



# RESEARCH BRIEF – MAY 2012

## “GROUND TRUTHING” VULNERABILITY IN AFRICA

### EXECUTIVE SUMMARY

Using indicators of climate hazard exposure, population density, household and community resilience, and governance and political violence, CCAPS researchers created geospatial representations of sub-national vulnerability in Africa. Researchers traveled to select African countries to test, or *ground truth*, the validity of CCAPS' remotely generated vulnerability assessments. The field interviews supported many of the intuitions of CCAPS maps; interviews also identified sources of divergence related to the weight CCAPS assigns to population density and the way CCAPS defines drought, as well as challenges in capturing vulnerability of pastoral communities and cross-border vulnerability spillovers.

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### CHANGING PARADIGMS FOR A CHANGING CLIMATE

The international community's recognition of climate change as a humanitarian and security concern is likely to reshape development aid in Africa. Traditional development strategies, predicated upon seasonal rainfall and temperature patterns punctuated by often-predictable patterns of drought, floods, and cyclone activity, do not provide for the uncertainty of long-term climate change. Consequently, the focus of international donors and aid recipients is shifting to structural solutions that aim to build local capacity to adapt to climate change.

The repercussions of this paradigm shift are significant. Definitions of vulnerability and adaptation will increasingly shape how donors allocate funds and how recipient governments and civil institutions spend them. Where and why places are vulnerable to climate effects will influence the priorities of both donors and recipients alike. The adaptation agenda presents new and compelling questions about how to systematically identify climate change vulnerability and formulate appropriate adaptation policy responses.

To address these challenges, in 2009 the Climate Change and African Political Stability (CCAPS) program commenced a study of climate change vulnerability in Africa. CCAPS has a specific security focus in its representation of vulnerability, focusing on the potential for climate change to put large numbers of people at risk of death from exposure to climate-related hazards. Using indicators of historical climate hazard exposure, population density, household and community resilience, and governance and political violence, CCAPS created geospatial representations of sub-national vulnerability in Africa.<sup>1</sup> Figure 1 shows the indicators selected to represent these four dimensions of vulnerability. The CCAPS model

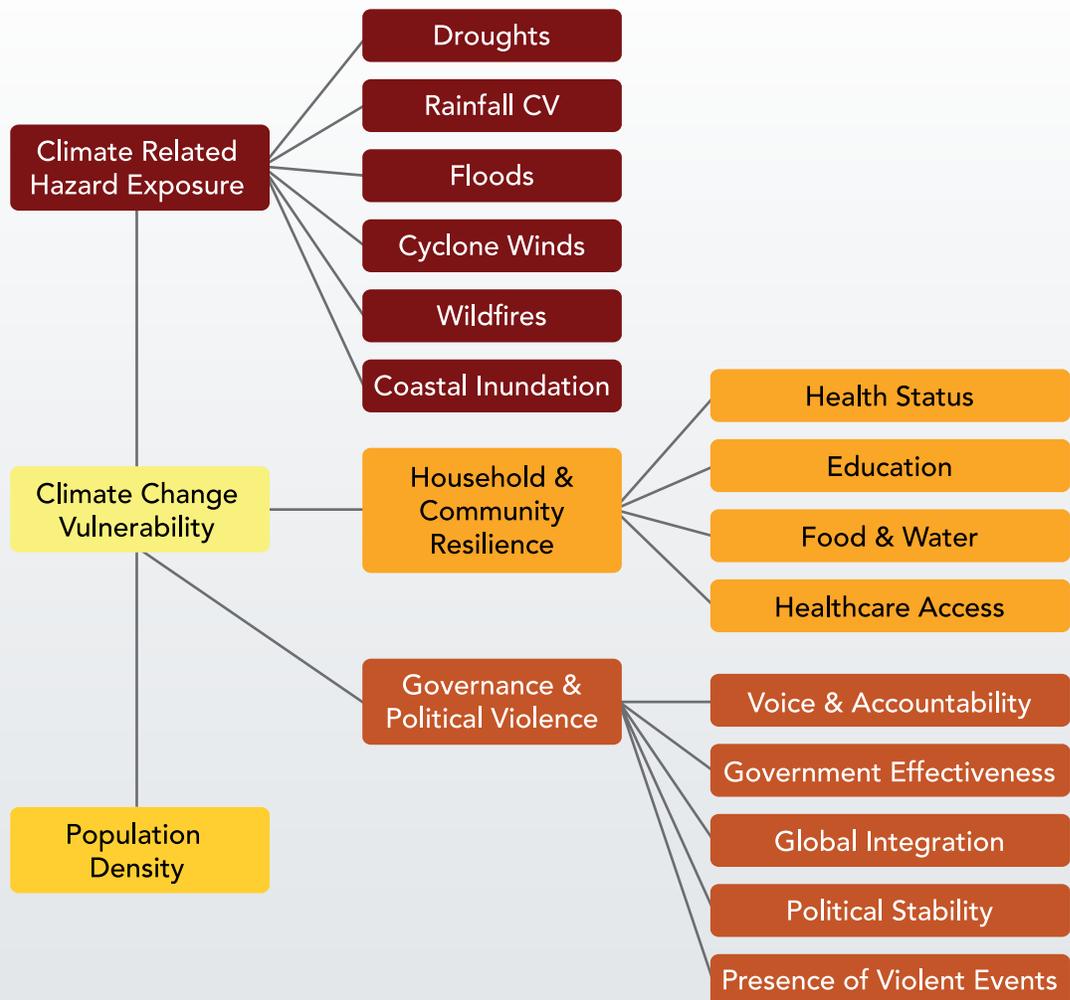
*The adaptation agenda presents new and compelling questions about how to systematically identify climate change vulnerability.*

weights these four dimensions equally and combines them in a composite index to assess overall vulnerability.

Over the last 18 months, CCAPS researchers traveled to select African countries to test, or *ground truth*, the validity of

CCAPS' remotely generated vulnerability assessments.<sup>2</sup> CCAPS *ground truthing* aims to assess how local actors conceptualize climate change vulnerability and to ensure these realities are captured by the CCAPS vulnerability modeling. Researchers met with academics, international organizations, regional organizations, bilateral donors, international and local development and environmental NGOs, government officials, and private sector actors, in an effort to gauge local perceptions of vulnerability and the nature of the response.<sup>3</sup>

Figure 1. These indicators were used in the first version of the CCAPS climate vulnerability model to create geospatial representations of national and sub-national vulnerability in Africa. The field interviews discussed in this brief assessed the inclusion of these indicators as effective measures of climate security vulnerability.



## SIMILARITIES AND DIFFERENCES IN VULNERABILITY ASSESSMENTS

Field interviews yielded results largely consistent with the program’s expectations. Aid officials and local actors agreed with CCAPS geospatial assessments that coastal areas, inland watersheds, drought-prone areas, and areas with generally high physical exposure to extreme weather are most vulnerable. Like CCAPS, national and international officials interviewed overwhelmingly saw good governance as a key component to adaptation.

At other times, however, interviewees’ opinions diverged notably from CCAPS’ geospatial analyses. In many cases organizations embrace a more focused approach to vulnerability than CCAPS’ broader design. Some interviewees viewed vulnerability primarily in terms of food security. Others, often government officials, felt that infrastructure is a key component of vulnerability. The CCAPS climate vulnerability model contrastingly does not directly capture certain food-related factors, such as agricultural dependence, or infrastructure quality. Similarly, interviewees in Uganda and Ethiopia typically viewed vulnerability as a function of water security and physical assets. But while CCAPS’ health and drought variables go a long way in capturing water access and variability, the findings may not accurately represent the water security of, say, a nomadic population.

Disparity in defining vulnerability is to be expected. CCAPS’ explicit focus on security and large-scale humanitarian risks is different from many local actors’ emphasis on livelihoods. Differences may also be explained by uncertainty regarding the explanatory power of climate change. Yet even where there is consensus on the nature and causes of vulnerability, disparities persist in assessments of the degree, location, and populations of most acute vulnerability. This brief offers four preliminary explanations

for such disparity: (1) Rural or urban biases in assigning weight to vulnerability; (2) Divergence in defining, locating, and assessing vulnerability specific to drought; (3) Prioritization of agricultural or pastoral sources of vulnerability; and (4) Imprecision in determining cross-border vulnerability.

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## THE IMPACT OF POPULATION DENSITY

Climate change-related events will likely impose new and greater demands on infrastructure and resources, including food, water, and medical care, in both urban and rural settings. The CCAPS vulnerability model assumes that these demands will be higher in densely populated areas than in rural areas. Population density thus constitutes 25 percent of CCAPS’ vulnerability model. Interviews on the ground, however, produced mixed views on the impact of population density on vulnerability. In the majority of cases, CCAPS assigns more vulnerability to urban areas than do local actors, many of whom focus more on the needs of rural areas.

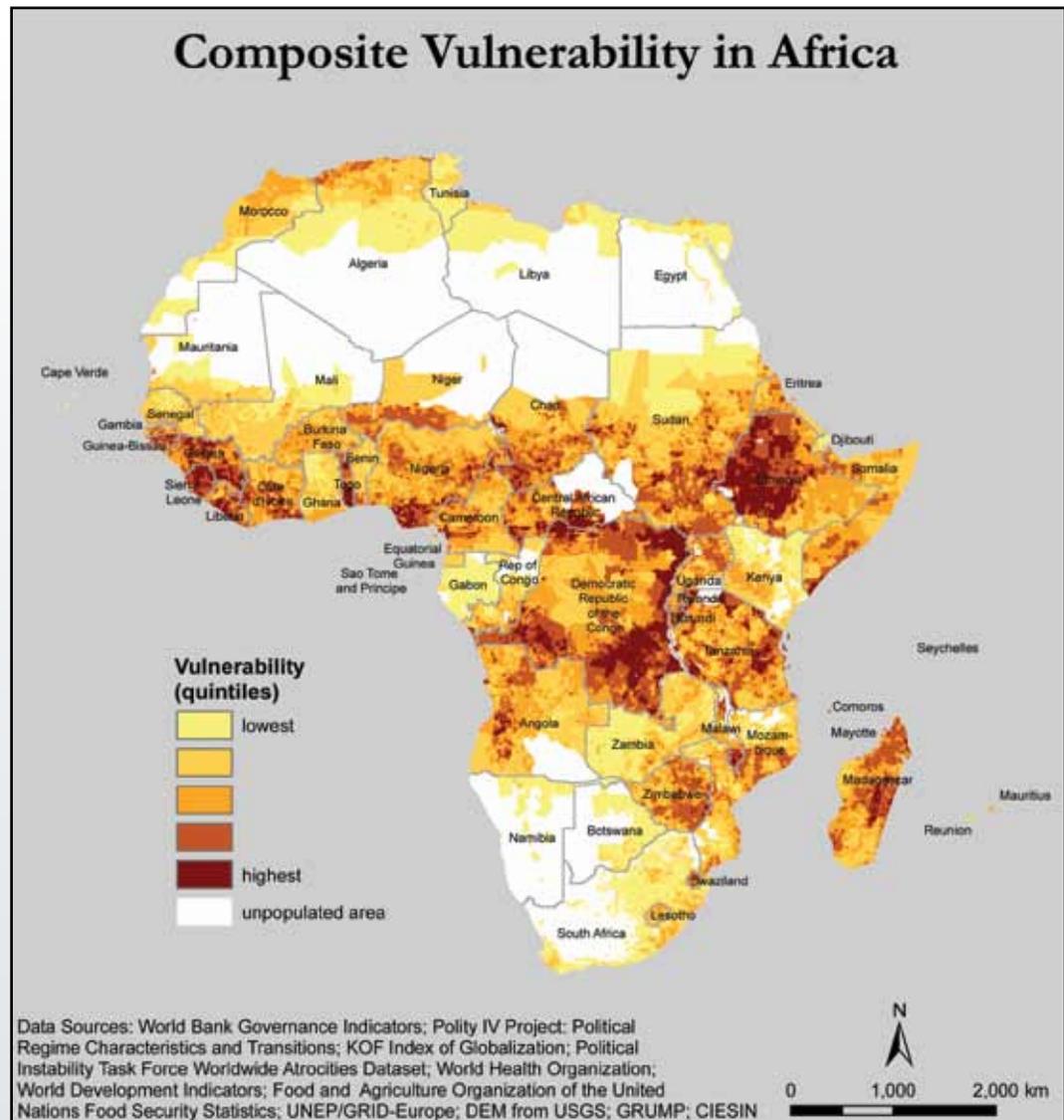
The local perception that climate change vulnerability is concentrated in rural areas was articulated by interviewees at a donor agency, local NGO, and intergovernmental agency in Kenya. They argued that less populated regions receive less rain, are less developed, less educated, and have restricted sources of income. Such arguments assign rural regions greater vulnerability than their urban counterparts, despite the fact that fewer people are affected, asserting that drought in the more populated center of Kenya is likely to lead to fewer deaths than in other regions.

Field interviews suggested that pastoral areas that transcend national borders are exceptionally prone to extreme weather and to conflict. Interviewees questioned CCAPS' drought-related vulnerability findings in south-central Kenya, saying the findings failed to adequately capture the exposure of chronic water scarcity in northern Kenya and the northeast near the Somali border.

Not all actors on the ground, of course, share this emphasis on rural vulnerability. South Africa is a unique case, for example, due to

its large cities, relatively low dependence on agriculture, troubled political history,<sup>4</sup> and the economic disparity it shares with its neighbors. A university professor expressed concern that South Africa does not have water resources to accommodate the large number of refugees coming from Zimbabwe and other countries. Changing weather patterns could exacerbate existing pressures on South African service provision. As an official at a European bilateral donor office in Pretoria observed, the options of the urban poor are extremely limited, whereas

*Figure 2. Vulnerability Map 1.0. The first iteration of climate security vulnerability in Africa based on the CCAPS model combines four components of vulnerability – physical exposure, household and community resources, governance and political violence, and population density.*



in rural areas people without land or assets still have access to common pool resources.

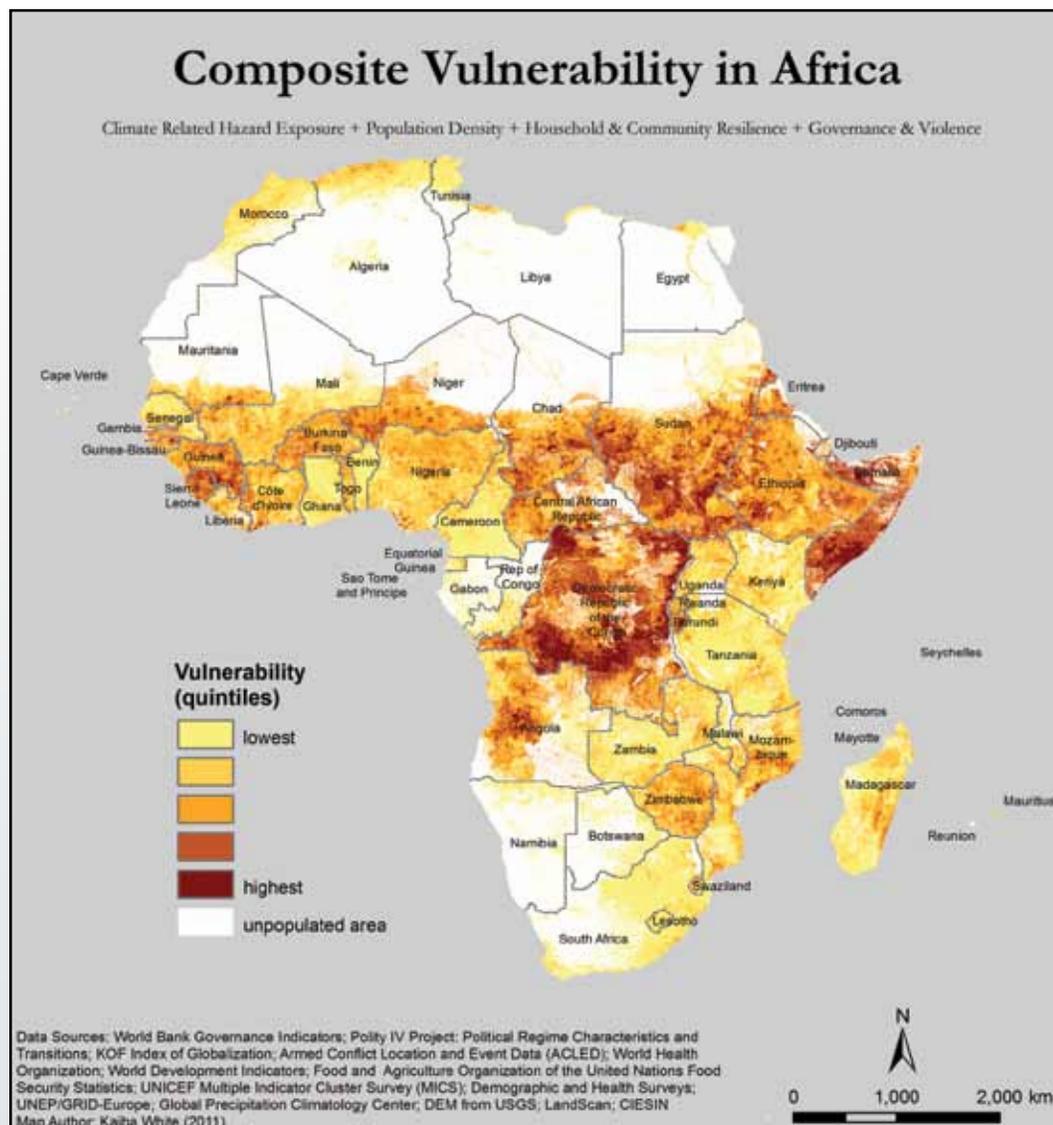
An official at a Scandinavian country embassy in Tanzania identified coastal urban areas in Tanzania as the country's most vulnerable spots, largely due to the abundance of unplanned settlements. Both humanitarian and government officials in Uganda warned of massive rural-to-urban migration and a consequent "explosion" in urban population density in cities like Kampala, resulting in high youth unemployment, high food price

inflation, and a proliferation of informal settlements. An official at a European humanitarian agency in Uganda asserted that the focus of vulnerability will soon shift to urban areas.

## LOCATING VULNERABILITY TO DROUGHT

By most accounts, drought is an agreed and significant source of vulnerability to both urban and rural communities in Africa.

Figure 3. Vulnerability Map 2.0. The revised map of climate security vulnerability, based on the second iteration of the CCAPS model, incorporates a measure of chronic water scarcity, among other new variables.<sup>6</sup>



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Drought threatens food security, economic well-being, and political stability, and can cause large-scale population shifts within and across borders.

By prioritizing population density, the CCAPS vulnerability model incorporates an urban bias in its vulnerability maps. Particularly in places where rural small-scale agriculture largely bears the impact of drought, rural biases may help to explain the perceived impact of drought on vulnerability. But field interviews also exposed differences in how drought can be defined. For example, CCAPS' original indicator of drought measured deviations from normal rainfall based on the Standardized Precipitation Index, in part to capture the impact of changing and unpredictable weather patterns. On the ground, however, many organizations define drought by chronic water scarcity.

To address the need to capture water scarcity, the CCAPS team incorporated a measure of chronic water scarcity in the next iteration of the vulnerability model captured through an indicator for the coefficient of variation in rainfall (see Figure 3).

## MEASURING CLIMATE'S IMPACT ON PASTORAL COMMUNITIES

Vulnerability assessments also reflect the lifestyle and economic behavior of the community in question. Pastoral communities face distinct climate-related

risks that set them apart from agricultural communities and render pastoral vulnerability particularly difficult to measure. Pastoral communities are generally nomadic, causing their vulnerability to move and thus distorting population density and climate exposure indicators. It follows that pastoral communities may be less likely to take advantage of government services, even when services are available, meaning governance indicators may be misleading. Finally, because pastoral communities rely upon livestock to sustain themselves, the value of their assets is stored differently than actors who store value monetarily or in fixed assets.<sup>5</sup>

Several interviewees expressed concerns about the vulnerability of pastoral communities. An officer at a multilateral development bank in Nairobi stressed the fragile livelihoods of pastoralists, first because of their migratory lifestyle, and second because drought uniquely kills off the assets of these communities. Interviewees pointed out that changing grazing patterns and weather patterns could lead to conflict between pastoral groups over shrinking grazing lands, or between pastoralists and agriculturalists.

Interviewees singled out chronically food insecure pastoral regions in Somalia, including the Mudug and Galguduud Regions. Also at risk are the urban areas into which Somali pastoralists move, such as Lower Juba and the Somali region of Ethiopia.

The nuances of pastoral vulnerability became apparent as discrepancies emerged between CCAPS' maps and information gathered on the ground in Uganda. CCAPS' remote determinations showed little variation of vulnerability throughout Uganda, but there is exceptional vulnerability in Uganda's "cattle corridor," comprised of pastoral drylands stretching from the northeast to the southeast of the country.

## CROSS-BORDER SPILL-OVERS

CCAPS' vulnerability maps reflect national or sub-national level variables and as a result cannot entirely capture spill-over of vulnerability across national borders. Indeed, it is highly unlikely that vulnerability stops abruptly at, for example, Uganda's borders with the Democratic Republic of the Congo (DRC) or South Sudan, as shown in CCAPS' geo-representations.

The abrupt change in vulnerability across borders in CCAPS' maps may in part be a function of national governance indicators. If bordering countries have large differences in governance quality at a national level, the maps may inaccurately suggest sharp local differences in vulnerability across borders. For example, representatives from two Namibian NGOs identified exceptional vulnerability in the north due to proximity to political instability in Angola. This governance-related vulnerability spill-over is not currently captured in CCAPS' remotely generated representations.

Indeed, given their distance from national capitals, many border regions, such as those areas of northern Kenya that border Ethiopia, Sudan, and Somalia, as well as Uganda's borders with the DRC and South Sudan, conceivably should share similar vulnerability across borders to the extent that the reach of national governments is limited in these areas.

Combining all of these factors, locating and measuring vulnerability becomes a complex exercise. Urban or rural, and agricultural or pastoral, biases pervade the development community's interpretations of drought and other sources of vulnerability. At the same time, current or anticipated climate-related migratory patterns are further cause for reflection. In seeking to reconcile these differences, CCAPS aims to move closer to generating a working definition of vulnerability that allows for accurate evaluation of the dynamics and adaptation responses. 🌍

## ENDNOTES

- <sup>1</sup> For information on the first iteration of CCAPS maps of climate security vulnerability, see Joshua W. Busby, Todd G. Smith, Kaiba White, and Shawn M. Strange. "Locating Climate Insecurity: Where are the Most Vulnerable Places in Africa?" Robert S. Strauss Center for International Security and Law, University of Texas at Austin, 2010.
- <sup>2</sup> This paper draws upon interviews conducted in Ethiopia, Kenya, Malawi, Morocco, Mozambique, Namibia, Senegal, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe in June, July, August, and December 2010, and March, June, July and August 2011. Researchers typically began interviews by asking where local actors thought climate change vulnerabilities were located and why such locations were thought to be vulnerable. Researchers would only then share CCAPS maps for comment before proceeding to a discussion of adaptation responses.
- <sup>3</sup> For purposes of this paper, the identities of CCAPS' interviewees have been kept anonymous.
- <sup>4</sup> A representative at a European donor in Pretoria explained that distortions in urban spatial dimensions under apartheid left swaths of people living far from the productive centers of South African cities.
- <sup>5</sup> Though the CCAPS vulnerability model does not include income, it includes a number of measures in its household basket on health and education that are highly correlated with income and for which subnational data are available. Additional information on assets might be desirable but might be hard to obtain and be highly variable between rural and urban areas.
- <sup>6</sup> For information on the CCAPS maps of climate security vulnerability that incorporate a measure of chronic water scarcity, see Joshua W. Busby, Todd G. Smith, and Kaiba White. "Locating Climate Insecurity: Where are the Most Vulnerable Places in Africa?" Policy Brief No. 3. Robert S. Strauss Center for International Security and Law, University of Texas at Austin, 2010. The map of sub-national climate security vulnerability of Africa presented in Policy Brief No. 3 updates an earlier version of this model from fall 2010 by including several new data sources and indicators including: 1) a new data source on droughts; 2) a new indicator for areas with chronic low rainfall; 3) a new sub-national indicator of access to improved water sources; 4) a new indicator for sub-national violence; 5) revised metrics of government effectiveness and voice and accountability which reflect a 3-year weighted average; and 6) an alternate, more fine-grained indicator of population density.

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