analyzing the poverty map/linking the poverty map with other data (e.g., natural resources degradation)?/ How was it done? What were challenges? Describe with regards to the above noted issues (see # 2)

3. Document current use and impact of poverty maps

a. How have the poverty maps been used? What decisions have been influenced by the poverty maps? Describe with regards to:

- type of decision (intervention for an emergency, funding decision for a social/poverty alleviation programs, or policy/program development)
- type of user (e.g., government, NGO, donor, or private inst.)
- level of decision (e.g., national-, regional-, or local-level)
- indicate if the poverty maps were linked with other data

b. *Who* and *what* sparked the initial use of the poverty maps to influence decision(s)? Describe the process (e.g., which institutions were involved in disseminating and using the poverty maps?)? What were challenges?

c. How has the use of the poverty maps affected/impacted:

- decision making (e.g., have the decisions been more credible? been made in a more timely manner?)
- analysis (e.g., depth and type)
- institutions (e.g., were the institutions considered more credible? was funding more easily obtained?)

d. Would the lack of the poverty maps have affected the final outcome of the above noted decisions? If so, how? (e.g., the decision may not have been as transparent and credible, a different area may have been targeted for a poverty alleviation effort, etc.)

e. Please document instances when groups didn't like the poverty mapping initiative and/or where the poverty maps were NOT used to influence decisions. Why were the poverty maps disliked and/or not used? E.g.,:

- political apprehension
- lack of awareness on the existence of a poverty map(s)
- insufficient collaboration/dialogue between and within institutions
- insufficient time

4. Document the long-term sustainability of the poverty mapping initiative

a. What types of other decisions do you envision poverty maps may *potentially* influence? How will this be carried out?

- opportunities
- challenges (e.g., data availability, accessibility and compatibility)

b. Briefly describe the long-term sustainability of the poverty mapping initiative (e.g., training in poverty mapping techniques, GIS, and analysis; equipment; funds; institutionalization of routine poverty mapping production and use).

Appendix 3   List of Interviewees

Country	Name	Organization	Contact
Brazil	Maria Luisa de Aguiar Marques	Fundação João Pinheiro	mluizamarques@globo.com
	José Carlos Libânio	UNDP	libanio@undp.org.br
Ecuador	Jesko Hentschel	World Bank	jhentschel@worldbank.org
	Peter Lanjouw	World Bank	planjouw@worldbank.org
	Ana María Larrea	Institute of Ecuadorian Studies	anamaria@iee.ecuanex.net.ec
	Carlos Larrea	Consultant	carlarr@uio.satnet.net
			clarrea_2000@yahoo.com
	Fernando Rodríguez	Ecociencia	sig@ecociencia.org
Guatemala	Alessandra Gallio	Ministry of Education	davidson@concyt.gob.gt
	Kathy Lindert	World Bank	klindert@worldbank.org
	Vivian Mack	SEGEPLAN	vmack@segeplan.gob.gt
	Jyotsna Puri	World Bank	jpuri@worldbank.org
	Carlos Sobrado	World Bank	csobrado@worldbank.org
Jamaica	Scarlet Gillings	Jamaica Social Investment Fund	sgilling@jsif.org
	Pauline Knight	Planning Institute of Jamaica	pauline_knight@pioj.gov.jm
	Berk Özler	World Bank	bozler@worldbank.org
Nicaragua	Florencia Castro-Leal	World Bank	clacayo@fise.gob.ni
	Carlos Lacayo	FISE	clacayo@fise.gob.ni
	Matilde Neret	SETEC	mneret@mipres.gob.ni
	Berk Özler	World Bank	bozler@worldbank.org
	Carlos Sobrado	World Bank	csobrado@worldbank.org
Panama	Edith de Kowalczyk	Ministry of Economy and Finance	*no e-mail — contact by phone*
	Francisco Lagruta	Nutrition Department, Panama Ministry of Health	flag@panama.c-com.net
	Kathy Lindert	World Bank	klindert@worldbank.org
	Salvador Moreno	Social Investment Fund	director_ejecutivo@fis.gob.pa
	Carlos Sobrado	World Bank	csobrado@worldbank.org
Peru	Jesko Hentschel	World Bank	jhentschel@worldbank.org
	Norbert Schady	World Bank	nschady@worldbank.org
	Patricia Vásquez Sotero	Ministry of Economy and Finance	evasquez@mef.gob.pe
Burkina Faso	David Bigman	International Service for National Agriculture Research	d.bigman@cgiar.org
Madagascar	Jesko Hentschel	World Bank	jhentschel@worldbank.org
	Leslie Caro Morinière	Ministry of Interior and CARE	zlie_moriniere@hotmail.com
			sircat@dts.mg
	Berk Özler	World Bank	bozler@worldbank.org
Malawi	Todd Benson	IFPRI	t.benson@cgiar.org
Mozambique	Ken Simler	IFPRI	k.simler@cgiar.org
South Africa	Miriam Babita	Statistics South Africa	miriamb@statssa.pwv.gov.za
	Berk Özler	World Bank	bozler@worldbank.org
Cambodia	Srey Chanthy	Consultant	srey@forum.org.kh
	Alain Gouffeau	Asian Development Bank	agoffeau@adb.org
	Mack Ramachandran	World Food Programme	mahadevan.ramachandran@wfp.org
			mahamack@hotmail.com
	Boreak Sik	World Food Programme	boreak.sik@wfp.org
Vietnam	Nisha Agrawal	World Bank	nagrawal@worldbank.org
	Bob Baulch	Institute of Development Studies, University of Sussex	b.baulch@ids.ac.uk
	Christopher Gibbs	World Bank	cgibbs@worldbank.org
	Nicholas Minot	IFRI	n.minot@cgiar.org
	Alan Piazza	World Bank	apiazza@worldbank.org

Appendix 4   List of Case Study Notes and Summary Tables

Summary tables for each of the fourteen country case studies have been included in this section. The detailed notes can be viewed and downloaded at http://population.wri.org/ or http://www.povertymap.net/pub.htm.

SUMMARY TABLE BRAZIL*

Users	**Brazil atlas** • national-, state-, and municipal-level government • private sector • civil society **Minas Gerais atlas** • state- and municipal-level government • civil society **Neighborhood atlases** • government • private sector
Uses	**Brazil atlas** • used in the so-called *Alvorada Program* for various poverty reduction schemes (e.g., in education, water, health, and infrastructure), affecting the allocation of approximately US$4.2 billion over three years (2000-2002) • used as a guideline to allocate social development expenditure in the 2001 national budget, affecting the allocation of approximately US$18.4 billion that year • used by a large insurance agency, Atlântica Boavista, to influence life insurance premiums • used by General Motors to locate a site for a new auto manufacturing plant • used by the Federation of Industry and Commerce in the State of Rio Grande do Sul (ranked highest according to the Human Development Index (HDI)) to attract investment • used by the largest industrial gas company in Brazil, White Martins, to provide youngsters (aged 15-17) with grants to act as community health or human rights agents (US$1.17 million) • used by the Ministry of Communications to identify poor municipalities for free access to e-government services and online information • used to allocate free medicines under the state's "essential pharmacy" program • referred to in political speeches and by civil society **Minas Gerais atlas** • used to formulate the "Robin Hood law," which transfers income from rich to poor municipalities (approx. US$1 billion) • Index of Social Responsibility (based in part on the HDI) expected to be used by São Paulo's Secretary of Planning and Minas Gerais to identify the state's development and investment needs **Neighborhood atlases** • used by a Community Kitchen project in Rio de Janeiro to allocate free breakfasts to poor households (project funds of approximately US$5.2 million) • used by the Telemar Co. to identify market demand for differentiated telephone services in Rio de Janeiro neighborhoods
Impacts	**Brazil, Minas Gerais, and neighborhood atlases** • helped facilitate more transparent and accountable resource allocation and decisions • resulted in the use of geographic targeting in programs • ignited media and local policy debate (e.g., reference to the HDI has become common) • generated demand for higher-resolution and more timely data • raised awareness of the limits of poverty data (e.g., that may be based on older data) **Brazil atlas** • raised awareness that poverty was distributed throughout Brazil (e.g., even in the richest state of São Paulo) **Minas Gerais atlas** • helped facilitate the transfer of income from the poorest to the richest municipalities (i.e., under the "Robin Hood law")
Driving Forces	**Brazil, Minas Gerais, and neighborhood atlases** • demand-driven: to provide high-resolution data (e.g., to respond to decentralization)

---

* *This summary includes contributions from Maria Luiza de Aguiar Marques, Fundação João Pinheiro (mluizamarques@globo.com) and José Carlos Libânio, UNDP (libanio@undp.org.br). A detailed case study note can be found at http://population.wri.org/ or http://www.povertymap.net/pub.htm.*

SUMMARY TABLE BRAZIL, CONTINUED

Products	**Brazil atlas** • national atlas: Brazil's *Atlas of Human Development* • CD version of the national atlas • poverty map included in UNDP's *Human Development Report* • revised geography curricula for secondary school and university entrance exams **Minas Gerais atlas** • state atlas for Minas Gerais **Neighborhood atlases** • neighborhood atlases for the cities of Belo Horizonte, Rio de Janeiro, and Recife

Dissemination	**Brazil atlas**
	• CD version of the atlas includes:
	  – user-friendly software to develop user-defined maps, desired indices, and thematic indicators
	  – has easy-to-use import and export functions
	  – software developed in-country from scratch to avoid expensive royalty fees
	  – software runs on commonly available IBM 486 computers and requires little hard drive memory
	• CD disseminated at no charge to all libraries and various federal and state agencies, think tanks, and research institutions
	• CD purchased by numerous national-, state-, and municipal-level governments, donors, and private agencies
	• CD currently sold out
	• simple, easy to understand, and easy to replicate indicators were intentionally developed
	• widespread publicity through newspaper and television coverage:
	  – two hours of prime-time television as well as front page newspaper coverage (estimated to have reached 16 million viewers)
	  – more than 50 newspapers from every region published editorials
	Neighborhood atlases
	• widespread newspaper coverage
	• the Rio de Janeiro atlas received 8 pages of special edition coverage in a major newspaper

Methods	**Brazil, Minas Gerais, and neighborhood atlases**
	• 38 simple human development indicators for five sectors:
	  – education, health, housing, income, and infant mortality indicators
	• development of composite indices:
	  – HDI and LCI (Living Conditions Index)

Data	**Brazil and Minas Gerais atlas** • 1970, 1980, and 1991 censuses **Neighborhood atlases** • survey data • 1970, 1980, and 1991 census • the Rio de Janeiro atlas further relied on qualitative surveys and other data sources **Plans to update Brazil atlas** • 2000 census **Plans to update the Rio de Janeiro State HDI maps (within Rio's 166 neighborhoods)** • qualitative data based on participatory research • survey • census
Scale	**Brazil atlas** • 4,491 municipalities, 558 micro regions, 27 states, 5 macro regions **Minas Gerais atlas** • municipal level (721 municipalities) **Belo Horizonte, Rio de Janeiro, and Recife neighborhood atlases** • neighborhood level

(continued on next page)

SUMMARY TABLE BRAZIL, CONTINUED

Production	**Brazil atlas (1998)** • interagency collaboration • 2 individuals from IPEA • 5 individuals from Fundação João Pinheiro • 1 individual from UNDP • 1 private consultant
Analysis	**Brazil, Minas Gerais, and neighborhood atlases** • time series analysis of HDI, LCI, and disaggregated data **Brazil atlas** • development of user-defined maps using CD mapping software has facilitated some data comparisons
Funding	**Brazil atlas** • UNDP covered cost of atlas and consultant fees • IPEA and Fundação João Pinheiro covered staff time **Update of Rio de Janeiro neighborhood atlas** • the Federation of Industries of Rio de Janeiro State will provide funding (approximately US$1 million) to update Rio's HDI at a finer resolution
Capacity Building	**Brazil, Minas Gerais, and neighborhood atlases** • high level of in-country capacity: various institutions have been involved in developing numerous versions of the atlas • widespread knowledge of the HDI **Brazil atlas** • HDI incorporated in secondary school curricula and university entrance exams

SUMMARY TABLE ECUADOR*

Users	**INFOPLAN maps** • primarily local- and national-level government agencies **World Bank poverty maps** • primarily poverty map producers in other countries
Uses	**INFOPLAN maps** • used by Imbabura province, Guatomote municipality, and Saquisili municipality to influence the participatory development of 15- to 20-year local development plans • used by EcoCiencia to help develop a system to monitor biodiversity • helped determine the distribution of loans to municipalities at the Ecuadorian Development Bank (i.e., under a current decentralization program) • used by the Ministry of Health to target the 50 poorest parishes in which to develop health initiatives • used by the Fund for Emergency Social Investment to target and finance small initiatives • Ministry of Social Development has not used the poverty map data in its malnutrition program to distribute food aid, continuing to distribute food primarily along the coast where greater electoral gains are at stake. **World Bank poverty maps** • initial World Bank poverty map was not used because the Ecuadorian government decided against eliminating a gas subsidy and thus did not need the map for allocating compensatory transfers
Impacts	**INFOPLAN maps** • helped to democratize decision-making • encouraged local-level participation by providing a tool with which community perceptions may be further informed, crosschecked, and grounded • highlighted that malnutrition is concentrated in the highland areas • facilitated the collection of socioeconomic and biophysical data for development of a system to monitor biodiversity • generated demand for updated poverty data • raised awareness of the need for institutional collaboration to help ensure that programs target the poorest areas **World Bank poverty maps** • development of improved methodology influenced poverty map initiatives worldwide (e.g., in South Africa, Panama, Guatemala, Nicaragua)
Driving Forces	**INFOPLAN maps** • supply-driven: to provide highly disaggregated poverty and poverty-related data **World Bank poverty maps** • demand-driven: to help the government, which was considering elimination of a gas subsidy, identify poor households for compensatory transfers • research-driven: to explore a methodology to integrate census and survey data
Products	**INFOPLAN maps** • CD with disaggregated data and mapping software • hardcopy INFOPLAN publication • various publications (e.g., *Geography of Poverty in Ecuador* in 1995) **World Bank poverty maps** • poverty map based on small area estimation for Ecuador • World Bank papers and reports (Hentschel and Lanjouw 1996, Hentschel et al. 2000, World Bank Poverty Report)

SUMMARY TABLE ECUADOR, CONTINUED

Dissemination	**INFOPLAN maps** • maps published in UNDP's *Human Development Report* for Ecuador • CD version of the INFOPLAN developed • training conducted on the use and constraints of the INFOPLAN maps and software **World Bank poverty maps** • various workshops in Ecuador on poverty map results and methodology (e.g., to INEC (the National Statistics Institute of Ecuador), academic institutions, and think tanks) • numerous presentations on poverty mapping methodology to international audiences (e.g., World Bank staff and various universities)
Methods	**INFOPLAN maps** • anchored in the World Bank methodology • further explored the use of GIS technologies • provide poverty data and additional indicators on health, education, malnutrition, employment, land use, and environmental risk **World Bank poverty maps** • integrated census and survey data (Hentschel and Lanjouw 1996; Hentschel et al. 2000): work in progress
Data	**INFOPLAN maps** • 1990 census • updated 1995 ECV (living conditions) survey data **World Bank poverty maps** • 1990 census • 1994 ECV survey data
Scale	**INFOPLAN and World Bank maps** • 400 cantons and 1,000 parishes

Production	**INFOPLAN maps (1998)**
	• centralized
	  — staff at ODEPLAN (Presidential Planning Office); Carlos Larrea was at the time working for ODEPLAN
	World Bank poverty maps (1996 – present)
	• primarily centralized
	  — a small team of World Bank consultants
	  — National Institute of Labor
	  — INEC

Analysis	**INFOPLAN maps** • principal components analysis (PCA) used to compare data sets • development of user-defined CD software has facilitated some data comparisons
Funding	**INFOPLAN maps** • World Bank State Modernization Technical Assistance Program • the Swiss Agency for Development and Cooperation (SDC) **World Bank poverty maps** • World Bank
Capacity Building	**INFOPLAN map** • fair amount of in-country capacity **World Bank poverty maps** • extensive capacity within a small team of World Bank poverty mapping experts • little in-country capacity to develop poverty maps based on small area estimation

SUMMARY TABLE GUATEMALA*

Users	**Map for Poverty Reduction Strategy Program (PRSP)**
	• primarily national government and donors
Uses	**Map for PRSP**
	• included in the PRSP
	• used in the new National Public Investment System (NPIS) guidelines, which heavily emphasize geographic criteria
	– will influence the allocation of approximately US$576.5 million for the 2002 fiscal year
	– line ministries and departments will be required to use the new NPIS guidelines if NPIS/national public investment funds are requested
	– used by the World Bank to develop a road strategy, affecting the allocation of US$100 million
	• used by a Ministry of Education elementary-school scholarship program to verify the allocation of scholarships to approximately 30,000 students
	• used under the lead of the Social Cabinet to designate 102 municipalities for anti-hunger initiatives
Impacts	**Map for PRSP**
	• facilitated significant changes in long-term national budgeting/NPIS procedures
	• resulted in more accountable and objective decision-making
	– improved SEGEPLAN's institutional credibility and led to SEGEPLAN's more active involvement in the development of national budget/NPIS guidelines
	• encouraged collaboration between institutions that had previously worked in isolation
	• used to validate involvement in and targeting of poor areas
Driving Forces	**Map for PRSP**
	• demand-driven: to improve targeting of national public expenditure and Guatemala's PRSP
Products	**Map for PRSP**
	• poverty maps on proportion in poverty, proportion in extreme poverty, poverty gap, extreme poverty gap, and severity of poverty
	• technical report on poverty map results
	• non-technical report on poverty map results (developed by the think tank *Facultdad Latinoamericana de Ciencias Sociales* (FLACSO))
	• inclusion of the poverty map in the PRSP
	• integration in NPIS guidelines that currently use geographic, political, and sustainability criteria to allocate NPIS funds
	• poverty map posters
	• plan to develop sector-specific guidelines for line ministries to integrate poverty maps in program and project planning
Dissemination	**Map for PRSP**
	• poverty map integrated in PRSP
	• various presentations (e.g., to the Cabinet, with an audience including the Vice President, Minister of Finance, and individuals from numerous other ministries and institutions)
	• guidelines developed on the use of the poverty map in geographic criteria that are currently used to allocate Guatemala's NPIS
	• training on NPIS prioritization guidelines conducted for 22 department delegates
	• poverty map obtained through a personal contact (e.g., Ministry of Education)
Methods	**Map for PRSP**
	• integrated census and survey data (Hentschel et al. 2000)
	Plans to update the poverty map
	• integrated census and survey data (Hentschel et al. 2000)

SUMMARY TABLE GUATEMALA, CONTINUED

Data	**Map for PRSP** • 1998/99 ENIGFAM (household expenditure) survey • 1994 census data **Plans to update the poverty map** • 2001 ENCOVI (living conditions) survey • 1994 census data
Scale	**Map for PRSP** • Municipal level, 300 municipalities

Production	**Map for PRSP (November 2000 – February 2001)**
	• interagency collaboration
	   – 4 staff from the SEGEPLAN (information user)
	   – 2 staff from the National Statistics Institute (INE) (information producer)
	   – 3 staff from the University Rafael Landívar (analysts)
	   – technical assistance provided by 1 World Bank staff and 1 external consultant
	   – developed under tight time constraints (three months) so that the poverty map could be included in the PRSP
	   – few computers available

Analysis	**Map for PRSP** • comparison of poverty map and roads data for a World Bank project that is developing a road strategy for Guatemala • plans to compare poverty data with other variables (e.g., health centers, schools, earthquakes, floods, landslides, and conflicts) – the poverty maps have recently been compared with vulnerability, nutrition, and other socioeconomic data to locate municipalities in need of anti-hunger initiatives
Funding	**Map for PRSP** • staff time covered by the government institutions involved • technical assistance provided by the World Bank
Capacity Building	**Map for PRSP** • capacity-development approach used, with training provided to several individuals from various institutions – same group expected to be involved in updating poverty map • training in complex econometric modeling was at times challenging

SUMMARY TABLE JAMAICA*

Users	**Planning Institute of Jamaica (PIOJ) poverty indicator** • predominantly national government, probably donors
Uses	**PIOJ poverty indicator** • used to target projects for social expenditure at the Jamaica Social Investment Fund (JSIF) • initially used by the PIOJ for general description of poverty in Jamaica • basis in outdated data (1991 census data) is thought to have limited the poverty map's use **Plans to develop a poverty map based on small area estimation** • help target a new Inter-American Development Bank (IDB) initiative on social safety-net reform
Impacts	**PIOJ poverty indicator** • raised awareness of the use of poverty maps to improve program targeting • generated demand for an updated and more reliable poverty map: the future use of a statistically accepted methodology (e.g., Hentschel et al. 2000) is being looked upon very favorably • gave the JSIF a higher level of confidence that investments were being made in poor communities • raised awareness that poverty is widespread throughout Jamaica's communities, a source of embarrassment to the government
Driving Forces	**PIOJ poverty indicator** • demand-driven: to provide data to help develop a national poverty-eradication policy
Products	**PIOJ poverty indicator** • poverty indicator/map
Dissemination	**PIOJ poverty indicator** • copies of the poverty map published in a book (PIOJ 1996) • poverty maps freely available upon request from the PIOJ • various presentations and newspaper coverage

Methods	**PIOJ poverty indicator**
	• selected and weighted four indicators:
	   – unemployment from age 15-29, primary school education, exclusive use of toilets, and piped drinking water
	   – challenging and time consuming to select and weight indicators
	   – conducted qualitative community-based assessments to further evaluate poverty and update results
	Plans to develop a poverty map based on small area estimation
	• anticipate to use the Hentschel et al. (2000) methodology

Data	**PIOJ poverty indicator** • 1991 census data and community-based qualitative assessments **Plans to develop a poverty map based on small area estimation** • 2001 census and 2001 Living Conditions Survey data
Scale	**PIOJ poverty indicator** • Community-level (500 communities) (number of households in each community varies significantly)
Production	**PIOJ poverty indicator (1995/1996)** • centralized map production including selection and weighting of indicators • some interagency collaboration (5 individuals at PIOJ and JSIF)
Analysis	**PIOJ poverty indicator** • linked the poverty map with patterns of crime and violence • Latin American NGO plans to use map to evaluate El Nino's impact on poor communities
Funding	**PIOJ poverty indicator** • World Bank
Capacity Building	**PIOJ poverty indicator** • some in-country capacity built (e.g., at the PIOJ)

SUMMARY TABLE NICARAGUA*

Users	**2000 poverty map** • predominantly national government and NGO **1992 and 1996 FISE maps** • predominantly national government
Uses	**2000 poverty map** • heavily relied upon by the Strengthened Growth and Poverty Reduction Strategy (SGPRS), especially the extreme poverty gap map; expected to affect the allocation of US$1.1 billion over five years (2001-05), including the development of health and education strategies • being used in the preparation of the 2001 national budget, including in a database for the General Directorate of Public Investment • will be used by the Emergency Social Investment Fund (FISE) to target infrastructure development (e.g., schools and health centers) • involvement of key information producers (e.g., the President's Technical Secretariat (SETEC)) is thought to have encouraged use **1996 FISE map** • affected the allocation of approximately US$160 million in FISE funds (1998-2001) • affected the allocation of Catholic Relief Services funds (US$7.5 million since 1999) and Save the Children funds (US$8 million for 2000) • used by the World Food Program and the International Fund for Agricultural Development (IFAD) to select areas of intervention **1992 FISE map** • affected the allocation of approximately US$200 million in FISE funds (1992–97)
Impacts	**2000 poverty and FISE maps** • promoted good governance through more accountable, equitable, and transparent decision-making • encouraged broader participation among government and civil society • highlighted previously neglected groups and regions (e.g., an Atlantic Coast department inhabited by ethnic and indigenous minorities) • increased the credibility of FISE, now considered to be one of the best-run and most accountable agencies in Nicaragua **2000 poverty map** • generated demand for institutional coordination and helped encourage synergy between initiatives (e.g., schools build with FISE funds in extremely poor municipalities will receive operational support from government) • prompted some concerns that the poverty map not be used as the only tool to target projects; e.g., sector-specific guidelines developed by the SETEC emphasize use in conjunction with community–based consultations and other tools and methods **1992 and 1996 FISE poverty maps** • raised awareness of the availability of poverty maps to better inform decisions
Driving Forces	**2000 poverty and FISE maps** • demand-driven: to help ensure transparent-decision making , as called for by a mayors' association
Products	**2000 poverty map** • maps of poverty, extreme poverty, severity of poverty, severity of extreme poverty, poverty gap, and extreme poverty gap • technical report on poverty map results and methodology • sector-specific guidelines on use of the poverty maps in decision-making (e.g., at the Ministry of Education) • database of the General Directorate of Public Investment currently includes the poverty map results **1992 and 1996 FISE maps** • poverty maps
Dissemination	**2000 poverty map (the extreme poverty gap map)** • poverty map included in the SGPRS • developed guidelines on use of the poverty map to allocate public expenditure and to better target other decisions (e.g., the education budget); conducted training on these guidelines (e.g., Ministry of Education, Ministry of Health, and regional health staff) • several presentations, especially to senior-level staff of various ministries **1996 FISE map** • various presentations and distribution of numerous copies of poverty map **1992 FISE map** • various presentations to numerous government agencies

---

SUMMARY TABLE NICARAGUA, CONTINUED

Methods	**2000 poverty map** • integrated census and survey data (Hentschel et al. 2000) **1996 FISE map** • small-area estimation method **1992 FISE map** • basic needs indicators (e.g., access to water and sanitation, nutrition, and displaced people) **Plans to update the poverty map in the near future** • integrated census and survey data (Hentschel et al. 2000)
Data	**2000 poverty map** • 1998 LSMS (Living Standards Measurement Survey) data • 1995 census (raising concerns about the impact of Hurricane Mitch (1998) on the distribution of poverty**)** **1996 FISE map** • 1993 LSMS data and 1995 census **1992 FISE map** • various data sources **Plans to update the poverty map** • 2001 LSMS and 1995 census
Scale	**2000 poverty map** • 7 regions, 17 departments, 151 municipalities **1992 and 1995 FISE maps** • municipal level (151 municipalities)
Production	**2000 poverty map (2000)** • interagency collaboration: individuals from INEC (National Statistics and Census Department), MECOVI (Program for the Improvement of Living Standards Measurement Surveys), SETEC, and FISE; 1 World Bank technical advisor; concern about lack of committed staff, resulting in eventual hiring of two full-time consultants **1996 FISE map (1995/1996)** • centralized (overseas) production, subcontracted to U.S. consulting firm (Research Triangle Institute) **1992 FISE map (1992)** • centralized, using FISE staff
Analysis	**2000 poverty map** • development of guidelines for description on how to compare the poverty map with other data (e.g., education indicators)
Funding	**2000 poverty map** • Government of Nicaragua (through FISE), World Bank, Inter-American Development Bank (IDB), United Nations Population Fund, MECOVI-Nicaragua, United Nations Development Programme, and the governments of Denmark (DANIDA), Norway (NORAD), and Sweden (Sida) **1996 FISE map** • IDB **1992 FISE map** • FISE
Capacity Building	**2000 poverty map** • some in-country capacity development (e.g., at INEC, MECOVI, SETEC, and FISE) **1996 FISE map** • no in-country capacity development (map production subcontracted overseas) **1992 FISE map** • FISE

SUMMARY TABLE PANAMA*

Users	**Ministry of Economy and Finance (MEF) poverty map** • primarily national government and donors

Uses	**MEF poverty map**
	   – used to improve targeting of Social Investment Fund (SIF) infrastructure development (e.g., roads, health centers, and schools), affecting allocation of approximately US$150 million over four years (1997-2001)
	   – helped target areas for a school lunch program (US$2 million), now considered one of the best targeted programs in Panama, reaching the extreme poor at impressive rates and affecting approximately 120,000 students in 1,500 schools annually
	• used as a first cut to identify the poorest districts for Nutrition Department programs
	• use of poverty map now required for all Inter-American Development Bank (IDB) loan requests for Panama

Impacts	**MEF poverty map** • helped legislators resist political pressure to alter funding decisions • resulted in more effective project development and more equitable, effective, and transparent decision-making • generated demand for an updated high resolution poverty map; funding to be provided (or located) by the Panamanian government • provided additional, often complementary information for research and monitoring (e.g., in nutrition programs by the Nutrition Department) • strengthened MEF's institutional credibility and encouraged its collaboration with other institutions • strengthened SIF's institutional image and assisted negotiation of future funding (i.e., an IDB loan to support SIF's next four-year plan)
Driving Forces	**MEF poverty map** • supply-driven: to provide updated, high-resolution poverty data • demand-driven: to help improve targeting of the SIF
Products	**MEF poverty map** • maps of percentage poor and percentage extreme poor • technical report on poverty map results and methodology
Dissemination	**MEF poverty map** • various presentations on the poverty map results (e.g., to line ministries and universities)
Methods	**MEF poverty map** • integrated census and survey data (Hentschel and Lanjouw 1996) • qualitative community-based surveys sometime used (e.g., by the Nutrition Department) to obtain more detailed information **Updated poverty map** • integrated census and survey data (Hentschel et al. 2000)
Data	**MEF poverty map** • 1997 ENV (living standards) survey • 1990 census data **Plans to update the poverty map** • 2000 census • 1997 ENV survey data
Scale	**MEF poverty map** • district level (75 districts) and some counties *(corregimientos)* • various users (e.g., the Nutrition Department) have stated that nationwide county-level poverty data would be preferable; in some instances, community-based qualitative assessments have been conducted to meet this need

SUMMARY TABLE PANAMA, CONTINUED

Production	**MEF poverty map (1998/1999)**
	• centralized
	   – 6 individuals from the MEF Social Policy Department (individuals with statistical and computer backgrounds)
	   – 1 World Bank technical advisor

Analysis	**MEF poverty map** • none noted
Funding	**MEF poverty map** • Government of Panama covered staff time • World Bank provided technical assistance **Updated poverty map** • Government of Panama intends to finance (or find funding for) the development of an updated poverty map
Capacity Building	**MEF poverty map** • capacity built at the MEF – the trained group at MEF feels confident about developing future poverty maps

SUMMARY TABLE PERU*

Users	MEF (Ministry of Economy and Finance), INEI (National Statistics Institute), and FONCODES (Social Fund) poverty maps
	• predominantly national government
Uses	**MEF poverty map**
	• used by the Ministry of Labor and Social Promotion to target its programs in urban areas
	• used by FONCODES to target its programs in rural areas
	FONCODES maps
	• influenced the allocation of US$564 million in FONCODES funds (1992-98)
	– influenced approximately 32,000 FONCODES community-based projects (US$285 million in funding between 1992 and 1998) in education, nutrition, and road development, etc.
	– affected the allocation of approximately US$98 million (1992-98) in several FONCODES "special projects," e.g., school breakfasts, school uniforms, and farm implements
Impacts	**MEF and INEI poverty maps**
	• increased debate on what type of poverty map to use rather than discussing which projects would benefit most from geographic targeting
	• a study (Schady 2000b) provided evidence that geographic targeting would produce substantial savings
	FONCODES maps
	• led to better targeting of FONCODES programs
	– Schady (2000b) indicated that better targeted FONCODES programs resulted in greater school attendance; by 1996, households in the wealthiest quartile were receiving virtually no FONCODES educational funds
	• raised awareness of the need for greater fiscal accountability; Schady (2000b) provided evidence that political as well as geographic criteria have influenced the allocation of FONCODES funds (i.e., spikes in the allocation of FONCODES funds were highly correlated with the 1992, 1993, and 1995 elections)
	• generated demand for a better balance between poverty criteria and economic viability in the allocation of funds
Driving Forces	**MEF and INEI poverty maps**
	• demand-driven: respond to need for data on poverty distribution
	FONCODES maps
	• demand-driven: to improve targeting of FONCODES
Products	**MEF, INEI, and FONCODES maps**
	• various poverty maps
Dissemination	**MEF and INEI poverty maps**
	• presentations
	FONCODES maps
	• primarily within FONCODES
Methods	**MEF poverty map**
	• integrated census and survey data (in the spirit of Hentschel et al. 2000)
	INEI poverty map
	• integrated census and survey data
	FONCODES maps
	• used UBN (Unsatisfied Basic Needs) indicators (e.g., rate of chronic malnutrition, illiteracy, school-aged children not in school, overcrowded housing, inadequate roofing, and proportion of the population without access to water, sanitation, and electricity)
	• in some instances, qualitative community poverty assessments were used to verify, update, and provide more detailed information on poverty levels

SUMMARY TABLE PERU, CONTINUED

Data	**MEF poverty map** • 1993 census • 1997 INEI survey data **INEI poverty map** • 1993 census • 1995 INEI survey data **FONCODES maps** • various census data (e.g., 1993 census) **UBN poverty indices and maps** • 1961, 1972, 1981, and 1993 **Proposed INEI 2001 poverty map** • 1993 census • 2001 INEI survey data **Concerns have been voiced regarding the use of old data (e.g., 1993 census data) to develop the 1996 and 1999 imputed poverty maps**
Scale	**MEF, INEI, and FONCODES maps** • district level (1,812 districts)
Production	**MEF poverty map (1999)** • centralized production, using staff at MEF **INEI poverty map (1996)** • centralized, using staff at INEI • technical assistance provided by CEPAR (the population agency of CEPAL, the Economic Commission for Latin America and the Caribbean) **FONCODES maps (several maps developed since 1991)** • centralized, using staff at FONCODES • technical assistance provided by the Inter-American Development Bank, Government of Germany (GTZ), and World Bank **Proposed INEI 2001 poverty map** • centralized, using staff at INEI
Analysis	**FONCODES maps** • comparison of the FONCODES maps with geographic data to determine if geographic variables help explain per capita expenditure (Escobal and Torero 1999)
Funding	**MEF poverty map** • MEF
Capacity Building	**MEF and INEI poverty maps** • some in-country capacity to develop poverty maps based on small area estimation (e.g., at INEI) **FONCODES maps** • extensive capacity at FONCODES to develop poverty/UBN indicators

SUMMARY TABLE BURKINA FASO*

Users	**World Bank poverty map** • poverty map producers in various countries • no users identified specifically in Burkina Faso
Uses	**World Bank poverty map** • methodology used by various poverty map producers in other countries (e.g., India and Malawi) • no specific poverty map use documented in Burkina Faso • could potentially be used in Burkina Faso antipoverty and cost-recovery programs • research indicated that better targeting would reduce leakage and under-coverage of anti-poverty program funding
Impacts	**World Bank poverty map** • raised awareness of and sparked interest in poverty mapping and its potential use • influenced further exploration of poverty mapping methodologies and the use of GIS (geographic information systems) in mapping methods • methodology used and/or referred to in various poverty mapping initiatives (e.g., India and Malawi)
Driving Forces	**World Bank poverty map** • research-driven: to develop a methodology useful in countries where detailed census data are unavailable or of poor quality
Products	**World Bank poverty map** • Burkina Faso poverty map • poverty map methodology development • research papers
Dissemination	**World Bank poverty map** • methodology and results published in a World Bank paper (Bigman et al. 2000) and a book on geographic targeting for poverty alleviation (Bigman and Fofack 2000) • poverty map results and methodology presented at a 1997 workshop for World Bank country economists in the Africa region • no specific efforts to disseminate the poverty map results in Burkina Faso
Methods	**World Bank poverty map** • econometric modeling and mapping (Bigman et al. 2000, Bigman and Fofack 2000)
Data	**World Bank poverty map** • demographic data from 1985 population census • household-level data from a variety of surveys (e.g., 1994 Household Income and Expenditure Survey) • community-level data on roads, public facilities, and water points • department-level data on agroclimatic zones • concern that several data sets were incomplete (e.g., census missed 1-2 regions, representing approximately 15% of the country)
Scale	**World Bank poverty map** • village level (3,871 rural and urban communities, i.e., approximately 57% of all villages in Burkina Faso)

Production	**World Bank poverty map (1996-97)**
	• statistical estimations
	  – primarily centralized: 1 individual from the World Bank and 2 individuals from the Catholic University of Leuven in Belgium
	• map production
	  – centralized: 1 consultant from I-Mage (Belgian consulting group)
	• data collection
	  – primarily centralized: 1 expatriate consultant and 2 Burkina Faso consultants

Analysis	**World Bank poverty map** • GIS data compilation has facilitated some data comparisons
Funding	**World Bank poverty map** • World Bank and Belgium Trust Fund
Capacity Building	**World Bank poverty map** • no in-country capacity developed; econometric modeling and GIS-related work conducted outside Burkina Faso

* This summary includes contributions from David Bigman, International Service for National Agriculture Research (d.bigman@cgiar.org).
A detailed case study note can be found at http://population.wri.org/ or http://www.povertymap.net/pub.htm.

SUMMARY TABLE MADAGASCAR*

Users	**CNS (Ministry of Interior's Risk and Disaster Management Unit)/CARE poverty map** • likely users include NGOs and government

Uses	**CNS/CARE poverty map**
	• anticipated to help target "hot spots" for risk and disaster management
	— poverty map will be used in conjunction with vulnerability and hazard data
	— poverty, vulnerability, and hazard maps are expected to help allocate and better target all future Risk and Disaster Management programming including:
	  — better informing CARE's projects, ranging from urban water and sanitation to natural resources to risk and disaster management
	  — influencing the allocation of US$3.5 million in CARE annual funding
	— envisioned to help facilitate decentralization in Madagascar by providing local-level decision/policymakers with high-resolution welfare information
	— anticipated to be included in Madagascar's Poverty Reduction Strategy Program (PRSP)
	— the World Bank expects to use the poverty data in its Rural Transport Project

Impacts	**CNS/CARE poverty map** • expected to lead to more transparent and objective decision-making, especially in CNS/CARE's risk and disaster management initiatives • facilitating institutional collaboration, e.g., between CNS and CARE
Driving Forces	**CNS/CARE poverty map** • NGO-/project-driven: to contribute to CNS's and CARE's risk analysis
Products	**CNS/CARE poverty map** • preliminary poverty map results
Dissemination	**CNS/CARE poverty map** • preliminary poverty map results presented at a Risk and Disaster Committee meeting (i.e., a committee consisting of NGOs and government agencies involved in risk- and disaster-related work)
Methods	**CNS/CARE poverty map** • integrated census and survey data (Elbers, Lanjouw, and Lanjouw 2002)
Data	**CNS/CARE poverty map** • 1993 population census • 1993 EPM *(Enquête Permanent auprès des Ménages)* household survey
Scale	**CNS/CARE poverty map** • 111 districts (fivondrona) and 1,332 communes *(firaisana)*
Production	**CNS/CARE poverty map (2001/ongoing)** • statistical estimations — centralized: 2 individuals at INSTAT (Madagascar's statistical institute) , 1 consultant, and 1 World Bank technical advisor • map production — centralized; will be developed at CNS/CARE (INSTAT does not have extensive GIS (geographic information systems) expertise)
Analysis	**CNS/CARE poverty map** • expected to be used in conjunction with vulnerability and hazard maps to better target CNS/CARE programs
Funding	**CNS/CARE poverty map** • CARE to cover INSTAT staff time (US$7,000) for conducting poverty mapping statistical estimations, a unique use of NGO funding • World Bank is covering technical assistance activities • poverty map work is being conducted under the CNS umbrella
Capacity Building	**CNS/CARE poverty map** • few staff currently trained; work in progress

SUMMARY TABLE MALAWI*

Users	**International Food Policy Research Institute (IFPRI) poverty map** • expected to be government, NGOs, and donors **Vulnerability Assessment and Mapping (VAM)** • government and donors
Uses	**IFPRI poverty map** • expected to be used in the "starter pack" program, which currently involves *universal* distribution of free fertilizers and seeds to rural households – potential reluctance to use the poverty map results for *targeted* distribution, as greater electoral gains are associated with universal distribution (even if less frequent, due to funding constraints) • not likely to be developed in time to be integrated in Malawi's Poverty Reduction Strategy Program (PRSP) **VAM** • determined areas in need of food security interventions
Impacts	**IFPRI poverty map** • expected to improve targeting of Malawi's poverty reduction initiatives • initial results indicate that poverty is widespread throughout Malawi
Driving Forces	**IFPRI poverty map** • supply-driven: to respond to an increasing demand for higher-resolution data (e.g., due to decentralization) • demand-driven: to help develop a poverty monitoring system for Malawi **VAM** • project-driven: to determine areas in need of food security interventions
Products	**IFPRI poverty map** • three draft "poverty incidence" maps • various poverty and inequality measures at different scales (Traditional Authority and government ward); 3rd iteration • initial preparation of the *Malawi Atlas of Social Statistics*
Dissemination	**IFPRI poverty map** • plans to develop a digital and hardcopy *Malawi Atlas of Social Statistics* • poverty map results will be posted on the National Statistical Office (NSO) website (http://www.nso.malawi.net)
Methods	**IFPRI poverty map (2001/ongoing)** • integrated census and survey data (Hentschel et al. 2000) • used GIS (geographic information systems) data to improve predictive power of the consumption model • made additional reference to Minot (2000), Bigman and Fofack (2000), and Statistics SA (2000) **VAM** • principal components analysis • time series analysis
Data	**IFPRI poverty map** • 1998 Population and Housing Census data • 1997/98 Integrated Household Survey (IHS) data – 50% of the IHS household samples had to be removed because of poor data quality • data access concerns; government lacks explicit policies on release of tabular and spatial data **VAM** • 1991 census • various other data sources (e.g., UNICEF data)
Scale	**IFPRI poverty map** • district (27), Traditional Authority (368), local government ward (851), and Enumeration Area (9,218) **VAM** • Extension Planning Area (154)

---

* *This summary includes contributions from Todd Benson, International Food Policy Research Institute (t.benson@cgiar.org). A detailed case study note can be found at http://population.wri.org/ or http://www.povertymap.net/pub.htm.*

SUMMARY TABLE MALAWI, CONTINUED

Production	**IFPRI poverty map (2001/ongoing)**
	• statistical estimations
	   – primarily centralized
	     – 1 individual at IFPRI
	     – 2 individuals at NSO
	     – work progressing relatively slowly since staff not working solely on poverty mapping
	• digital file and map production
	   – primarily centralized
	     – 1 individual at the Department of Surveys (developed digital maps for a separate project funded by the governments of Japan (JICA) and Denmark (DANIDA)
	     – information on local government wards provided by the Malawi Electoral Commission
	VAM (1996)
	• staff at the Famine Early Warning Systems (FEWS) project

Analysis	**IFPRI poverty map** • poverty maps still in development; anticipate creation of poverty and poverty-related time-series data (e.g., based on the 1978, 1988, and 1998 census data) **VAM** • time-series analysis
Funding	**IFPRI poverty map** • Rockefeller Foundation **VAM** • United States Agency for International Development
Capacity Building	**IFPRI poverty map** • some capacity built (e.g., at the NSO); work in progress • future analytical capacity will be required; will likely entail working with an academic institution (e.g., Center for Social Research) **VAM** • FEWS

SUMMARY TABLE MOZAMBIQUE*

Users	**International Food Policy Research Institute (IFPRI) poverty map** • various users anticipated **Province-level poverty map** • national government
Uses	**IFPRI poverty map** • expected to be used for geographic targeting of various programs and to help explore the spatial determinants of poverty **Province-level poverty map** • used by the Ministry of Health to help allocate its funding • used as a key input in the National Action Plan to Reduce Absolute Poverty (PARPA) and the Poverty Reduction Strategy Program (PRSP)
Impacts	**IFPRI poverty map** • envisioned to provide empirical evidence for and improve targeting of decision-making • expected to stimulate a demand for poverty data analyses and analysts **Province-level poverty map** • generated substantial interest in developing a higher-resolution poverty map • indicated that incidence of poverty is especially high in the central provinces
Driving Forces	**IFPRI** • demand-driven: to respond to a demand for higher-resolution poverty data **Province-level map** • demand-driven: to inform Mozambique's PRSP • supply-driven: to address lack of in-country data of nationwide scope after the end of Mozambique's civil war
Products	**IFPRI poverty map** • preliminary set of poverty maps (developed in mid-March 2001) • maps on the poverty headcount, poverty gap, and inequality measures to be developed **Province-level poverty map** • province-level map on incidence of poverty
Dissemination	**IFPRI poverty map** • not yet disseminated **Province-level poverty map** • presentation at a national conference (October 1998) • results published in a poverty assessment report (early 1999)
Methods	**IFRPI poverty map** • integrated census and survey (Hentschel et al. 2000) **Province-level poverty map** • relied on a household welfare indicator based on food consumption and non-food goods and services
Data	**IFPRI poverty map** • 1996-97 National Household and Living Conditions survey • 1997 National Population and Housing Census data **1998 poverty map** • 1996-97 National Household and Living Conditions survey data
Scale	**IFPRI poverty map** • district (141) and administrative post (418) • error assessments being conducted to see if a poverty map can be developed at the level of *localidades* and *bairros* (1,933 total) **Province-level poverty map** • province level (11)

SUMMARY TABLE MOZAMBIQUE, CONTINUED

Production	**IFPRI poverty map (2001/ongoing)** • primarily centralized: 1 staff from Ministry of Planning and Finance (MPF) and 1 staff from IFPRI • concerns raised about part-time (rather than full-time) effort **Province-level poverty map** • interagency collaboration − staff at MPF, Eduardo Mondlane University, and IFPRI
Analysis	**IFPRI and province-level poverty map** • none; maps still in development
Funding	**IFPRI poverty map** • Rockefeller Foundation
Capacity Building	**IFPRI poverty map** • lack of trained individuals; need for concerted effort to build a cadre of broadly-trained analysts − shortage of analytical staff expected to be a problem in future; lack of educated (much less university-trained) persons in the wake of the 15-year civil war

SUMMARY TABLE SOUTH AFRICA*

Users	**Statistics South Africa (SA) poverty map** • primarily national government • probably NGOs and private sector (e.g., commercial banks), though no uses specifically documented
Uses	**Statistics SA poverty map** – used for the first time by the municipal grants program (2001-02), which requires equitable distribution of nationally raised revenue to municipalities based on poverty levels – expected to affect the allocation of approximately US$305 million – recently used to develop a medium-term, three-year grants budget (2001-04) • helped contain the spread of cholera in the KwaZulu Natal province in early 2001 – collaborative disease control plan developed by the Department of Health, Department of Water Affairs, Statistics SA, the Public Works Department, local government authorities, and other departments – speedy, well-coordinated response led to the effective containment of cholera within two months, resulting in one of the world's lowest fatality rates (0.22% among approximately 100,000 cases) • used in a study of the socioeconomic factors correlated with crime • helped to identify priority areas for Integrated Sustainable Rural Development Programme (ISRDP) and Urban Renewal Programme • generally used by public and private agencies and NGOs to plan interventions and ensure the efficient and effective use of resources
Impacts	**Statistics SA poverty map** • prompted the development of compatible spatial data sets reconciling apartheid and post-apartheid census data (i.e., 1991 and 1996) – the compatible spatial data sets have been used in many applications, including in the development of the South African census time-series database at the University of Pennsylvania for Pan African Census Explorer (PACE) • built capacity to conduct poverty assessments based on various geographic configurations (e.g., police areas and health districts) • helped highlight and focus attention on poor areas; provided an easily understandable format and important tool for communicating about poverty • improved the targeting of poor areas (e.g., under the municipal grant program) • encouraged integration of poverty as an issue in policy and program design; generated demand (e.g., among various service providers) for further research and provision of poverty, vulnerability, and natural disaster maps • institutional impacts – Statistics SA increasingly considered a *knowledge* vs. *data* provider – Statistics SA image changed from an institution that collected data for selected areas (e.g., urban areas) while neglecting others, to an institution committed to contributing to socioeconomic development of South African society as a whole – increased confidence and capacity of Statistics SA staff • influenced the development of poverty mapping elsewhere (e.g., Malawi and Mozambique)
Driving Forces	**Statistics SA poverty map** • demand-driven: to explore improved targeting in a municipal grants program
Products	**Statistics SA poverty map** • poverty map based on the headcount index • papers (Alderman et al. 2001, Statistics SA 2000) • matched administrative units/boundaries in 1991 (apartheid) and 1996 (post-apartheid) censuses
Dissemination	**Statistics SA poverty map** • various papers on the poverty map results and methodology (Alderman et al. 2001, Statistics SA 2000) • numerous presentations – senior-level staff at Statistics SA, President's office, Health Ministry, Department of Provincial and Local Government, cabinet, United States Agency for International Development, various academic institutions, and numerous provincial-level government agencies – international agencies and regional organizations (e.g., in Zambia, Kenya, Uganda, and Ethiopia)

SUMMARY TABLE SOUTH AFRICA, CONTINUED

Methods	**Statistics SA poverty map** • integrated census and survey data (Hentschel et al. 2000) • compared census and survey data on income to determine which generated better estimates of poverty; census income data was determined to be a weak proxy for poverty rates

Data	**Statistics SA poverty map**
	• 1996 census
	• 1995 Income and Expenditure Survey (IES)
	• 1995 October Household Survey (OHS)
	• spatial reconciliation of data sets
	   – the OHS and IES were based on apartheid administrative units used in the 1991 census, while the 1996 census used post-apartheid administrative units
	   – codes for over 9 million households in the census had to be added to link the datasets

Scale	**Statistics SA poverty map** • province (9), district council (45), and magisterial district (354)

Production	**Statistics SA poverty map (1999/2000)**
	• centralized
	   – 4 staff at Statistics SA
	   – 2 World Bank technical advisors
	   – emphasis placed on building trust, especially with senior-level staff (e.g., by building institutional capacity and responding to country needs)

Analysis	**Statistics SA poverty map** • comparison of poverty map and disease, sanitation, and safe and clean water data to develop a map of high-risk areas in a cholera outbreak • comparison of poverty maps and socioeconomic data to help develop crime prevention strategies for South Africa (work in progress)
Funding	**Statistics SA poverty map** • staff time covered by Statistics SA • World Bank covered technical assistance costs
Capacity Building	**Statistics SA poverty map** • sufficient capacity built at Statistics SA • concerns that if trained staff leave or are promoted, there will be little capacity – province-level staff are currently being trained in response to this concern

SUMMARY TABLE CAMBODIA*

Users	**2001 and other World Food Program (WFP) maps** • national government, donors, and NGO users
Uses	**2001 WFP poverty map** • expected to affect the allocation of US$50 million in food aid (2001-03) • recently used by the Asian Development Bank's (ADB) Northwestern Rural Development Project (approximately US$30 million over five years) to help allocated funding for rural infrastructure, capacity building, and micro-enterprise development • used during a Participatory Poverty Assessment (conducted at the Ministry of Planning) to select communes for focus group discussions on poverty **2001 and other WFP maps** • used annually since 1997 in WFP's "food-for-work" program to identify the poorest communes • requested by the Ministry of Education, Ministry of Planning, European Union, United Nations Development Programme (UNDP), World Bank, and International Fund for Agricultural Development • full potential of the poverty maps not yet reached; e.g., the Public Investment Program, a major program that targeting national expenditure for rural and urban social projects, has not yet used the poverty map results
Impacts	**2001 WFP map** • 2001 poverty map regarded as the most comprehensive and reliable data set on poverty in Cambodia (e.g., by the ADB) **2001 and other WFP maps** • resulted in better targeting of programs and policies • helped establish WFP as a reputable institution whose decisions are regarded as transparent and objective • generated a demand for institutional coordination
Driving Forces	**2001 and other WFP maps** • NGO-/project-driven: to identify the poorest communes in need of food aid in WFP's food-for-work program
Products	**2001 and other WFP maps** • annual 1997-2001 poverty maps; time-series poverty data available • various reports
Dissemination	**2001 WFP map** • 150 copies of various reports distributed in 2001 • numerous discussions with and presentations to various ministries, donors, and other agencies **2001 and other WFP maps** • poverty map results directly disseminated to provincial-level staff of Ministry of Rural Development and WFP field staff responsible for mobilization of food aid • approximately 15% of time at WFP's Vulnerability Analysis and Mapping Unit is spent on disseminating the poverty map results
Methods	**2001 WFP map** • integrated census and survey • no detailed error assessment conducted; results were instead crosschecked with 1997, 1998, 1999, and 2000 poverty maps as well as local knowledge **Other WFP maps** • various methods; used mostly qualitative assessments
Data	**2001 WFP map** • 1999 Cambodian Socio-Economic Survey (CSES) • 1998 National Population Census • some concerns that the 2001 poverty map results inadequately represent poverty distribution in communes where there has been significant immigration and resettlement since 1998 **Other WFP maps** • mostly qualitative field surveys

---

SUMMARY TABLE CAMBODIA, CONTINUED

Scale	**2001 and other WFP maps** • commune level (1,609) • a village-level map (13,406 villages) would have been preferable for some uses, including a Participatory Poverty Assessment conducted by the Ministry of Planning

Production	**2001 WFP poverty map**
	• centralized
	  — 2 staff at WFP's Vulnerability Analysis and Mapping Unit (1 local, 1 expatriate)
	  — 1 expatriate consultant
	  — WFP worked closely with the Ministry of Planning
	Other WFP maps (1997, 1998, 1999, 2000)
	• centralized
	  — WFP staff
	  — field verification and qualitative assessments conducted by the Ministry of Rural Development and WFP field staff

Analysis	**2001 WFP map** • crosschecked 2001 results with results from 1997, 1998, 1999, and 2000 poverty maps • integrated 1997-2000 poverty maps to identify poverty "hot spots" • recently compared the poverty map results with data on flood- and drought-prone areas under Cambodia's Qualitative Disaster Study
Funding	**2001 and other WFP maps** • WFP
Capacity Building	**2001 and other WFP maps** • lack of staff with poverty mapping skills • when WFP phases out work in Cambodia, poverty mapping activities are expected to be transferred to agencies with strong analytical skills (e.g., the ADB, UNDP, and World Bank)

SUMMARY TABLE VIETNAM*

Users	**2000, 1998, Ministry of Labor, Invalids, and Social Assistance (MOLISA), and Committee for Ethnic Minorities in Mountainous Areas (CEMMA) maps/indicators** • national government, donors, and NGOs
Uses	**2000 and 1998 poverty maps/indicators** • used to crosscheck and verify poor areas targeted for MOLISA and CEMMA initiatives • used by the Food and Agriculture Organization of the United Nations (FAO) to identify poor districts in need of food security interventions • some reservations about using current or future poverty maps; as northern areas are highlighted as especially poor, some decision makers may be concerned about possible exclusion of southern areas from antipoverty initiatives • copies requested by Oxfam, CARE, and donors (e.g., the Asian Development Bank (ADB) and Swedish Rural Mountains Development Program) **MOLISA and CEMMA indicators** • used to provide poor households with free or subsidized primary schooling for children, health cards, credit programs, and sometimes exemption from local taxes in MOLISA's Program 133 and CEMMA's Program 135 • used to select the six poorest provinces for the World Bank's Northern Mountains Poverty Reduction Project (US$120 million) and the 13 poorest provinces for the World Bank's Community Based Rural Infrastructure Project (US$123.4 million) • bureaucratic inertia is thought to be limiting the use of the highly disaggregated poverty indicators
Impacts	**2000 poverty map** • identified several "quick and dirty" indicators of household-level poverty, e.g., consumer durables ownership and housing characteristics (Minot and Baulch 2001) **MOLISA and CEMMA indicators** • generated awareness of the need to develop poverty indicators based on objective criteria and measurable indicators **2000, 1998, MOLISA, and CEMMA maps/indicators** • highlighted that poorest areas are concentrated in northern areas far from cities, in hilly areas, and in areas with large ethnic minorities
Driving Forces	**2000 and 1998 poverty maps** • research- driven: to identify poor areas based on objective criteria and measurable indicators • supply-driven: to increase availability of poverty data and thus encourage their use **MOLISA and CEMMA indicators** • demand-driven: used in poverty reduction programs
Products	**2000 poverty map** • 2000 poverty map **1998 poverty map** • 1998 poverty map **MOLISA and CEMMA indicators** • MOLISA and CEMMA indicators

SUMMARY TABLE VIETNAM, CONTINUED

Dissemination	**2000 poverty map** • draft results presented in a paper (Minot and Baulch 2001) • map results included in the 2001 *Vietnam Development Report* and in a *Vietnam Investment Review* article • presentations to approximately 100 participants at a Ministry of Planning and Investment-World Bank workshop and to about 30 participants at a (United Kingdom) Department for International Development (DFID)-funded training program • various poverty maps disseminated upon request (e.g., copies requested by the World Bank, Asian Development Bank, Swedish Rural Mountains Development Program, and UNDP) **1998 poverty map** • various presentations (e.g., MOLISA, Minstry of Agriculture and Rural Development (MARD), United Nations Development Programme (UNDP), FAO, World Bank, Oxfam, and CARE) **Plans to update the poverty map** • plans to develop a CD, posters, and reports • plans to conduct a series of workshops
Methods	**2000 poverty map** • integrated census and survey (Hentschel et al. 2000) • distinguishes poverty in rural and urban areas **1998 poverty map** • integrated census and survey data (Minot 1998, Minot 2000); developed concurrently with and similar to Hentschel and Lanjouw (1996) **MOLISA and CEMMA indicators** • criteria used to identify poor households vary widely and are based on different welfare estimates, poverty lines, and units of analysis
Data	**2000 poverty map** • 3% sample of 1999 census • 1998 Vietnam Living Standards Survey (VLSS) data **1998 poverty map** • 1992-93 VLSS data • 1994 Agriculture Census — access to household-level data was not obtained; used district-level means and no standard error was estimated **Plans to update the poverty map** • access to 33% sample of census data obtained • 1998 VLSS survey data **MOLISA and CEMMA indicators** • data collected by a system of commune- and district-level agencies
Scale	**2000 poverty map** • incidence of poverty estimated for rural and urban areas in 61 provinces (total of 122 geographic areas); 3% sample of census data was used • coarser scale (relative to MOLISA indicators) thought to have limited use **1998 poverty map** • district level (543 of 545; i.e., data missing for 2 districts) • coarser scale (relative to MOLISA indicators) thought to have limited use **MOLISA and CEMMA indicators** • commune level (approximately 10,500; number varies slightly from year to year, e.g., 10,477 in 1999) **Plans to update the poverty map** • hope to obtain full access to census data; district- (545) and possibly commune-level (ca. 10,500) poverty results will be estimated

SUMMARY TABLE VIETNAM, CONTINUED

Production	**2000 poverty map (2000)**
	• statistical estimations
	   – primarily centralized
	     – 1 expatriate from IFPRI/MARD
	     – 1 expatriate from the University of Sussex, Institute of Development Studies
	     – 3 individuals from the General Statistics Office (GSO)
	• map production
	   – centralized
	     – 3 staff from a local GIS (geographic information systems) firm (2 Vietnamese and 1 expatriate)
	1998 poverty map (1998)
	• statistical estimations
	   – primarily centralized
	     – 2 individuals from the GSO
	     – 1 IFPRI technical advisor
	• map production
	   – centralized
	     – 1 local GIS specialist at the National Institute for Agricultural Planning and Projection (NIAPP)
	Plans to update the poverty map
	• collaborative approach proposed

Analysis	**None indicated**
Funding	**2000 poverty map** • DFID Poverty Trust Fund and the World Bank Development Economics Research Group **1998 poverty map** • UNDP
Capacity Building	**2000 and 1998 poverty map** • some capacity built (e.g., at the GSO) **Plans to update the poverty map** • proposed collaborative approach will emphasize capacity development and creation of a broad cadre of skilled, in-country poverty mapping analysts

World Resources Institute

10 G Street, NE
Washington, DC 20002 USA
www.wri.org

World
Resources
Institute

UNEP/GRID-Arendal

Service Box 706
4808 Arendal Norway
www.grida.no

UNEP

GRID
Arendal