

# Decision Intelligence Document Degradation and Loss of Peri-Urban Ecosystems

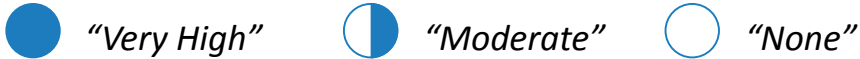
Cycle 2

November 2013

***Rapid degradation of peri-urban ecosystems is resulting in a loss of associated ecosystem services. Water provision, storm- and waste-water regulation, along with protection from natural disasters and erosion, are the impacted services that most acutely affect poor or vulnerable populations. The poor may be disproportionately impacted by loss of ecosystem services due to lack of political power around land use decision making and limited alternatives for livelihoods, housing, or basic services. Vulnerability extends to urban populations that depend on the ecosystem services provided by or flowing through peri-urban areas. Often, the loss of ecosystems is irreversible and the replacement of associated services is costly, if even possible.***

## Key Messages

1. Loss of ecosystem services is happening on a global scale, but drivers and symptoms vary by region. Asian cities account for the most urban land growth in absolute terms, but African cities are growing at the fastest rate. Ecological hotspots include the tropical forests of Southeast Asia and Central Africa, as well as the Himalayan mountains. East African desertification-prone landscapes face acute stresses from rapidly expanding cities and these crises will only grow worse. Latin America, already more urbanized, faces challenges in major urban centers and in particular in coastal cities and those reliant upon threatened water resources. The nature of the problem in the United States is different than the other regions investigated. More information on the U.S. context can be found in the appendix.
2. Loss of peri-urban ecosystems, and thus negative outcomes for the poor, are exacerbated by political systems that poorly and inconsistently determine land use, and because market prices (particularly for land) do not capture full ecosystem service value.
3. Unprecedented urbanization and infrastructure spending threaten to push stressed ecosystems to the point where only billions of dollars will be able to restore them, if they can be restored at all.
4. Dynamism in this space is moderate. The three areas demonstrating dynamism are converging in some instances, particularly between governance coordination and growing use of market-based approaches, demonstrating increasing momentum. The areas of dynamism are not all necessarily pro-poor, but all could be guided to emphasize the poor or vulnerable.
5. There is limited evidence of positive tipping points in the near term. Transformative positive change could happen if governments and economic incentives begin to support the preservation of peri-urban ecosystems in a widespread manner. Environmental disasters could significantly accelerate the timeframe by creating an opening to include and better serve the poor or vulnerable in disaster risk reduction and beyond. There is a risk, however, of continuing the current trajectory towards a negative tipping point, which would be characterized by peri-urban ecosystems suffering degradation to an irreparable point.
6. A combination of solutions will be necessary, and will likely include policy-based solutions at its core. Existing solutions are not inherently pro-poor and need to be designed to help vulnerable populations. Scaling remains a challenge across solutions.
7. Funders see the problem in many ways, leading to a broad range of solution approaches and a sense that cooperation could be improved. There may be an opportunity to facilitate alignment among funders.

Term	Definition
<b>Ecosystem Services (UNEP definition)</b>	The benefits people obtain from ecosystems, which include <i>provisioning services</i> such as food and water, <i>regulating services</i> such as waste treatment and flood control, <i>cultural services</i> such as spiritual and recreational benefits, and <i>habitat services</i> that maintain the conditions for life on Earth.
<b>Payments for Ecosystem Services (UNEP definition)</b>	A voluntary transaction in which a well-defined environmental service, or a form of land use likely to secure that service, is bought by at least one buyer from a minimum of one provider, if and only if the provider continues to supply that service
<b>Peri-urban</b>	The term “peri-urban” does not have a scientific definition, and as the FAO has stated, “[the term] is often used to describe seemingly contradictory processes and environments.” However, for the sake of this document, the concept embodied by the term “peri-urban” will generally refer to the urban fringe. While the specific characteristics of “peri-urban” areas vary greatly by geography, under this definition “peri-urban” areas are most often transitional areas where people, resources, and goods connect and move between rural and urban areas. Peri-urban areas shift and move in relation to the expanding urban fringe, so they are not necessarily static geographic spaces.
<b>Vulnerable</b>	Vulnerability of populations to lost peri-urban ecosystems is determined by the extent of exposure (e.g., access to land, access to services, price changes, and quality of services) and the ease of those populations to adapt (e.g., availability of alternatives, having resources to adapt, political influence, and access to information).
<b>Harvey Ball Key</b>	 <p>“Very High”      “Moderate”      “None”</p>

## What you will find in this section:

- An explanation of how this problem affects the daily lives of the poor or otherwise vulnerable.
- A description of the broad scope and scale of the problem, including graphic representations that demonstrate its nature and urgency.
- An identification and analysis of the root causes of the problem and the system failures that cause or exacerbate it.
- A survey of the prevailing perspectives on the problem and which groups or institutions tend to hold them.

# What is the impact on ecosystems?

***Rapid urbanization threatens both inland and coastal peri-urban ecosystems. Water provision, along with protection from disasters, stormwater, and erosion, are the impacted services most acutely affecting poor or vulnerable.***

## Impact on Ecosystems and Ecosystem Services

Peri-urban ecosystems are increasingly at risk of degradation and loss as natural resource consumption and waste in peri-urban areas increase due to rapid urbanization and increasing human activity.

Across both inland and coastal or marine areas, the impact of urban growth on peri-urban ecosystems depends on whether growth is characterized by increasing sprawl or by increasing population density.

- **Sprawl:** Migration of populations into peri-urban areas effectively extends the urban border, often transforming the use of peri-urban lands and leading to reductions in air quality, water supply, drainage and erosion control, and food production services.
- **Density:** Population growth within existing urban borders increases the resource draw and stress on the surrounding peri-urban ecosystem, which often leads to reduction of water quality, waste treatment, and increased storm vulnerability, particularly in the case of coastal cities. It should be noted that density can have positive consequences that improve the efficiency of service delivery as well.

**Cities do not operate in isolation but within a “sphere of dependence” on surrounding areas and their ecosystems. As such, the degradation of these ecosystems results in loss of ecosystem services that support urban and peri-urban populations.**

- **Water provision:** This is often the most important service lost, as paving over or polluting above-ground rivers and lakes destroys accessible sources of freshwater for drinking. Population growth increases demand for this diminishing water supply, and water tables drop as underground aquifers fail to recharge. The resulting in-flow of seawater may permanently salinize the water supply if water tables drop too low in coastal areas.
- **Disaster, stormwater, and erosion protection:** In many cases, this is one of the most valuable services threatened, as paved surfaces prevent natural drainage and can exacerbate floods, while bare land is a risk factor for mud slides and dust pollution. Removal of wetlands leaves coastal cities directly exposed to tropical storms, compounding the risk of property damage and loss of life.
- **Waste treatment:** Wetland destruction undermines the ability of the ecosystem to filter refuse from water supplies. Effluents from peri-urban industry, excessive untreated human waste, and garbage pollute the remaining waterways.
- **Food production:** As the urban fringe expands, industry and housing developments (both formal and informal) replace productive agricultural land, which often displaces poor farmers and can lead to lower volumes and higher food prices, particularly in cities that are highly dependent on nearby agricultural supply. Furthermore, peri-urban industrial parks release air pollutants like sulfur dioxide that can induce acid rain in peri-urban and even nearby rural areas, directly impacting agricultural productivity.
- **Climate and air quality regulation:** Peri-urban land supports green vegetation cover that absorbs air pollution and ambient heat, but the clearing of vegetation slows the process of filtering toxic compounds from the local atmosphere. As landscapes that used to be permeable and shady become dry and solid, a “heat island” effect can occur, leading to higher temperatures in a region.
- **Fuel wood and timber:** Deforestation removes a source of fuel wood and timber that nearby residents depend upon. Meanwhile, increasing urban density can create demand for forest timber beyond replenishable supply.

# What is the impact on the lives of poor or vulnerable people?

***The poor are disproportionately affected by peri-urban ecosystem loss due to their propensity to live in peri-urban areas, high ecosystem dependence, and the economic impacts of land use change.***

## Impact on the Lives of the Poor or Vulnerable



**The poor are more likely to live in peri-urban areas and are thus more directly affected by the degradation of their local ecosystems.**

- According to the UN, peri-urban areas tend to be occupied by low-income families and are typified by illegal settlements and slums. In addition, peri-urban areas are poorly served by urban infrastructure and experience worse sanitation conditions than their urban counterparts.<sup>1</sup>

**The impact on the poor in developing countries is fundamentally different than the impact on the poor in the United States as the poor in developing countries are likely to depend on ecosystems for both basic services and their livelihoods, while often also facing more dire poverty.**

- The peri-urban poor in developing countries often rely on ecosystems to provide basic services including water, waste disposal, regulation of climate and air quality, food production, and materials (e.g., timber, fuel, medicines) that they cannot access elsewhere. This is partially because public provision of such services is significantly inferior in peri-urban zones than in urban centers.<sup>2</sup>
- A UN study found the peri-urban poor in developing countries depend heavily on natural resources for income, as their livelihoods are in many cases based upon agriculture, horticulture, animal husbandry, forestry, or fishing.<sup>3</sup>

**The economic impacts of land use change are disproportionately absorbed by the poor because of their high vulnerability to service or habitat loss, and the economic cost of lost land is high due to a lack of resources, influence, or alternatives for income, housing, or basic services.**

- **Lack of resources:** When basic services provided by ecosystems are lost, the only alternative for the peri-urban poor is often to pay for services previously secured for free, and often at exorbitant prices, paying as much as 100X more per unit than the rich. This is largely a function of lack of economies of scale, with the poor unable to purchase bulk quantities of goods.<sup>3</sup>
- **Lack of political power:** Peri-urban areas generally have less political power and experience rapid turnover, attracting newcomers from an array of cultures, causing disorganization and poor defense of community land use interests. This leads to poor compensation when land is converted.<sup>4</sup>
- **Lack of alternatives:** In many cases, the peri-urban poor depend on local ecosystems for basic services because there are no alternatives, and the loss of their lone source can inflict heavy costs. For example, in peri-urban South Lunzu, Malawi, the only water sources available to the poor are wells with fecal coliform concentrations up to 10X higher than the EU standard for bathing water, leading to an array of local health challenges. In addition, residents are often pushed to marginalized land that can leave them highly exposed to storms and other natural elements.<sup>5</sup>

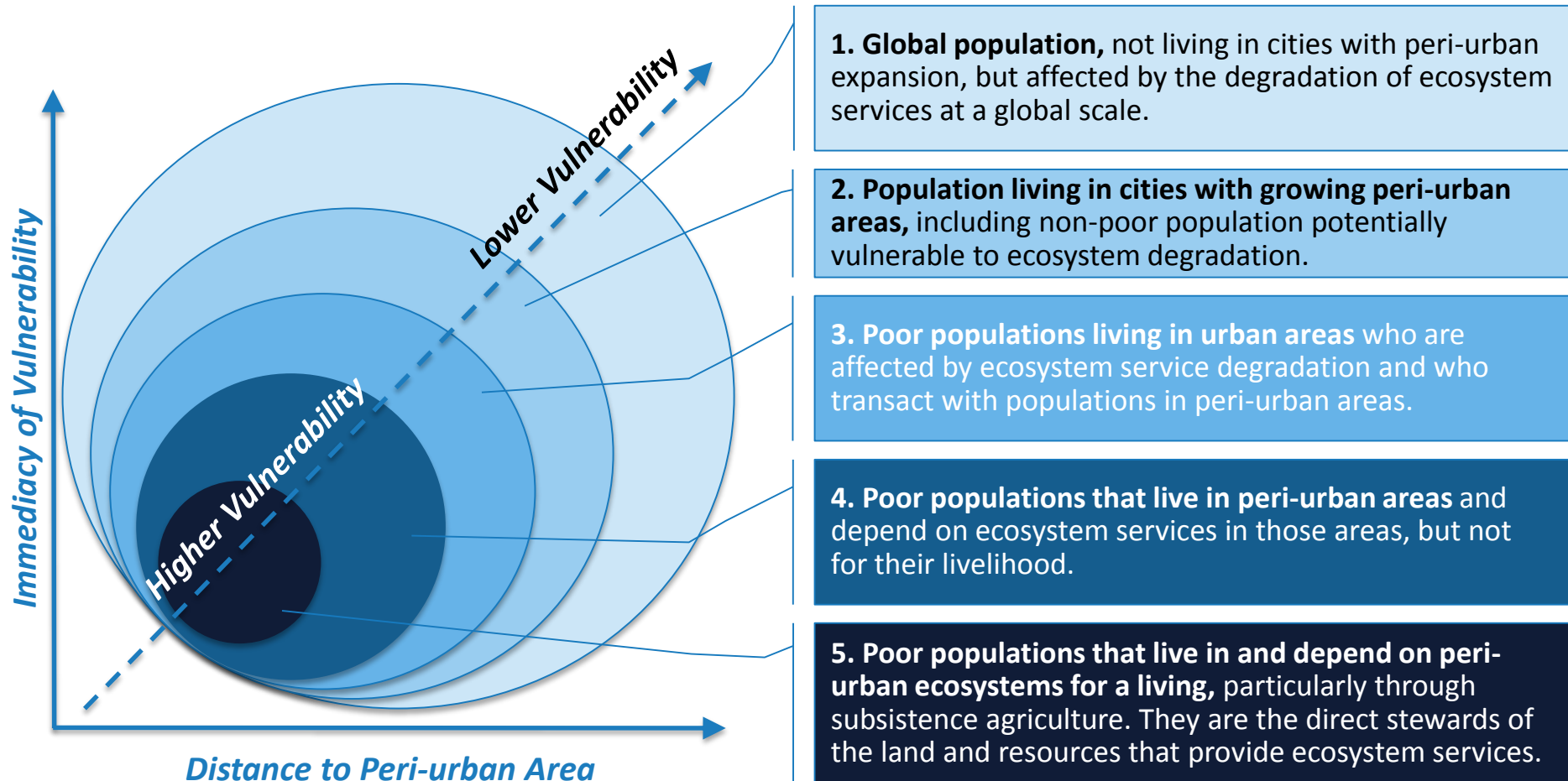
**Women, minorities, and children are disproportionately vulnerable to peri-urban ecosystem loss as they are overrepresented in peri-urban zones and thus are more likely to be the direct users of peri-urban ecosystem services.**

- Women account for a large percentage of the peri-urban poor and are often directly involved in peri-urban agricultural activities. Destruction of peri-urban ecosystems therefore disproportionately impact women, as they are less likely to have alternative sources for food or income.<sup>6</sup>
- In São Paulo, Brazil, peri-urban areas have 2X as many children and 3X as many minorities per capita as surrounding stable areas.<sup>7</sup>

**Vulnerability extends to urban populations that depend on the ecosystem services provided by peri-urban areas.**

- Benefits to urban populations include climate and air regulation, water provision, food for sale, and protection from and mitigation of storms.
- Loss of food production for urban markets resulting from peri-urban ecosystem degradation can contribute to rising food prices, affecting all urban inhabitants, but disproportionately impacting the poor.

*The poor who live in and depend on peri-urban ecosystems are most vulnerable, but vulnerability extends to other population segments as well.*



# Impact of Ecosystem Degradation on Poor or Vulnerable Segments

*Water provision and disaster protection are key issues that affect the entire city, but more acutely impact the peri-urban and urban poor. To a lesser degree, the same is true of food production and waste treatment. Climate and air quality affect populations across the city. The assessments in this chart represent a consensus view of the most important issues for poor or vulnerable populations based on interviews with experts during the course of the Search.*

		Population Segments Affected		
		Population living in cities with growing peri-urban areas	Poor living in urban areas depending on peri-urban ecosystems	Poor living in and depending on peri-urban ecosystems
Services Impacted	<b>Water Provision</b>	<ul style="list-style-type: none"> <li>Less likely than poor to lack water alternatives</li> </ul> <p>●●●○○○</p>	<ul style="list-style-type: none"> <li>May depend on ecosystems for water, but more likely than peri-urban to have alternatives</li> </ul> <p>●●●●○○</p>	<ul style="list-style-type: none"> <li>Poor or vulnerable often do not have another water source</li> </ul> <p>●●●●●●</p>
	<b>Disaster and Erosion Protection</b>	<ul style="list-style-type: none"> <li>If city is coastal, then potential impact on all urban residents</li> </ul> <p>●●○○○○</p>	<ul style="list-style-type: none"> <li>Impact may be high in coastal cities</li> <li>Can also be impacted by draining of lakes and wetlands in peri-urban zones</li> </ul> <p>●●●●○○</p>	<ul style="list-style-type: none"> <li>Peri-urban poor highly exposed, particularly if city is coastal or has seasonal inland flooding</li> </ul> <p>●●●●●●</p>
	<b>Waste Treatment</b>	<ul style="list-style-type: none"> <li>More likely than poor to have municipal waste treatment services</li> </ul> <p>●○○○○○</p>	<ul style="list-style-type: none"> <li>May need ecosystem waste treatment depending on state of municipal services</li> </ul> <p>●●●●○○</p>	<ul style="list-style-type: none"> <li>Poor or vulnerable people often use rivers and streams for managing waste</li> </ul> <p>●●●●●○</p>
	<b>Food Production</b>	<ul style="list-style-type: none"> <li>Could have limited effect on food price and quality</li> </ul> <p>●○○○○○</p>	<ul style="list-style-type: none"> <li>Mixed evidence; conversion of land can affect food price and quality, but can increase efficiency</li> </ul> <p>●●○○○○</p>	<ul style="list-style-type: none"> <li>Potential source of income</li> <li>Food security (price, availability and quality)</li> </ul> <p>●●●●○○</p>
	<b>Climate and Air Quality</b>	<ul style="list-style-type: none"> <li>Air temperature and quality</li> <li>Mitigation of sea level rise, storm surge</li> </ul> <p>●●●○○○</p>	<ul style="list-style-type: none"> <li>Air temperature and quality</li> <li>Mitigation of sea level rise, storm surge</li> </ul> <p>●●●○○○</p>	<ul style="list-style-type: none"> <li>Air temperature and quality</li> <li>Mitigation of sea level rise, storm surge</li> <li>Polluter industries often fill open land</li> </ul> <p>●●●●○○</p>

●○○○○○ Low	●●○○○○ Low to Medium	●●●○○○ Medium	●●●●○○ Medium to High	●●●●●○ High	●●●●●● High to Very High
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# What is the scale and scope of the problem? Why is the problem pressing?

***Expanding urban zones are rapidly degrading and destroying peri-urban ecosystems. The resulting loss of ecosystem services is happening on a global scale, but drivers and symptoms are concentrated locally and differ by geography.***

## Scale: Why It Is Important

**Urban areas continue to expand, converting surrounding land and increasing population pressure on the environment.**

- By 2030, 60% of the world's population will live in urban environments (up from 51% in 2010 and 46% in 2000).<sup>1</sup>
- By 2030, urban land area stands to increase by up to 1.2 million km<sup>2</sup>, a 185% increase over urban land cover in 2000. However, this increase accounts for only 2.5% of the world's agricultural land. While this may impact some local food systems, urban land as a percentage of world land area will likely remain <1%, indicating this trend may not significantly impact global food production.<sup>1, 3, 4</sup>
- Forty-five percent of the 1.4 billion additional expected city residents by 2020 are projected to live in peri-urban areas.<sup>2</sup>

**Cities are highly dependent on their local ecosystems to provide basic services, and peri-urban degradation directly impacts urban residents.**

- Industrial and human waste dumped into nearby rivers threatens urban water supply and public health. Jakarta's Citarum River is contaminated with heavy metals and leaves skin rashes on those who use it for washing, though the river supplies 80% of Jakarta's drinking water.<sup>5</sup>
- About 40 million farmers, 5-10% of all smallholders, grow crops in urban or peri-urban areas. In Asia and Africa, these farmers supply their cities with 80-100% of leafy vegetables and 50-80% of poultry and eggs.<sup>6, 13</sup>

**Continuous degradation of peri-urban ecosystems increases city vulnerability to catastrophic impacts.**

- A 10% loss in national forest cover is associated with 5-25% increases in flood frequency. This risk is serious in a low-lying coastal city like Lagos, which has experienced a 20% decline in wetlands area since 1978 due to development, a trend that is expected to continue.<sup>14</sup>

## Scope: Global Relevance

**Both Asia and Africa face urgency, though Africa is likely more in need of support due to greater lack of government capability.\*\***

- **Africa's** urban land may increase 500% in 2000-2030, led by the world's fastest growing cities in both land and population – Dar es Salaam, Nairobi, Kampala, and Addis Ababa. Sprawl and informality characterize urban areas already acutely stressed, with little planning or regulation.<sup>2, 9</sup>
- **Asia**—led by China and India—will account for nearly half of growth in urban land cover. Densification in Asia is on the rise, and will lead to ever-growing acute pressures on local resources, particularly water.<sup>2, 9</sup>

**The Americas are already heavily urbanized, but struggle to manage widespread urban sprawl.**

- **In Latin America**, 79% of people live in cities, which will rise to 83% by 2030. The urban poor in megacities like São Paulo are concentrated on the outskirts, where land is over 10x cheaper than at the city center.<sup>1, 12</sup>
- **The United States** faces similar pressures as urban land cover is projected to nearly double between 2000 and 2030, but the nature of the problem is different than in Africa, Asia, and Latin America.<sup>8</sup> A deeper analysis of the U.S. context can be found in the Appendix to this deck.
- **In several transitioning "hotspots," urbanization is creating immediate risks for humans and biodiversity alike.**
- **Southeast Asian** tropical forests are highly valuable, but contain some of the fastest expanding cities – Ho Chi Minh City and Bangkok.<sup>9, 10</sup>
- **East African** desertification-prone landscapes face acute stresses from rapidly expanding cities and these crises will only grow worse.
- **The Himalayan mountains** are the world's most plentiful source of water, supplying cities in Afghanistan, Pakistan, and India that will add 2.5 million people to their populations annually for the next 10 years.<sup>9, 11</sup>

# What is the urgency of the problem?

***Continued unplanned urban and peri-urban development, paired with record infrastructure spending and climate change, is stressing ecosystems to the point where ecosystem restoration is arduous and expensive. In some cases, damage may be irreversible.***

## Urgency



**Rapid and often unplanned or informal development continues, particularly in developing Africa and Asia, placing unsustainable pressures on peri-urban ecosystems.**

- Reflecting broader developing world trends, the informal population in Hyderabad grew 256% from 2001-2011, to 2.3 million, with continued growth expected. Such unplanned-for population growth and subsequent informal sprawl degrades ecosystems and services.<sup>9</sup>

**As urbanization continues, the global economy is experiencing an infrastructure boom with the largest increase in spending on water, transportation, energy, and communications systems since World War II. Between now and 2030, there is a unique opportunity to have impact by ensuring future growth unfolds responsibly and with consideration for peri-urban ecosystems.**

- According to UN-HABITAT, 60% of land forecast to be urban in 2030 has yet to be developed. This presents a small but potentially sufficient window to influence the principles by which this land is developed and with what environmental considerations.<sup>8</sup>
- The coming global expansion of infrastructure such as roads, pipes, and landfills threatens to degrade, if not wholly destroy, peri-urban ecosystems globally if such projects are not built with appropriate planning, ensuring they are built properly and are built to minimize impact on local environments. In addition, once such infrastructure is built, ability to undo any damage done to ecosystems is minimal.
- From 2000-2030, \$50 trillion is forecast for investment in infrastructure globally, with \$20 trillion in Asia, Africa, and the Middle East.<sup>1</sup>
- Emerging economies will need to invest \$1.1 trillion annually in infrastructure through 2030 just to keep pace with demand for basic services and physical and electronic networks. China and India alone are on track to spend more than \$500 billion each on infrastructure before 2015.<sup>1, 2</sup>

**Replacing ecosystem services often requires spending billions of dollars in rehabilitation investments over several decades, and in some cases destruction may be irreversible.**

- After 40 years of restoration efforts, Cleveland's Cuyahoga River, so polluted it infamously caught fire in 1969, still fails 8 of 14 EPA criteria for river health. Due to lingering mercury pollution, water and fish from the river may never be safe to consume.<sup>3</sup>
- Natural disasters are an impetus for reexamining the worth of ecosystems. Louisiana rejected a \$17 billion, 30 year plan to restore coastal wetlands in 2003; after Hurricane Katrina in 2005, the legislature proposed a \$40 billion ecosystem restoration plan.<sup>5</sup>

**Climate change is increasing the likelihood of extreme weather, threatening the viability of peri-urban ecosystems already under stress.**

- Eighty-one percent of cities report an increase in natural hazards in the past 5 years; 41% cite more intense storms, and 31% cite prolonged droughts.<sup>6</sup>
- Rising temperatures and reduced precipitation will increase water shortages and contamination, increasing the vulnerability of 40-90% of residents in developing cities without access to improved water and sanitation.<sup>7</sup>

# What are the root causes at play? What systems failures are causing or exacerbating the problem?

*Loss of peri-urban ecosystems is exacerbated by political systems that lack participation, transparency, and capacity for determining optimal land use, and by market prices that do not incorporate full ecosystem service value.*

## *System Failures: Underlying constraints that exacerbate the problem*

### **Political System**

The processes and laws pertaining to land use decisions regarding peri-urban spaces often lack transparency, are driven by short-sighted gains, and can involve corruption. Some municipal governments do not have jurisdiction over the entire ecosystem area. Simultaneously, lack of engagement with peri-urban communities regarding their needs has led to disenfranchisement. In addition, due to the transient nature of peri-urban populations, organization is often lacking and results in sub-optimal representation and voicing of their needs.

### **Market System**

Prices (particularly land prices) do not incorporate the full ecosystem value of peri-urban land. Economic incentives and information gaps lead to land use focused more on short-term growth (commercial, residential, governmental). This stimulates increasing pressure from an array of actors to convert peri-urban land for development purposes, often destroying peri-urban ecosystems along with the valuable services they previously provided.

## *Root Causes: Main forces that directly contribute to the problem*

### **Limited Urban Planning and Implementation Capacity**

Expansion of urban land is shaped by policies that encourage sprawl versus densification. Even well planned policies can be ineffective when cities lack sufficient capacity to implement and enforce them.

### **Lack of Rural Economic Opportunity**

Urban migration is often driven by rural residents seeking greater economic opportunity and employment in the cities. Many migrants end up in peri-urban areas, which places a strain on local ecosystems.

### **Lack of Societal Understanding of and Information Regarding Issue**

Decision makers and the general public alike remain poorly informed regarding the direct and indirect impacts of land use change and development on peri-urban ecosystems.

### **Economic Growth and Consumption**

Rising incomes in urban zones are leading to increases in consumption of resources per capita, increasing strain on local ecosystems and the services they provide. In addition, increasing land values are pressuring the peri-urban poor to leave their property.

# What are the prevailing perspectives on this problem?

*Expert perspectives in the space overlap, but few address peri-urban ecosystems holistically given the diverse complexities of peri-urban issues. “Environmental Justice” and “Adaptation and Resilience” are the perspectives that link most to the poor.*

## “Planetary Boundaries” Perspective

**“We are increasingly living beyond the thresholds of Earth-system processes in peri-urban zones. We must reverse this path or we will compromise the needs of future generations.”**

The concept, and our growing understanding of, the thresholds, limits and carrying capacities of our planet and its systems and the necessity for humans to live within those means. The view is held by international environmental activists and researchers with a natural sciences background.

## “Nexus” Perspective

**“The problem of peri-urban ecosystem degradation and loss can only be understood in the broader context of the interdependencies across water, energy, and food.”**

The growing appreciation of the acute tradeoffs arising from use of land and resources for human use and the need for those tensions to be resolved. The view is held by locally-based research institutes, policy think tanks and policymakers, especially those based in North America and Latin America.

## “Natural Capital” Perspective

**“We need to construct market mechanisms that wholly and accurately price peri-urban natural assets or else they will remain undervalued relative to alternative uses of the land they occupy.”**

The emerging view of natural resources as a distinct asset class. This view is held by research institutes based in economics, including those advocating for payment for ecosystem services interventions. It is unclear how pervasive this perspective is among investors and policymakers.

## “Adaptation and Resilience” Perspective

**“If we do not preserve the healthy functioning of peri-urban ecosystems, we will increase vulnerability and decrease resilience of human populations to adverse impacts of climate change.”**

The appreciation of the need for preserved ecosystems as they will underpin human adaptation to climate change. The view is held by socially-activist NGOs and policymakers focused on adaptation and well-being of the poor or vulnerable, and is growing in those geographies at risk to be affected most by climate change, such as Africa and Asia.

## “Faith in Technology” Perspective

**“Investment in and support of technological innovation is the best (if not only) way to ensure peri-urban ecosystems can either be saved or the services they provide can be adequately replaced.”**

The belief that modern challenges such as peri-urban ecosystem loss will be solved by increasing the pace of breakthroughs and innovations and that answers lie in pushing technology through the right channels. This is a marginal view held by aspiring entrepreneurs, mostly in urban agriculture in the United States.

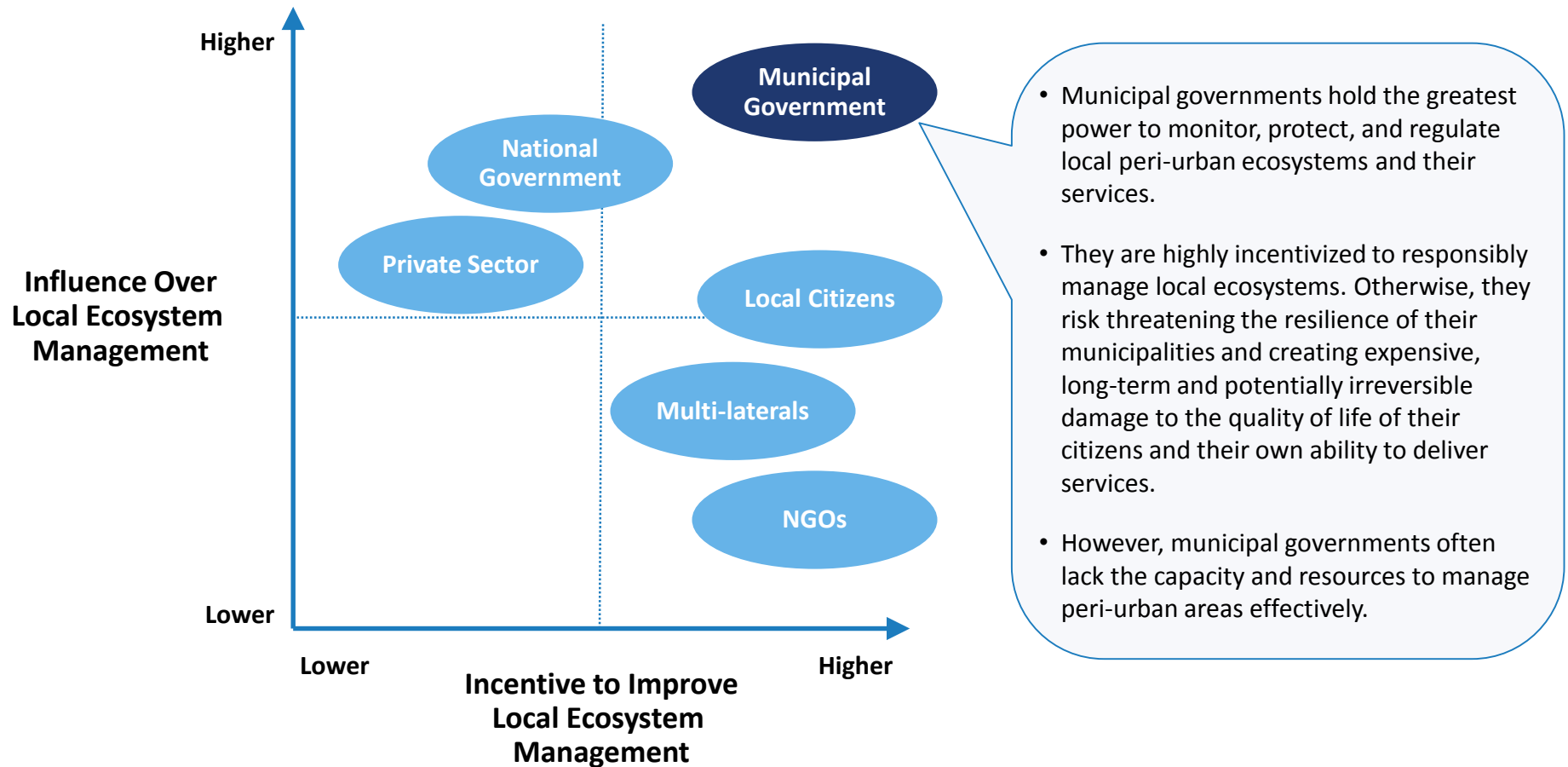
## “Environmental Justice” Perspective

**“The poor or vulnerable are burdened disproportionately with environmental hazards. Especially in peri-urban areas where the poor are likely to live, ecosystem protection must be prioritized to ensure justice for the poor.”**

Minorities and the poor are disproportionately susceptible to environmental hazards, and simultaneously less likely to enjoy environmental benefits. Ecosystem protection in peri-urban areas populated by the poor or vulnerable is not just an issue of quality of life or of the environment, but an issue of justice for the poor.

# Who are the most relevant stakeholders?

*Due to their power in local regulation and the long-term incentives they will realize by responsibly managing ecosystems, municipal governments are the primary stakeholders and most relevant potential partners in the space.*



## What you will find in this section:

- Descriptions of the three areas of dynamism that demonstrate movement towards solutions in the space.
- An analysis of each of the areas of dynamism, including a judgment of their relative strength and a description of the evidence that supports it.
- Descriptions of what would need to happen to reach potential tipping points, which could be near-term, longer-term, or even non-existent.
- An analysis of the potential risks or uncertainties in the space that could inhibit transformative change.

# What areas of dynamism demonstrate movement towards a solution in the space?

***Dynamism in this space is moderate. The three areas demonstrating dynamism are converging in some instances, particularly between increasing governance coordination and growing use of market-based approaches, demonstrating increasing momentum. The areas of dynamism are not all necessarily pro-poor, but all could be guided to emphasize serving the poor or vulnerable.***

## Increasing Best Practice Sharing and Coordination Across Administrative Boundaries to Govern Peri-urban Areas

Improved coordination within and across cities is increasing recognition of the need to address impacts of urbanization on peri-urban areas, leading to greater ownership of environmental duties. Integration of planning at the city level and increased sharing of best practices globally is helping to highlight the scale of ecosystem degradation and identify solutions, while building stronger trans-national economic and political ties between cities. This is important as rapid expansion of urban land area and populations continue. Uptake of increasingly sophisticated location-based planning has allowed municipalities to visualize the peri-urban region, while stakeholders are realizing that coordination across this region is essential for proper management of ecosystems. All of these drivers are helping to address limited urban planning and implementation capacity, which is a key cause of ecosystem degradation.





## Growing Use of Market-based Approaches to Manage Ecosystem Services

Increasing demand for tools to support data-driven policymaking has fueled a surge in research and experimentation with environmental finance and incentives. This, and a growing appreciation for resource scarcity, has emboldened cities and the private sector to apply approaches like mitigation banking, pollution taxes, and payments for ecosystem services to better manage peri-urban areas and address the consequences of rapid economic growth and consumption. Additionally, the rise of socially-responsible investing is a positive trend creating momentum in this space. These solutions provide new revenue for peri-urban and rural communities, helping to address lack of rural economic opportunity. Entrepreneurs and NGOs have responded with increasingly sophisticated methods, technologies, and analyses in efforts to decrease the cost of preserving peri-urban ecosystems.

## Growing Public Awareness and Community Organization to Protect Peri-urban Resources

Real time engagement with global crises via social media has led to greater awareness of climate change and environmental issues. Growing visibility of rapid land conversion, decline in urban water and air quality, and heightened coverage of urban crises has helped the public recognize peri-urban ecosystems as distinct from rural environments. This has been most evident in places like China and Bangladesh, where environmental crises are forcing the public to take notice, leading to a rising global middle class that is not only increasingly involved in civil society, but also aware of environmental threats. This is the most inherently pro-poor of the three dynamic areas, with an emphasis on inclusive decision making and local empowerment. In some sectors, notably urban agriculture, awareness has translated into successfully pressuring municipalities to recognize peri-urban ecosystem value.




**Area of Dynamism: Increasing best practice sharing and coordination across administrative boundaries to govern peri-urban areas**

Drivers	Increasing knowledge sharing between cities via regional and global urban networks	Growing recognition of inter-municipal alignment within metro regions as key element of peri-urban planning	Rapid uptake of spatial strategies for urban and peri-urban land use planning	Retreat from siloed sector planning toward holistic planning approaches for managing urban growth
Relative Strength				
Geographic Notes	<i>Large and mega-cities across the world, particularly across Asia and LatAm</i>	<i>Most proactive implementation has been witnessed in Spain and Brazil</i>	<i>Major global cities have taken the lead as they have access to more resources to try new tools</i>	<i>Evidence of water-focused activity in Asia and food-focused activity in Africa</i>
Signals	<ul style="list-style-type: none"> <li>Recently formed networks like the World Urban Forum (2002), C40 Cities (2005), and the Resource Center for Urban Agriculture and Food Security (2005) show city interest in global innovation, sharing best practices.</li> <li>Over 8,000 participants from 151 countries attended 2012's World Urban Forum; C40's membership has grown from 40 mayors to 60 today.<sup>14</sup></li> </ul>	<ul style="list-style-type: none"> <li>In Spain, 50% of local governments now participate in consortia for solid waste collection and 33% do so for water waste treatment.<sup>16</sup></li> <li>In Brazil, local governments have built a culture of coordinating for healthcare, urban development, transportation, and more.<sup>16</sup></li> <li>Portland's Metro Council includes city and county representatives that direct regional planning.<sup>18</sup></li> </ul>	<ul style="list-style-type: none"> <li>Planning offices in Cape Town, New Delhi, Jakarta, and Australian cities are currently funding GIS projects to integrate spatial planning approaches into urban growth management.<sup>17</sup></li> <li>Urban Observatory, launched in 2013, features GIS data contributed by 16 global cities on population density, water distribution, power grids, and other features for public consumption.<sup>19</sup></li> </ul>	<ul style="list-style-type: none"> <li>Since 2003, Singapore, Karachi, and other cities have integrated water plans with land use planning.<sup>9</sup></li> <li>Starting in the mid-2000s, 8 African cities began accounting for urban agriculture in zoning.<sup>2,5</sup></li> <li>Citigroup held a competition for the most innovative city in 2012, recognizing policies for economic growth, social equity, and environmental sustainability.<sup>10</sup></li> </ul>
Expected Trajectory	<b>ACCELERATING:</b> Networks like C40 and others are growing fast and seeing their influence grow too.	<b>STEADY GROWTH:</b> Increasing evidence of success from early movers is encouraging others to attempt similar approaches.	<b>ACCELERATING:</b> Ease of dissemination and sharing of technological tools is leading to rapid uptake.	<b>STAGNANT:</b> Examples of activity and innovation are generally ad-hoc and do not seem to be coalescing.







# Dynamism: Increasing Use of Market-based Approaches to Manage Ecosystem Services

## Area of Dynamism: Growing use of market-based approaches to manage ecosystem services

Driver	Increasing ability to collect, process, quantify, and visualize ecosystem data	Application of technology to enhance or replicate ecosystem functions	Increasing usage, diversity, and experimentation of methods to monetize ecosystem service value
Relative Strength			
Geographic Notes	<i>A global phenomenon with the development of new tools</i>	<i>High tech predominant in United States; practical solutions rising across Africa, elsewhere</i>	<i>LatAm leading PES schemes; ecotax leaders include Europe, Oceania, and Asia</i>
Signals	<ul style="list-style-type: none"> <li>Tech advances raised the number of published works on spatial mapping of ecosystem services from 31 in 2011 to 99 in 2013.<sup>3</sup></li> <li>More researchers are focusing on natural capital and value of urban ecosystems; number of studies rose from 194 in 2011 to 381 in 2013.<sup>3</sup></li> <li>In 2011, the UK Department for Environment released its first national ecosystem assessment, the largest ecosystem valuation undertaken at a national scale.<sup>4</sup></li> </ul>	<ul style="list-style-type: none"> <li>Plantagon, a company focused on urban “integrated solutions for energy, excess heat, waste, CO2 and water,” broke ground on the world’s first vertical farming greenhouse in February 2013.<sup>5</sup></li> <li>Since 2007, the NGO Umande Trust has built 52 biogas centers in Nairobi’s Kibera slum, which generate natural gas cooking fuel from pay-per-use community toilets, reducing solid waste contamination.<sup>6</sup></li> </ul>	<ul style="list-style-type: none"> <li>Since 2003, Mexico City has used payment for ecosystem services mechanisms to pay peri-urban residents to keep forests standing in aquifer recharge areas.<sup>1</sup></li> <li>The city of Bogotá seeks to apply Clean Development Mechanism credits to 60,000 hectares of forest near the city’s upriver water supply, a novel approach.<sup>2</sup></li> <li>Cape Town’s 2009 study valued the city’s natural capital assets for the first time at \$4-8 billion, with an ROI on municipal investment 12% higher than the general city economy.<sup>7</sup></li> </ul>
Expected Trajectory	<b>ACCELERATING:</b> Development of new tools for information collection and analysis breeds ever-increasing innovations and applications.	<b>STEADY GROWTH:</b> Innovation and momentum are building, but through siloed applications, so there is not enough convergence to reach acceleration.	<b>STEADY GROWTH:</b> There is increasing piloting of a range of market-based initiatives that is leading to steady growth, but scaling is needed to reach acceleration.

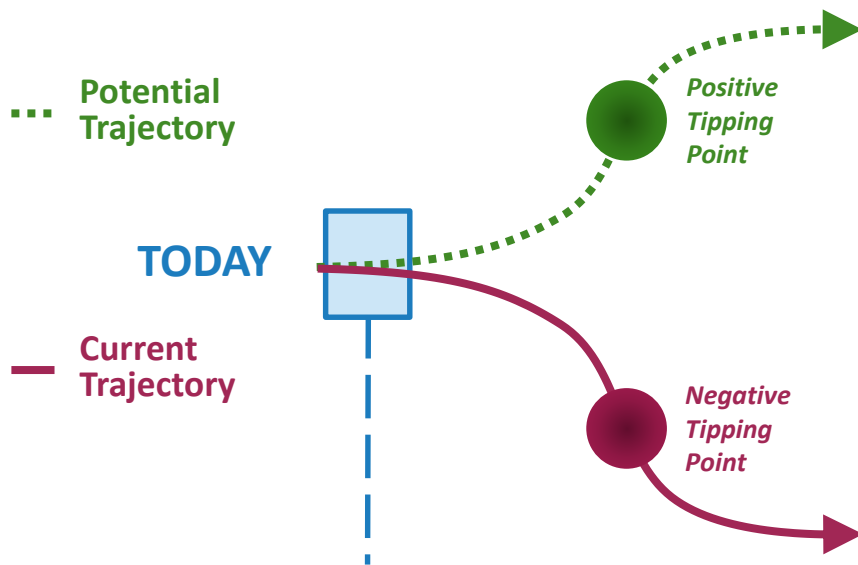
# Dynamism: Awareness and Community Organization to Protect Peri-urban Resources

## Area of Dynamism: Growing public awareness and community organization to protect peri-urban resources

Driver	Increasing interest in environmental impact	High-profile crises periodically draw public attention to links between public safety and peri-urban ecosystems	Increasing awareness of “peri-urban” issues as distinct from urban or rural challenges	Establishment of more peri-urban community groups, especially focused on agriculture
Relative Strength				
Geographic Notes	<i>Asian and African awareness in urban zones, particularly, is rising as living conditions degrade</i>	<i>The highest activity is among affected large coastal cities such as New York and Mumbai</i>	<i>There is particular attention in the literature to peri-urban zones of LatAm and Africa</i>	<i>There is much activity across SSA in peri-urban areas of Ghana, Kenya, and others</i>
Signals	<ul style="list-style-type: none"> <li>Chinese protests over air and water pollution believed to endanger public health caused the government to close down two factories in 2011; the protests were fueled by microblogging sites.<sup>9</sup></li> <li>Efforts to develop Portland, Oregon’s 145 mi<sup>2</sup> greenbelt were voted down 3 times via public ballot in recent years.<sup>5</sup></li> </ul>	<ul style="list-style-type: none"> <li>Public consultation was used to draft NYC’s plan on Rebuilding and Resilience after Hurricane Sandy, and restoration of coastal ecosystems is a high priority.<sup>8</sup></li> <li>Nearly 100% of food purchased by the poor in Nairobi is sold at local markets, but a fragile supply chain has doubled prices in recent years, causing riots.<sup>4</sup></li> </ul>	<ul style="list-style-type: none"> <li>Web media mentions of the term “peri-urban” rose from 8,900 from 2008-10 to 15,400 from 2011-2013.</li> <li>JICA and USAID have joined DFID in including peri-urban areas in water and sanitation and agriculture programs.</li> <li>Peri-urban areas expressly mentioned in proposed post-2015 Development Agenda for urban areas.<sup>7</sup></li> </ul>	<ul style="list-style-type: none"> <li>In 50% of RUAF member cities, a community group leads efforts to advance urban agriculture.<sup>3</sup></li> <li>Cities Without Hunger (São Paulo) was founded in 2004 and has gardens serving 600+ peri-urban residents.<sup>1</sup></li> <li>URBANET, established in 2003, has organized 113 urban and peri-urban farmer groups in Ghana.<sup>2</sup></li> </ul>
Expected Trajectory	<b>ACCELERATING:</b> Worsening water and sanitation crises in developing cities are increasing pressure on governments to find solutions.	<b>STEADY GROWTH:</b> Climate change-linked crises will continue to occur with greater frequency and increasing impact.	<b>STEADY GROWTH:</b> Understanding of the linkages between peri-urban and areas around them will rise as research findings grow.	<b>STEADY GROWTH:</b> There is a lack of action by decision makers. As ecosystems degrade and crises worsen, more activity is expected.

# What potential tipping points are emerging?

**Rapid change could occur within 10 years if governments support peri-urban ecosystems in a widespread manner. Environmental disasters could significantly accelerate the timeframe below, creating an opening to include and better serve the poor or vulnerable in disaster risk reduction and beyond.**



## Near-term (<5 years) Tipping Points

In the near term, there are no likely tipping points that will greatly alter the trajectory of the space. However, in the longer term there are significantly different potential paths that will diverge over time.

In addition, future environmental disasters could significantly change the current trajectory of the issue, accelerating momentum and action in the space.

## Longer-term (>10 years) Positive Tipping Points

**Governments proactively create and enforce policies to protect ecosystems while incentives for managing ecosystems align with and become integrated into urban economic decision making.**

This would happen if:

- Crisis events increase in frequency and severity.
- Investment is provided to scale promising solutions.
- Market-based solutions are strengthened and mainstreamed.
- Big data is leveraged in building urban-focused models that value urban ecosystems and their services.
- Strong political leadership leads to adoption of global ecosystem management reforms by leading nations.

## Longer-term (>10 years) Negative Tipping Points

**Continued expansion compounds conflicts between jurisdictions, strategic plans conflict, responsibility for infrastructure remains unclear, and ecosystems degrade to an irreparable point.**

This could happen if:

- Governments continue their current approach to management of ecosystems and peri-urban areas.
- Economic prosperity of cities and population growth continue to fuel expansion and population pressures.
- Public and private developers continue to devalue ecosystem services in favor of short-term gains from housing and business.

# What are potential risks surrounding the dynamism in this space?

***Even well-planned initiatives or policies may fail when municipalities have limited implementation capacity or when ecosystems are located in informal settlements with weak or unclear municipal jurisdiction.***

Greatest risk

## LIMITED MUNICIPAL IMPLEMENTATION CAPACITY

**Even well laid plans may fail if municipal governments have insufficient executive capacity.**

- Municipal governments are widely regarded as a key player in addressing almost any solution space. However, governments often operate on limited budgets with limited expertise and information.
- Furthermore, municipalities do not always have jurisdiction over the neighboring areas where ecosystems are located and from which problems originate.
- The dependence on municipal actors for technical implementation and/or oversight means that even if appropriate interventions are supported and reliable partners are identified, success in achieving impact may lie in the hands of others.

## CONTINUED EXPANSION OF UNPLANNED-FOR SETTLEMENTS

**Legal or regulatory mandates may be less relevant if developments that are outside of formal regulation continue to expand in peri-urban areas.**

- In some regions, developers build illegal settlements in peri-urban areas where municipal jurisdiction is weak or unclear. Enforcement of laws and regulations with regard to peri-urban ecosystems is difficult in such areas.

## SPECIALIZATION LEADING TO UNCOORDINATED SILOS

**Specialization can contradict the need for multi-dimensional solutions that span sectors.**

- Concentration of focus on individual ecosystem services can lead to uncoordinated and inefficient initiatives that do not leverage related work occurring across linked ecosystem service spaces.
- Furthermore, urban planners rarely have sufficient knowledge of ecosystem services, so it can be difficult to link science with policy or behavior change.

## DIFFICULTY OF ACHIEVING SCALE

**Solutions might only be adopted on a small scale or among select segments of the population.**

- Due to the localized nature of peri-urban ecosystems and threats to their functioning, the challenge of scaling solutions is significant. For example, concepts such as integrated urban planning and PES schemes can be disseminated widely, but in practice, these solutions will need to take very different forms to meet case-by-case peri-urban needs, making rapid scaling more challenging.
- Wealthier or more influential groups may adopt new solutions without those ideas reaching poorer communities.

# What are potential uncertainties surrounding the dynamism in this space?

*Implemented projects may have unintended consequences, unpredictable changes in public perception, or municipal leadership can make it difficult to sustain long-term support, and future global economic conditions can impact priorities.*

Greatest uncertainty

## UNINTENDED CONSEQUENCES

**Since many solutions are implemented without a systems approach, and we are early in the innovation cycle, the possibility of unintended consequences on people or ecosystems is real.**

- Many possible interventions in the space that are new and innovative but target only one ecosystem service may have unintended negative consequences for other ecosystem services.
- Optimizing for ecosystem services does not necessarily optimize for the poor, so the dynamism around interventions that show promise in delivering ecosystems benefits may end up causing harm to the poor.

## FUTURE GLOBAL ECONOMIC CONDITIONS

**Global economic conditions can have significant impact on the prioritization of environmental issues.**

- Prolonged economic downturns lower interest in and emphasis on environmental issues, as employment and economic concerns are prioritized.
- For example, conducting a study on environmental concern levels throughout the 2008 global recession, Professors Matthew E. Kahn of UCLA and Matthew J. Kotchen of Yale concluded, “During recessions there may be diminished political will and interest to enact new environmental legislation and to enforce existing laws intended to internalize externalities.” Similarly, they found that higher unemployment levels erode public concern about the environment.

## UNPREDICTABLE SHIFTS IN PUBLIC OPINION

**Public perception of issues can be swayed by events or trends.**

- Disasters or environmental shocks can bring public attention to an issue, but momentum often dissipates rapidly as other events occur.
- Despite increasing usage of the term “peri-urban” in public discourse, general awareness remains low.
- Elections and turnover in leadership can lead to changes in municipal priorities.

## DIFFICULTY QUANTIFYING ECOSYSTEM VALUE

**The complexity and multi-dimensional nature of ecosystems makes them difficult to quantify monetarily.**

- In many cases, data may be limited or unavailable. Intangibles may be difficult or impossible to quantify.
- Over or under-estimation of the value of an ecosystem service can create false incentives.

- Dynamism in this space is moderate. The three areas demonstrating dynamism are converging in some instances, particularly between increasing governance coordination and growing use of market-based approaches, demonstrating rising momentum. The areas of dynamism are not all inherently pro-poor, but all can be steered to emphasize serving the poor or vulnerable.
- There is limited evidence of a positive tipping point in the near-term. Transformative positive change could happen rapidly if governments and economic incentives began to support the preservation of peri-urban ecosystems in a widespread manner. However, based on current activities, there is little evidence to suggest that this tipping point will be reached in the next ten years.
- There is an overarching risk that we continue our current trajectory towards a negative tipping point, which would be characterized by peri-urban ecosystems suffering degradation to an irreparable point.
- Success in this space would require policy work, so a major risk relates to institutional implementation capacity, which is key to the often complex multi-jurisdictional solutions required. Another key risk in this space is the potential of informal peri-urban settlements to resist policy regulation of these areas where municipal jurisdiction has previously been unclear.
- The dynamics of peri-urban ecosystems are rapidly changing with urbanization. Key uncertainties to consider include potential shifts in public opinion about ecosystems priorities, uncertainties around global economic conditions in the future, and the possibility of unintended consequences from solutions that do not take a systems perspective.

## What you will find in this section:

- An overview of the most prevalent current approaches to addressing this problem.
- A snapshot of the existing evidence on the success or failure of these approaches.
- Stories highlighting some of the exciting and interesting innovations uncovered by the Search.
- An analysis of both the current patterns of innovation and the potential for future innovation in this space.

# What are the dominant approaches and solution spaces?

***A combination of solution approaches will be necessary to address the issue, and will likely include policy-based solutions as a key component. These spaces are not inherently pro-poor and need to be designed as such to ensure they help poor or vulnerable populations. Scaling will remain a challenge across solution spaces.***

<p><b>Policy-based solutions to rethink and include peri-urban ecosystems in the planning process</b></p>	<p>Governance and policy support are viewed by many experts as critical to achieving desired long-term outcomes in this space. Legislation may institutionalize approaches to ecosystem challenges, create funding streams for initiatives, formalize ownership or oversight of peri-urban areas, outline the involvement of relevant stakeholders like municipal governments or utility companies, or create enforceable mechanisms for accountability in the provision of ecosystem services. Research programs and mapping of ecosystem services are especially active in influencing necessary policy actions by providing empirical evidence.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• Can be difficult due to challenge of local political dynamics.</li> <li>• More evidence of successful policy principles needed.</li> </ul>
<p><b>Market-based solutions to quantify the value of peri-urban ecosystem services</b></p>	<p>Solutions include a range of mechanisms such as carbon pricing, mitigation banking, pollution taxing, PES schemes, and more that use incentives to revalue peri-urban ecosystems in efforts to change behaviors and improve ecosystem management. It should be noted that market-based solutions are not inherently pro-poor and need to be consciously designed as such to improve the lives of poor or vulnerable. To date, most market-based initiatives aim to price only 1-2 ecosystem services and do not successfully capture the full value of ecosystems services due to the early stage of such mechanisms.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• Achieving sustainability.</li> <li>• Attracting financing to scale.</li> <li>• Unintended distributional consequences.</li> </ul>
<p><b>Community-based solutions to empower peri-urban residents to protect their natural resources</b></p>	<p>The most inherently pro-poor solution space. Efforts to organize, inform and empower peri-urban communities and provide them with self-determination is the surest way to include them in the land use decision making process and ensure their needs are heard. Inclusive urban planning is a growing theme in the space as actors recognize the importance of community-based initiatives to the long-term demand, adoption, and maintenance of any solution. Participatory approaches include surveys and public forums, formal training programs, and partnerships with local universities or NGOs.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• Approach does not lend itself easily to scaling.</li> <li>• Often need others (i.e., lawmakers) to make change happen.</li> </ul>
<p><b>Technology-based solutions to improve existing ecosystem services and information sharing</b></p>	<p>Technologies relevant to peri-urban ecosystems typically fall into two clusters. First are those that improve access, productivity, or efficiency of an existing ecosystem service, such as aquaponic infrastructure that supports more productive urban agriculture. Second are spatial mapping tools and associated data-based technologies that help quantify the value of natural resources or land to influence decision makers.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• Useful tools exist but few, if any, are urban focused at this point.</li> </ul>







# Where is there evidence for success or failure?

*The solution space remains immature and relatively localized, limiting the immediate opportunities to drive impact at scale. Evaluations have begun to capture lessons learned for the future, but scaling remains a challenge across spaces.*

Approach	Observations	Illustrative Evidence of Success	Illustrative Evidence of Failure
<b>Policy-Based</b>	<ul style="list-style-type: none"> <li>Can achieve real change but requires unique situation of will, resources and effort</li> </ul>	<p><b>Bayamo, Cuba Localizing Agenda 21:</b> Launched to address key urban environmental challenges employing inclusive consultation, issue prioritization, and creation of mechanisms for information exchange, coordination and decision-making.</p> <ul style="list-style-type: none"> <li>UNEP study findings:<sup>2</sup> <ul style="list-style-type: none"> <li>3 cities are currently replicating the program.</li> <li>Pollution in the Bayamo River has reduced significantly due to LA21 action.</li> </ul> </li> </ul>	<p><b>Mexico City, Mexico Peri-Urban Informality:</b> Reforms to divide peri-urban land into parcels with land titles have been inadequate, and capacity to enforce has been limited, which has led to growing peri-urban settling threatening local ecosystems.</p> <ul style="list-style-type: none"> <li>MIT study findings:<sup>3</sup> <ul style="list-style-type: none"> <li>Current growth conditions directly contaminate the city's aquifer and diminish its recharge areas.</li> <li>Reforms have been a positive step but have not sufficiently curtailed urbanization of communally owned peri-urban lands.</li> </ul> </li> </ul>
<b>Market-Based</b>	<ul style="list-style-type: none"> <li>Early stages; will require funds and time to get it right</li> </ul>	<p><b>Vietnam Watershed PES Pilots in Lam Dong and Son La:</b> Upstream poor were paid for protecting water provided to urban areas.</p> <ul style="list-style-type: none"> <li>Rutgers University study findings:<sup>1</sup> <ul style="list-style-type: none"> <li>Fees collected amounted to nearly \$8M over 2 years.</li> <li>81% of these funds were successfully directed to 8,000 households protecting forests on yearly contracts.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Rutgers University study findings:<sup>1</sup> <ul style="list-style-type: none"> <li>Lack of ability to capture value of other services.</li> <li>Lack of evidence of actual behavior changes.</li> <li>Evidence of exclusion of poorest homes from scheme.</li> </ul> </li> </ul>
<b>Community-Based</b>	<ul style="list-style-type: none"> <li>Good at solving specific local problems, difficult to scale meaningfully</li> </ul>	<p><b>Dhaka, Bangladesh Community-based Composting:</b> A local NGO built community buy-in around collecting and selling compostable waste.</p> <ul style="list-style-type: none"> <li>Indira Gandhi Institute of Development Research study findings:<sup>4</sup> <ul style="list-style-type: none"> <li>Improved yields and food quality for local farmers.</li> <li>Created incomes for peri-urban poor, improved water quality, empowered local community, and conserved land.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Community solutions are highly sought, but offer challenges, as illustrated by Indira Gandhi Institute of Development Research study findings:<sup>4</sup> <ul style="list-style-type: none"> <li>Lack of support from partners (i.e., State and others).</li> <li>Lack of a strong champion organization or leader.</li> </ul> </li> </ul>
<b>Technology-Based</b>	<ul style="list-style-type: none"> <li>Easiest to replicate and shows lots of potential, but can be the most indirect form of impact</li> </ul>	<p><b>Singapore NEWater Reclamation System:</b> Singapore has invested heavily in research and technology to diversify and secure its water supply.</p> <ul style="list-style-type: none"> <li>The Guardian observations:<sup>5</sup> <ul style="list-style-type: none"> <li>NEWater plants use advanced membrane technologies and ultra-violet disinfection to purify reclaimed water.</li> <li>Alone meets 30% of city's water needs, aims for 50% by 2060.</li> <li>Siemens recently named Singapore the best-performing city in Asia in its latest "Green City Index."</li> </ul> </li> </ul>	<p><b>Arba Minch, Ethiopia Sanitation Towers:</b> A pilot targeting sanitation challenges in peri-urban Ethiopia with greywater towers was successfully implemented but faced sustainability and growth challenges.</p> <ul style="list-style-type: none"> <li>Sustainable Sanitation Alliance study findings:<sup>6</sup> <ul style="list-style-type: none"> <li>Absence of sufficient finance constrained scale-up.</li> <li>Wear and tear of the towers raised long-term maintenance concerns after the program was completed.</li> </ul> </li> </ul>

# Who are the major players in the solution space?

***There are opportunities to work with a number of major players, including foundations, NGOs, and multi-disciplinary research programs with the resources and partnerships to drive solutions to scale.***

Organization	Description	Takeaway
	<p><b>CONNECTING DELTA CITIES NETWORK</b> links a network of delta cities that are active in the fields of climate change related spatial development, water management, and adaptation. CDC cities have joined together to share knowledge, develop innovative climate change adaptation strategies, share best practices, and build networks to further cooperation and coordination.</p> <ul style="list-style-type: none"> <li>• <i>Focus geographies: CDC cities to date include Jakarta, Ho Chi Minh City, New Orleans, New York, Rotterdam, Tokyo, Copenhagen, Hong Kong, Melbourne, and London.</i></li> <li>• <i>Example Project: Jakarta and Rotterdam have partnered in the water management sector for a defined period, 2009-2015, with potential for extension in the future. The cooperation consists of mud dredging equipment operational management and knowledge exchange in flood handling master plan preparations.</i></li> </ul>	<ul style="list-style-type: none"> <li>• Leaders in building cooperation and sharing ideas between leading, forward thinking global cities</li> </ul>
	<p><b>UN-HABITAT</b> is the UN agency on human settlements. Based on the Millennium Development Goal to improve the lives of at least 100M slum dwellers and their access to clean water, UN-HABITAT's strategy is to advocate for global norms, analyze information, field-test solutions, and finance.</p> <ul style="list-style-type: none"> <li>• <i>Focus Geographies: Global.</i></li> <li>• <i>Example Project: The Urban and Regional Economy sub-program is undertaking a study of urban policy implications of urban and peri-urban agriculture and rural-to-urban food flows in Nairobi, Kenya.</i></li> </ul>	<ul style="list-style-type: none"> <li>• Leaders in urban resilience and the poor; are increasingly focusing on ecosystems and sustainable cities</li> </ul>
	<p><b>ASIAN DEVELOPMENT BANK</b> is a regional development bank fighting poverty in Asia and the Pacific. The Bank is increasingly emphasizing urban environmental improvements as Asian cities increasingly face natural resource crises. The Bank has also recognized the link between water supply, waste management, and other municipal infrastructure, planning, and services support.</p> <ul style="list-style-type: none"> <li>• <i>Focus Geographies: Asia and the Pacific.</i></li> <li>• <i>Example Project: Providing technical expertise to improve the delivery of water supply services to peri-urban and urban populations in Hai Phong, Vietnam, with the goal of improving environmental sustainability and health outcomes in the area.</i></li> </ul>	<ul style="list-style-type: none"> <li>• Leaders in funding Asian peri-urban and urban capacity projects, from water to poverty alleviation</li> </ul>
	<p><b>INTERNATIONAL WATER MANAGEMENT INSTITUTE (IWMI)</b> is a non-profit, scientific research organization focusing on sustainable use of water and land resources in developing countries. It is headquartered in Sri Lanka with regional offices across Asia and Africa. IWMI works in partnership with governments, civil society, and the private sector to develop scalable agricultural water management solutions impacting poverty reduction, food security and ecosystem health.</p> <ul style="list-style-type: none"> <li>• <i>Focus Geographies: Africa and Asia.</i></li> <li>• <i>Example Project: Aimed to provide innovative business opportunities in Hyderabad to small-scale enterprises in the collection, treatment, marketing, and reuse of organic waste and crop products, while demonstrating the benefits of organic waste reuse in peri-urban agriculture.</i></li> </ul>	<ul style="list-style-type: none"> <li>• Leaders in water related issues, both in research and practical implementation of community - focused solutions</li> </ul>

# What innovations exist in the space?

*Some of the most interesting innovations to date have addressed information asymmetries by using technology to visualize data and organize communities.*

## Arizona State University “Decision Theater”



Decision Theater is a research facility and decision lab for exploring and understanding decision making. By using state-of-the-art visualization, simulation and solutions tools, including a meeting space with a 260-degree faceted screen used to display panoramic computer graphics or 3D visualizations during convenings, the Decision Theater enables decision makers to communicate within and across disciplines, develop consensus and make knowledge-based decisions. The group works with municipalities, schools, private companies, and others in areas of planning, business development, and optimization. While not specifically designed for peri-urban ecosystems, the Decision Theater has seen lots of demand for environment and urban growth projects. In one example, the Decision Theater was used by the city council of Surprise, Arizona to help them discuss their vision for general land use, such as their desire to create open spaces. The city council used the Decision Theater to create and visualize a set of “what if” scenarios to help inform their thinking and future planning.

**Opportunities for growth:** The Decision Theater opened a second location in the fall of 2012 as part of the McCain Institute for International Leadership at ASU in Washington, D.C. In addition, significant interest for replication has been indicated by several Chinese universities.

## FrontlineSMS and KPC Bogor FRONTLINE<sup>SMS</sup> CLOUD

### Cleaning the Ciliwung river

KPC Bogor was founded in 2009 in West Java, Indonesia and has served as an innovative example of how to leverage technology to empower peri-urban communities to solve their own ecosystem challenges. The sustainability of the Ciliwung River to the city of Bogor and its surrounding areas was greatly endangered due to growing concentrations of garbage and waste in the river. Members of KPC leveraged experts from Bogor Agricultural University to conduct research and experts in forest mapping to map the river using GPS. Through their research, the group uncovered both high levels of inorganic waste contaminating the river and low levels of public knowledge regarding the problem. KPC Bogor then connected with FrontlineSMS to recruit and communicate with community volunteers to schedule regular trash cleanup days at the river. The recruitment of volunteers has been so successful there is now an annual “Garbage Scavengers Race” held in Bogor which attracted more than 1,500 participants in 2012.

**Opportunities for growth:** Due to the success of the community outreach, KPC Bogor has expanded into providing environmental education for elementary school children and conducts research on water quality and biodiversity in the river ecosystem. The group now receives funding for waste cleanup through the city budget and its efforts have been recently featured by PBS’s “IdeaLab.”

# What are the patterns of innovation in the space?

*Opportunities to build on existing innovations are strongest in information technology and market integration, whereas innovation is more nascent in policymaking and financial platforms.*

Most  
Ongoing  
Innovation

## Technology innovations improving services and information

**Description:** Technology innovations in the space primarily relate to improved spatial mapping, improving land tracking, and analysis. They also include improvements to access, productivity or efficiency of existing ecosystem services.

**Observations:** Activity is growing around food and water services, such as aquaponics and desalinization. There is less activity in air and sanitation, though Bill & Melinda Gates Foundation has prioritized sanitation innovation. Improved spatial mapping is leading to a plethora of information, but to-date, tools specifically for urban and peri-urban ecosystems have not been developed.

## Market mechanisms that account for ecosystem value and incentivize preservation

**Description:** Market integration innovations include spread of pollution taxing, mitigation banking, REDD+, Payment for Ecosystems (PES) schemes, and other tools that quantify the value of ecosystem services. Other examples include the rise of urban business models incorporating peri-urban workers into urban supply chains (i.e., peri-urban farmers and urban food supply chain).

**Observations:** There is growing innovation in this space, particularly in Latin America and Asia in accounting of ecosystem services through PES schemes. In the United States, innovative markets are building demand for short urban food supply chains, further integrating peri-urban producers.

## Policymaking innovations towards more inclusive approaches

**Description:** Policy innovations focus largely on developing new approaches to managing peri-urban and urban ecosystem services and natural resources. These new approaches include holistic and inclusive management planning with regards to urban and peri-urban environments.

**Observations:** Municipal governments are signaling they are rethinking their approach, but few have built successful, replicable new approaches to urban resource and land management. Leaders include Brazil and Spain, where municipalities are recognizing significant benefits through coordination and cooperation. In the United States, NYC, S.F., Chicago, Seattle, and Portland are leading early efforts.

## Financial platforms that facilitate transactions related to ecosystem services

**Description:** Innovations in finance include platforms to facilitate accounting of ecosystems (i.e., carbon exchange markets), as well as the development of funds and pools of money (e.g., the Africa and Asia focused Critical Ecosystem Partnership Fund) to address urban environmental challenges.

**Observations:** Activity is lagging in this area. Although innovations in carbon exchange markets and others exist (e.g., Chicago Climate Exchange), adoption and public understanding/accessibility of such platforms remains low. The Critical Ecosystem Partnership Fund is demonstrating success with 32 million acres protected over 10 years, but more funding is needed (only ~\$15M in grants per year).

Least  
Ongoing  
Innovation

# What is the innovation potential in the space?

***Overall there is a moderate level of innovation potential in the solution space, mainly driven by the extent of cross-pollination and wide sharing of ideas.***

## Innovation Enablers

## Strength of Enabler and Assessment of Current Innovation in the Space

**Evidence of Cross-pollination:** Ideas being shared, replicated and scaled across actors, issues and geographies.



- There is growing activity in the building of networks across geographies (e.g., The Climate Group and others).
- Linking ecosystem issues between peri-urban and urban areas (i.e., food, water, air, pollution) and holistic approaches remain low, but could lead to significant and rapid innovation if increased.

**Track Record:** Amount of evidence of success among existing technologies and practices.



- Different pieces of the problem have received varying amounts of resources and thus stand at different stages of innovation maturity.
- Food systems have experienced the most innovation to date, while innovations to address air quality and sanitation are lacking.

**Breadth of Innovation:** Ability of space to encompass many types of innovation, and current distribution across categories of innovation.



- As the solution space combines approaches to air, water, land use, food, sanitation, waste, and urban planning, there is potential to create innovations that ripple across sectors exists.
- However, the difficulty of integrating solutions across sectors is significant, and replicability may be elusive due to the need for customized solutions to localized problems.

**People and Skills:** Presence of active change-makers and existence of education and training.



- Technology-based tools and increased networking are driving increasing information and knowledge capture to improve processes and practices.
- However, current skill levels remain low; government authorities remain unable to implement proper land use policies, and the general public has low awareness of ecosystem service value.

# Who are the innovators and thought leaders?

***Sitting at the intersection of an array of issues, the leaders and innovators in the space range from water NGOs to urban policy experts to government networks, and each brings a unique perspective.***



## THE CGIAR RESEARCH PROGRAM ON WATER, LAND, AND ECOSYSTEMS

*Mission:* Bring together innovative thinking on agriculture, natural resources and poverty alleviation to deliver effective solutions.

*Focus geographies:* Global



## STOCKHOLM RESILIENCE CENTER

*Mission:* Advance research for governance and management of social-ecological systems to secure ecosystem services for human wellbeing and resilience for long-term sustainability.

*Focus geographies:* Global



## THE URBAN DESIGN LAB FOR SUSTAINABLE DEVELOPMENT, COLUMBIA UNIVERSITY

*Mission:* Apply a design-based approach to sustainable urbanism.

*Focus geographies:* Global



## SACIWATERS

*Mission:* Addresses peri-urban water issues through education research and advocacy across Asia.

*Focus geography:* South Asia



## THE NATURAL CAPITAL PROJECT

*Mission:* Develop use-driven tools and approaches to ecosystem valuation for decision makers.

*Focus geographies:* Projects ongoing in Belize, China, Colombia; completed in Canada, Tanzania, Indonesia



## BEYOND THE EDGE, AUSTRALIA'S FIRST PERI-URBAN CONFERENCE

*Mission:* Examine the major issues emerging in peri-urban areas and how communities, government, and other service providers are responding to challenges and opportunities.

*Focus geography:* Australia initially, plans to build international presence



## CONNECTING DELTA CITIES: A C40 CITIES INITIATIVE

*Mission:* Develop a network of delta cities active in climate change related spatial development, water management, and adaptation, in order to exchange knowledge on climate adaptation and share best practices that can support adaptation strategies.

*Focus geographies (cities):* Tokyo, Ho Chi Minh City, Jakarta, London, Hong Kong; Melbourne, New York City, New Orleans, Rotterdam, Copenhagen

- A combination of solution approaches will be necessary to address the issue, and will likely include policy-based solutions as a key component. These spaces are not inherently pro-poor and need to be designed as such to ensure they help poor or vulnerable populations. Scaling will remain a challenge across solution spaces.
- The solution space remains immature and relatively localized. While evaluations have begun to document lessons learned for the future, there are no best practices. Evidence suggests increasing activity in policy-based and growing potential in market-based and community-based interventions.
- There is evidence of interventions overlapping solution spaces. For example, in the case of Payment for Ecosystem Services (PES) schemes, initiatives are often a hybrid employing policy, market-based mechanisms and community-based solutions in one.
- The most ongoing innovation is observed in technology solutions that improve services and information, such as more widespread spatial mapping of peri-urban ecosystems and their services and improved tools for land tracking and analysis.
- The future innovation potential in this space is moderate, driven by the breadth of innovation (due to work on the various ecosystems services provided in peri-urban spaces) and evidence of an increasing desire to share information and lessons across both geographies and sectors.

## What you will find in this section:

- An outline of how change could potentially happen in this space, based on the evidence from the dynamism assessment.
- Descriptive scenarios that illustrate potential choices around entry points and pathways to impact, with high-level descriptions of the type of activities the pathways might include.
- Illustrative estimates of potential impact ranges, using assumptions based on the size of investment and reach of previous interventions in the space.



# How We Think Change Could Happen

**Based on the areas of dynamism and solution spaces, a preliminary impact goal could be structured around achieving responsible management of peri-urban ecosystems.**

## Areas of dynamism that could be catalyzed towards high-level outcomes

### Increasing best practice sharing and coordination across administrative boundaries:

*Integration of planning across departments at the city level and increased sharing of best practices globally is helping to highlight the scale of ecosystem degradation and identify solutions.*

### Growing use of market-based approaches to manage ecosystem services:

*Experimentation with carbon and water pricing, pollution taxing, and PES schemes is creating new revenue for peri-urban areas and demonstrates the potential to change behaviors.*

### Growing public awareness and community organization to protect peri-urban resources:

*Heightened coverage of urban crises (i.e., Hurricane Sandy) has helped inform the general public about peri-urban ecosystems. In some sectors, such as urban agriculture, awareness has translated into growing community action.*

## High-level outcomes that would be required to achieve the impact goal

Widespread adoption of more inclusive urban planning and policymaking

Greater capacity and will of municipal governments to govern peri-urban zones and enforce peri-urban land use policies

Mainstreaming of market mechanisms that accurately account for the full value of peri-urban ecosystems

Development and dissemination of better technology-enabled tools to better understand and communicate ecosystem thresholds to policymakers

Increased public awareness and engagement to demand a change in the collective valuation of peri-urban ecosystems and their services

## Potential Impact goal

### IMPACT GOAL:

The value of peri-urban ecosystem services, particularly to the poor or vulnerable, are understood and are explicitly incorporated into peri-urban and urban governance – preserving the quality, quantity, and sustainability of such services to ultimately increase the resilience of the peri-urban and urban poor.

**Potential scenarios for impact need to consider several tradeoffs, including breadth versus depth across ecosystems, solution spaces, and activities. While two of the illustrative scenarios highlight particular geographies, there is potential for impact globally.**

## Scenario 1: Localized solutions for peri-urban and urban water and sanitation in Asia

### Specific geography, specific service:

Availability of freshwater and sanitation is a critical need in growing Asian cities, as the needs of populations in urban centers are overwhelming local water resources. Simultaneously, growing economic strength and government will provides opportunities for interventions in partnership with local and regional governments at a practical level. This scenario could address limited urban planning and implementation capacity and economic integration of ecosystems through market-based and policy-based solutions.

### Example potential activities:

- **Invest in replication and scaling of existing market models:** Support models such as carbon pricing and wetland banking.
- **Convene Asian water and sanitation actors:** Bring together an array of actors, including municipal governments, water organizations, and businesses across Asian urban zones to share water and sanitation best practices, leveraging peri-urban ecosystems.
- **Lead research into new financing mechanisms for individuals:** Create micro-loan and other products helping poor to access peri-urban water services.

## Scenario 2: Solutions for broad peri-urban ecosystem management across Africa

### Specific geography, broad services:

Rapidly growing cities characterized by weak governance and lacking resources, paired with unplanned sprawl of African urban areas, is increasing the need for a broad approach to peri-urban ecosystem management. This scenario provides opportunities to address a lack of societal understanding of the issue through building community-based solutions to empower peri-urban communities in ecosystem management. This scenario also provides opportunities to address limited urban planning and implementation capacity.

### Example potential activities:

- **Strengthen community-led organization:** Provide tools for organizing peri-urban communities around protection of peri-urban ecosystems (e.g., group texting platforms, cleanup days, education sessions, rallies).
- **Provide education and training:** Offer governments information and skills to understand the linkages between ecosystem services and their role in managing ecosystems responsibly.
- **Invest to scale PES pilots:** Implement PES schemes across ecosystem service types to demonstrate viability in the region.

## Scenario 3: Elevate peri-urban and urban water and sanitation issues globally

### Broad geography, specific service:

Due to broad information gaps and government limitations, the global nature of threats to water and sanitation services faced by peri-urban areas is creating a need for coordination across national and regional leaders. This scenario provides opportunities to address a lack of societal understanding of the issue and at a higher level, support governments with limited urban planning and implementation capacity through technology and policy solutions.

### Example potential activities:

- **Expand decision making tools:** Support development of tools, information, and data, such as the “Decision Theater” at ASU.
- **Convene global leaders on water and sanitation issues:** Bring together national and regional leaders (government, NGO, and private) to elevate dialogue and raise peri-urban ecosystems on the global agenda, emphasizing water and sanitation.
- **Invest in a global prize fund:** Leverage partner network and resources to create a fund to catalyze innovative projects across geographies, targeting management of peri-urban ecosystem water services.

## Affected Populations<sup>1</sup>

### Peri-urban poor or vulnerable of Asia

- The ten fastest growing cities (by population) in Asia are home to ~150 million people.
- **25-50 million peri-urban poor or vulnerable could be directly affected in these ten cities alone.**

### Peri-urban poor or vulnerable of Africa

- The ten fastest growing cities (by population) in Africa are home to ~65 million people.
- **10-20 million peri-urban poor or vulnerable could be directly affected by targeting these ten cities alone.**

### Global poor or vulnerable in peri-urban zones

- In less developed countries, almost 2.9 billion live in urban areas.
- **450-900 million peri-urban poor or vulnerable could be affected by elevating water as a global issue.**

## Possible Solution Spaces

- **Policy-based solutions targeting local governments:** Provide local governments with the tools, information, and resources to better protect peri-urban ecosystems for water and sanitation needs.
- **Policy-based solutions targeting high level decision making:** Provide regional and national policymakers with the tools, information, and resources to raise water and sanitation issues on the global agenda.
- **Market-based solutions targeting individuals:** Work with partners to develop financing mechanisms targeting individuals with micro-loans and other tools to help access peri-urban water services.
- **Market-based solutions targeting incentives:** Invest to scale market mechanisms such as carbon pricing, pollution taxing, wetland banking, or PES schemes.
- **Community-based solutions:** Empower peri-urban poor and vulnerable communities to manage their own water and sanitation systems and represent their own needs.
- **Technology-based solutions:** Support the development of new policymaking tools and innovations that can be replicated and shared.

## Visions of Scale<sup>2</sup>

- **Directly increase the resilience of 750 thousand to 3 million peri-urban poor or vulnerable.**  
Assumes an implementation cost of \$30 to \$90 per beneficiary.
- **Impact the peri-urban ecosystem management of major developing country cities, affecting 25 to 75 million peri-urban poor or vulnerable.**  
*Assumes reach of 10 to 20 developing country cities with fastest growing populations.*
- **Directly increase the resilience of 4 to 11 million peri-urban poor or vulnerable.**  
Assumes an implementation cost of \$10 to \$25 per beneficiary.
- **Directly increase the resilience of 100 to 400 thousand peri-urban poor or vulnerable; preserve 35 to 140 thousand hectares of peri-urban land.**  
Assumes an implementation cost of \$250 to \$1,000 per beneficiary.
- **Directly increase the resilience of 3 to 7 million peri-urban poor or vulnerable.**  
Assumes an implementation cost of \$15 to \$35 per beneficiary.
- **Impact the peri-urban ecosystem management of major developing country cities, affecting 25 to 75 million peri-urban poor or vulnerable.**  
*Assumes reach of 10 to 20 developing country cities with fastest growing populations.*

Note: (1) Due to a lack of data on global peri-urban population size, estimates were created using available city level data from Asian and African cities to estimate an average peri-urban population of 20-40% per city and up to 80% of the peri-urban population as poor or vulnerable; (2) See the appendix for impact benchmarks.

## What you will find in this section:

- An analysis of who provides funding in the space and an analysis of both relative levels and the gaps in current funding in the space.
- A survey of the perspectives held by different funders and how this has affected their funding strategies.

# Who is providing funding in this space?

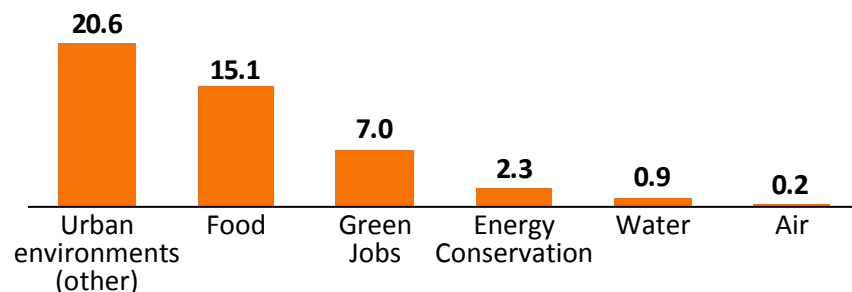
***Funding partners in the space would likely be multi-laterals, not foundations, as multi-laterals are actively funding projects in the developing world while foundations are primarily targeting the United States.***

## Funding Landscape: Key Observations – U.S. Foundation Support

- Between 2008-2012, foundation funding in the space amounted to \$46.2M across 655 grants (average grant size ~\$70K).
  - +99% targeted U.S. recipients (\$225K to China; \$35K to Canada).
- A highly fragmented funding space with blurred lines and definitions across funding areas; no clear funding leaders.
- Leading grant recipient organizations are all U.S.-based and include Foot Trust, Sustainable Pittsburgh, Greater Newark Conservancy, Detroiters Working for Environmental Justice, Sustainable South Bronx, Grow Pittsburgh, and In Our Backyards.

## Funding Related to Peri-urban and Urban Ecosystems (2008-2012)

USD, millions



## Funding Landscape: Key Observations – Public Sources, Bilateral and Multilateral Agencies

- Many organizations have broader urban development and environmental/ecosystem focused workstreams. but few, if any, have specifically prioritized peri-urban ecosystem preservation as it relates to urbanization.
  - **DFID:** Has focused environment work to-date on reducing pollution and waste, and protecting biodiversity and land to keep air and water clean. Budget in 2012 was \$12B, and \$410M was allocated to their “Climate and Environment Group.”
  - **FAO:** Within the organization, the natural resources and environment group works directly in land and water resources and land tenure. Budget for the 2012-2013 biennium is \$1B, though reliable breakdowns of their activity by theme is not readily available.
  - **World Bank:** Have invested heavily in both urban development and environment and natural resources management, but typically position the topics in separate silos. Budget in 2012 was \$31B, with \$4B for environmental and natural resource management.
  - **UN-HABITAT:** Although their environmental priority is climate change impacts in cities, they are active in urban environmental policy. Budget in 2012 was \$186M, with \$28M dedicated to urban basic services.
  - **UNEP:** Have prioritized both ecosystem management and environmental governance as two of six primary pillars, though the organization does significant work outside of peri-urban and urban areas. Budget in 2012 was \$227M, and \$55M was spent directly on ecosystem management and environmental governance, while other expenditures were indirectly related (e.g., climate change).

***Funders see the problem in many different ways, leading to a broad range of solution approaches and a sense that cooperation could be improved. There may be an opportunity to facilitate alignment among funders.***

## Empower peri-urban and urban poor through community-based solutions

- Focusing on education, raising awareness, and building collective action among poor peri-urban and urban communities will lead to appropriate and relevant customized solutions, local empowerment, and the amplification of local voices. It will also hopefully address one of the root causes of the problem, a lack of societal understanding and information regarding the issue.
  - *Examples: (RUAF Foundation, UN-Habitat)*

## Link green jobs and economic development to the environment

- The linking of environmental issues to urban green jobs and socioeconomic development will raise the profile of natural resource issues and build a broader support base for the urban environment, while helping to reduce peri-urban and urban poverty. Making this link will also hopefully raise awareness of the general public around environmental issues and address the current lack of understanding and information regarding the issue.
  - *Examples: (Asian Development Bank, World Bank, UN-Habitat)*

## Build a more inclusive urban planning process to protect urban environmental interests

- Reformatting the policymaking process to incorporate perspectives and expertise from an array of stakeholders traditionally excluded from the process will lead to better informed decision making regarding urban sustainability, and ultimately, better outcomes for ecosystems. It will also hopefully address limited levels of urban planning and implementation capacity, which is one of the main drivers and root causes of the problem, particularly in the developing world.
  - *Examples: (UNEP, UN-HABITAT, Asian Development Bank, C40 Delta Cities Network, DFID)*

## Urban agriculture and food systems is an environmental issue with momentum to rally around

- The attention and resources attracted by the issue of urban agriculture and urban food systems has created a hub around which environmentalists can rally to build a broader platform for urban ecosystem and sustainability issues. This will hopefully address the lack of societal understanding and information regarding the issue, which is one of its main drivers.
  - *Examples (FAO, DFID)*

## Coverage Drivers

- Coverage tended to be driven by the increasing stress between urban and rural geographies and the impact of climate change on water resources and food supplies. In addition, there was coverage of the launch of government initiatives across Africa and India, aid programs led by the UN World Food Programme, FAO and other agencies, and projects funded by the World Bank.
- There were also some research reports and events, such as a report issued by the International Institute for Environment and Development and a conference in Liberia focused on enhancing peri-urban agriculture in 2013, but these were less prominent in the coverage.

## Gap Analysis

- Media coverage tends to focus on the impact on ecosystems, but there is less discussion of the impact on impoverished populations living in peri-urban areas, including smallholder farmers and people migrating from rural to urban areas.
- There is a lack of agreement on which word or phrase to use to describe issues around “peri-urban” environments and populations. For example, coverage in Africa often referenced the impact on peri-urban areas in terms of food production, referred to as “urban agriculture” and “urban horticulture.”

## Volume, Geography, and Tone

- Volume of coverage increased between 2010 and 2011; however, there were dips in coverage in 2006 and after 2012. The significant increase in coverage from 2010 to 2011 is likely due to the 2011 release of the United Nations Population Fund (UNFPA) report of reaching the global population milestone of 7 billion people. In the last year, the term appeared on Twitter 1,692 times and was included in conversations related to agriculture, food, and water.
- Top countries/regions cited in the coverage include Africa (mostly referencing Zimbabwe, Nigeria, Kenya, Ghana, Tanzania, and Mozambique); India, Indonesia, and the United States (particularly South Florida, Atlanta, Santa Barbara, West Virginia, and the Potomac region).
- The tone of media coverage in Africa and Asia is often marked by the urgent need to address water and sanitation issues that have resulted from environmental degradation in peri-urban areas and insufficient government responses and action. U.S. media focused on human impact related to expanding housing developments near sensitive peri-urban ecosystems.

## Media Linked to Areas of Dynamism

- **Government reforms:** Media coverage over the last year from across Africa, Southeast Asia and Latin America often highlighted the lack of progress and coordination of government urban planning reforms, contributing to a continued expansion of housing developments, pollution of fresh water sources, and deforestation in peri-urban areas.
- **Environmental finance and incentives:** Media in these markets have generally not covered the introduction of financial incentive mechanisms such as mitigation banking, pollution taxing, and payments for ecosystem services. There is more media coverage related to how UN agencies and NGOs are playing a key role in promoting urban and peri-urban horticulture as necessary for supporting food security, as well as supporting access to fresh water and sanitation services.
- **Public awareness:** Civil society organizations in Africa and Asia have called on municipalities to recognize peri-urban ecosystem contributions, but media reporting indicated CSOs have not been very effective in pressuring governments to make the necessary urban policy reforms. There was similar commentary in U.S. media, but also some examples of where U.S. civil society may have influenced government policy, such as in Miami-Dade County and Atlanta, where local groups were particularly active in urging protection of peri-urban ecosystems.

## White Space Recommendation

- The high amount of coverage focusing on polluted fresh water sources, urban flooding, and water scarcity from drought in urban areas demonstrates there is an opportunity to draw a stronger connection between how water-related environmental degradation in peri-urban ecosystems impacts not only farmers and families living in these areas, but also urban economies that rely on water resources. There is a need to educate and persuade governments, businesses, civil society, and the public of the value of protecting peri-urban ecosystems on which they all ultimately depend.



## Problem Assessment

- Rapid degradation of peri-urban ecosystems is resulting in a loss of associated ecosystem services. Water provision, along with protection from disasters, stormwater, and erosion, are the impacted services that most acutely affect poor or vulnerable populations. Quite often, the loss of ecosystems is irreversible and the replacement of associated services is costly.
- The poor may be disproportionately impacted due to lack of resources, limited political power regarding land-use decision making and fewer alternatives for income, housing, or basic services. Vulnerability extends to urban populations that depend on the peri-urban ecosystem services.
- Loss of peri-urban ecosystems is exacerbated because political systems lack inclusive participation, transparency, and capacity for determining optimal land use and market prices (particularly land prices) do not incorporate full ecosystem service value.

## Dynamism Assessment

- Although Dynamism in this space overall is only moderate, the three areas demonstrating dynamism are converging in some instances, particularly between increasing governance coordination and growing use of market-based approaches, demonstrating potential momentum.
- There is limited evidence of a positive tipping point in the near term. Transformative positive change could occur rapidly if governments and economic incentives began to support the preservation of peri-urban ecosystems in a widespread manner. There is an overarching risk that we continue our current trajectory towards a negative tipping point, which would be characterized by peri-urban ecosystems suffering degradation to an irreparable point. Environmental disasters could significantly accelerate the timeframe by creating an opening to include and better serve the poor or vulnerable in disaster risk reduction and beyond.

## Solution Spaces

- There is no single dominant solution space, as the challenge of peri-urban ecosystem preservation sits at the nexus of an array of high priority urban issues. Ongoing activities include market-based, policy-based, technology-based, and community-based solutions.
- Success in the space will likely require a combination of approaches, with policy change being especially important.

## Early View of Impact

- Scenarios for impact need to consider tradeoffs, including breadth versus depth across geographies, ecosystems, solution spaces, and activities. Examples of potential approaches could include focusing on one ecosystem service in a particular geography, providing support across ecosystems services within a particular geography, or working globally to elevate the importance of peri-urban ecosystems issues.

# Appendix

Appendix Slide Title	Slide Numbers	Summary of Content
United States context research findings	47-52	Includes slides from the DID that contain information on the problem of peri-urban ecosystem loss and degradation in the United States
Conceptual definition of vulnerability	53	A visual explanation of the definition of “vulnerability”; including a breakdown of two key criteria, “extent of exposure” and “ease of adaptability”
Overview of urbanization impact on ecosystems	54	A high level primer with explicit examples of how peri-urban ecosystems are harmed by urbanization and how this links to poor or vulnerable populations
Estimated value of ecosystem services	55	Separation of ecosystem service values by service type: provisioning, regulating, habitat and cultural
Top world metro areas by land area growth	56	List of the 15 fastest growing cities by urban land area growth globally, both by absolute growth and percentage growth
Top world metro areas by population growth	57	List of the 15 fastest growing cities by urban population growth globally, both by absolute growth and percentage growth
Preliminary potential criteria for city prioritization	58	A preliminary framework to help provide guidance in selecting potential locations of focus for an intervention
Scale and scope of the problem in the United States	59	Mapping of the particular vulnerability in the United States of the 13 states that make up the Southeast region of the country

- Given initial assumptions about the differences in the nature of the problem in the United States as compared to the developing world, time during the Search was also spent separately investigating the U.S. context to better understand these differences. These assumptions were confirmed, and research highlighted two key differences, among others:
  1. In the U.S. context, the negative implications of the loss and degradation of peri-urban ecosystems have less direct ties to the poor and vulnerable. The poor and vulnerable in the United States are less likely to rely directly on peri-urban ecosystems for livelihoods and food security. Further, fewer poor people are affected as compared to populations in other regions of the world.
  2. Work on peri-urban ecosystems in the United States has focused mainly on coastal protection, whereas work globally has addressed a wider array of ecosystems services.
- The following slides are the results of this research, and employ a subset of the slides used in the rest of the Decision Intelligence Document in order to present relevant conclusions. These research findings highlight key differences in the nature of the problem and how it affects poor and vulnerable populations, the drivers of dynamism surrounding the issue, and dominant approaches to the solution space.

***In the United States, the confluence of urban population growth, economic growth and climate change effects are increasing the pressure on urban and peri-urban ecosystems. Essential ecosystem services such as protection from natural disaster and erosion (e.g., storm, flooding and coastal protection), water provision, and climate and air quality are severely affected. All urban citizens, particularly those in coastal areas, are vulnerable to the deterioration of the services that surrounding ecosystems provide to the cities, but the poor are especially vulnerable given their limited resources to prepare, respond, and recover from natural disasters.***

## Key Messages

1. In the United States, ecosystems in urban and peri-urban areas are increasingly under stress due to population and economic growth, as the absolute number of people dependent on these services and their per capita consumption increases.
2. As compared to the developing world, U.S. cities place greater value on coastal protection related ecosystem services and less on food security. Water is a common priority in both regions, but developing countries focus more on water quality and availability, while the United States focuses on water availability and storm drainage.
3. All U.S. residents are vulnerable to deterioration of ecosystem services, particularly those supporting resilience against natural disasters. Nevertheless, the poor are disproportionately affected due to higher exposure to climate change effects and limited ability to prepare, respond, and recover from crisis. However, compared to developing countries, poor populations in the U.S. are less directly dependent on services provided by ecosystems.
4. The 50% of the population living in coastal counties face increasing risk of frequent storms, flooding and sea level rise. As climate change-related effects intensify, more needs to be done in order to protect and restore ecosystem services.
5. The traditional neglect of ecosystem services on which cities depend has been driven by market prices not incorporating full ecosystem value, and political systems lacking the technical capacity in determining optimal land use.
6. The “peri-urban” concept is not widely used in the United States. Consequently, not many interventions directly address peri-urban ecosystem services. However, peri-urban areas still have the potential to benefit from holistic city plans that indirectly integrate ecosystems.
7. Dynamism is accelerating in the number of holistic plans prioritizing long-term resilience, investment in green infrastructure for water-based services, and use of more sophisticated IT tools to efficiently manage ecosystem services.
8. The solution space is largely driven by local municipal government action, especially in coastal areas where vulnerability to ecosystem loss, natural disasters, and extreme weather is particularly acute.
9. Existing innovations that provide the strongest opportunities to build on are climate change resilience policies and technology driven solutions, whereas activity is more nascent in market-based and community-led approaches.

## Problem Assessment – United States

### ***Impact on ecosystem services***

- In the United States, the confluence of urban population growth, economic growth and climate change effects are increasing the pressure on urban and peri-urban ecosystems. Essential ecosystem services such as protection from natural disasters and erosion (e.g., storm/flooding and coastal protection), water provision, and regulation of climate and air quality are severely affected.
- As juxtaposed to the developing world, U.S. interventions place greater value on ecosystems services related to coastal protection and less on food security. Water services and availability are a common priority for both geographies, but developing countries are primarily concerned about water quality, whereas the main concern in the United States is stormwater drainage systems.<sup>1</sup>

### ***Impact on poor and vulnerable people***

- All urban citizens, in particular those in coastal areas, are vulnerable to the deterioration of the services that surrounding ecosystems provide to the cities, but the poor are especially exposed given their tendency to be located in highly vulnerable areas and their limited resources to prepare, respond to, and recover from natural disasters and chronic stresses such as limited water availability or storm drainage. 80% of all U.S. counties that experience persistent poverty lie in the 13-state region of the Southeast, which is particularly susceptible to drought, hurricane force winds, flooding, and sea-level rise.<sup>2</sup>

### ***Scale of the problem***

- Eighty-two percent of the total U.S. population currently resides in urban areas. From 2010-2050, the total U.S. population is expected to grow 36%, creating demand for 74.3 million new homes.<sup>3</sup>
- Over 50% of the nation's total population currently lives in major urban cities located in coastal counties.<sup>4,5</sup>
- Population growth in urban areas is primarily taking the form of increased densification rather than sprawl. Since the 2008 recession in the United States, population growth in urban areas has outpaced suburban and peri-urban areas, reversing historic trends of urban sprawl.

### ***Urgency of the problem***

- The populations in 16 of the 20 largest U.S. cities have grown at an accelerated rate since 2010, driven largely by urbanization rates as high as 2.3% annually, thus increasing the pressure on surrounding ecosystem services and the demand for improved livability, inclusive economic opportunities, and resilience to climate change effects.
- The 50% of the population living in coastal counties are highly vulnerable to increased storm frequency, flooding and sea level rise, which is occurring 60% faster than researchers predicted.
- The United States underspends on infrastructure compared to other nations (the United States spends 2% of GDP on infrastructure compared to 5% in Europe and 9% in China), which can add to stress on ecosystem services and leave areas vulnerable to damage in natural disasters.<sup>6</sup>

*Loss of peri-urban ecosystems is exacerbated by the failure of market prices to incorporate full ecosystem service value, and institutional systems lack transparency and participation in determining optimal land use.*

## *System Failures: Underlying constraints that exacerbate the problem*

### **Market System**

Prices do not incorporate the full value of the services provided by ecosystems. Economic incentives and information gaps lead to more short-term growth focused uses of the land (commercial, residential, governmental). This stimulates increasing pressure from an array of actors to convert peri-urban land for development purposes, often destroying peri-urban ecosystems, along with the valuable services they previously provided.

### **Institutional System**

The processes and laws pertaining to land use decisions regarding peri-urban spaces lack transparency and have often been driven by short-sighted gains. Some municipal governments do not have jurisdiction over the entire ecosystem area. Simultaneously, lack of engagement with peri-urban communities regarding their needs has led to disenfranchisement.

## *Root Causes: Main forces that directly contribute to the problem*

### **Economic Growth and Consumption**

Rising incomes in urban zones are attracting more people to cities, and are leading to increases in consumption of resources per capita, placing growing strains upon local ecosystems and the services they provide.

### **Climate Change Effects**

Higher frequency and intensity of extreme weather events and climate-induced natural disasters are affecting the productivity, availability, and overall health of ecosystems.<sup>1</sup>




### **Lack of Societal Understanding of and Information Regarding Issue**

Decision makers and the general public alike remain vaguely informed regarding the direct and indirect impacts of land change use on ecosystem services.

### **Historic Expansion into Suburban and Exurban Areas**

Expansion of urban land was shaped by policies that encouraged sprawl versus densification. Even if sprawl in suburban areas has been consistently decreasing during the last 5 years, many ecosystems were harmed during the expansion of city boundaries into peri-urban areas.<sup>2</sup>

**Area of Dynamism:** U.S. cities are increasingly incorporating ecosystem management into their urban planning processes and recognizing the importance of ecosystem services to urban resilience

Driver	Increasing number of long-term resilience plans that prioritize ecosystem services management through a multi-stakeholder approach	Growing application of green infrastructure to manage water-based ecosystem services	Rising number of innovations in information technology to efficiently monitor, value, and manage ecosystem services
Relative Strength			
Signals	<ul style="list-style-type: none"> <li>• <b>Resilient Communities for America</b> is a national campaign launched in May 2013 through which hundreds of local officials pledged to prepare cities for climate change and extreme weather by adopting policies that protect vulnerable populations and ecosystem services from climate impacts; reduce carbon emissions; and evaluate local vulnerability to heat waves, air pollution, droughts, and floods.</li> <li>• <b>Revitalizing Baltimore</b> is a partnership among 17 organizations that includes non-profits, community-based watershed associations, businesses, and academic institutions, to value the linkages between urban forestry and other urban environmental issues such as brownfields, water and air quality, energy use, habitat conservation, and green infrastructure in the formation of smart growth policy.</li> </ul>	<ul style="list-style-type: none"> <li>• To combat the degradation of Philadelphia’s waterways, ecosystems, and water quality as land development increases, the <b>Philadelphia Water Department</b> launched a 25-year Green Cities, Clean Water plan to protect watersheds and alleviate sewer overflows by managing stormwater runoff with green infrastructure tools such as rain gardens, wetlands, basins, and porous paving.</li> <li>• <b>Portland, Oregon</b> has applied green infrastructure such as green roofs, infiltration planters, street trees, and landscaping requirements to reduce industrial and urban pollution of the Willamette River and resulting sewer overflows.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Miami-Dade, Florida</b> is applying predictive analytics and smart metering tools from IBM to conserve water by monitoring consumption and identifying water leaks, leading to an expected reduced water consumption of 20 percent and cost savings of \$1 million annually.</li> <li>• <b>The Natural Capital Project’s InVEST</b> mapping technology is being applied for marine planning in New England by mapping where coastal habitats provide protection from sea-level rise and storms to help target conservation and restoration activities, as well as identifying potential for wind energy and effective management of fisheries.</li> </ul>
Expected Trajectory	<b>Accelerating:</b> Increasing number of global and regional actors like C40, City 2.0 and ICLEI USA bolster knowledge sharing among cities.	<b>Accelerating:</b> Adoption rising as market- and policy-based incentives become more sophisticated.	<b>Steady growth:</b> Data and mapping technologies continue to proliferate and influence policy decisions.



***In the United States, loss of peri-urban ecosystems is an issue that cuts across many urban and environmental challenges; as such, solution spaces are often cross-cutting and can complement one another.***

<p><b>Policy-based solutions involve long-term city resilience plans which integrate peri-urban areas</b></p>	<p>City resilience plans set clear targets and mandates for long-term outcomes by institutionalizing approaches to ecosystem challenges, creating funding streams for initiatives and formalizing oversight of peri-urban areas. In response to Hurricane Sandy, the City of New York launched the Special Initiative for Rebuilding and Resiliency, a \$19.5 billion plan to build coastal infrastructure to protect against storm surge, retrofit buildings in the floodplain, expand green infrastructure to protect communities from extreme weather, and improve the health of the urban forest and surrounding natural areas.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• Difficult to replicate due to case-by-case needs.</li> <li>• Limited action by state and national governments.</li> </ul>
<p><b>Market-based solutions provide innovative financing options for green infrastructure</b></p>	<p>Solutions focus on financial incentive programs, such as tax credits, subsidies, or fee offsets, for natural approaches to storm water management and mitigation of water surges during storms or in anticipation of rising sea levels. The city of Philadelphia pioneered green infrastructure financing by implementing a fee structure in which local commercial owners receive a nearly 100% credit for installing rain gardens and green roofs that capture runoff before it reaches overstressed sewer systems.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• High initial cost.</li> <li>• Lack of technical capacity.</li> <li>• Lack of data on green infrastructure performance.</li> </ul>
<p><b>Community-based solutions engage citizens in improving livability and use of natural resources</b></p>	<p>Inclusive urban planning is driven by recognition of the importance of community-based initiatives to the long-term demand, adoption, and maintenance of any solution. Participatory approaches include surveys and public forums, community advisory boards, and incentives for citizen adoption of practices that preserve ecosystem services. The Chicago Sustainable Backyards Program offers City of Chicago residents rebates of up to 50% for purchases of trees, native plants, compost bins, and rain barrels. An online platform facilitates ease of rebate redemption and educational resources.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• Difficult to replicate due to case-by-case needs.</li> <li>• Often need others (i.e., lawmakers) to make change happen.</li> </ul>
<p><b>Technology-based solutions inform policy decisions by helping value peri-urban ecosystems</b></p>	<p>Technologies relevant to peri-urban ecosystems typically fall into two clusters. First are those that facilitate the sustainable use of natural resources, such as rainwater harvesting systems. Second are spatial mapping tools and data-based technologies that help quantify the value of natural resources or land to influence decision makers. GreenPrint Maryland is a first-in-the-nation mapping tool that illustrates the relative ecological importance of every parcel of land in the State, influencing land conservation decisions to preserve areas of high ecological importance.</p>	<p><b>Barriers to impact:</b></p> <ul style="list-style-type: none"> <li>• High initial costs.</li> <li>• Lack of technical capacity.</li> </ul>

*Vulnerability of populations to lost peri-urban ecosystems is determined by the extent of exposure and the ease of that population to adapt.*







The extent of exposure may take the following forms:

- **Price changes** in the form of long-term increases, or short-term volatility and shocks
- **Access to land** (e.g., for agriculture production and livelihood)
- **Availability of services** (i.e., reduced volume of services)
- **Access to services** (i.e., reduced ability to get the services)
- **Quality of services** (e.g., nutrition of food, cleanliness of water)

The ability of a person to adapt to exposure depends on:

- **Access to alternatives** (e.g., replacing tainted tap water with bottled water)
- **Having resources to adapt:** (e.g., savings or liquid assets that buffer against shocks)
- **Political or community strength** to influence the distribution of services
- **Access to information** and feedback loops that make it easier to anticipate

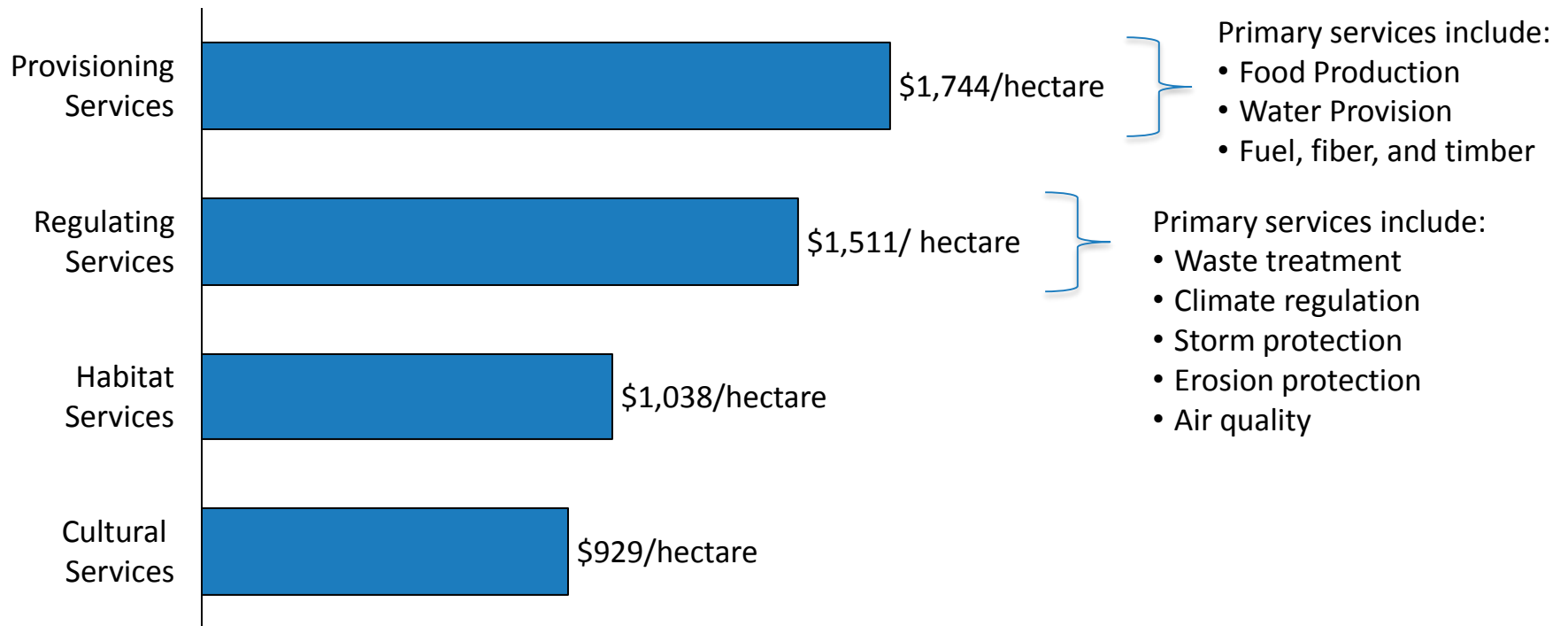
	Impact trend	Impact on ecosystems	Illustrative actions driving the trend	Impact on poor or vulnerable
	Rising waste	<ul style="list-style-type: none"> <li>Toxic waste, open-site dumping degrades soil, contaminating livestock and land</li> </ul>	<ul style="list-style-type: none"> <li>Mining and extractive activities for construction</li> <li>Slaughterhouses</li> </ul>	<ul style="list-style-type: none"> <li>Limit food production for incomes and consumption</li> <li>Declining air/health quality</li> <li>Declining resource access</li> </ul>
	Rising natural resource consumption	<ul style="list-style-type: none"> <li>Ecosystem degradation and collapse upon over-extraction</li> </ul>	<ul style="list-style-type: none"> <li>Deforestation</li> <li>Increased demand for meat and water</li> </ul>	<ul style="list-style-type: none"> <li>Decline in air/health quality</li> <li>Rising prices for resources</li> <li>Increased pressure on land from outside parties</li> </ul>
	Disruption of ecosystem functioning	<ul style="list-style-type: none"> <li>Cessation of essential ecological functions; recycling of nutrients and aquifers recharge</li> </ul>	<ul style="list-style-type: none"> <li>Conversion of soil/vegetation to impermeable land; rerouting rainwater</li> </ul>	<ul style="list-style-type: none"> <li>Limit food production for incomes and consumption</li> <li>Strain water access</li> </ul>
	Decline in prevalence of natural ecosystems	<ul style="list-style-type: none"> <li>Elimination of arable, productive land, full destruction of ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>Conversion of open horticulture fields for residential development</li> </ul>	<ul style="list-style-type: none"> <li>Force livelihood transition</li> <li>Eliminate food supply</li> </ul>

## Estimated value of ecosystem services

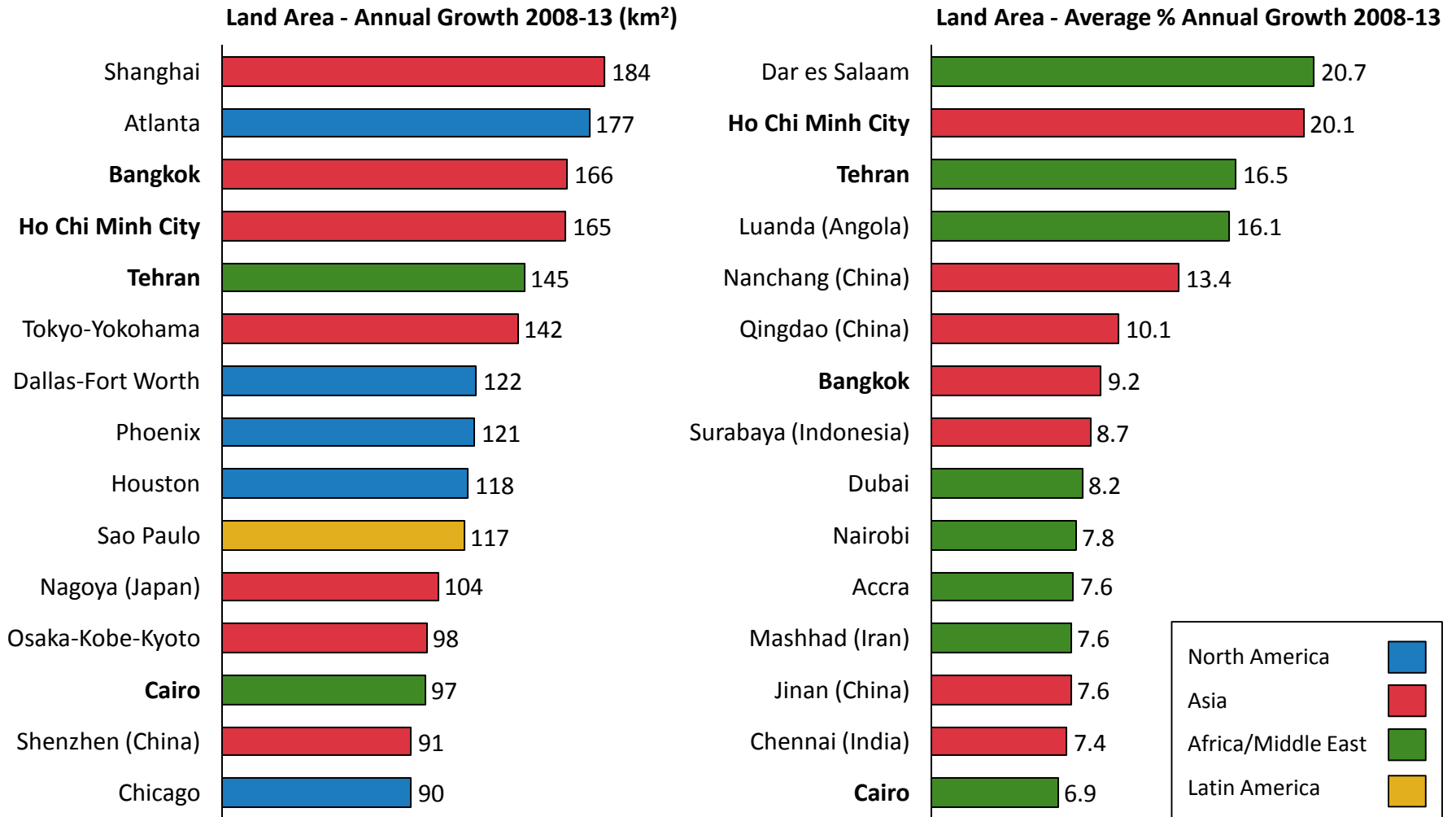
### Estimated monetary values of specific services across ecosystem types

*Across all ecosystem biomes, the average value of services provided per hectare is highest for provisioning services (e.g. food and water), followed closely by regulation services (e.g. waste treatment and protection from storms) followed by habitat and cultural services.*

### Median economic value (USD, 2007) of 1 hectare/year across all ecosystem biomes



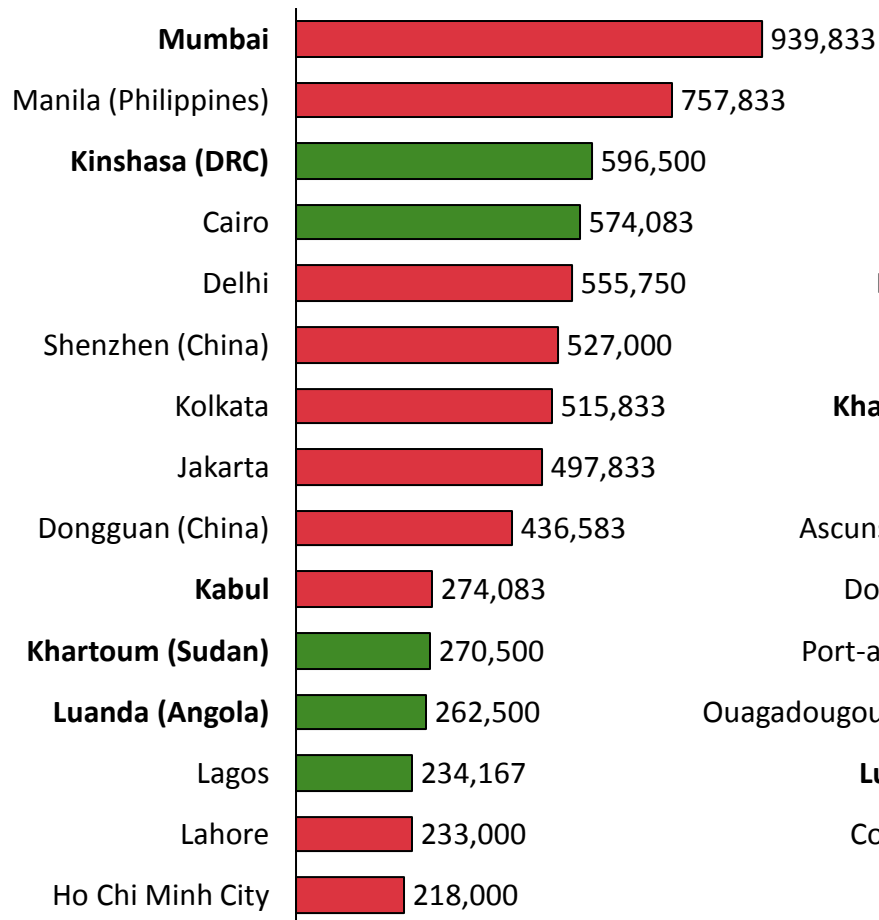
*Though cities in the U.S. and Japan show major growth in absolute terms, the relative rate of land area expansion is highest in developing Asia and Africa.*



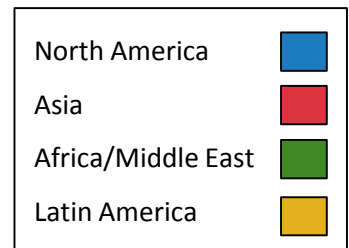
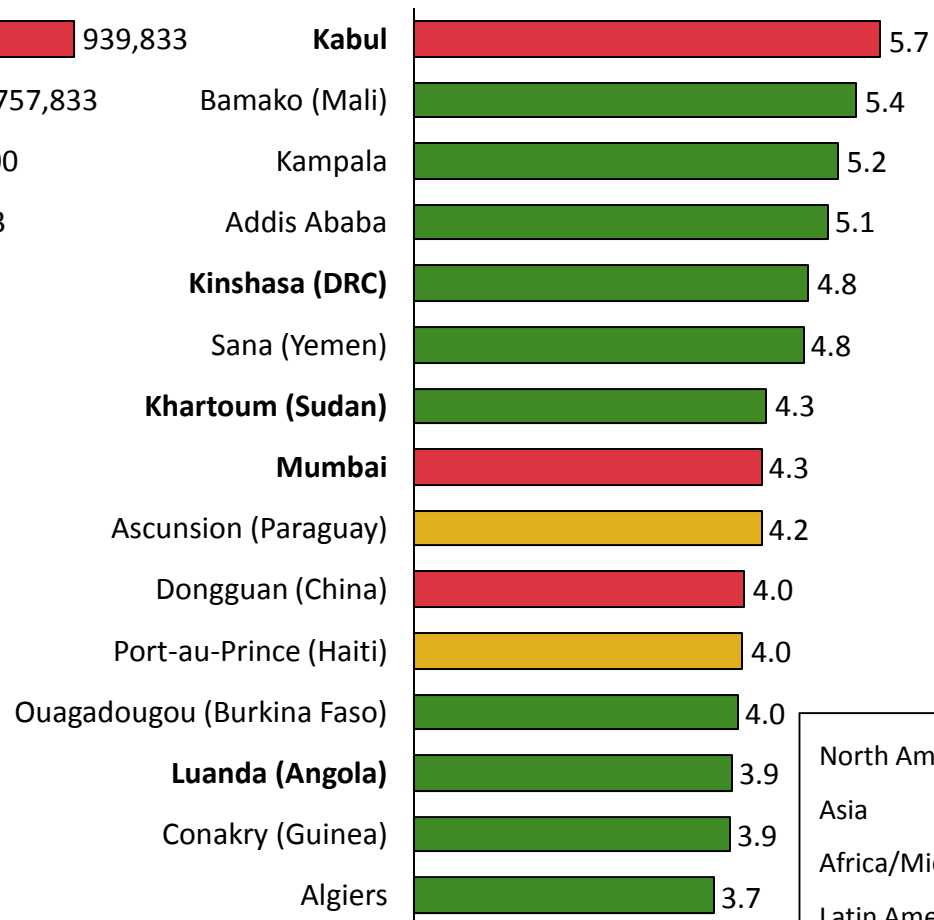
## Top world metro areas by population growth

*The populations of Asian cities are expected to grow the most by 2025, but smaller African cities are expected to grow most rapidly as a percentage of their current base.*

Population - Projected Annual Growth to 2025



Population - % Projected Annual Growth to 2025

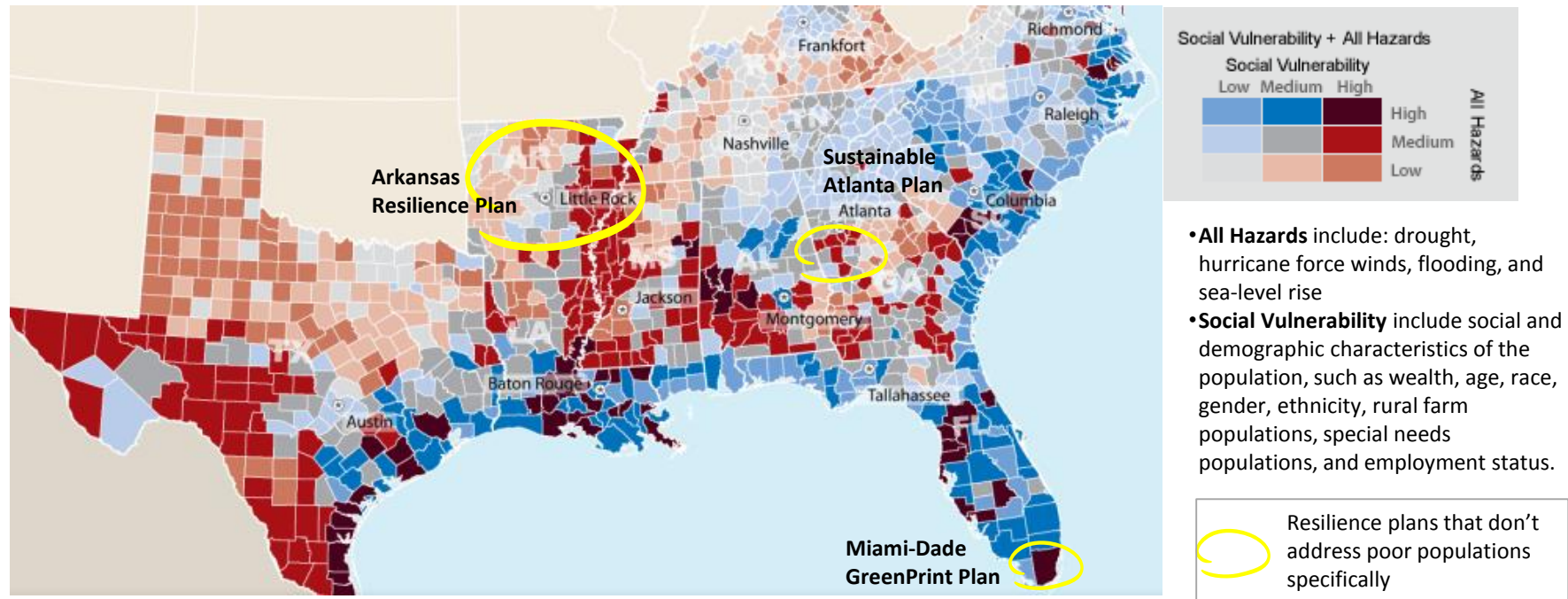


## Preliminary potential criteria for city prioritization

Criteria	Metrics	Rationale
<b>Relative Size</b>		
<b>Current Population</b>	<ul style="list-style-type: none"> <li>Total population, 2013 estimate</li> </ul>	<ul style="list-style-type: none"> <li>Indicator of the current potential pressure on ecosystems</li> </ul>
<b>Population Growth</b>	<ul style="list-style-type: none"> <li>Population growth rate, 2008-2013 estimates</li> </ul>	<ul style="list-style-type: none"> <li>Driver of population density and land area growth, which directly affect ecosystem impact</li> </ul>
<b>Potential for Environmental Impact Index</b>		
<b>Population Density</b>	<ul style="list-style-type: none"> <li>Population density</li> <li>Population density growth</li> </ul>	<ul style="list-style-type: none"> <li>Indicator of the intensity of demand for ecosystem services, now and in the future</li> </ul>
<b>Land Area</b>	<ul style="list-style-type: none"> <li>Land area</li> <li>Land area growth rate</li> </ul>	<ul style="list-style-type: none"> <li>Total land area impacted by the population, and potential to expand into additional peri-urban areas</li> <li>Likelihood that urban/peri-urban populations are heavily reliant on ecosystem services</li> </ul>
<b>Access to City Services</b>	<ul style="list-style-type: none"> <li><i>Peri-urban land growth estimate</i></li> <li><i>Urban access to improved water sources</i></li> <li><i>Slum population, peri-urban if possible</i></li> <li><i>Urban reliance on smallscale agriculture</i></li> </ul>	
<b>Ecosystem Vulnerability</b>		
<b>Value of Ecosystem Services</b>	<ul style="list-style-type: none"> <li>Ecological biome</li> <li>Monetary value of biome services</li> </ul>	<ul style="list-style-type: none"> <li>Degradation of ecosystems that provide highly valued services represent the greatest loss for urban populations</li> </ul>
<b>Inadequacy of Urban Environmental Policies</b>	<ul style="list-style-type: none"> <li>Quality of current environmental protection or regulation regarding air quality, water sources, greenbelts, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Current degree of policy protection ecosystems receive and potential for future growth to be regulated</li> </ul>
<b>Ecosystem Threats</b>	<ul style="list-style-type: none"> <li>Current level of urban ecosystem degradation</li> <li>Severity of climate change threat in terms of food, water, and propensity for natural disasters</li> </ul>	<ul style="list-style-type: none"> <li>Current state of the environment and likelihood of climate change to independently reduce quality of ecosystem services</li> </ul>

## Scale and scope of the problem in the United States?

*Roughly 80% of all U.S. counties that experience persistent poverty<sup>1</sup> lie in the 13-state region of the Southeast, which is particularly susceptible to the hazards of drought, hurricane force winds, flooding, and sea-level rise.*



**While increasing dynamism is observed in the design and implementation of urban planning and resilience initiatives in this corridor, these plans do not always cater specifically to poor and vulnerable populations**