Managing Ecosystem Goods to Foster Equitable Economic Growth in Cities

Cities Alliance
Cities Without Slums

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Authors:
Technical Supervision: Dr. Rene Peter Hohmann, Cities Alliance Secretariat
Coordination and Editing: Arne Georg Janssen, Prerna Bhardwaj, Cities Alliance Secretariat
Communication Coordination: Yamila Castro, Cities Alliance Secretariat

Graphic design:
Creatrix Design Group

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The Cities Alliance is the preeminent global partnership for the promotion of cities in poverty reduction and sustainable development. Headquartered in Brussels, it is a unique partnership with diverse members – local governments, national governments, international non-governmental organizations, foundations and multilateral organizations – which have come together to strengthen both impacts and coherence in urban development. Cities Alliance is hosted by the United Nations Office for Project Services (UNOPS).

In accordance with the priorities, the Cities Alliance has established a Joint Work Programme (JWP) focused on fostering equitable economic growth in cities. The JWP aims to better understand and address the link between public service provision and equitable economic growth trajectories in cities. To accomplish this goal, it works with local governments, city stakeholders and development partners to produce global knowledge, facilitate policy dialogues and support city-level diagnostics and policy recommendations to respond to the challenges of inequitable economic growth in cities. The UK Department for International Development (DFID) funds and chairs the JWP, with active facilitation by the Cities Alliance Secretariat. Further information on the JWP can be retrieved at: http://www.citiesalliance.org/equitable-econ-growth.

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Executive Summary

To respond to continuous rapid urbanization, local governments must provide adequate public services to its rapidly expanding population, as well as fully use their public goods and services to promote equitable economic growth. However, leveraging ecosystem goods, such as water, green space and land, for economic and public use poses several challenges to urban ecosystem services, whose lack of conservation often leads to an existential threat to sustainable urban development. Climate change, extreme weather events, terrestrial and aquatic pollution and general ecosystem degradation put additional pressure on ecosystem goods and directly affect the well-being of individuals and communities and the productivity of a city's economy. The inadequate or poor management of ecosystem services and goods places loads and stresses on the environment, like polluted and toxic water and air; degraded natural landscapes; and increased vulnerability to natural disasters and climate change impacts. These loads and stresses are directly detrimental to the lives of individuals and communities, and to the operation of businesses. Successful development must be associated with the sound conservation, enhancement and better functioning of ecosystem system services and goods. The value of these services and goods has been recognized and often monetarized to demonstrate their worth.

Managing ecosystem goods and services presents both a challenge and opportunity for decision makers in cities. On the one hand, the pressures on vital ecosystems from urban development can threaten the benefits residents derive from these goods and services. Local government's limited resources, institutions, and the city's ever developing infrastructure can also limit its ability to supply effectively these goods. On the other hand, local governments can play a key role in ensuring the supply of ecosystem services, which can be achieved in ways that are consistent with the aims of rapidly growing cities, such as clean and efficient infrastructure, healthy residents, and quality employment opportunities.

Ecosystem services are essential to healthy cities and form a foundation of equitable economic growth. The benefits provided by ecosystems are wide ranging and can help people in several ways. Whereas many provisioning services, such as food or timber, can be directly used or consumed by people, regulating and cultural services, such as air quality and aesthetic quality, lead to health and well-being benefits that are less tangible but vital to people's lives. Maintaining the functions and availability of ecosystems in and around cities ensures equitable access to these benefits.

Local policymakers have a variety of tools at hand, not only to reduce the environmental impact of cities, but also to sustainably manage resources to increase equitable economic growth. Maintaining the quality of the local environment is essential for cities because of the numerous benefits that people can get from a well-managed environment. Ecosystem goods and services refer to the benefits provided by the environment, which make life possible and improve its quality. This brochure aims to demonstrate the importance of local government in maintaining these goods and reviews the tools local governments can use to manage ecosystem services.

This brochure seeks to guide policymakers about tools that are appropriate to make the most productive use of existing ecosystem assets, such as water and green spaces. Through the suggested theoretical approaches, this brochure provides a conceptual link between local government action, ecosystem service management and economic outcomes. The framework highlights the roles that local governments can play in managing, conserving and providing access to ecosystem goods and services. These policy tools include the following: investing in infrastructure, creating zoning policies to protect the environment, utilizing new technology to monitor ecosystems, coordinating stakeholders, providing public services and more. Crucially, these policies can benefit equitable economic growth through their impacts on the health of the labour force and a productive business environment that generates employment growth.

This brochure further analyses four ecosystem service policy interventions in cities, which illustrate the tools local governments used to provide and manage ecosystem services. The policy interventions in Arequipa, Bengaluru, Kinshasa and Chengdu show that local governments in cities can play a leading role in promoting better health outcomes through ecosystem service management. Additionally, all of the case studies demonstrate that successful ecosystem service provision requires the use of multiple policy tools. While many ecosystem service interventions require significant investment, there are effective policy actions local governments can take that do not involve upfront expenditure.

This brochure finds that local governments can play a leading role in promoting better economic and health outcomes by managing both the supply of and demand for ecosystem services. The governments can do so by coordinating international, national and institutions and by advocating for a city's needs. Additionally, managing ecosystems proactively is less costly than subsequently restoring an ecosystem, and therefore local governments can prevent future costs by integrating ecosystem considerations into construction, development and other urban policies. The conclusion provides several actionable recommendations for local policymakers and an overview of the how to overcome the challenges and constraints local decisionmakers may face. The brochure concludes with a discussion of policy success factors and challenges in driving equitable economic growth.

Purpose and objective

Local policymakers (particularly those in the governments of secondary cities in low and lower-middle-income countries) have limited resources, funding, and negotiating power to provide public services. Although the economic gains from investing in key infrastructures, such as roads, schools and housing, are routinely made, the economic benefits of providing or safeguarding critical environmental assets rarely translate into improvements in the economic and social well-being of city residents. This brochure aims to guide thinking about this relationship and the trade-offs along the following overarching research questions:

- How are ecosystem goods and services, public services, and the promotion of equitable economic growth linked in cities?
- What type of ecosystem services are associated with the deepest impacts to entrepreneurs in the city, and why?
- How can ecosystem services be best managed in an effective manner to promote equitable economic growth in rapidly urbanizing cities?

The brochure explores these questions by highlighting the tools that policymakers and local governments, particularly those working in developing countries, have utilized to make the most productive use of existing ecosystem assets in a manner that promotes equitable economic growth. A thorough literature review of the existing knowledge on the topic has guided the discussions and recommendations of this brochure.

This brochure discusses ecosystem services, their types and impacts, followed by theoretical approaches that can be used to link ecosystem service, its provision and positive impacts on the economy. The section ends with a summary that describes the local government's role in providing ecosystem services through different policy actions. The second section illustrates four case studies from both primary and secondary cities across the global south. It provides a general description of the intervention, its impacts on well-being and economy, and the challenges faced. The final section summarizes the key findings, the challenges that stand in the way, and the knowledge gaps the researchers encountered when analysing the relationship.

Overall, the brochure focuses on the contribution of ecosystems towards improved well-being, especially of low-income or marginalized residents, such as those working in the informal sectors of economy or who live in slums. As cities expand, these ecosystem benefits could create more liveable cities and facilitate business environments. This brochure makes a case for protecting ecosystems and investing in service provision as urban populations rapidly grow, allowing these growing populations to obtain the benefits of ongoing service provision.

GLOSSARY

The following terms are commonly used in the ecosystem service literature and throughout this report. Many of these terms do not have a universal definition; therefore, the definitions in this box refer to the way that the terms are used in this document only.

Biodiversity: The diversity and abundance of animal and plant species in a given area (Millennium Ecosystem Assessment, 2005).

Cultural services: The nonmaterial services people obtain from engaging with ecosystems. These services include aesthetic appreciation, spiritual and religious value, recreation and ecotourism, educational values, creating a sense of place, cultural heritage and social interaction (La Rosa, Spyra, and Inostroza, 2016).

Ecosystem: The system of plant, animal, micro-organism and human communities along with the non-living environment and the relationships within this system (Millennium Ecosystem Assessment, 2005).

Ecosystem service/good/asset: Ecosystem goods or assets and services represent the benefits human populations derive, directly or indirectly, from ecosystem functions (Costanza et al., 1997). These services can be provided by parkland management, water treatment and pollution control systems, waste collection and disposal measures and other policy tools.

Green growth/sustainable development: Economic growth and development that occurs, while simultaneously managing and protecting environmental assets to provide ecosystem services (OECD, 2011).

Green space: Areas of vegetation in urban environments set aside for recreation or aesthetic purposes (Oxford University Press, 2018a).

Informal sector/informal labour/informal economy: Labour or employment that occurs outside legally regulated or socially protected work. This labour spans informal self-employment or informal wage employment (M. A. Chen, 2012).

Natural capital/natural asset/environmental asset: Elements of the natural environment that provide services to people, including those offering indirect use benefits (OECD, 2007). These assets can be managed to provide benefits for society, such as potable water, clean air, flood prevention, recreational areas, and the ability to adapt to or combat climate change impacts.

Payments for ecosystem services (PES): A policy tool of payments offered as an incentive for management or maintenance of ecosystems that deliver services (Salzman, Bennett, Carroll, Goldstein, and Jenkins, 2018).

Peri-urban: The area directly outside or surrounding a city.

Provisioning services: The products that are used from ecosystems. Examples of these services include food, fuel and water. A market price is often attached to these products (Millennium Ecosystem Assessment, 2005).

Regulating services: The benefits obtained from the regulation of ecosystem processes, which include, air quality maintenance, water purification and water flow regulation. These services do not generally have a market price (Millennium Ecosystem Assessment, 2005).

Secondary city: Within the context of the country, this city is not the primary city in terms of population, economy or political leadership. Secondary city is a relative term and depends on the economic and political function of the city within the national or regional system of cities (Roberts, 2014).

1. INTRODUCTION

The world's cities continue to grow and are expected to home more than six billion people by 2045 (World Bank, 2018). Urbanization is often associated with improvements in standards of living, job opportunities and better public goods provision than in rural areas. Accordingly, cities generate more than 80 per cent of global gross domestic product (GDP) and will continue to be the primary locations of economic growth. However, the process of urbanization stresses cities' limited resources, institutions and infrastructure. In part because of these pressures, high levels of inequality, poverty, and environmental degradation feature in many cities, particularly those proliferating in developing countries.

Managing ecosystems can provide a range of goods and services that can foster economic growth through benefits, such as better health and employment opportunities. The pressures on vital ecosystems from urban development are often significant and threaten the benefits residents derive from these goods and services. For instance, water scarcity is increasing, and it is estimated that 160 million people will live in cities with water shortages in 2050 (Dos Santos et al., 2017). In another example, outdoor air pollution in urban areas caused three million deaths in 2012 (World Health Organization, 2016). Efficient long-term investment decisions of local governments must therefore balance current and future urban needs. Decisions made now can be locked in because of the long-lived nature of many investments. These decisions can affect the welfare of citizens long into the future.

Equitable economic growth is long-term, sustainable economic growth with the following characteristics:

- Creates economic opportunity in both the formal and informal sectors.
- All elements of society regardless of economic status, gender or ethnicity can benefit.
- Disproportionally benefits the poorest and most marginalized, but not at the expense of the rest of society.

1.1 ECOSYSTEM SERVICES, THEIR IMPACTS AND THE ECONOMY

What are ecosystem services?

Ecosystem goods and services refer to the benefits that an intact environment provides, making life possible and improving its quality. As shown in Table 1, it is possible to derive several benefits and services from ecosystems. The services can be characterized by the provision of material goods, such as food, timber or water, which people can directly use or consume, or regulating and cultural services, such as air and aesthetic quality. Regulating and cultural services lead to benefits that are less tangible but vital to people's lives. The role of ecosystems as a habitat must not be underestimated. For example, the services of an intact biodiversity for the agricultural sector is of crucial importance to any food production.

Table 1: Ecosystems Provide a Range of Services that Support Human Health, Well-being and Productivity

Provisioning Services	Regulating Services	Habitat or Supporting Services	Cultural Services
• Food • Timber • Biomass fuel • Hydroelectricity • Clean water and sanitation • Medicinal resources from plants	• Climate stability • Temperature • Flood water • Air quality • Water quality • Soil quality	• Habitat for species • Maintaining genetic and species biodiversity • Pollinators for agriculture	• Opportunities for recreation and physical activity • Tourism • Aesthetic quality

Source: Vivid Economics and Brander & Eppink (2012).

Provisioning services

Provisioning services provide material goods that are essential for a city's residents life and their well-being in cities, and they include clean water and food, sources of energy and raw materials. These goods are supplied by ecosystems both inside and outside cities. For example, water may be sourced from lakes or groundwater within or outside cities, while agriculture in peri-urban or rural environments supplies food. Provisioning services not only supply materials that are freely available, but they also provide opportunities for livelihoods. For example, high quality soil provides opportunities for commercial and subsistence agriculture, and forests provide biomass for energy and wood products. The challenge for cities is to ensure sustainable management of ecosystems and resources so that these services can continue to be available (Gaston et al., 2013).

Regulating services

Regulating services maintain environmental conditions and mitigate damages, resulting in improved human health and city's resilience (Mader et al., 2011). Regulating services for human health include air and water quality, sanitation services and noise regulation. For example, by removing pollutants, vegetation and tree cover can provide both air and noise regulating services (Gómez-Baggethun and Barton, 2013). Regulating services are particularly vital in developing cities where populations are often exposed to high levels of air pollution and unclean water (Satterthwaite, 2003). The World Health Organization (WHO) found that urban air pollution is increasing in low and middle-income countries and causes more than three million early deaths each year (WHO, 2016). Proper use and maintenance of regulating services could reduce these early deaths.

Regulating services can also help build resilience and adaptive capacity to natural disasters. Cities are vulnerable to natural disasters such as floods and droughts. For flood control and storm protection, maintaining an intact watershed is imperative, for example. Climate change accentuates the risks to cities and maintaining natural regulating services will help to better adapt to the damages of climate change (Depietri et al., 2014). Maintaining ecosystem services also improves the resilience of a city towards climate change. While it is crucial to protect these ecosystems, they are endangered by the effects of climate change themselves. To protect these services will therefore become even more crucial for city authorities (B. Locatelli, 2016).

Habitat or supporting services

Habitat or supporting services benefit humans by supporting plant and animal life (Mader et al., 2011). In particular, whole habitats support biodiversity services, such as pollination, soil quality and ecosystem resilience (Elmqvist et al., 2013; Laros and Jones, 2010).

Support services typically underpin other services and determine the quality of ecosystem goods and services that can be provided. For example, soil quality affects agricultural productivity and water retention. As cities expand, development at the peri-urban frontier threatens these supporting services (Douglas, 2008). Active management and long-term planning of non-urban areas, and mapping of existing ecosystem goods can avoid loss of and create access to new ecosystems that provide services to cities.

The empirical evidence on the benefits of biodiversity services in urban environments has mixed results. It is challenging to value the benefits of urban biodiversity, because there are several definitions of biodiversity and its measurement. Studies that measure biodiversity often use different species or

vegetation indicators, making it challenging to compare outcomes. Moreover, there has been little quantitative work on the value of biodiversity in cities (Schwarz et al., 2017).

Cultural services

Ecosystems offer opportunities for activities that improve quality of life and support well-being. Cultural services are often supplied by urban green spaces, which provide spaces for recreation, opportunities for exercise, a sense of place and improve the aesthetic quality of an urban environment. Managing and providing cultural ecosystem services tend to be a lower priority in cities of the developing world. To better justify and support investments in ecosystem services with cultural benefits, these benefits can be valued and incorporated into policy decisions (Vivid Economics, 2017). However, this is not an easy task, as some of the benefits of cultural ecosystem services can be difficult to evaluate due to the multitude of ways different groups use and value these spaces (Ahern, Cilliers, and Niemelä, 2014; X. Chen et al., 2018; La Rosa et al., 2016). A study in Barcelona, Spain, found that residents value green spaces in ways that traditional monetary valuation methods do not capture, such as environmental learning values (Langemeyer, Baró, Roebeling, & Gómez-Baggethun, 2015).

As mentioned earlier, managing cultural ecosystem services is not given much importance in cities of developing countries as a result of which much of the literature is focussed on developed cities where studies show that people in richer countries have a higher willingness to pay for cultural ecosystem services (Xiao, Haiping, and Haoguang, 2017). Ecosystem services that help meet basic needs often take priority in cities of the developing world. Integrating cultural ecosystem services into urban planning early in the development process is crucial to realize benefits later on (X. Chen et al., 2018).

IMPACTS OF ECOSYSTEM SERVICES

The research conducted to understand how ecosystem services affect a city's economy, particularly in developing countries, is limited. While there is a significant body of literature on the benefits of ecosystem services for individuals, particularly for their health (Anthonj, 2014), there is limited work on the relationship between ecosystem services and local businesses. Research on firm-level impacts tends to emphasize green growth and sustainable development without explicitly defining how maintaining the environment directly affects the growth of local businesses. Similarly, the negative economic effects of degrading ecosystem goods and services are more commonly discussed rather than the benefits of conservation and management (Sadler et al., 2018; R. White, Turpie, and Letley, 2017).

In developing countries, the informal sector can play an important role in supporting ecosystem services, but there is limited supporting evidence on this relationship. Because the informal sector is unregulated and often unquantified, empirical work is limited. Some evidence does exist that informal work supports ecosystem services, particularly in waste management (Ruzek, 2015). Waste pickers service many urban dumps by sorting and salvaging valuable materials and recyclables. City governments can aid these informal waste pickers by improving urban waste disposal systems, which can help prevent environmental degradation and reduce health hazards for informal waste pickers (Amin, 2005). Additionally, since ecosystem services have significant benefits for individuals and informal workers, businesses are likely to benefit from better ecosystem service provision.

Ecosystem service impacts through improved health and well-being

Ecosystem services contribute towards improving physical and mental health and reducing diseases by increasing access to spaces for physical activity, and lessening the occurrence of diseases through improved water quality, sanitation and air quality (Molla, 2015; Dunn, 2010; Jansson, 2014; Jennings et al., 2016). Physical inactivity is associated with higher risks of cancers, diabetes and cardiovascular diseases (WHO, 2018) and results in significant healthcare, productivity and mortality costs to both individuals and cities (Bird, 2004). Access to such ecosystem services as green space is shown to improve mental well-being and life satisfaction (M. P. White, Alcock, Wheeler, and Depledge, 2013). A 2014 Chinese Physical Activity Survey Report found that limited time and access to space for physical activity are the first and third leading causes of physical inactivity respectively (Wang and Liu, 2017).

Water is a priority for human health, because it satisfies a basic need, yet it can be detrimental if it carries pathogens (Anthonj, 2014). WHO estimates that nearly 500,000 deaths from diarrhoeal disease could be avoided annually with access to potable water and sanitation services (Prüss-Ustün, Wolf, Corvalán, Bos, and Neira, 2016). Safe water and sanitation services provision through management of ecosystem services can also ameliorate intestinal worm infections, trachoma (visual impairments), and schistosomiasis (parasitic infection) incidences (Schuster-Wallace, Grover, Adeel, Confalonieri, and Elliott, 2013).

Similarly, ecosystem service management can help reduce air pollution, which is associated with significant incidence of morbidity and premature mortality. Throughout the world, particulate matter pollution causes nearly 4 million deaths annually (not including morbidity or the effects of other air pollutants). The risk is even higher for people living in cities with higher levels of pollution from cars (WHO, 2016). In India alone, where there are many metropolitan areas with dangerously high pollution levels, estimates indicate that reducing pollution to Indian national standards would save 2.1 billion life years (Greenstone et al., 2015).

Having individuals with improved health and well-being increases the productivity of the labour force, which supports the general performance of the private sector. Morbidity can lower firm productivity through illness, absence from work and reduced efficiency in the workplace (Ricardo-AEA, 2014). There is significant evidence that air quality, in addition to causing respiratory and cardiovascular disease incidences, affects worker productivity, particularly for agricultural and manufacturing workers (Zivin and Neidell, 2012). In the United States, a 10 parts per billion reduction in ozone air pollution is estimated to save the economy $700 million[1] in productivity gains. The economic impact in developing cities where air pollution exposure is much higher would be even larger (Pascal et al., 2013; Zivin and Neidell, 2012). Forgone labour output resulting from particulate matter (PM) pollution in 2013 was estimated to be 0.39 per cent of GDP in South Asia and 0.23 per cent of GDP in sub-Saharan Africa (Narain et al., 2016).

Products from ecosystem services also provide opportunities for employment. Food production through fishing and farming is a key source of income for individuals and firms in the formal and informal sectors (Benson et al., 2014). In addition, raw materials such as timber are produced and used in nearby cities for fuel and building materials (Davies, Doick, Handley, O'Brien, and Wilson, 2017). While the production of these goods generates income for the private sector, regulation of locations activities and protection of ecosystems

[1] *All dollar amounts are in U.S. dollars, unless noted.*

from overexploitation is important for ensuring these benefits are delivered sustainably (Paudyal, Baral, and Keenan, 2016).

Local government investment in ecosystem services creates a functional and attractive business environment. Infrastructure, market access and provision of such services as water and energy, are critical for businesses to operate effectively. Cities that provide consistent and quality ecosystem services create a more hospitable business environment (Economist Intelligence Unit, 2018). Firms are more likely to locate in cities with a reliable and low cost source of electricity that does not create detrimental impacts on liveability (Mans, 2014). Additionally, firms are more likely to locate in resilient cities versus areas vulnerable to climate change and natural disasters, which may disrupt supply chains and production (Waage and Kesterl, 2013).

The public sector too benefits from effective management of ecosystem services benefits as doing so lowers the costs of providing such key services as healthcare. Managing ecosystems to reduce exposure to air and water pollution provides both individual and public benefits. Ecosystem services reduce the need to use government resources on public health. Globally, $240 to $630 billion is spent on air and water pollution-related healthcare each year (Preker, Adeyi, Lapetra, Simon, and Keuffel, 2017).

Local governments can increase revenues, fund expenditures and recoup investments by pricing and charging for some ecosystem services, such as water, sanitation and energy. This revenue can fund expenditure on the maintenance of these services and increase revenues. Investing in improvements in infrastructure can result in efficiency gains by reducing losses from leakages, expanding the number of users, and increasing the revenue base. Increased government revenues can increase government capacity and ability to provide services (Watson, Withana, and ten Brinks, 2015). This revenue also allows cities to provide better access to ecosystem services for residents who may be priced out. Increasing local government capacity to provide public services can also reduce inequalities. There is evidence that the government's ability to provide services such as healthcare, education and infrastructure can reduce income poverty and stimulate economic grow (Ali and Pernia, 2003; Anand and Ravallion, 1993).

Ecosystem service impact on equitable economic growth

Equitable economic growth is characterized by rising incomes, increased economic opportunities, improved labour conditions and reduced inequalities for all residents.

Ecosystem services benefit individuals, support businesses and build government capacity. Figure 1 illustrates how ecosystem services result in economy-wide benefits. Ecosystems services primarily affect the economy through impacts on human health by reducing exposure to pollution, other environmental hazards, and water and airborne diseases (Millennium Ecosystem Assessment, 2005). Individual productivity is a function of education and health (Kraay, 2018). Ecosystem services improve individual productivity and the ability of these individuals to participate in the labour force and generate income. The health of residents and workers also affects businesses, which benefit from a productive workforce. The cumulative effects on individuals and businesses feed back into the public sector, which benefits from higher tax revenues generated from more productive businesses and from the avoided costs of treating ill health.

Equitable access to ecosystem services can contribute to reducing inequality and poverty. While urban populations typically have better access than non-urban populations to such services as water supply, there are large disparities in access to these services, especially between high and low-income residents,

particularly in informal settlements where supply may be limited, low-quality or non-existent (Dunn, 2010; WHO and UNICEF, 2014). Slum dwellers often have non-existent or inadequate sanitation and drainage services, as a result of which they are exposed to serious health hazards, such as insect and water-borne diseases, including malaria, dengue fever and trachoma (Satterthwaite, 2003). Increasing access to ecosystem services can help level the playing field for more equal economic opportunities and healthier lives. Ecosystem service management can also reduce environmental hazards for informal workers in the sanitation or waste recycling sectors who have higher occupational risks (Amin, 2005; Satterthwaite, 2003).

1.2 THEORETICAL APPROACH TO EFFECTIVE ECOSYSTEM SERVICE MANAGEMENT

The theoretical approach discussed here provides a conceptual framework linking local government action, ecosystem service management and the economic outcomes. The framework in Figure 1 highlights the roles that local governments in secondary cities can play in managing, conserving and providing ecosystem goods and services. These benefits contribute to equitable economic growth through a healthy labour force and a productive business environment.

Cities can use various policy instruments to manage and protect ecosystem assets and the services they provide. These policy instruments are the foundation of effective and efficient ecosystem service provision. Policy options include investing in water infrastructure, protecting green spaces and taxing the use of pollutants.

Ecosystems provide services that are essential to healthy cities by meeting basic needs and creating the conditions for liveable cities. They include the supply of clean water and sanitation, the regulation of air quality, and space for leisure and social networking, among others. Maintaining the functions and availability of ecosystems in and around cities ensures continuing access to these benefits.

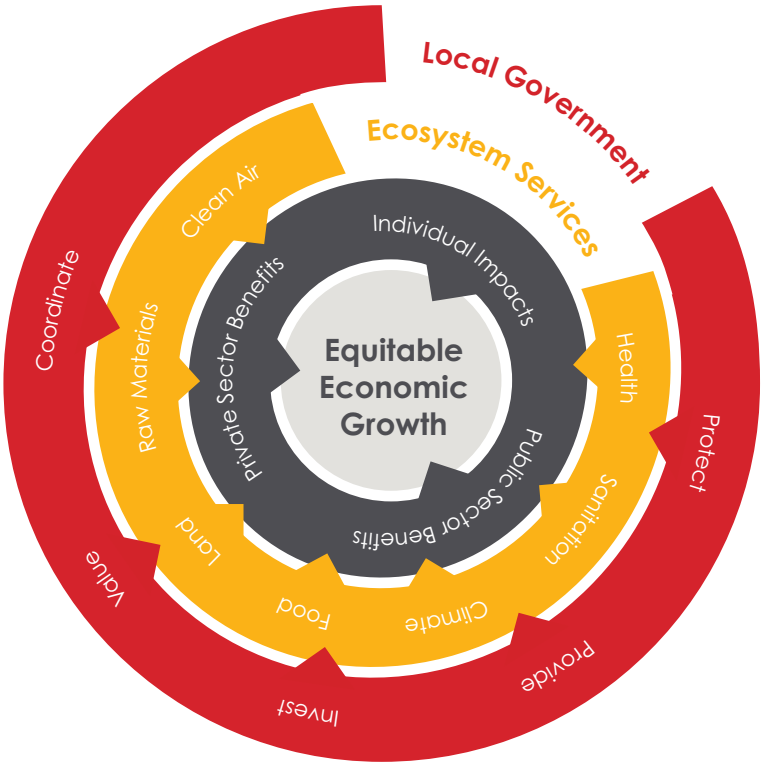
Ecosystem services form a foundation for equitable economic growth in cities. Primarily, ecosystem services drive equitable economic growth through increased economic opportunities. Ecosystem services increase economic opportunities by doing the following:

- Supporting and underpinning the health of individuals
- Improving the productivity of businesses
- Building the governments capacity (and vice versa).

For example, clean water and opportunities for exercise are crucial for a healthy and productive workforce.

Furthermore, ecosystem services contribute to a productive business environment by providing raw material inputs and infrastructure for production. The provision of ecosystem services can feed back to local governments in the form of higher revenues and lower public expenditure. For example, when governments efficiently provide such services as energy access, they can increase profitability, resulting in greater resources. Ecosystems, if managed carefully, assist local governments in secondary cities in providing such services.

Figure 1: Conceptual Link between Ecosystem Services and Equitable Economic Growth



Local governments role in managing ecosystem services

- Protect ecosytems and ecosystem services
- Provide public ecosystem goods and services
- Invest in environmental assets
- Value ecosystem services and price goods
- Coordinate local and regional stakeholders

Ecosystem Services in Urban Areas

- Clean air
- Opportunities for excercise
- Water provision
- Sanitation services
- Energy provision
- Agriculture
- Equable climate
- Noise regulation
- Opportunities for recreation
- Exposure to disease vectors
- Land management
- Access to public spaces
- Raw material use
- Resilience to climate risk

Individual Impacts

Basic services increased opportunities

Private Sector Impacts

Resources and markets infrastructure

Public Sector Impacts

Increased revenues reduced costs

Equitable Economic Growth

Reducd inequality, reduced poverty, increased incomes increased economic and business opportunities greater government capacity to provide public goods

Local government can control access to ecosystem services and reduce inequalities through ecosystem service provision. Vulnerable populations in cities typically have the least access to basic services, such as potable water, sanitation and green spaces. Inequality can be reduced by improving the quality of assets and increasing impoverished group's access to ecosystems services.

Ecosystem services are not new concepts in academic research or policy discourse and are recognized as important for supporting human life. Their benefits have been addressed from various perspectives, including ecosystem service management incentives, the negative impacts of urbanization and poor ecosystem service management on human health, and analysis of specific policy interventions. However, most urban literature focusses on the developed world, and little is known about the role of local government in promoting ecosystem service management in a low to middle-income countries.

Gaps in the literature

This brochure will focus on the two key gaps in the literature:

1. There is a lack of research attributing **local government policies on ecosystem services to equitable economic growth** in a developing economy's urban context. For example, while research might examine ecosystem services in secondary cities, it may not necessarily be in a developing context, or link to economic growth. Most academic literature on the topic focuses on case studies or concentrates on the development of mapping tools.
2. Most research on the role of ecosystem services in **secondary cities** of the global south does not identify channels of impact to achieving **equitable economic growth**. A large body of work highlights the negative impact of urbanization on ecosystem services through land conversion, air pollution, and other means. Despite this situation and common terms such as 'sustainable development', 'green growth' and 'urban green infrastructure', the literature fails to highlight the specific processes, drivers or links between local government action with respect to ecosystem services and outcomes.

It is clear from this discussion that more theoretical work is required to get a clearer picture on the relationship between equitable economic growth and ecosystem services. This is especially true for both primary and secondary cities in the global south, where less research has been conducted and data availability is often poor. The theoretical approach provides a framework in the context of ecosystem services in cities of the global south and eases to identify potential pathways to combine urban growth with equitable economic growth.

The following section describes these pathways for local government to provide ecosystem services while supporting equitable economic growth; it is supported by academic literature and economic outcomes, where possible.

1.3 ROLE OF LOCAL GOVERNMENT IN ECOSYSTEM SERVICE PROVISION

Local governments foster ecosystem services through several channels. Their role is to protect and appropriately manage ecosystems under their purview. Their influence includes protecting ecosystems, providing public goods, investing in ecosystems, building resilience to climate change and natural disasters, and coordinating or engaging with stakeholders. Depending on the ecosystem, a local government may manage the supply and demand for ecosystem services. For instance, a government may supervise private firms in supplying water through investments in infrastructure and manage the demand for water through pricing policy.

Local governments are best placed to understand local needs when managing competing demands on ecosystems both locally and regionally (Laros and Jones, 2010). Regional resources, such as large bodies of water, provide many ecosystem services in cities. When ecosystems service multiple areas, cities can coordinate with regional actors and advocate for the city's needs (Ernstson et al., 2010). Regional government have an important role when rural and peri-urban ecosystems supply food, forest products and water to cities (Laros and Jones, 2010). This coordination between the local and regional governments was evident when Bengaluru, India, appealed to the national supreme court for access to water from the Kaveri River. The appeal was granted and the city and its residents now have access to cleaner water. Local governments also need to coordinate with overlapping or competing management agencies, because ecosystems within cities often provide multiple services and there may be competing interests in them (Gaston, Ávila-Jiménez, and Edmondson, 2013). For example, a fisheries agency and a water management agency may have different priorities while managing a body of water. City governments play an important role in arbitrating, coordinating and balancing the needs of multiple stakeholders (Hansjürgens, Brenck, Bartz, and Kowarik, 2018). In the future, local government roles may have to assume even greater importance with rapid urbanization and intensifying climate change impacts.

Secondary cities in the developing countries face unique institutional challenges in managing ecosystem services. They may have lower institutional capacity to prepare for and recover from natural disasters and climate change, and to manage rapid urbanization (Boyle et al., 2003). Many times, these cities have to compete with other cities for resources and face political constraints in accessing regional ecosystem services (Ernstson et al., 2010; Mans, 2014). For instance, a national government may control access to a large body of water and allocate more resources to primary cities.

Protect ecosystems and ecosystem services

Local governments can protect ecosystem degradation through development and land management policies. Cities' urban planning and development policies can be used to protect, maintain, extend and enhance ecosystems. An example is the management of critical watersheds, which provide water to cities. Buffer zones around wetlands and no-development areas help prevent ecosystem degradation and ensure the continued delivery of ecosystem function, including water protection (Depietri, Guadagno, and Breil, 2014). Conservation policy is particularly important for peri-urban and non-urbanized areas, which provide services to cities but are threatened by urban expansion (Pelorosso, Gobattoni, La Rosa, and Leone, 2015). For example, deforestation threatens the services that trees provide, including soil water retention, which impacts urban water supplies.

Provide ecosystem goods and services

Local governments develop and provide infrastructure to supply ecosystem goods and services. Local governments are often responsible for delivering goods and services that provide the basic needs of urban residents (Beard, Mahendra, and Westphal, 2016). Managing ecosystem services efficiently allows local governments to provide residents with services such as water, timber and clean air (European Commission, 2009).

Invest in environmental assets

Investments in ecosystem restoration and quality improvement benefit cities. Local governments have an important role in both improving environmental assets and protecting existing assets from quality degradation. Investing in ecosystems can fill gaps in service provision and improve the quality of existing services (Beard et al., 2016). For example, restoration of a degraded watershed can reduce vulnerability to hydrological hazards, such as flood risk (Depietri, Renaud, and Kallis, 2012). Investments towards restoration or even in the creation of ecosystems may also benefit new populations, such as developing new green spaces can provide benefits to previously underserved communities (Richards, Passy, and Oh, 2017). A study on green spaces in the Kumasi Metropolis, Ghana, found that local government actions to protect and prioritize urban green spaces could improve the quality and accessibility to spaces for residents (Mensah, 2015).

Local governments can also invest in monitoring tools and impact assessments to better manage environmental assets. The maintaining of existing ecosystems is cost effective in comparison to restoring broken ecosystems (Richards et al., 2017). Monitoring can help policymakers identify the most valuable and vulnerable ecosystems to prioritize their conservation strategies (Ranganathan et al., 2008). For example, this brochure analyses a policy in Bengaluru, India, that plans to map local water sources and integrate construction buffer areas into zoning policies. The case study demonstrates that monitoring can help maintain ecosystems that are vulnerable to natural and man-made hazards, such as flooding and urban expansion (Mader, Patrickson, Calcaterra, and Smit, 2011).

Value ecosystem services and price goods

Local governments use economic incentives, such as pricing, to limit exploitation. Most ecosystem goods and services are not traded in markets, so their use is not priced, which can lead to overexploitation and depletion of resources (Depietri et al., 2014). This is in line with the tragedy of commons, which stipulates that individual users of a shared resource act in self-interest rather than in common good. For example, water sources with unrestricted public access and no incentives for conservation can be quickly depleted (Gaston et al., 2013). Introducing some form of pricing system could help in managing the scarce resources and avoid the uncontrolled prodigality of it. This system also raises funds for infrastructure maintenance and can increase public revenues.

A potential drawback of pricing ecosystem goods is that some residents may not be able to access essential services. For instance, uniform pricing of water supplies forces lower-income residents to spend a higher share of income on water. Governments may be able to address equity issues through income support and subsidies for services (OECD, 2003).

Cities can create incentives to conserve ecosystems outside urban areas through payments for ecosystem services (PES) (Mader et al., 2011; UNEP, 2010). PES schemes work by governments or users paying for management or maintenance of ecosystems that deliver services. They have mainly been applied to forest and water services (Salzman et al., 2018). An urban example is New York City's scheme, which pays rural landowners to maintain the quality of water used by the city (Appleton, 2002).

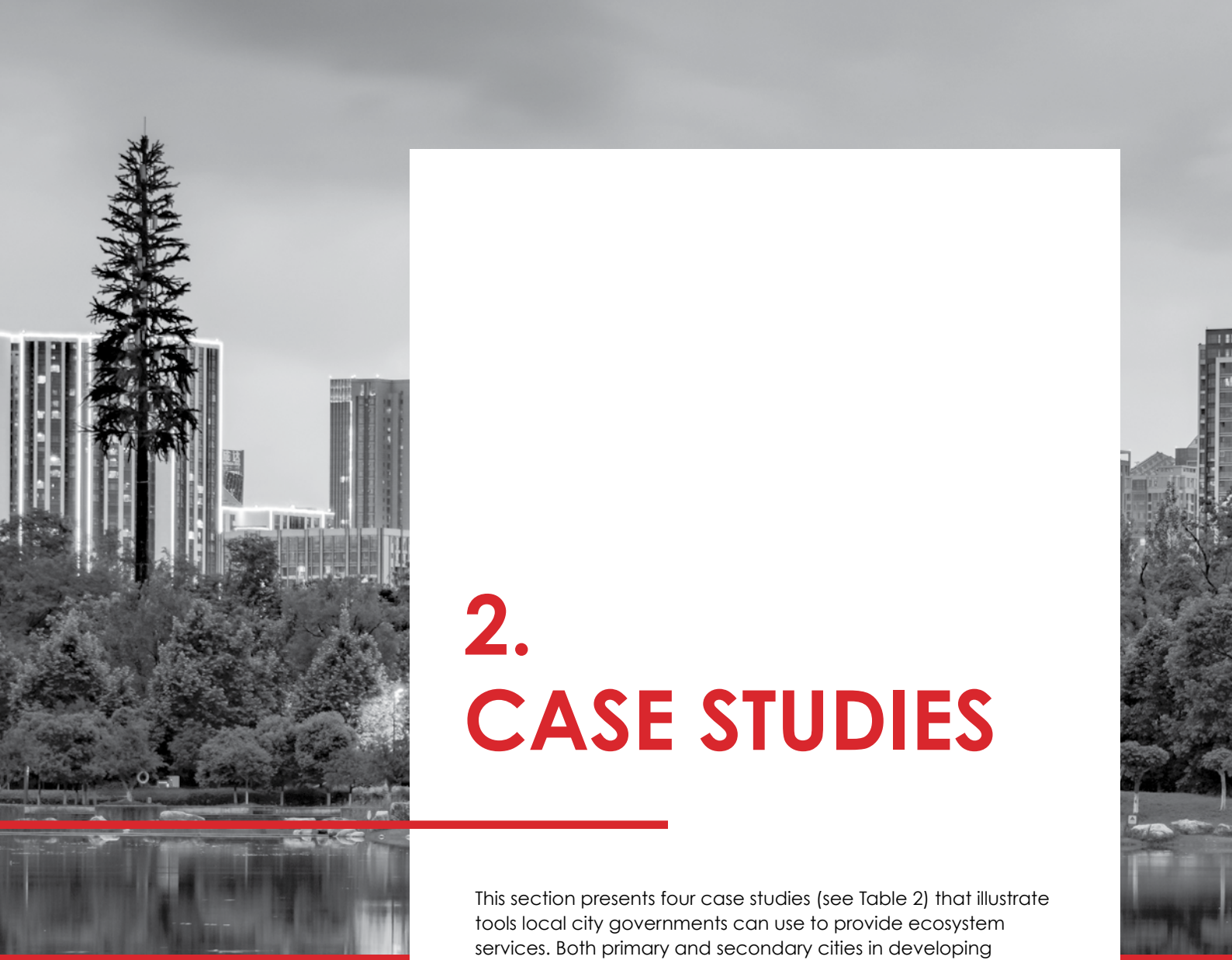
Engaging with local and regional stakeholders and coordinating actors

Local government can foster cooperation and coordination with local and regional stakeholders. This coordination role is important because secondary cities in the developing world face numerous challenges in managing urbanization, including the lack of institutional capacity and inadequate financial resources (Ernstson et al., 2010; Mans, 2014). Local government may not be the primary decision maker in the use of regional resources, and smaller or emerging cities may be a lower priority in resource allocation. For example, large bodies of water can supply drinking water and sanitation to multiple cities, as well as supporting other ecosystem services, such as tourism and recreation. A well-coordinated, holistic approach can help in managing ecosystems goods.

Local government can foster public-private partnerships to supply access to ecosystem services. This partnership can include engaging with organizations of the urban poor, both slum dwellers and the working poor in the informal economy. This approach may be especially useful as it will generate local knowledge from the groups most affected and with least access to the benefits of ecosystem services. Additionally, local governments can use public-private partnerships to efficiently provide services.

There may be competing demands for ecosystem and land uses as cities develop and grow. It is important for local governments to consider actual or perceived rights to land and ecosystem services, while making planning decisions. Local governments must serve the purpose of fostering cooperation to account for the range of local stakeholders (Boyle et al., 2003; Elmqvist et al., 2013). In case the local government fails to do so the effects are detrimental to both the ecosystems and the intended beneficiaries of its services. Mensah (2015) cites conflicts over land ownership rights on green spaces in the Kumasi Metropolis as a factor in poor green space provision for urban residents.

Cities must supply infrastructure to support ecosystem services for the development of markets. Doing so helps producers in the informal sector to participate in the economy and allows individuals and businesses to benefit from using ecosystems to produce products, such as food. Local governments can play a crucial role in providing the physical location for agri-food markets and regulate food safety, access to water for irrigation, flood risk mitigation and environmental performance to help producers reach a standard to sell products on markets (Benson et al., 2014).



2.
CASE STUDIES

This section presents four case studies (see Table 2) that illustrate tools local city governments can use to provide ecosystem services. Both primary and secondary cities in developing countries face unique practical challenges in developing and implementing policies that aim to protect ecosystems and deliver ecosystem services. Each case describes a policy or suite of policy tools that is currently used by city governments to provide these services to urban populations and how the delivery of ecosystem services contributes to equitable economic growth. The cases also discuss the challenges the cities faced and how these challenges were overcome.

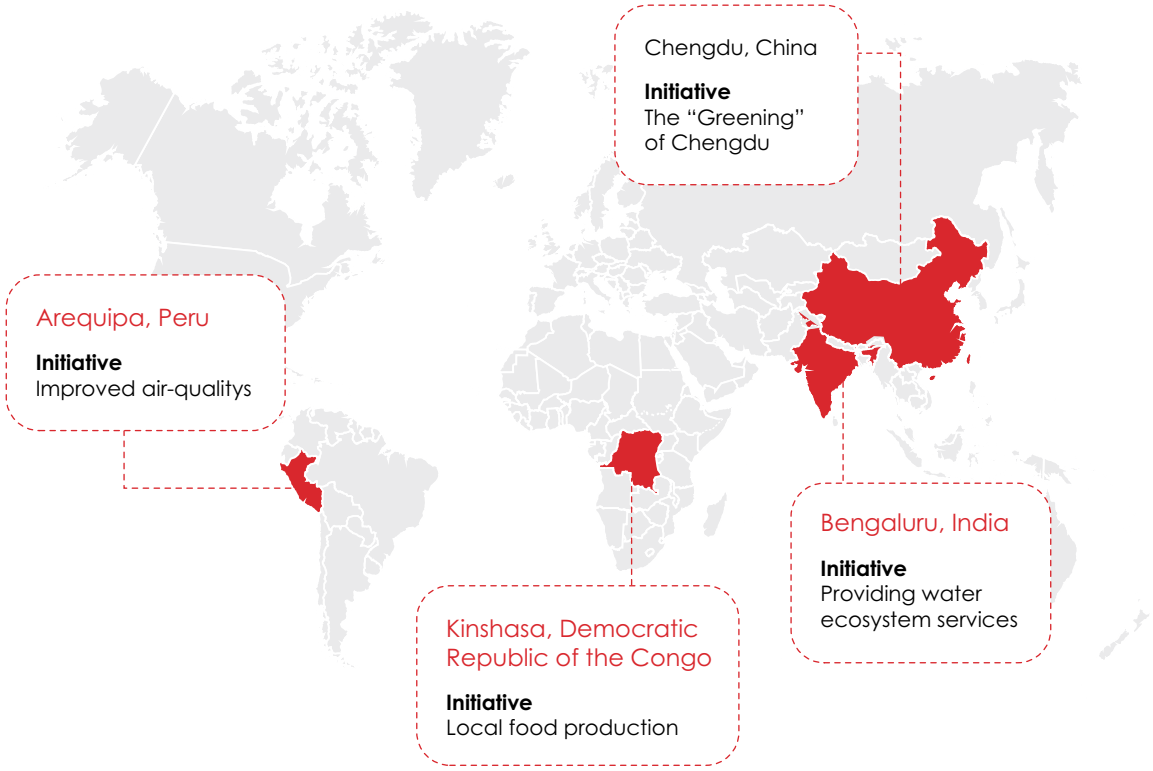
The purpose of analysing specific case studies is to test how policies fit the theoretical approach and where the theory fits with or diverges from reality. The cases explore the background to the policy, its aims and co-benefits beyond ecosystem service provision. They also investigate practical challenges in local government's ability to provide equitable access to ecosystem services and challenges in applying the policy to other contexts.

The case studies explore a range of geographic, institutional and environmental contexts for ecosystem service provision. While the case studies vary across diverse urban environments and levels of urbanization, several themes emerge among policy successes as well as challenges. The final section discusses these challenges and successes, along with findings for other secondary cities to replicate.

Table 2: Overview of Case Studies

	BENGALURU, INDIA	AREQUIPA, PERU	KINSHASA, DEMOCRATIC REPUBLIC OF THE CONGO (DRC)	CHENGDU, CHINA
Ecosystem	Freshwater	Atmosphere	Agricultural land	Green spaces
Initiative(s)	Revised Master Plan for Bengaluru 2031, Bengaluru Water Supply and Sewerage Project	Integrated Transport System (SIT)	FAO Programme for Urban and Peri-urban Horticulture	Tianfu Greenway System
Ecosystem focus	Provide basic needs	Provide basic needs	Support livelihoods	Improve well-being
Provisioning services	Water supply, irrigation, hydropower, sanitation	Clean air to breathe	Agriculture, nutrition	
Regulating services	Water purification, flood regulation	Local air quality, quality of water, equable climate	Soil quality, water quality	Air quality, temperature regulation, carbon sink
Supporting services	Biodiversity, fisheries	Biodiversity	Biodiversity	Biodiversity
Cultural services	Tourism, recreational activities		Historic/indigenous land rights	Physical/recreational activity, tourism, place-making
Policy objective	*Improve management of water ecosystems to provide basic services*	Improve health of the population through efficient public transport and pedestrian-focused areas	Promote sustainable land use and food production by securing land rights, investing in infrastructure and education	Build on and link the existing network of greenways and provide greater benefits to urban residents

Figure 2: Case Studies Geographic Distribution



INDIA

2.1 PROVIDING WATER ECOSYSTEM SERVICES IN BENGALURU, INDIA

Population growth has put pressure on Bengaluru's resources, resulting in high levels of inequality and insufficient access to water ecosystem services. Bengaluru (formerly known as Bangalore) is one of the most populous and productive metropolitan areas of India. The city experienced rapid urbanization over the past four decades, growing from under 3 million residents in 1980 to more than 11 million in 2018 (UN Department of Economic and Social Affairs, 2018). However, population growth has resulted in high levels of inequality and spatial segregation because of social conditions, rural-to-urban migration and pressure on public services and infrastructure (Roy, Lees, Pfeffer, and Sloot, 2018). Bengaluru's slum population has increased dramatically, with estimates ranging from 25 to 35 per cent of the urban population living in informal housing (Roy, Palavalli, et al., 2018).

Bengaluru has experienced a 79 per cent reduction in local water sources from 1973 to 2017, forcing the city to outsource its supplies to meet increasing demand (Ramachandra, Vinay, and Aithal, 2017). The city is not adjacent to a major surface water body and therefore relies heavily on urban lakes and reservoirs. However, land conversion, construction, waste disposal and increased demand for water have degraded and depleted many local sources (Sekhar et al., 2017; Sudhira and Nagendra, 2013). As a result, the city increasingly depends on piping in water from the Kaveri River, which is more than 100 km south of Bengaluru (Ramachandra et al., 2017). This situation imposes significant costs on the Bengaluru Water Supply and Sewerage Board (BWSSB), which spends 75 per cent of its revenue on electricity to transport water (Lakshmi, 2007).

Restricted access to clean water and sanitation is costly to the health and productivity of Bengaluru residents. Despite efforts to bring in new sources of water, many people still have limited access to water and sewage systems, and they experience water shortages on a regular basis. The poor and slum populations are severely affected as they rely on illegal connections to the water supply, because public sources are poorly maintained and are often contaminated (Chandrashekar, 2006). Additionally, slums have the least access to sanitation services, creating unsafe and unhealthy living conditions (Roy, Lees, et al., 2018).

Policy interventions

Bengaluru has sought to improve the provision of water ecosystem services and reduce inequalities in access by protecting water ecosystems. The city plans to increase access to clean water and sanitation to support a healthy population and a productive labour force. Bengaluru's policy interventions manage both the supply of and demand for water ecosystem services.

The Bengaluru Development Government (BDA) targets increasing local supplies by implementing new regulations to monitor and conserve existing sources and investing in restoration. The BDA revised Master Plan for Bengaluru 2031 includes policies to map all urban lakes, tanks and streams and invest in urban lake rejuvenation. It has also increased buffer areas for protection around all water bodies and integrated these buffer areas into zoning and development planning to conserve ecosystems and reduce degradation (Bangalore Development Government, 2017).

BWSSB has expanded access to water and sanitation by improving the efficiency of distribution systems. The Comptroller and Auditor General of India reported that between 2009 and 2013 half of the water piped in from the Kaveri was lost from leakage or theft because of inadequate plumbing (Saldanha, 2016). BWSSB has developed infrastructure to more efficiently and consistently supply water. It has also invested in new supply systems to increase access and reduce water loss, build new treatment plants for wastewater, and upgrade the pipeline to reduce pressure on local groundwater resources. Efficient infrastructure allows BWSSB to manage demand and prevent losses, recouping the initial investment and costs of transporting water (Venkataraju, n.d.).

Ecosystem services and equitable economic growth

Equitable provision of water and sanitation services drives economic opportunities through health benefits.

BDA and BWSSB have addressed the need to consistently and equitably provide water and sanitation services. BWSSB's metering technology has resulted in more equitable distribution of water through monitoring demand and flow to each region (Venkataraju, n.d.). BWSSB is now able to monitor when and where the areas of greatest demand occur and respond accordingly by distributing water to those regions. BDA's conservation policies aim for 'enhanced liveability' by protecting surface water, which assists in supplying slum residents with basic water and sanitation services (Bangalore Development Government, 2017). The improvements in accessibility are expected to improve health and reduce poverty, particularly for women and children (UN-Water, 2006). However, sewerage systems and water supplies are still insufficient to meet current population demand (Akshatha and Menzese, 2019).

What is smart water metering?

A water meter is a device used to measure the amount of water consumed in a building. A 'smart' water meter can store and transmit consumption data frequently. Sometimes 'smart' meters are referred to as 'time-of-use' meters because in addition to measuring the volume consumed, they also record the date and time the consumption occurs.

Traditional water meters are read monthly or bi-monthly by a person and a water bill is generated from this manual reading of the meter. Smart meters can be read remotely and more frequently, providing instant access to water consumption information for both customers and water utilities (Alliance for Water Efficiency, n.d).

There may be trade-offs between sustainable supply and equitable accessibility to water provisioning services. Inequality of access and opportunity is a significant and growing issue in Bengaluru, particularly for slum residents (Roy, Lees, et al., 2018). Some low-income populations only have access to water through theft and may lose access from the smart metering technology and new pipes, which are designed to reduce non-revenue water. To address this potential reduction in access, BWSSB contends that the increased revenues will provide more resources to supply public water access points (Venkataraju, n.d.).

BWSSB's investments in smart metering and improved pipes benefit the public sector and local businesses. Efficient provision not only improves service quality for households and firms, but also reduces operating costs. In particular, the smart metering system has helped BWSSB reduce losses from leakage and more effectively manage resources, increasing their financial capacity to undertake repairs and maintain water sources.

Challenges and limitations

Bengaluru's long-term efforts demonstrate the importance of proactive management of water ecosystem services in the context of population growth and land conversion. BWSSB has been addressing service supply issues for more than a decade because of insufficient infrastructure. BDA has shown that future degradation can be prevented by not only investing in restoring degraded sources, but also by integrating ecosystem considerations into zoning policies. Managing proactively is typically less costly than restoring degraded ecosystems retroactively (Richards et al., 2017).

However, both the smart metering and the planned lake rejuvenation are costly interventions, which may be difficult to scale. The BWSSB intervention was only made possible by building on existing initiatives with financing from the Japan International Cooperation Agency (JICA), a Japanese government agency which provides official development assistance (JICA & NJS Consultants Co., 2017).

Supply and demand management of water ecosystem services requires institutions that can cooperate and coordinate effectively amongst themselves. The BDA policy focusses on maintaining water ecosystems, while the BWSSB policies aim to efficiently and equitably distribute ecosystem services. Both policies are necessary but require strong institutional capacity and cooperation between development governments and environment governments.

2.2 IMPROVED AIR-QUALITY IN AREQUIPA, PERU

Arequipa is one of the most polluted cities in South America because of vehicle emissions, high volumes of traffic and poor fuel quality. It is the second most populous and industrialized city in Peru, with an economy primarily based in manufacturing. Between 2003 and 2008, per capita GDP growth in Arequipa was the fastest of any South American city (Gonzalez and Diaz, 2009). The current population is now more than 900,000 people and continues to grow following high levels of rural-to-urban migration (Knoema, 2016). However, Arequipa's rapid growth outpaced the capacity of its transport infrastructure.

Arequipa's existing bus transport system is both overused and inefficient. The city has 240 bus routes, which often overlap and do not serve cover the whole city. Most buses in the fleet are old with low-fuel efficiency and carrying capacity, and these buses produce higher levels of emissions (Condori, 2018). Poor public transport is one reason for an oversupply of taxi transport and private vehicles, which in turn has led to congestion and further increased vehicle emissions and road accidents (Tong, Hung, and Cheung, 2000). As a result of this inefficiency of the public transport system, Arequipa remains one of the most polluted South American cities.

Clean air contributes to good health, reducing the incidence of cardiovascular and respiratory diseases, including asthma, bronchitis and decreased lung function. WHO recommends that particulate matter (PM)10 concentrations do not exceed 50 µg/m3 24-hour mean (WHO, 2006). In 2017, Arequipa's municipal region exceeded the limit every month, with two months exceeding 150 µg/m3 (Gerencia Regional de Salud, 2017). Sixteen main roads

in Arequipa reached levels as high as 178 µg/m3 (Arequipa con los humos subidos, 2017). In Lima (Peru's capital which has comparable levels of air pollution) nearly 4,000 deaths per year can be attributed to pollution from vehicle emissions (Vidal, 2016). Improving air quality is particularly important for Arequipa because of its reliance on the manufacturing sector. Manufacturing workers tend to be exposed to higher levels of pollution from production activities, further increasing illnesses and lowering productivity (Hansen-Lewis, 2018).

Policy interventions

Arequipa's provincial municipality is seeking to improve air quality and consequently the population's health through efficient public transport and increasing pedestrian-focused areas. The provincial municipality is re-structuring the transport system to eliminate overlapping routes. Arequipa's rapid bus transport system follows the model set by Bogotá, Colombia's highly successful TransMilenio, a rapid transport system developed in the late 1990s. Policies include constructing a new rapid transport bus system, reducing the number of bus routes from 240 to 79 while connecting previously underserved areas of the city to the system, upgrading the fleet to newer, more fuel-efficient vehicles and integrating more pedestrian-focussed areas into urban planning (Municipalidad Provincial de Arequipa, 2017).

Ecosystem services and equitable economic growth

Managing air quality provides critical ecosystem services benefits, including reduced disease incidence, higher worker productivity and improved urban quality of life.

The Integrated Transport System (SIT) seeks to reduce the negative impacts of air pollution on public health. Bogotá's rapid transport system led to a 43 per cent reduction in SO2, an 18 per cent reduction in NOX and a 12 per cent reduction in PM pollution levels (Turner, Kooshian, and Winkelman, 2012). These three pollutants are associated with significant health damages, loss of life years and increased incidence of cardiovascular and pulmonary disease (WHO, 2006). Lower income populations tend to be disproportionately exposed to urban environmental hazards, and therefore may receive increased benefits from efforts to improve public health (Satterthwaite, 2003).

Arequipa's investments in transport systems generate co-benefits of increased mobility and accessibility. In addition to improvements in public health, the rapid transport system is expected to make Arequipa a more mobile and equitable city. High quality and accessible public transport infrastructure in Bogotá transformed transportation by increasing pedestrian transport (walking and cycling), reducing travel times by 32 per cent and decreasing the number of traffic collisions (Turner et al., 2012).

Challenges and limitations

Rapid transport systems are expensive and are both politically and technically challenging to implement. Arequipa has overcome political and financial barriers to implementing the SIT by coordinating with private sector transport providers and attracting international development finance. The planning process has taken more than 10 years and several elements remain under development. Investing in a new fleet of vehicles required significant public investment, as well as large loans, which may not be replicable for smaller or lower income cities. One quarter of the 600 million soles (approximately $180 million) needed to finance the entire project is provided by development bank loans (Del Mar, 2017).

Arequipa needs to address potential equity issues to avoid pricing out low-income populations and ensure that new services are accessible to all residents to promote equitable economic growth. Although the new bus system will be faster, more fuel efficient and have a higher carrying capacity, some residents may be priced out or have reduced accessibility because of the route reorganization. While the new routes have not been officially disseminated, there is concern that some areas will lose coverage from the reduced number of routes. Bus fares are also likely to increase. The rapid transport fare in Bogotá is 30 per cent higher than the average fare for non-rapid bus routes, and it is likely that Arequipa's new system will require similar increases (Turner et al., 2012). Other cities across the world, such as Bengaluru, lost opportunities for low-income users when the bus fares in the city increased (Baindur and Rao, 2016). Wassach Front, Utah, has avoided equity issues by implementing distance-based fares, which were found to benefit low-income and elderly residents (Farber, Bartholomew, Li, Páez, and Nurul Habib, 2014).

2.3 LOCAL FOOD PRODUCTION IN KINSHASA, DEMOCRATIC REPUBLIC OF THE CONGO

Kinshasa, the capital of the Democratic Republic of the Congo (DRC), is one of the fastest growing cities in the world. It is Africa's third largest urban area, with an annual population growth rate of 5.1 per cent. The city experienced mass rural to urban migration in the late 1990s and early 2000s following the enduring conflict in eastern DRC (World Bank Group, 2017). The influx in population in the early 2000s stressed the city's land resources, limiting access to food and economic opportunities.

The urban population's demand for food led to unsustainable agricultural practices, low yields and degraded land. Prior to the policy intervention in the early 2000s, urban and peri-urban growers in Kinshasa had limited resources and incentives to use sustainable agricultural practices, such as composting (Food and Agriculture Organization of the United Nations [FAO], 2010a). As a result, local yields and grower incomes were low, meaning that food supplies had to be outsourced. The city's population suffered from high food prices and high levels of chronic malnutrition. In 1995, more than 40 per cent of children under four suffered from chronic malnutrition, and more than 10 per cent from acute malnutrition (World Bank, 2005).

Policy interventions

In 2000, the Ministry of Rural Development with the strong support from the city government implemented the urban horticulture programme. Urban horticulture is the small-scale cultivation of food crops on urban or peri-urban lands.

What is Urban Horticulture?

Urban horticulture includes all corps grown for human consumption and ornamental use within and in immediate vicinity of cities. The crops produced include a variety of vegetables, cereals, flowers, ornamental trees, aromatic vegetables and mushrooms (Bon et al., n.d).

CONGO-DRC

Kinshasa received $10.4 million in funding and technical support from the FAO for a local urban horticulture initiative. The city invested this funding in irrigation infrastructure and flood control to secure clean water for growers, which reduced the growers' dependency on wastewater or water from polluted streams. The city also developed micro-credit and insurance programmes for more than 15,000 beneficiaries to reduce production risk, encourage more sustainable practices, and reduce the need for synthetic pesticides. This allowed growers to test and introduce more than 50 new plant varieties, as well as make and use bio-pesticides (Baudoin, n.d.).

The local government used a suite of land management policies to support urban livelihoods and earning potential for growers. Kinshasa introduced regulations to legalize urban horticulture and secure rights for informal growers. The city secured 1,500 hectares of land for urban horticulture. The central government supported local growers and increased yields by developing field schools for 4,500 farmers on sustainable practices. The local government also played a coordinating role by linking farmers to supply chains and markets to sell products (Baudoin, n.d.).

Ecosystem services and equitable economic growth

Encouraging sustainable land management and growing practices increased agricultural yields, resulting in income benefits for growers and food supply increases for the wider urban population.

Kinshasa's land management policies increased yields, connected producers to consumers and improved urban food security and health. After the programme was implemented, urban and peri-urban growers produced 28.6 kilos of vegetables per year per city dweller, which led to increased supply to urban supermarkets, restaurants and hotels, increased per capita daily intake of micronutrients, and reduced malnutrition. The policy created jobs and economic opportunities for both growers and in the local food supply chain (FAO, 2010b).

The urban horticulture programme created sustainable economic opportunities for previously informal workers with limited resources. It generated opportunities for the urban poor and women who previously relied on the informal economy to earn income and supported 45,000 jobs directly and indirectly (Baudoin, n.d.; FAO, 2010a). Annual farm income increased from $500 in 2004 to $2,000 in 2010 (FAO, 2010b).

Challenges and limitations

The urban horticulture programme in Kinshasa was successful in achieving its goals but provided a small-scale intervention that was specific to the local context. It is likely to be replicable in other cities, although urban horticulture cannot replace large-scale agriculture for large urban populations. The DRC still has significant hunger and malnutrition problems, with undernutrition estimated to cost the DRC 4.6 per cent of GDP in 2016 (World Food Programme, 2018).

Multiple local and national institutions supported the programme. In addition to significant technical and financial support from the FAO, Kinshasa received national support from the Ministry of Rural Development. Furthermore, the programme was implemented across four cities in the DRC and was overseen by municipal consultation committees chaired by city mayors. This situation ensured that the programme's objectives would be integrated into other urban planning and development initiatives (FAO, 2010a).

Small-scale interventions can be successful when tailored to the specific needs and resources of both the urban environment and local population. The programme was built around the specifics of the rural migrant influx from conflict. An informal growing sector already existed because rural migrants brought a specific skill set and background in agriculture (FAO, 2010a). Additionally, Kinshasa had land that could be set aside for horticulture. Urban and peri-urban land may not be available or suitable for horticulture in other cities.

2.4 THE "GREENING" OF CHENGDU, CHINA

China's urban population has rapidly grown over the past three decades. Sixty per cent of China's 1.4 billion residents live in cities and urban residents in China are projected to exceed 1 billion by 2030 (UN Department of Economic and Social Affairs, 2018; Woetzel et al., 2009). Many Chinese cities have rapidly urbanized at the expense of high-quality, functional urban green spaces. While total urban green space per capita is high in Chinese cities as compared to many cities in the developed world, green space in Chinese cities is often not functional, accessible, or equitably distributed. Park space per capita is much higher in the United States and Japanese cities than in Chinese cities. Shanghai has 16.2 per cent green space coverage, yet only 2 per cent of Shanghai's green spaces are park spaces (Wang and Liu, 2017; World Cities Culture Forum, 2018).

Chengdu has an urban population of 8.8 million, and is expected to grow to 11 million during the next 15 years (World Population Review, 2018). Despite nearly 2 per cent annual population growth since the early 2000s, the city has maintained and expanded its green spaces. This proactive management and enhancement of the city's green spaces for more than two decades has resulted in high levels of green coverage and accessibility to it for the city residents. Chengdu's focus on green spaces has contributed to a higher standard of living for residents and the city is consistently ranked as a top city for business development and foreign investment (Dutch Ministry of Foreign Affairs, 2017).

Policy interventions

Chengdu Urban and Rural Construction Commission developed two new greenway networks for pedestrian use and ecological protection. The expansion builds on and links the existing network of greenways to provide greater access to urban residents. Chengdu has made efficient use of limited land space by developing pedestrian-focussed green spaces that are narrower than traditional parks. These 'greenways' are corridors of green spaces that border highways and bodies of water. The Tianfu greenway programme is a citywide, three-tier greenway system that links the entire city. The 1,920 km district-level greenway will connect to more than 5,000 km of urban-level greenways, which connect to more than 10,000 km of community-level greenways. The full greenway will cover 14,000 km^2 and will serve multiple pedestrian-focussed functions (Shenggao, 2018). Greenways are more accessible, functional and efficient than large swathes of park space as they connect the pedestrian areas of the city.

Chengdu has used greenway construction to proactively protect important ecosystems. Greenways provide space to support life and create natural buffer zones to protect ecosystems. The Jinjiang Greenway was developed in 2017 to help protect Dujiangyan irrigation system, an ancient irrigation system and UNESCO heritage site, which is still in use today (Shenggao, 2018).

Ecosystem services and equitable economic growth

Chengdu's greenways support population and ecological health, making the city an attractive place to live and work.

The Tianfu Greenway has been designed as a pedestrian-focussed space for activities that improve the population's health and well-being. The Tianfu greenway provides space for recreational activities and physical exercise, encourages tourism and sightseeing, makes the city more aesthetically

pleasing, and seeks to transform pedestrian transportation by increasing access to public transport. These spaces provide opportunities for activities that provide physical and mental health benefits. As discussed in Section 1.1, by increasing the ease and accessibility of public spaces, greenways can facilitate increased use, physical activity, and overall health benefits.

Accessible and functional green spaces in Chengdu have contributed to the city's high liveability, attracting a productive labour force, business investment and tourism. Chengdu has been consistently recognized as a city with a high standard of living and high reported life satisfaction. The business environment and access to a productive labour supply have spurred economic growth and business development (Dutch Ministry of Foreign Affairs, 2017; Shelly Lin, 2018). The sightseeing opportunities also attract tourists and Chengdu's tourism industry is the second fastest growing in China (World Travel & Tourism Council, 2017).

Challenges and limitations

Despite Chengdu's emphasis on ecological conditions and high share of green space cover, air pollution in Chengdu is amongst the worst in China. Currently, Chengdu's particulate matter (PM) pollution levels exceed WHO standards nearly every day of the year. One of the proposed benefits of Chengdu's greenways is that they will help improve the city's air quality. However, the effects of green space on air quality are not large enough to make a significant difference in Chengdu's pollution levels. Chengdu has significantly more green space than Shanghai, and yet PM 2.5 levels in Chengdu were approximately 50 per cent higher in 2015 (Lowsen and Conway, 2016). Conversely, if the Tianfu Greenway achieves its objective of improving pedestrian access to public transportation, the greenways may help to reduce traffic emissions.

3 CONCLUSIONS

Themes emerge across all four cases that will inform and transfer well to similar policies in other cities. Although the four case studies take place in unique urban environments and examine different ecosystem services, common lessons arise relating to the challenges and the successes of the policy interventions.

Local governments can play a leading role in promoting better health outcomes by targeting ecosystem service management, although they face multiple constraints that can prevent them from doing so, including lack of financial resources, lack of political capital, limited institutional capacity, and limited understanding of the benefits that ecosystem services can offer. Healthy individuals are critical for a skilled and productive labour force and, therefore, underpin the local economy. Equitable access to ecosystem services supports health to the most disadvantaged or vulnerable residents, providing opportunities for generating more income. The case studies in Bengaluru and Arequipa demonstrate the impact that poor ecosystem service provision can have on cities, particularly on low-income residents. Polluted water and air increase disease incidence, reduce productivity and increase mortality rates. Bogotá's air quality management policy shows the potential for Arequipa to reduce these detrimental health effects. Moreover, Chengdu's proactive management of green spaces has increased opportunities for residents to undertake physical activity, promoting physical and mental well-being.

Policies manage and protect ecosystems by targeting pressures on the supply of and demand for ecosystem services. The four case studies demonstrate the use of multiple policy tools in successful ecosystem service management. Table 3 illustrates the policy tools available to local policy makers and the benefits and challenges of each tool.

Some interventions involve significant investment, but there are other, effective actions by local governments that do not require significant upfront expenditure. Although some aspects of the intervention in Arequipa involved upfront capital costs, other components of the policy were lower cost actions with large impacts. For example, Arequipa designed a new traffic system to reduce the number of vehicles and prioritize public and pedestrian transport. Similarly, the interventions in Kinshasa and Bengaluru involved a mix of high-cost and low-cost actions. Kinshasa created policies to support informal grower rights and connect growers to markets, improving the efficiency of supply chains. Bengaluru's zoning policies that restrict land conversion were free of initial expenditure.

Table 3: Brief analysis of Policy Tools

POLICY TOOL	EXAMPLES	PROS	CONS	CHALLENGES TO IMPLEMENTATION
Regulatory Standards Sets requirements on ecosystem use or activities that impact ecosystems	Regulations on chemical runoff to water • Vehicle emissions standards • Cost-benefit analysis for land conversion	Ensures a fixed level of ecosystem service protection is achieved	Inflexible, no incentives to improve quality above standard, may not be most efficient level of regulation	Likely to face political challenges and requires a high level of institutional capacity to monitor; health standards for pesticides, chemicals may face less political/industry resistance
Conservation Protects threatened land, water or forest space from human activity	• Protected water bodies, green spaces and forests • Construction/ development buffer zones • Integrated transport systems for air quality	Protects critical ecosystem services	Inflexible, may have social impacts or displace rural livelihoods	Requires a high level of institutional capacity to monitor and enforce; however, protected zones are technically simpler policies than regulatory standards
Market-Based Instruments Uses markets or prices to provide incentives for sustainable ecosystem uses	• Fuel taxes • Emissions cap-and-trade • Price water according to use value • Congestion zones • Payments for ecosystem services	Encourages efficient use of ecosystem goods or activities that impact ecosystems; can raise revenues and recoup investment	Trade-offs between efficiency and equity, may have distributional impacts	Requires high technical capacity to set prices/ caps at the efficient level; pricing goods may face resistance from the private sector and the larger public
Public Investment Government expenditure on systems for maintaining, monitoring or distributing ecosystem services	• Sanitation/sewage plants • Expand access to electricity grid • Invest in public transport and facilities • Invest in irrigation infrastructure	Expands ecosystem service access and builds critical infrastructure	High up-front cost, private sector may be better placed to provide goods in some cases	Difficult to finance for cities with limited resources and access to credit
Property Rights Assign rights to ecosystems or ecosystem services	• Assign or protect land, or forest property rights • Distribute water use rights	Can encourage conservation, maintenance and environmental stewardship	Property owner incentives may not align with public interest	Politically challenging to distribute rights to 'free' resources, establishing property rights may face resistance from individuals or firms
Behavioural Changes Intervention designed to encourage sustainable ecosystem use	• Labelling/ certification schemes • Education on conservation and sustainable practices	Induces people and businesses to participate in ecosystem service management without monetary or regulatory incentives	Behavioural changes may need to be complemented by other policy tools	Limited challenges to small-scale low-cost interventions

3.1 KEY FINDINGS FROM STUDY

Cities should employ or improve policies that manage the supply of and demand for ecosystem services. Many ecosystems, such as water and forests, face competing demands for provisioning services. To ensure a sustainable ecosystem, both the supply of the relevant ecosystem services and the demand pressures on them need to be carefully managed. For example, the Bengaluru Water Supply and Sewerage Board has implemented piping and metering systems that target both supply and demand management. The pipes more efficiently distribute supply and allow the Board to more effectively monitor and control demand for water. Another example is Malawi's Charcoal Strategy, which recognizes that a successful deforestation policy must both reduce demand for charcoal and tighten regulations on sustainable forest management.

Local government can coordinate international, national and local institutions, along with the private sector and residents. Local governments often have a good understanding as to which actors are relevant in the provision and management of ecosystem services and, therefore, can coordinate action effectively. In Kinshasa, for example, the local government effectively assumed multiple coordinating roles to implement the FAO programme. Local governments collaborated to integrate grower rights into urban planning, protect lands, and liaison between growers and markets to create a more efficient supply chain for ecosystem goods.

Local government coordination and advocacy on a national level is particularly important when there is an urban-rural divide. Often ecosystems are in peri-urban or rural areas, forcing the city to coordinate with the national government to manage the demands on ecosystems. In Bengaluru, the city was able to reduce the water stress for its growing population by advocating for increased water supplies from the Kaveri River, which was ultimately awarded to the city by the Supreme Court of India (Indian Environment Portal, 2018).

Local governments having access to initial external international or national financing is in most cases required for cities to overcome financial and capacity constraints. The challenges Arequipa has faced in developing and financing the rapid bus transit demonstrate how local government can act in a coordinating role to attract international donor finance and secure national government support. Bogotá's policy success can be partly attributed to the national government's support and coordination with cities to implement integrated transport systems. Bengaluru has also played a key role in attracting international donor finance from JICA to invest in water supply and sewerage infrastructure.

Conservation policies should be integrated into construction and development regulations that threaten ecosystems. Ecosystems may face pressure from multiple actors and fall under the purview of multiple local institutions. For example, a body of water is affected by fishing regulations, agricultural regulations, construction and more. Bengaluru's Development Government developed strict zoning policies of no-construction zones around urban bodies of water. Kinshasa and Chengdu set aside land for urban agriculture and green spaces, respectively. These policies may be politically challenging because they require local governments to forgo economic activity from construction and development, which generates tax revenues for the local government. However, the protection of ecosystems from land conversion can prevent long-term costs from degraded ecosystems.

Proactive management is easier and less costly than retroactively restoring an ecosystem or rebuilding supply systems. The Arequipa and Bengaluru cases illustrate the difficulties in developing and financing the construction of city-wide systems. Bengaluru's Development Government is currently restoring city lakes and groundwater that previously supplied the city's population. For Arequipa, the development of plans to reorganize an entire city's transport infrastructure has been a 10-year undertaking. Other cities could pre-empt these challenges by protecting ecosystems earlier in development by planning a low-emission and active transport-focussed transport system. Conversely, Chengdu's proactive management of green spaces has contributed to the city's economic growth and liveability.

3.2 CHALLENGES IN PROMOTING EQUITABLE ECONOMIC GROWTH

Improved access to ecosystem services for a population may come at the cost of access for some people within that population. Policies should be designed with these potential trade-offs in mind to ensure continued and equitable access to ecosystem services for all. Box 3 identifies scenarios where ecosystem service access may be reduced for some, and the strategies local governments can take to address equity concerns and promote equitable economic growth.

Making changes in access to some ecosystem services without addressing potential equity issues may negatively impact low-income or marginalized communities.

Market-based instruments to induce ecosystem conservation may prevent low-income residents from accessing ecosystem services. In Bengaluru, a stated goal of the new piping system is to reduce water lost to leakage or theft. Since many low-income and slum residents previously accessed water through illegal points, the new systems curtail access. This is also a potential concern in Lilongwe. The Charcoal Strategy intends to decrease the availability and increase the price of charcoal, which could reduce access to energy for low-income residents who are unable to access the electricity grid or switch to more fuel-efficient cookstoves.

Local governments could increase public provision of critical ecosystem services to address potential equity concerns.

The creation of new or improved access to ecosystem services can affect local property values. Arequipa is reorganizing the bus routes to increase efficiency and coverage. However, when Bogotá reorganized its bus system, rental prices increased by up to 22 per cent in areas with access to Transmilenio, which likely priced out existing low-income residents (Lincoln Institute of Land Policy, 2008). There is also a potential housing price increase in Chengdu for the areas around the new greenways. In a recent study of urban areas in the United Kingdom, the UK Office for National Statistics (ONS) found that housing prices within 200 meters of green spaces are up to 1.5 per cent higher, all else being equal (UK Office for National Statistics, 2018).

Local governments may subsidize affordable housing or ensure ecosystem services are provided in low-income and affordable areas.

Ecosystems do not operate in isolation, therefore, the provision of one ecosystem service may come at the expense of another ecosystem or service. For example, in Lilongwe, logging supplies such forest goods as charcoal at the cost of reducing forest regulating services and reducing water provision. In Bengaluru, there are trade-offs between water provision for different regions. Bengaluru was granted access to outsource water from the Kaveri River at the expense of local access to Kaveri water supplies. Conversely, there are some ecosystem services that are complementary which local government can use to support investment. As part of the FAO programme in Kinshasa to support sustainable growing practices, the city invested in new infrastructure to improve access to clean irrigation water. This situation allowed growers to reduce their reliance on wastewater, which improved yields and increased access to water services.

A well-designed policy intervention should consider potential complementarities or trade-offs between different ecosystem services and promote alternative livelihoods when displaced.

3.3 KNOWLEDGE GAPS

This final section lays out the knowledge gaps and suggestions for further research and exploration. This brochure attempts to bridge gaps in the conceptual literature on ecosystem services and equitable economic growth and provide practical policy tools for local governments. However, there are many areas of research where further knowledge would help local governments address challenges and create targeted and efficient policies.

Local governments play several known and important roles in providing ecosystem services; however, there is a lack of guidance on where local government capabilities are most limited and how to overcome these shortcomings. Further research should guide local governments to where they are best placed to intervene and when to engage with local actors, national governments or the private sector to provide ecosystem services. For example, it is unclear to what degree local government should play a role in rural and peri-urban ecosystem management. Urban demand for such ecosystem goods as water, forest products and land conversion can threaten rural ecosystems, and local governments need better guidance on managing urban demand.

Two key issues for effectively managing ecosystems are equitable access and short-sighted policy prioritization. Section 2.2 discusses this recurring challenge and future research should identify policies proven to overcome equity concerns. Moreover, there is limited guidance on how to prioritize ecosystem services at different stages of development and with different amounts of resources. For example, green spaces in urban areas provide significant health benefits to residents; however, clean water and affordable housing take priority in earlier stages of development, often at the cost of green spaces. Future work should aim to provide guidance on how cities in early stages of development can provide basic needs without compromising current resources or leaving management challenges for the future.

There are limited studies demonstrating direct, measurable impacts of ecosystem services on inequality, growth and poverty. Local governments would be better placed to invest in ecosystem services with more concrete information on the direct effects of ecosystem services on equitable economic growth. A challenge to local government actions is that there is more known about the costs than the benefits of ecosystem service management. Measurable benefits would aid in understanding the returns on investment to ecosystem service management.

This brochure has identified some of the key strategies, as well as policies and tools available for local governments to approach the challenges and opportunities of urban growth, equitability, and ecosystem services. Although this desk research could not collect or analyse any primary data, any further investigation of the subject should answer the pending questions identified and help to close the research gaps identified in the literature.

Pending questions on equitable economic growth:

- What is the timing of the returns on investment in ecosystem services?
- How can local government use cost-benefit analysis or appraisal tools to understand the opportunity costs of investing in ecosystem services?
- What is the relationship between ecosystem services and informal sector work? Do ecosystem services support growth of the informal sector, support movement out of the informal sector, or both?

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Annex

LITERATURE SEARCH METHODOLOGY

The literature review covered academic and policy literature. Five search strings were used, see Table 4, in the search engine Google Scholar, identifying 699 papers. The titles of all papers were reviewed for quality and relevance. From the initial results, 110 papers were selected for further review. After a more thorough evaluation of the abstracts for relevance to the theory of change, 38 studies were selected for inclusion in the review. Additional papers were selected from a manual review of the grey literature.

Table 4. The academic literature review resulted in identification of 38 pieces of relevant work

Theory of Change	Google Scholar Search String	Total Results	Title Check	Abstract Check
Local government roles	('local government' OR institution*) AND ('ecosystem service' OR 'ecosystem services' OR (ecosystem AND management))	55	11	2
Local government roles	(city OR urban) AND (plan OR planning OR policy) AND ecosystem	233	43	*17*
Ecosystem services in urban areas	'ecosystem service*' AND (city OR cities OR urban*) -case	235	26	*8*
Equitable economic growth	(city OR urban) AND (labour OR labour OR health OR employ* OR product*) AND ('ecosystem service' OR 'ecosystem services') AND -case	43	9	6
Equitable economic growth	('green space' OR 'greenspace' OR ecosystem) AND ('city' OR 'cities' OR 'urban*') AND (growth OR poverty OR economic)	133	21	*5*

Note: 'Total results' include several papers that were identified in multiple search strings. These duplicates were refined in the title check.

Source: Vivid Economics

Cities Alliance
UN House
Boulevard du Régent, 37
1000 Brussels, Belgium
www.citiesalliance.org

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