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UNU-IAS Policy Report

Cities, Biodiversity and Governance:
Perspectives and Challenges of the Implementation of the Convention on Biological Diversity at the City Level

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Cities, Biodiversity and Governance:
Perspectives and Challenges of the Implementation of the Convention on Biological Diversity at the City Level

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Foreword

The world is on the brink of a confounding crisis, which is brought about by a cumulating cascade of factors such as rapid changes in our natural climatic conditions, environmental degradation brought about by unsustainable production and consumption practices, depletion of environmental and biological resources, and a sharp decline in various indicators of well-being. While noting that it is our actions and, often times, inactions that have precipitated these impending crises, it is imperative that we the citizens of our planet should quickly come up with effective measures to mitigate the consequences and adapt to the changes in our natural ecosystems. This would require us to pay more attention to the enhancement and maintenance of natural resources and processes as well-functioning ecosystems with the diversity of resources contained therein so as to enable sustainable production, consumption, and related livelihood activities. Obviously, this would require inputs from various scientific, technological, and allied academic fields in terms of innovations and radically new ideas; from business communities by fostering best practices in the use and disposal of resources and transactions with others in the supply chain; from civil society in fostering responsible stewardship of natural resources and social concerns; and, from governments in terms of development and implementation of appropriate policies that are sensitive to the needs of the diverse sections of the society they govern. And the implications of actions by the various stakeholders need to be analysed in a timely, and, often, anticipatory manner, in order to draw attention to benefits and concerns related to decisions made at different levels.

In this context, I am pleased to state that the United Nations University Institute of Advanced Studies (UNU-IAS) has been actively contributing to advancing awareness of various concerns related to biodiversity and ecosystems among a variety of stakeholders. Our research has straddled areas in the interface between the natural world, human aspirations, and well-being consequences. We have focused especially on the notion of fostering equitable transactions between different stakeholders over the years.

This year, we are launching several new publications that are of particular relevance to the Conference of Parties (COP) to the Convention on Biological Diversity (CBD). The publications examine a diverse set of topics that include, among others, the effectiveness of implementation of national biodiversity strategies by different countries; the governance and management of bio-cultural landscapes such as *satoyama* and *satoumi*; the status of biodiversity in the South East Asian region; the impact of emerging biofuel technologies to the provision of ecosystems services; scoping the role of urban centres in green development; and underscoring the need for bridging epistemological divides between modern and traditional world views in securing development goals and conservation priorities – all of which are topics that are of keen import to the CBD's objectives as well as to the broader sustainable development agenda. I expect each of these publications will provide a basis to inform discussions and facilitate designing of implementable policies in their related areas.

I would like to take this opportunity to thank our partners and collaborators for their support in our research and capacity development activities. There are several expectations from the outcomes of this COP, and we hope to continue our work in the future informing and providing relevant inputs to policy-makers, academics, and practitioners alike.

Govindan Parayil,
Director, UNU-IAS and Vice-Rector, UNU
October 2010

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Executive Summary

City governments can contribute more to implementing the Convention on Biological Diversity (CBD), as the 2010 target to reduce the rate of biodiversity loss set by governments during the World Summit on Sustainable Development in 2002 is not being achieved. The necessity for city governance to tackle the challenges of biodiversity loss has increased as urban populations have grown enormously in the last decades, particularly in developing countries. The way cities are designed, planned, and governed influence the amount of their direct and indirect impacts on biodiversity.

However, the process of interaction between cities and biodiversity is still not well understood, both in theory and in practice. This gap needs to be closed if we want to make progress on the implementation of CBD since more than half of the world's population lives in cities today. As cities are the consumption centres of world resources, and this proportion will grow in the future, there is no time to lose.

This report analyses the general relationships among cities, local governance, and biodiversity. Initially, it will examine the relationships between cities and biodiversity by looking at the major influences cities can have on biodiversity loss or on conservation within and outside the city boundaries, as well as the benefits of biodiversity conservation for cities, such as the provision of ecosystem services. The report then moves to understand the main instruments and governance mechanisms that exist, allowing cities to effectively implement the directives of CBD.

Cities are some of the biggest beneficiaries of biodiversity and ecosystem services, as citizens and economic activities depend on those services. However, their involvement in the CBD process is still limited as compared to their potential contribution and amount of benefits they could gain from biodiversity. There are many conceptual underpinnings and governance obstacles to overcome, and we need to create new and adapt existing conservation strategies, as well as city planning and management instruments to deal with biodiversity properly.

Nevertheless, the interest of cities in the biodiversity agenda is moving fast, and there are a lot of opportunities to bring cities to be effective actors in the implementation of CBD. This requires a large effort for collective action to create better governance mechanisms. Good governance at the city level, which indeed can deliver an effective implementation of CBD, depends on governmental and non-governmental actors, not only from one city but from other levels of governments, including international organisations, and of course the cities themselves. The key point in the governance structure is not only the capacity of individual organisations but the strength of coordination among them.

Urbanisation creates new challenges for biodiversity conservation. As a large part of the world's population gradually moves from rural to urban areas, there are changes in the link between human activities and biodiversity, and consequently in the way we should think about biodiversity conservation policies. Scarce attention has been given to understanding how to make cities more biodiversity-friendly, not only within, but particularly in the faraway places.

Understanding how cities can create better governance mechanisms to effectively support the preservation of biodiversity within and beyond city boundaries is the key to implement the directives of the CBD. The actors, instruments, and processes that should be in place are still not completely understood enough to move the city and biodiversity agenda forward. This report argues the need to study the conceptual underpinnings of the relationships among city, governance, and biodiversity to create the basis for policies at the global, national, and local level, as well as provide some practical insights on the way to move the biodiversity agenda in cities forward.

1. Introduction: How are cities related to biodiversity, particularly with regards to the implementation of CBD?

The Convention on Biological Diversity (CBD) was agreed by world leaders in the Earth Summit in Rio de Janeiro, Brazil, in 1992. It has three broad (and ambitious) objectives: the conservation of biological diversity,[1] the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of its genetic resources. The main component for preservation of biodiversity is the habitats where the species live. As such, the progressive degradation of ecosystems is the main threat to biodiversity. The 2010 target to reduce the rate of biodiversity loss set by governments during the World Summit on Sustainable Development in 2002 is not being achieved (SCBD, 2010).[1]

The way cities[2] develop definitively influences biodiversity conservation and the distribution of its benefits among different groups in society. The discussions at the on CBD even recognised the importance of involving cities and local governments in its implementation at COP 9 in Bonn, held in 2008. However, the process of interaction between cities and biodiversity is not well understood, both in theory and in practice. This conceptual gap needs to be closed if we want to make progress on the implementation of CBD since more than half of the world's population lives in cities today. As cities are the consumption centres of world resources, and the number and proportion of urban dwellers will grow in the future, there is no time to lose. Moreover, key decision-makers, whose decisions affect biodiversity, live in cities. Many decisions made by city inhabitants directly affect biodiversity, both in the city and beyond. The lack of a conceptual understanding of the city-biodiversity interaction hinders the development of effective governance mechanisms to manage the impacts of the cities on biodiversity and vice-versa. To start this discussion, we pose several fundamental questions to be addressed in this report.

Firstly: How do cities influence biodiversity? There are three levels of interaction between cities and biodiversity. Cities and biodiversity interact within the urban fabric. There is a variety of species living within city boundaries, the so called *urban biodiversity*, includes those species well-adapted to the urban life, such as rats or pigeons. Urban biodiversity can influence the form of a city as well as its inhabitants. The development of a city also directly impacts urban biodiversity and how it is distributed among the different groups within the population. Urban biodiversity seems to be the most researched area so far.

Cities can also have a huge impact on the biodiversity in their nearby surroundings, what we call here *regional biodiversity influence*. City activities generate sewage, solid waste and air pollution, which generally impact the biodiversity in the nearby areas, such as rivers and marine or terrestrial hinterlands. The expansion of cities, both spatially and economically, also has tremendous impacts on the surrounding areas. Moreover, a lot of resources needed in a city come from its surroundings (materials, water, food, etc).

[1] Target: "to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on Earth" (SCBD, 2010, p.9).

[2] There are many definitions for cities. In this report, we will use a broad definition of a city as a geographically limited area dominated by a mostly urban landscape, which can include a part of, one or various administrative units. In certain contexts in the report, the word city is also used to represent its inhabitants or governments. We will assume in most of the cases that cities are sub-national governments, as there are a limited number of city states, but most of the text can be applied to city states as well.

Additionally, cities consume large amounts of resources coming from faraway places, influencing the biodiversity of those places, what we call here *global biodiversity influence* (related to the green agenda of cities). For example, some of the unregulated timber consumed in cities around the world comes from trees of distant forests such as the Amazon or Borneo. The high demand for marine species, such as blue fin tuna in some Asian cities, poses a threat to those species. These varying levels of influence enabled by globalisation in many markets means it can be hard to precisely identify the impact of a given city in different regions across the world.

Secondly, we consider the inverse question to that above. Namely, how does biodiversity influence cities and city dwellers? Biodiversity provides a series of benefits (commonly termed ecosystem services) to cities ranging from the more directly perceived such as water supplies and recreation facilities (parks) to less directly tangible effects of large biodiverse areas such as plants which may help cure diseases or help with long term climate stability. The services biodiversity provide to cities are important to city planning both in terms of design, as well as convincing citizens and policy-makers in cities about the importance of implementing the CBD. However, those services, and the costs to maintain them, are not distributed evenly among different groups of citizens within the same city, among cities, among urban and rural citizens, and among countries. Understanding conceptually the main benefits brought by biodiversity to cities can help direct policies.

Thirdly: Which biodiversity should we preserve? Cities are found in all natural environments and as such, they are subject to and exert different levels of influence on biodiversity. Urban biodiversity may not accommodate the native biodiversity of the surroundings as this may not be compatible with the urban environment or the demands of city dwellers. For example, Manaus in Brazil is surrounded by the Amazon jungle, but its citizens do not expect to share their daily life environment with local fauna, such as boas or piranhas. Some native trees may not be suitable for the urban environment because of natural limitations (e.g., need for space, clean air, water or certain species) or due to management constraints (e.g., frequent need of trimming or cleaning beyond a city's reasonable capacity). Indeed, the removal of some species from cities, like mosquitoes, can add a better quality of life for urban citizens. Therefore, the role of cities to foster biodiversity will vary according to its individual context. For one city, the urban biodiversity may comport with the surrounding biodiversity and the city can leave a corridor for this biodiversity. In this case, the urban fabric would be intertwined with the local habitats. For another city (like Manaus), this may not be possible, or at least not in regards to some species.

Cities also affect other aspects of biodiversity mentioned in the CBD. Cities can be a threat to biosafety, as many genetic experiments or exotic species exist in cities, or more importantly, cities can be an easy route to the introduction of those species in the wild environment. The uncontrolled spill of some of those could cause problems to the urban biodiversity or biodiversity as a whole.

Thus, the governance of cities - the way they are designed, planned, and managed - is important to determine the outcomes of their influences on the biodiversity at the different levels. Understanding how cities can create better governance mechanisms to effectively help in the preservation of biodiversity is the key to implement the directives of the CBD. The actors, instruments, and processes that should be in place are still not completely understood. This report aims to shed light on the conceptual underpinnings of the relationships between city, governance and biodiversity to create the basis for policies at the global, national, and local level, as well as provide some practical insights on the way to move the biodiversity agenda in cities forward.

We do this by attempting to understand the relationship between cities and biodiversity and by looking at conceptual and practical aspects of this interaction. The report begins by discussing urbanisation and city planning in the context of the environment and indirectly, biodiversity in section 2. Section 3 then moves to understand how cities benefit from and is affected by biodiversity and ecosystem services. Section 4 examines the main instruments for making cities and biodiversity conservation compatible. The final section in five analyses the governance of biodiversity and the role of cities in the implementation of the CBD, looking at the challenges and opportunities that lie ahead.

2. Processes of Urbanisation and Biodiversity

Urbanisation creates new challenges for biodiversity conservation. As a large part of the world's population moves from rural to urban areas, there are changes in the link between human activities and biodiversity, and consequently in the way we should think about biodiversity conservation policies. For example, human activities in rural areas tend to pose more direct threats to ecosystems by imposing land-use changes to permit the expansion of agricultural land. Urbanisation poses a relatively small scale impact in terms of direct land use for urban infrastructure; however, cities depend a lot on outside resources for its activities and needs, posing indirect threats to the world's ecosystems. This is exacerbated by the easy flow of goods and services, often without proper account of the environmental externalities. Thus, in an urbanised world, understanding and controlling the indirect impacts of cities is one of the major challenges.

2.1 A brief history of cities in the environment

2.1.1 Past

Since the Neolithic revolution and the emergence of the earliest cities in Mesopotamia around 4000-3500 BC, the clustering of human beings in settlements of increasing size, density, and complexity has been perhaps the central organising feature that characterises human civilization. The reasons as to why mankind adopted this mode of organisation are disputed but many scholars point to the development of sedentary agriculture as a factor, which facilitated settlement and urbanisation to begin. Hence, it may be said that from the very outset, the history of human civilization may be characterised as one of managing ecosystems to provide a surplus as some areas may not be able to access all resources necessary within its boundaries. Whilst cities have grown to encompass an ever growing array of human endeavours, which prima facie appear to be testimony to the primacy of humans, one inescapable fact is that their existence is based on appropriating ecological goods and services from outside of its boundaries.

The industrial revolution began the process of accelerating urbanisation that has touched almost every part of the world, and has been responsible for the pre-eminent societal transformation of the last 200 years. Industrialisation also increased enormously the scale and speed cities affect biodiversity. However, when set in the context of the history of human societies, the magnitude of this change is quite astounding, not just in scale but in speed. Although cities are a large and highly visible expression of human activity across the planet, it is worth noting that given the large number of people and economic activities they accommodate, it is arguably the most efficient means of spatial organisation yet devised. As such cities, given their history, find themselves in the paradoxical position of consumers of vast amounts of ecological resources but also playing a key role in their sustainable management given their central reliance on these resources (Rees and Wackernagel, 2008).

2.1.2 Present

Cities are human-dominated ecosystems, which have become "dense nodes of energy/material consumption and residuals production"; "urban" population depends on "flows and services provided by nature" more than ever, and the patterns of consumption in "high-income urbanised countries" cannot be sustained for a global population (Rees, 1997). However, the impacts of cities on biodiversity are both direct and indirect and can vary over a wide spatial scale. As with biodiversity, the distribution of people across the Earth's surface is not an equal one. People preferentially live at lower elevations (and by association nearer coasts) than at higher altitude and prefer temperate to tropical zones (Cohen and Small, 1998). The distribution of human population is shown in the top panel of Figure 1 (in the inside back cover, p.59), with its urban expression in the form of satellite observed night-time lights in the lower panel. The world's most endangered regions are overlaid on both maps to show the proximity of these areas to both major urban areas and zones of high population. We see that many biodiversity hotspots occur in developing countries which are currently experiencing high levels of urbanisation. Distances between protected areas and cities tend to decrease over time and most of the protected areas affected by urbanisation are located in medium and low income countries (Mcdonald, et al., 2008).

Split by region, Africa and Asia remain predominantly rural with urbanisation levels of 39 and 41% respectively. As such, these two regions have the greatest potential for growth in urban population and by 2050, 63% of the world's urban population is estimated to be in Asia and one-quarter in Africa. However, in a world where urbanisation grows apace, it is tempting to make the false assumption that all cities are growing and this it is a one-way process. Growth rates differ markedly not just by region but also by city size. The UN-HABITAT reports that the urban population of the developing world grows at a rate of five million people per month (UN-HABITAT, 2008). This is ten times the rate of the developed world urban expansion. Much of the urban growth in developing country happens informally. Although the percentage of population of developing regions living in slums conditions fell from 47% to 37% between 1990 and 2005, the rapid urbanisation may change this trend (UNO, 2007). On the other hand, cities in the developed world will expand primarily through in-migration rather than natural increase. The population of 46 countries including many major economies (Japan, Germany, and Italy) is expected to be smaller in 2050 than they are now. This will inevitably be reflected at the city-level. Whilst urban growth attracts most attention in the urban literature due to the enormous pressures of urbanisation on the developing world, there is the counter phenomenon of shrinking cities, mainly in the developed world, which also has a bearing on biodiversity, as this could be an opportunity to rethink biodiversity in the city landscape.

2.1.3 Future

The regional levels of urbanisation referred to above bring to light another more important trend in contemporary urbanisation; that of the rise of the city region. Although conurbations and megacities (cities > 10 million people) exist in many countries, the development of dense and efficient transportation links not just within but between cities has facilitated the rise of whole city regions, which are vast urban corridors, home to tens of millions of people. Several of these exist not just in Europe and North America, but are also emerging throughout Asia along with Brazil linking several cross national borders (Florida, et al., 2008). The largest, Hong Kong-Shenhzen-Guangzhou in China, is a conurbation of about 120

million people (UN-HABITAT, 2010). Such regions concentrate economic and intellectual resources and in time, may even compete economically and politically with nation states. The fact that more than 50% of people live in cities is significant in the sense that humanity can be said to now share an urban experience. More people know what it is like to live in a city than those who do not. Whilst this poses a challenge in terms of consumption, the dense concentration of people nonetheless facilitates the production and dissemination of ideas and social interaction, which is crucial to moving forward on tackling issues related to governance of the commons.

As such, the merging of cities into larger more pervasive urban landscapes poses both threats and opportunities. (Bio)diversity is seen as a precondition for the resilience of ecosystems (Elmqvist, et al., 2003), including urban agglomerations. Urban health, for instance, as much as ecological health, refers to the capacity of a system to recover and self-renew; adaptation refers to the ability of an organism to change "the state or structure of the system, the environment, or both" (Sontag and Bubolz, 1996). Because land use change is a main cause for the decrease of biodiversity, massive land consuming (sprawling) urbanisation requires the concomitant designation of preservation areas. Currently 29[3] out of 825 eco-regions are more than 1/3 urbanised (Mcdonald, et al., 2008). Seen purely from the perspective of spatial expansion; of the 779 rare species with only one known population, 24 are expected to be affected by the growth in urban areas by 2030.

In the future, changing environmental conditions will affect millions of people worldwide and can lead to massive forced migration (e.g., Cernea, 2000; Cernea and Guggenheim, 1993; Courtland Robinson, 2003; McGranahan, et al., 2007). With rapid urban development and fundamental land policy reform during the past three decades, issues of climate change and biodiversity have not received the necessary attention by many governments. For example, in China, temperatures have risen more than the global average over the last 100 years and the country has already suffered billions in economic loss with increasing frequency of extreme weather events, such as droughts and floods (for recent examples, see Branigan, 2009; Qian, 2009; Xinhua News Agency, 2009a, 2009b). By 2020, it is estimated, the urban population might comprise 60% of the total population in China (Yusuf and Nabeshima, 2008). Many of China's growing cities are located in low elevation coastal zones, hence particularly threatened by climate change related issues, like e.g., sea level rise (McGranahan, et al., 2007). Biodiversity enhancing initiatives could help to build resilience in vulnerable areas, such as on riparian or coastal areas, as well as mitigate the effects of climate change.

2.2 Converging views in the movements for biological conservation and urban planning

Urbanisation processes *per se* have been politicised in the past, and the views on what constitutes "sustainable" urban forms differ. The various definitions of "urban" influences the patterns of urbanisation, which in turn affect ecological processes (McIntyre, et al., 2000). Urbanisation can be defined as an ecological and social phenomenon similar to a "disturbance" comparable to fires or floods. However, with the shift in ecology toward

[3] Home to 213 endemic terrestrial vertebrate species.

a non-equilibrium paradigm recognising system openness, disturbance as part of system dynamics, and succession and adaptation as highly unpredictable, urban ecosystems have received renewed attention (Pickett, et al., 2004).

Historically, the modern ideas and movements of urban planning and biological conservation came from very different intellectual traditions and have had very different practical applications over time. This has made it difficult to think about both concurrently. However, as movements and concepts change over time, both movements may now be converging with some common grounds and principles, as we can also see from the growing number of urban ecologists and green urbanists, which could help to make both movements compatible in the near future, both in theory and practice.

The modern policies for biological conservation have evolved from promoting a complete separation between humans and nature to a larger integration of humans and human activities as part of the nature and conservation process. Even though initiatives for biological conservation, such as the creation of protected areas, have been carried out for centuries (Ceballos-Lascurain, 1996), the concept of promoting biological conservation has a landmark in the idea of modern natural parks, starting with the establishment of Yellowstone National Park in the USA in 1872. The idea of the park, separating humans from nature, is expressed by the word of early modern American conservationist John Muir: "Our wild mountains should be saved from all sorts of commercialism and marks of man's work" (Nash, 1978).

For over a century, the spirit motivating Yellowstone has inspired the creation of protected areas for recreational, scenic, and economic values throughout the United States and many other countries. The establishment of those areas is still necessary to preserve most of our biodiversity. However, when the conservation movement expanded to developing countries, many protected areas were created regardless of the needs of local people. Often these people had inhabited the region for generations, sometimes before formal states were established. Lines for conservation areas were drawn without considering the fact that people lived in those areas or used them for cultural, religious, or subsistence activities, such as hunting, fishing, and collecting fruits and firewood (Diegues, 1994; Rawat, 1997). In the last four decades, as many developing countries have expanded their protected areas, such moves have provoked local conflicts (Tisdell, 1995; Fiallo and Jacobson, 1995). Thus, policy-makers, conservation advocates, and academics have realised that local people should be part of any conservation strategy, and are fundamental to their design and implementation of conservation actions, so conservation should take into account local people's cultural and social values and economic interests (MacKinnon, et al., 1986; McNeely, 1992; Ceballos-Lascurain, 1996; Albers and Grinspoon, 1997). As the urban population has grown dramatically, there is an increasing need to understand how to integrate the needs of urban citizens into conservation strategies, as they should be a part of, not apart from nature.

On the other hand, the city planning movement, moved from separating the different functions in different spaces to a more diverse land use in the same space, including more bio-diverse landscapes. The modern concept of urban planning started with the creation of the Garden Cities (Howard, 1902) in the UK at the end of the 19th century. The idea was to design well planned urban environments to move people away from the increasing polluted and congested industrial cities and bring them closer to the rural environment and nature. The functions of the cities would be divided to allow a clear distinction among the different

activities of the cities. Residential, industrial, and commercial uses had to be separated. As the city planning field evolved in the 20th century, this idea of functional division (industrial, residential, etc.) of the cities was crystallised by planners like Le Corbusier and Lucio Costa in cities such as Brasilia. Biological conservation was addressed only by the introduction of green areas, mostly urban parks or green belts, having their main function as providing recreation to urban citizens. However, this planning tradition was challenged both from those that criticise the functional division of the city and those that advocate for a more process oriented, bottom-up input in the planning process (Davidoff, 1965).

As urban planning moved to the 21st century, plans and planners have indeed become more process oriented and have increasingly become aware of the sustainability challenges. The idea of having cities divided by functions created problems, like urban sprawl and car-dependent and climate-unfriendly cities, and has lost ground recently to a more multi-functional urban areas, multi-use land use, compact cities, such as those in the *smart growth* (Bullard, 2007) and *new urbanism* movement (CNU, 1996), which are argued to be more environmentally and people-friendly[4]. New uses that are not traditionally from cities, such as urban agriculture, has gained attention recently as well as a way to provide green spaces, food security, jobs, and climate mitigation from the transport of agricultural products. The inclusion of biodiversity concerns in city planning is still in the early stages of conceptualisation, as for a long time green areas and biodiversity conservation were interchangeable concepts. However, there is today an intellectual space to include biodiversity issues when thinking about urban landscapes and multi-uses and should definitively be introduced in discussions and planning processes.

Thus, as biological conservation has moved to become more "people-friendly", urban planning has become more "biodiversity friendly". The two movements which seemed far apart in the past, now include some ideas that have allowed them to come closer to each other. Even though those movements still have to evolve to fully incorporate each other's ideas, this convergence now allows us to discuss both concepts together. Furthermore, this could help to find a combination that moves the city and biodiversity agenda forward on both sides (urban planning and biological conservation) and to make cities a major implementation agent of the CBD.

[4] "…urban places should be framed by architecture and landscape design that celebrate local history, climate, ecology, and building practice." (Charter of New Urbanism, CNU, 1996)

3. Linking Cities and Biodiversity

Biodiversity is considered an underpinning element of ecosystems and as such the key determinant of ecosystem functioning. Several of the services provided by ecosystems[5] which contribute significantly to human well-being are direct products of biodiversity; therefore, biodiversity loss can, in one way or another, affect almost all services provided by ecosystems (MA, 2005).

3.1 Biodiversity and urban well-being: provision of ecosystem services

Urban residents benefit directly or indirectly from a multitude of ecosystems services that range from provisioning services (e.g. food, fuel, water) to regulating (e.g. climate and air pollution regulation, waste assimilation, flood and fire regulation) and cultural services (MA, 2005; TEEB, 2010). Indeed, urban systems are net consumers of ecosystem services considering the fact that there is a much higher net inflow of ecosystem services to cities. City dwellers are usually more aware of ecosystem services that are located within cities such as recreation and cultural services from parks or potable water from rivers and lakes. Stockholm's residents benefit tremendously from ecosystem services provided by the parks and water bodies situated within the city (Bolund and Hunhammar, 1999). Such services include air pollution regulation, micro-climate regulation, noise reduction, rainwater drainage, sewage treatment, and numerous recreational and cultural services (Ibid). In the same manner, food and other ecosystem services (e.g. sanitation, nutrient recycling) can be provided through urban agricultural activities particularly in cities situated in developing nations (e.g. Pearson, et al., 2010; Eaton and Hilhorst, 2003).

However, the fact remains that the contribution of ecosystems to the well-being of urban residents is much higher if the services provided by ecosystems adjacent to cities or very distant to the city itself are considered.

For example, ecosystem services such as food, medicine, and other non-timber forest products can be provided by ecosystems that are adjacent to cities (e.g. FAO, 2008; Mwampamba, 2007; Tacoli, 2006; Dietmar, 2005; Midmore and Jansen, 2003). Additionally, most major cities are located within the catchments of major rivers and lakes that can provide ecosystem services such as potable water, water purification, food and energy (from upstream or downstream hydro-electrical facilities). It is no wonder that coastal and inland water ecosystems are on average more urbanised than the other systems assessed in the Millennium Ecosystem Assessment (MA, 2005).

The appropriation of ecosystem services from distant ecosystems is mainly associated with urban production and consumption processes and trade (MA, 2005) (also refer to Sections 3.3.2 and 3.3.3). Generally speaking, the richer a city is, the higher its appropriation of natural capital and particularly the appropriation of ecosystem services from faraway ecosystems tends to be (e.g. Folke, et al., 1997). For example, urban residents are benefiting tremendously from climate regulation services offered by distant ecosystems, e.g. through the removal of CO_2 from the atmosphere.

[5] Ecosystem services are defined as those "...benefits people obtain from ecosystems" (MA, 2005: 27).

3.2 Major drivers of biodiversity loss and its links to urban activity

Urbanisation can contribute significantly to biodiversity loss and degradation (McKinney, 2002; Sukopp, 2004; Whitford, et al., 2001). In addition to the impacts within the city, wider impacts at regional and global scales are also likely. According to the CBD (2007), most of the fundamental threats to biodiversity loss are related to public services and instruments, of which city governments are directly responsible.

Considering the importance of ecosystem services on the well-being of urban residents[6] and the fact that biodiversity directly and indirectly provides numerous ecosystem services, it is important to understand how urban activity can affect biodiversity at various spatial scales. According to the MA, the major human drivers of biodiversity loss are habitat destruction, pollution, the introduction of alien species, overexploitation, and climate change. All of these drivers can in one way or another be linked to urban activity. The remainder of this section unravels how urban activity can influence the main drivers of biodiversity loss.

3.2.1 Habitat destruction

There is significant evidence in the academic literature regarding the impact of habitat destruction and land use change on biodiversity inside urban centres and along urban-rural gradients (Alberti, 2005; McKinney, 2002). At the same time, consumption activities within cities have been blamed for habitat destruction in peri-urban areas and distant ecosystems, including land clearing for the production of food and an array of consumer goods such as furniture.

3.2.2 Pollution

Pollution can affect biodiversity in and around cities. There is significant evidence which links air pollution to the loss of biodiversity. For example, more than 1,300 species were threatened in Europe alone due to acid deposition in 1990s (Tickle, et al., 1995). Water pollution can also significantly affect biodiversity in coastal and inland water ecosystems through toxicity and eutrophication among other processes (MA, 2005; SCBD, 2010). It is interesting to note that the main water pollutants can be either directly emitted by urban areas (e.g. sewage, industrial activity) or indirectly (e.g. run-off from agricultural and mining activities, ship discharges due to increased trade) and affect extended areas and aquatic ecosystems.

3.2.3 Introduction of alien species

There seems to be a greater prevalence of introduced species across a rural-urban gradient towards the city centre (McKinney, 2002). This implies the existence of "disturbed" habitats that provide opportunities for non-native species to find niches and compete with native species and potentially turn into invasive species, in the city and beyond, making the city a hub for the introduction of alien species in a region or ecosystems. For example, ornamental plants can use different characteristics of the urban system to disperse within it and outside

[6] Biodiversity is increasingly considered to have an intrinsic value. As a result, more voices are currently articulating that biodiversity should be conserved irrespective of its contribution to human well-being (i.e. irrespective of the ecosystem services it provides).

of it (Säumel and Kowarik, 2010; Gulezian and Nyberg, in press). In South Africa, more than 300 plant invasive species cause diverse kinds of problems (Bromilow, 2001). In certain cases, these non-native species have become invasive after their planned or uplanned introduction into cities. Two famous cases are those of the European starling and of the water hyacinth. European starlings were introduced in America in the 1890s. From an initial population of 40 pairs in New York's Central Park, it currently numbers around 200 million individuals across the US and is competing with native bird species (MA, 2005). The water hyacinth was introduced as a water purification mechanism and as a pond ornamental plant but it has taken over whole freshwater ecosystems and is competing with local flora and fauna for oxygen often, causing asphyxiation and massive population die-offs (MA, 2005).

3.2.4 Overexploitation

An example of biodiversity overexploitation is the case of bushmeat overconsumption in urban poor and rural households in Africa. Bushmeat is a significant component of the human diet around the Congo Basin with its demand having grown significantly due to the increasing urban consumers and even illegal exports (Kinver, 2010). This demand is resulting in a defaunation ring around population centres (in peri-urban areas), and may be driving unsustainable levels of hunting in more distant areas (Wilkie and Carpenter, 1999). A second example of the overexploitation of biodiversity is the trade, in most cases illegal, of wild animals and plants for pet, food, ornamental, medicinal, and other purposes. In several cases, the illegally traded animals and plants can be endemic (Flores-Palacios and Valencia-Diaz, 2007) or threatening[7]. It has been suggested that it is urban demand associated with the generally higher incomes of urban residents (and not local demand), which is driving this wildlife trade in several parts of Asia (World Bank, 2008) and possibly around the world.

Box 1: Food consumption and long-range effects on biodiversity

Whilst much attention is devoted to the capacity of cities to preserve and enhance biodiversity within their borders, it must also be realized that a cities appropriate resources from outside their borders in the process of catering to the needs and desires of its citizens. One of the most obvious exurban biodiversity effects of urban development and rising affluence is in the domain of food. Cities in both developed and developing countries exert this pressure.

In general, this can be conceived of as the increase in meat products. This has lead to wide scale deforestation to make way for ranches and soya plantations which provide feed for increasing numbers of cattle. The efficiency of commercial fishing has the potential to decimate fish stocks and several have been declining for many years. The increased consumption in species like tuna is raising fears of collapse of the bluefin tuna in the northeast Atlantic and Mediterranean Sea (MacKenzie, et al., 2008)

Rare and endangered species are also at risk through the bushmeat trade. In Vietnam for instance, rising affluence of a growing middle class in urban areas is increasing demand for domestic wild animal products. This new market has shifted the consumption of wild species from what was previously a subsistence activity to an almost entirely a commercial one (Drury, 2009). The consumption of wild species is also finding a wider market in many European and Asian cities for both food and traditional medicinal uses. A recent study estimates 5 tons of bushmeat per week is smuggled into Paris-CDG airport. The species discovered include CITES-listed species including primates and crocodiles. Some of these meat products can fetching 20 times the price between Africa and Europe (Chaber, et al., 2010).

[7] Refer to Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) which lists approximately 800 such species <http://www.cites.org/eng/app/appendices.shtml>

Currently the illegal transit of wild species is a low priority with customs agencies since most are focused on, and incentivized to intercept drugs. Improved methods of detection and procedures to easily identify species which are seized are also required; the use of genetic barcodes is a promising development in this area (Science Daily, 2009). Ultimately education and cultural change are the mechanisms by which the demand for rare species will wane. The evidence from Vietnam shows that there is a strong connection to status in consuming wild species since it is perceived as rare, precious and of high quality. Substitution to farmed equivalents of wild species is unacceptable or may even intensify demand for bona fide wild species (Drury, 2009).

Sources:
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MacKenzie, B.R., Mosegaard, H., and Rosenberg, A.A., 2009. Impending collapse of bluefin tuna in the northeast Atlantic and Mediterranean. *Conservation Letters*, 2(1), pp.26-35. doi: 10.1111/j.1755-263X.2008.00039.x.

Science Daily, 2009. First DNA Barcodes of Commonly Traded Bushmeat: New Tool for Tracking Global Trade in Wildlife. September 8th 2009. [online] Available at: <http://www.sciencedaily.com/releases/2009/09/090904165105.htm> [Accessed 12 July 2010].

3.2.5 Climate change

Climate change is considered to be an emerging threat to biodiversity (Thomas, et al., 2004, IPCC, 2007b). Urban activity is directly and indirectly driving changes in the global and local climate through the emission of GHGs, the direct and indirect land use change and other processes (IPCC, 2007c). The urban heat island (UHI) effect is one phenomenon that shows how urban activity can affect the local climate. Studies have revealed the mechanisms of UHI and have suggested that the impacts of global climate change can be exacerbated in areas that experience UHI effects (Rosenzweig, et al., 2005). Aspects related to urban biodiversity such as prolongation of vegetation time, early flowering of plants, or increased frequencies of bird broods have been connected to the UHI phenomenon. For example, floristic maps of cities have shown a close connection between species distribution and warmer cities (Wittig, 2004). Likewise, several authors have pointed out the importance of winter roost of birds in northern cities (Sukopp and Werner, 1982).

3.3 Linking biodiversity loss to urban processes

The previous section introduced the major human drivers of biodiversity loss. In the following sections, we provide a detailed discussion of how different urban processes affect these drivers directly and indirectly. It should be noted that this discussion is not exhaustive due to the complexity of these processes and their impacts.

3.3.1 Urban development

Perhaps the most visually straightforward influence of urban activity on the drivers of biodiversity loss is land use and land cover change. Population and economic growth generally results in greater demand for housing and basic infrastructure such as roads, public spaces, drinking water, sanitation, and community development. To meet these demands, "natural" land is transformed into human-made landscapes, most of which create impermeable and vegetation-free surfaces. For example, out of the total area urbanised in Concepcion (Chile), "*...55% corresponded to wetlands and 45% to agriculture, forest, and shrub land cover types*" (Pauchard, et al., 2006).

Such urban development is argued to bring significant conservation challenges (McKinney, 2002) and directly affects three of the main drivers of biodiversity loss, namely habitat destruction, overexploitation, and the introduction of invasive species.

Urban development can also induce the extinction of native species and the replacement of native species with alien (non-native) species (McKinney, 2002). Urban-rural gradient studies in different cities reveal that the level of native species decreases in central parts of cities, where the ratio of built spaces to green spaces and the proportion of impervious surfaces are high (Zerbe, et al. 2003; McKinney, 2002; Sukopp, 2004).Pauchard, et al. (2006) on the other hand find a correlation between road density and the number of alien species, which is concentrated along roadsides and disturbed grounds.

Most of the above mentioned underlying effects of urban development on the drivers of biodiversity loss can be linked to urban planning in various ways. Residential developments in cities mostly put stress over the surrounding ecology but can also stress ecosystems faraway. Generally speaking, housing expansion in developed countries affects biodiversity due to its large consumption of resources (e.g. timber) and land (e.g., suburbanisation). On the other hand, housing needs in most developing nations are largely satisfied through informal and uncontrolled ways. In some cases, the lack of urban planning as a mechanism to control urban development contributes to environmental deterioration. In many Turkish cities, a significant part of illegal and unauthorised residential developments took place within forests and agricultural lands in urban fringes. In the Beykoz District in Istanbul, unplanned urban development reduced forest and agricultural land from 76% to 60% and from 15% to 10% respectively between 1984 and 2001 (Musaoglu et al., 2005). They also noted that most of this conversion took place within Elmali Reservoir Watershed, which can affect water supply. Similarly, in many other cases, the expansion of residential developments, especially informal settlements, takes place in an unplanned manner in areas which are not targeted by the formal sector. These areas are sometimes located in or adjacent to highly biodiverse ecosystems such as forest and mangroves. For instance, Rio de Janeiro lost a large part of its forests and mangroves due to the expansion of favelas (slums). It is estimated that 9% of the sandbank mangroves were lost in the last three years alone (O Globo, 2010).

However, it should be clarified that on certain occasions, urban planning does not necessarily mitigate the causes of environmental deterioration in general, and of biodiversity loss in particular. Half of the US population lives in suburban housing within sprawling developments, which is accepted as a major threat to peri-urban ecosystems (Pauchard et al., 2006). Most, if not all, of these suburban residential developments are planned and

authorised. Thus, what prevents urban planning to make a positive change is the lack of an ecological understanding and thinking in our current planning approaches. Perhaps, the lack of such urban planning approaches that have integrated sound ecological understanding can be perceived as an underlying cause of biodiversity loss within and around cities.

Box 2: Conflict between biodiversity preservation and unauthorized housing in Mumbai

The Sanjay Gandhi National Park (SGNP), which covers an area of 103 square kilometers in the north of Mumbai, is one of the largest parks in the world in a metropolitan area. The park is known to include a rich and diverse ecosystem along with numerous historical assets. A dense forest with substantial flora and fauna diversity and two main lakes as important sources of water for Mumbai are found in the park area. Needless to say, the park also functions as a major carbon sink within the dense and congested city of Mumbai.

SGNP was exposed to illegal urban development, which was accelerated greatly after 1990, both in terms of squatters of urban poor and the large bungalows of the wealthier sections of society. Between mid-1995 and mid-1996 there occurred the loss of 27 ha forest land by such urban development[1]. Environmentalists led in large part by the middle class citizens filed a Public Interest Litigation case against the local government to ensure the protection of the park. Shortly after, the court case turned against the poor groups, who were regarded as the main threat to environmental sustainability. Squatter settlements became the mere focus of the court case, which lasted from 1995 to late 2003. The court ruled in favour the relocation of 33,000 people (those with proofs of residence) to a village far away from their present location and work places, and the immediate eviction of 24,000 people (those without proofs of residence), who were considered as illegal settlers.

Resistance by the individuals and resident associations followed the final judgment of the court. Numerous challenging petitions were filed in the court, yet all of them were dismissed. However, no significant progress has taken place since the final judgment of the court. Most of the poor inhabitants of the park area refused to move, and those, who moved, went to some other illegal settlements nearby, in order not to lose their close connection to the city. Such attitudes by the inhabitants of park area are regarded as a logical response, as the judges neglected the rights of the urban poor as citizens of Mumbai. The Judges' decision implied that the "right to the city" is not applicable to low-income and poor groups.

The case of Sanjay Gandhi National Park (SGNP) in Mumbai shows how the lack of proper housing policies and unauthorized urban development could affect green spaces, which contain critical ecosystem and habitats. However it also highlights that conservation and preservation efforts should be carried out in a way to consider the urban poor and to bring pro-poor solutions. Prevalence of the explicit conflicts between conservation and sheltering could inevitably marginalize the poor, and hence relocate the problems rather than solving them.

Source:
Zerah, M.H., 2007. Conflict between green space preservation and housing needs: The case of the Sanjay Gandhi National Park in Mumbai. *Cities*, 24(2), pp. 122-132.

[1] Econet, (1997), A comprehensive environmental assessment of SGNP (Borivili National Park), Mumbai, Vijay Paranjpye and Econet, Study Commissioned by the Maharashtra State Division of the WWF, Mumbai

3.3.2 Production and consumption in cities

Cities are centres of production of consumer goods, with natural resources being massively processed and transformed into commodities in or around urban areas. At the same time, urbanisation has brought significant changes in human lifestyles, such as the rise of consumerism (Davis, 2000), which complements production. In fact, while cities occupy only around 2% of the Earth surface, they consume an estimated 75% of its utilised resources (UNEP and UN-HABITAT, 2005). With urbanisation, comes rising affluence and changes in taste. Higher incomes and higher levels of *disposable* incomes allow new consumers to express their demand for tastes previously unattainable. Production and consumption activities within cities can affect directly and indirectly several drivers of biodiversity loss such as overexploitation, habitat change, pollution, and climate change.

The UN Human Development Report of 1998 (UNO, 1998) has already discussed the impacts of the huge growth in consumption during the 20th century. Larger consumption is a sign of growing living standards and several parts of the world now benefits from the comfort of individual local transport, hot water, electricity, larger houses, abundance of food, and access to air transportation. However, the report also highlights the skewed distribution of these benefits and the consequences of uncontrolled consumption, particularly by the rich urban centres, on the environment. Urbanites around the world increasingly demand more food, timber, minerals, oil, electricity and other commodities to satisfy their growing needs fuelled by their increasing incomes. The urban residents' appetite for different kinds of products drives most of the habitat destruction and overexploitation of biodiversity in peri-urban areas and distant ecosystems and thereby global environmental change. For example, the rising standards of living, particularly in urban centres of the developed and rapidly developing world have been associated with shifts in diets and particularly with increases in meat consumption (e.g. FAO, 2006). Livestock production has been blamed as perhaps the single largest threat to biodiversity given that it currently appropriates almost a third of the planet's ice-free land, and it is the major driver of deforestation and a significant emitter of greenhouse gases (GHGs), among other relevant environmental impacts. It is estimated that of the 35 identified biodiversity hotspots worldwide, 23 are affected significantly from livestock production (FAO, 2006).

In a similar manner, Tokyo's residents have not only have increased their seafood consumption over time, but they are increasingly consuming more species, or "eating down the food chain" than ever before (Gadda and Marcotullio, 2007). Certain fish species prevalent in the human diet are not only overfished but are also threatened by fishery collapse[8]. Although a direct connection between increasing affluence and another facet of over-exploitation (the number of endangered species) can be difficult to demonstrate (Chambers, et al. 2008) in regions like East and South East Asia, rapid economic development brings the competition of globalisation to traditional medicine and other cultural consumption. The Asian tiger, shark fins, and rhino horn are today desirable commodities, which can find an expression in the urban markets. Whilst their habitats may not be directly threatened by urban encroachment, poachers supplying an urban demand could still render a species extinct.

[8] Such an example is the case of the Atlantic blue fin tuna that is now considered critically endangered by the IUCN.

Production activities, on the other hand, have shifted geographically in the last two decades. Industrial production is now a major function in many cities in the developing world and is generally located within or just outside the cities and in close proximity to surrounding natural resources and labour. In a nutshell, industrial production processes generate sewage and solid waste, which can impact biodiversity in adjacent areas and faraway areas. Soil pollution, water pollution, and air pollution such as GHG emissions by industrial activities are also major threats to biodiversity at different spatial scales. The need exists for a reformulation of urban development objectives, particularly for a move away from purely economic growth targets and towards the inclusion of "environmental sustainability, efficient urban forms, and liveable communities"(Ingram, 2009; see also Yusuf and Nabeshima, 2008).

Box 3: Linking consumption and its impacts – Garstang and 100% fair trade

One of the biggest challenges to address biodiversity issues in cities is to find a way to control the impacts of consumption, sometimes in far away places, without restricting individual freedom or hurting economic possibilities for trade. The fair trade movement could be the beginning of a solution, even though its main objectives are to improve the lives of farmers in developing countries. Different kinds of certifications and definitions try to include impacts on biodiversity as one of the main points to consider a product as a fair trade product, such as making sure areas of conservation are identified and preserved by producers, harvest of natural species are done sustainably and endangered species are not collected or hurt.

The town of Garstang in Lancashire, North West England, is considered the first "Fairtrade Town", a network of more than 800 towns in 19 countries. Fair trade towns are recognised by the Fairtrade Foundation, which follow a series of criteria to assess whether communities give full support to fair trade initiatives, such as having the town councils enacting a resolution to fully support fair trade, engage communities in awareness raising, and make fair trade products available in the retail market and at public places like schools and colleges when it is possible.

In April 2000, the people of Garstang voted almost unanimously to make the city the first fair trade place in the world. The town was a pioneer in a global initiative to make fair trade more mainstream, what could also be a seed to a global initiative to make consumption more accountable to its impacts on people and biodiversity.

Source:
Fairtrade Towns, 2010. International fairtrade town movement. [online] Available at: <http://www.fairtradetowns.org> [Accessed 12 July 2010].

3.3.3 Trade and transportation

The increasing need for roads and parking lots in and between cities are a clear direct impact of transportation on ecosystems, as well as the effects of the local pollutants caused by vehicles. Moreover, the expansion and growth of urban areas is also considered an important factor for the increase of trade and the circulation of commodities. As a result, trade and transport is indirectly linked to biodiversity loss drivers such as GHG-induced climate change and the introduction of invasive species.

The global transport systems currently account for almost 25% of the world's carbon dioxide emissions (World Energy Council, 2007), and this is increasing at a faster rate than any other energy using sector (IPCC, 2007a). Levels of emissions from transportation are higher

than the world's average in many developed nations. Cities' shares in transportation-related emissions can also be significant. In São Paulo , 48.6% of GHG emissions are due to land transportation related emissions (Puppim de Oliveira 2009). In the United States, almost 40% of carbon dioxide emissions come from cars and residencies (EIA, 2009).

Increasing trade as a result of urban appetite for global commodities might also have direct impacts on biodiversity. For instance, ship discharges along trade routes can be an avenue for the introduction of invasive species. Such an example is the case of the European zebra mussel which was introduced in the Great Lakes of North America through the ships' ballast water. The European zebra mussel has a significant impact on the biodiversity of the ecosystems it invaded (MA, 2005).

3.3.4 Heat stress related to the urban heat island effect

Climate change is a growing concern with extensive implications for life on Earth. Ecosystem and biodiversity, on which human existence depends, are increasingly facing multiple anthropogenic stresses, caused by macro and micro climate change. Cities, as aggregates of human activities, require energy in a variety of forms. Much of the primary energy sources transformed to be available to most of the cities around the world are still fossil-based, resulting in global climate change. In addition to this, cities are encountering particular problems related to urban climatology.

There is a growing accumulation of research work on the urban climatology issue, especially in the US, Japan, and Europe. Recent studies are increasingly consolidated with urban factors that potentially alter the main elements of the urban climate, where temperature is the most highly affected variable and the one most characterising urban climate (Gomez, et al., 1998). The Urban Heat Island Effect (UHI), which represents the temperature differences between cities and their surrounding areas, is increasingly recognised as creating biophysical hazards most typical to cities (Landsberg, 1981). Heat stress and concentration of secondary air pollutants are the examples of such hazards (Solecki, et al., 2005). There are many causes for UHI effects, including reduced vegetation cover, impervious surface area, and morphology of buildings in cityscapes that lower evaporative cooling, store heat, and warm the surface air (Bonan, 2002).

Heightened air and surface temperature in urban areas relative to surrounding areas creates habitat modification in urban ecosystems. Although few works have explicitly considered heat island effects on the urban ecology and related issues (Bradley, 2006), a strong correlation is generally recognised between urban climate change and its effects on the biological distribution and composition in urban areas. One survey, for example, observed earlier cherry blossom distribution in metropolitan centres than in its suburbs (Omoto and Aono, 1990). When the habitat modification intensified, different trophic biophysical elements may appear in urban areas, becoming the threats to the indigenous ecosystem in the cities. It can even change patterns of transmission of infectious diseases (Foley, 2005).

Several vector-borne diseases may respond to temperature change related to urbanisation (Schochat, 2006). Reduced seasonality in urban areas could further affect the persistence of parasites (Louis, 2005). Also, it can increase population growth rates of some wildlife hosts by extending their breeding period, observed in the case of dark-eyed juncos inhabiting an urban site in California (Altizer, et al., 2006). Conversely, reduced seasonality has a chance to

lower the infectious disease risks on the individual level, due to better nutritious conditions through food availability, for example. The feedback loop associated with urban climate change is, therefore, highly complex and needs careful examination (Bradley, 2006).

4. Instruments for Improving the Contribution of Cities to the CBD

4.1 Development and implementation of proper housing and infrastructure policies

Proper housing policies involve several aspects of the promotion, control, and provision of residential spaces. Developed and developing countries face different challenges to have more environmentally or biodiversity friendly housing policies. While habitat and biodiversity is threatened by formal expansion in developed countries, developing countries lack the capacity to provide proper housing for its urbanising population, leading to the occupation of sensitive areas by informal settlements. Moreover, more sustainable use of material, particularly concerning biodiversity sensitive materials, is still incipient.

Addressing residential issues is vital for controlling cities' ecological footprint in developed nations. Those nations suffer from high consumptions of resources and land due to urban expansion. Although they are planned and controlled, residential developments extend over a large area in developed nations. Urban sprawl and suburbanisation are in large part caused by the demand for suburban lifestyles by middle- and high-income groups. McKinney (2002) mentions that due to the spread of suburban housing in the US, the growth rate of urban land use surpassed that of lands preserved as parks or conservation areas. By means of infill developments and urban regeneration projects, the need and the demand for peripheral development and suburbanisation could be diminished by planning guidelines and economic incentives. Policies favouring and facilitating the development of compact urban forms by better utilisation of inner-city lands could reduce the ecological footprints of cities, as well as voluntary or mandated green procurement for construction materials.

Some middle-income developing countries face the same suburbanisation process of developed countries, as the higher income population moves to certain suburbs or new towns. However, cities in most developing countries lack the capacity of providing adequate housing and infrastructure to their growing urban population, which ends up in informal settlements in biodiversity sensitive areas. There is a need of strong housing policies that could provide low-cost, environmentally sustainable, and adequate housing for the low income population, but at the same time controlling illegal settlements in areas not proper for housing to avoid disasters and loss of biodiversity.

Thus, addressing housing issues is vital for controlling cities' ecological footprint while contributing to urban resilience and social development. One example of an initiative in this area is "Eco-housing", a programme developed jointly by UNEP and UN-HABITAT, a concept that applies sustainability principles to the entire lifecycle of a housing project, considering environmentally friendly approaches to the design, site assessment and material selection, and energy, water, and waste management at the household and community levels. Implementing eco-housing principles in cities of developing countries on a global scale will certainly have positive connotations for biodiversity conservation, both in reducing footprints and in creating less polluting urban environments. Yet, according to UN-HABITAT, projects are effective only if considered within their social-economic dimension. The Experimental Reimbursable Seeding Operations (ERSO) is an alternative social instrument

involving commercial loans and direct repayment elements by the householders themselves. ERSO aims at increasing the affordability of housing and providing seed-capital to community projects for slum upgrading and infrastructure projects through local financial institutions.

Box 4: The planning-implementation gap in Dongtan Eco City, China

Located north of Shanghai, Chongming Island is the world's largest alluvial island and home to precious wetlands and migrating birds. In 2005, British engineering firm Arup was commissioned to design the master plan for Dongtan—a new eco city for 500,000 people occupying one third of the Island and envisioned to become a model for China's future urban development.

The concept for Dongtan focused clearly on environmental sustainability, largely neglecting political, economic, and social factors. Arup's master plan featured zero-greenhouse-emission transportation, complete self-sufficiency in water and energy, zero energy building principles, and close-to-complete waste recycling, among other innovative intentions. The plan claimed that existing wetlands would be protected by buffer zones between the city and the wetlands, and that the total area covered by wetlands currently would even be increased by land use conversion from agriculture. The original plan envisioned 5,000 people to live in Dongtan Eco City by 2010, in time for the Shanghai World Expo, but the project failed to materialise for reasons undisclosed, and its future remains uncertain (Sigrist, 2009).

Envisioning tourism—resorts, theme parks, stadiums, and exhibition centres—as the main contributor to the economic development of Chongming Island, Shanghai's municipal government focused on the construction of a bridge-tunnel between Shanghai and the Island as a first step toward to development of the Dongtan project. Indeed, the completion of the bridge-tunnel in November 2009 attracted 480,000 visitors in just ten days, and visitor traffic forced local authorities to consider charging fees for scenic spots and limiting touristic activities to designated areas. Parking areas quickly took the place of agriculturally used land, and toilet blocks and other infrastructure needed to sustain the visitor torrent spread quickly and subject to loose control (Shen, 2009). Land use conversion owing to the tourist boom swiftly forced local farmers out of business, and many continue to wait for the local government to deliver on their promise to re-employ them in the tourism industry around the wetlands (Lu, 2009). The current tourism boom and the seemingly uncontrolled development on the Island, far from Arup's original plans, clearly increases resource consumption, and furthermore, poses a growing danger to agricultural land, precious wildlife habitats, and local culture, while its justification as a source for local employment has not lived up to expectations to date.

Since it was first made public, Dongtan Eco City has attracted mixed reactions, ranging from its appraisal as a model of urban sustainability to accusations of sociopolitical totalitarianism. Dongtan, should it ever materialise, can only be considered socially sustainable if it clearly addresses the existing and emerging problems around its current population. If future development, indeed, succeeds in addressing equally all aspects of sustainability, without giving priority to economic gains, Dongtan may become a replicable model; so far, it has ceased to meet even basic requirements, and the gap between the original vision and the current, profit-oriented development, causes much concern. In any case, building more cities on undeveloped land seems less promising than converting existing cities to meet the criteria for social, environmental, economic, and political sustainability.

Sources:

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Sigrist, P., 2009. Dontan Eco City: A Model of Urban Sustainability? *The Urban Reinventors*, 09(3), [online] Available at: <http://urbanreinventors.net/3/sigrist/sigrist-urbanreinventors.pdf> [Accessed 24 June 2010].

4.2 Provision of a good network of urban green spaces and functional aquatic habitats

Remnant natural vegetation and urban green areas, such as parks and urban forests are the major sources of biodiversity in and around cities. Many rare and endangered species are found in urban near-natural remnant areas. These remaining spaces do not only exist in the urban fringe but also in the middle of megacities. Notable examples of pristine remnants, even partly located in the middle of a city, are, among others: the remnant forests of the Mata Atlantica in Rio de Janeiro (Brazil), the evergreen forests of the Botanical Garden in Singapore, the National Park El Avila with its rock faces in Caracas (Venezuela), various remnants of bush land in the Australian cities of Perth, Sydney, and Brisbane, remnants of natural forests in York (Canada) and Portland (USA), and rock faces and outcrops in Edinburgh (Scotland). Therefore, provision of a network of green spaces is among the most effective instruments to preserve and enhance urban biodiversity (Niemela, 1999). State preservation of all kinds of vegetated spaces is the most efficient way to incorporate biodiversity in an urban environment (Roetman and Daniels, 2008). Studies and research have shown that more nature in cities in terms of more green and tree cover result in better environmental performances including lower temperatures, lower carbon emissions, and higher biodiversity (Sukopp, 2004; Whitford, et al., 2001).

Yet, only allocation and designation of some open spaces as green areas are not enough to bring more nature to cities. Green spaces should be designated and designed in relevant ways to ensure biodiversity preservation. In this respect, provision of a variety of green spaces is essential. Uniformity has to be avoided when creating new open spaces as part of urban nature conservation strategies (Zerbe, et al., 2003). Urban planning must guarantee the allocation and development of different kinds of green spaces in and around cities, particularly using native species and the maintaining and restoring remnants of natural areas where possible. Parks at the regional, urban, and district levels, nature parks, forests and woods, wetlands, agricultural lands, meadows, and gardens are among the relevant kinds of green spaces. Enhancing conservation in peri-urban areas also improves biodiversity in inner-parts of the city (Snep, et al., 2006).

Qualities of plant and animal species in green spaces also influence the services that these spaces provide. More native plantation and avoidance of planting alien species, when it is possible, are argued to be the major guideline for the design of green spaces (Zerbe, et al., 2003). Revegetation with a diversity of native plant species especially in areas where land development is intensive is recommended as a way to increase animal biodiversity (McKinney, 2002). In addition, sizes of green spaces have to be considered while designing these spaces. As small parks are observed to be disturbed patches of habitat, it is argued that they make slight contributions to preserving biodiversity in cities. In this sense, priority needs to be given to the provision of large parks to preserve and improve urban biodiversity, as well as connect small patches to make large connected systems (Roetman and Daniels, 2008).

The use of GIS-based gradient analysis in Shanghai confirmed the hypotheses that patch density increases while mean and variance of patch size and landscape connectivity decrease with the degree of landscape modification (Zhang, et al., 2004; Forman and Godron, 1986; Godron and Forman, 1983). In Shanghai, the degree of human impact depended on the distance from the centre. Urbanisation "has resulted in dramatic increases in patch density,

edge density, and patch and landscape shape complexity, and sharp decreases in the largest and mean patch size, agriculture habit area, and landscape connectivity" (Zhang, et al., 2004). Small urban areas spreading in fragmented habitats have limited impact on connectivity in a study of 66 urban areas in the US, and that connectivity is threatened where larger urban areas spread through previously highly connected habitats (Bierwagen, 2007).

Furthermore, critically important habitats and ecosystems have to be designated as "protection or conservation zones" for an exclusive protection of species. Urban development has to be avoided and controlled within these areas. "Protection or conservation zones" should not be left as isolated and disconnected patches. Instead, a continuous network of these protected zones together with other urban greenery has to be established. To this aim, "green belts" surrounding cities and "green corridors" running through cities are the effective strategies (Niemela, 1999). These belts and corridors not only prevent urban sprawl but also ensure the connection between green and natural patches. Green corridors, which link different habitats, allow species to find food and shelter, and to breed and disperse (Roetman and Daniels, 2008). Effective provision of "green belts" and "green corridors" as a strategy necessitates their mainstreaming into the relevant plans at regional and urban levels (Breuste, 2004).

It should also be noted that increased vegetation cover and more greenery within cities are also effective strategies for urban heat management. To reduce UHI effects, these strategies can be pursued with urban spatial strategies.

There are numerous and incredibly diverse mechanisms currently being implemented in cities across the globe to bring cities and nature more closely. For example, the city of Curitiba (Brazil) has launched a 175 million USD "BioCity" programme, which includes the use of native species for ornamental purposes, establishment of conservation areas with direct involvement of civil society, revitalisation of the nearby water river basin, planning for tree linen streets and public transportation corridors including bicycles and pedestrians' lines, as well as linear parks. Porto Alegre is another example in Brazil, with a project to allow people to adopt trees in order to preserve its one tree per person ratio by reducing tree city mortality. Nairobi (Kenya) holds the Managing Urban Biodiversity programme in order to integrate the management of its renowned part into urban policy. Bonn (Germany) is working towards integrating biodiversity into urban planning, designating 51% of urban space as specially protected areas.

In addition to green spaces, aquatic urban habitats are also a key source of urban biodiversity. Therefore, the sustainable design, planning and management of urban streams, canals, rivers, ponds, impoundments, reservoirs, lakes and other water bodies, constitutes a key instrument for improving the contribution of cities to biodiversity. For urban aquatic habitats to preserve its basic characteristics and contribute to the adequate performance of their associated biological communities, proper management of morphology, effluents, including temperature, pollutants and waste, as well as water catchments should be taken into account (Lafont, et al., 2007). One example of an integrative policy instrument targeting the sustainable management of urban aquatic habitats is the Urban Biosphere Reserve (UBR) approach for the city of Istanbul (Tezer, 2005). A city with over 10 million people, Istanbul relies heavily on the Omerli Watershed for drinking water provision. Urban development poses an acute threat to its ecological integrity, including water quality and

aquatic biodiversity. The Urban Biosphere Reserve (UBR) proposes a governance instrument aiming at reconciling urban development and water quality and biodiversity conservation in a sustainable way, through integrated urban aquatic habitat management.

Box 5: Integrating biodiversity and urban planning in Curitiba

Curitiba in Southern Brazil is synonymous of innovative city planning around the world. Since 1970s, the city has implemented a series of initiatives to become more sustainable, even before the buzzword "sustainable city" became fashionable. Its master plan of 1970s started the process of planning to a sustainable growth with actions in areas such as transportation, waste and green areas. Curitiba was pioneer in the cost-effective Bus Rapid Transit (BRT), now used in many other cities around the world, what makes the consumption of the fuel in the city proportionally 20% less than the country's average. The city is also well-known for its large extension of green areas, more than 50 square meters per inhabitant, one of the largest rates in the world. Many of the parks are well planned, occupying former degraded areas (like quarries) or areas under flood risk, such as lowlands.

Following the footpath of its green area policies, the city is trying to address the biodiversity issues and integrate it in the city's urban plan. The article 20 of its Municipal Plan of Environmental Protection and Sustainable Development explicitly states that the city should take into account the goals of the international protocols signed by Brazil. Thus, the city has been involved in the implementation of international agreements, particularly the CBD. It hosted the 8th Conference of Parties in 2006, and took the initiative together with the SCBD to host the First Curitiba Meeting on Cities and Biodiversity in 2007. The 34 mayors who came to the meeting launched the Curitiba Declaration on Cities and Biodiversity, which is a landmark in the area.

Following its footpath in the establishment of green areas, the city now tries to address specifically the biodiversity issues, particularly focusing on the 2010 biodiversity targets. Since 1980s, the city gives tax breaks of up to 100% for landlords that keep more than 70% of native or old growth forests. Owners who preserve 100% can use their development rights in other areas of the city. Moreover, the city collects information and protects the large number of native reptiles, mammals and fish (more than 30 species each) and its more than 200 species of birds. A series of cross cutting programs exist to preserve water and awareness raising for biodiversity issues.

Source:
Convention on Biological Diversity, 2010. City of Curitiba, Brazil. [online] Available at: <http://www.cbd.int/authorities/casestudy/curitiba.shtml#measures> [Accessed 12 July 2010].

4.3 Local sustainable production methods for biodiversity in urban areas

The more "local" planning and design practices are, the better results in terms of biodiversity preservation can be expected, as local planners are usually better informed and potentially more flexible to react to particular challenges. Creating, transforming, and consuming local products, appropriate to place and localities, can make cities economically and ecologically resilient over time, and to be resilient, cities must be more self-sufficient (Hawken, 1993). In developed countries with mature systems of regulation, urban form and city life are subject to formal planning and permit. This is often not the case in many cities in the so-called developing world, where much of urban life and economy goes unplanned and unsupported by formalisation, allowing for cities to remain potentially more diverse in terms of cultural and land uses. As the rule of interdependent adjacencies in urban ecology has it: the more diversity, and the more collaboration "between unlikely partners", the better the

chances for biodiversity, sustainability, and resilience (Hester, 2006). Linked to this idea is the concept of Continuous Productive Urban Landscapes (CPULs), which represent a powerful urban design instrument for achieving local sustainability while reducing cities' ecological footprints (Viljoen, 2005).

Yet any policy instrument aiming at integrating non-human species in cities faces cultural challenges. Cultural values and norms play a role for the propensity of local populations to accept, embrace, or even strive toward coexistence with other species, particularly in urban contexts (the coexistence of people and animals elsewhere considered "farm" or "wild animals", be they goats or monkeys, for instance, is a common phenomenon in Indian cities).

Although the CBD does not address agricultural diversity directly per se, species and varieties of agricultural interest (including germ plasm) and thus the agroecosystem in general, constitute an important component of the declaration. Policy instruments focusing on urban agro-ecological management can potentially contribute to:

- Reducing ecological footprints of cities by providing local access to foods, fuels, fibres, ornamental species, etc;
- Creating spaces for in situ conservation by using traditional varieties and improving ecological corridors;
- Contributing to social inclusion and traditional knowledge preservation by involving civil society;
- Contributing to technological innovation in waste management and building design (e.g. vertical farming).

A good example of urban agro-ecological management leading to biodiversity conservation is Oakland (USA). The city's urban agriculture programme in public lands "Cultivating the Commons," aims at using city spaces for organic food production as a tool for access to fresh foods, thus reducing the city ecological footprint, while contributing to environmental education of local residents (McClintock and Cooper, 2009). In Tokyo (Japan), an agricultural park in Adachi ward sponsored by the neighbouring ward offices and developed in conjunction with the Japanese Organic Agriculture Association (JOAA, 2007), not only serves as a local green space for conservation and leisure, but contributes to local food provision at affordable prices and educational purposes.

In developing countries, urban agriculture is often associated with urban land squatting and thus considered a socio-economic problem, not a solution. Local authorities are hesitant to be more proactive on urban agriculture because it is largely seen as resulting from a failure to address adequately rural development needs (Mougeot, 2006), or that the city will lose status, as many policy-makers associate agriculture to backwardness. There is also resistance to urban agricultural products with the fear that they can pose health risks. Yet Havana (Cuba) is a remarkable example of developing policy instruments to increase food security for urban residents while reducing the use of fossil fuels and oil-based fertilisers (thus reducing CO_2 emissions and ecological footprints), and making significant changes

in the educational curriculum to include sustainable farming disciplines (Cruz and Sanchez-Medina, 2003). However, given the singularity of the Cuban political system, other cities may not easily replicate the Havana initiative.

The shrinking cities phenomenon presents an intriguing policy space of economic crisis and ecological opportunity directly linked to urban agriculture. Whilst commonly thought to be a developed world artefact, socio-economic decline also occurs in developing countries where outmigration from smaller cities to larger ones leaves behind an aged population (Haase and Schetke, 2010). Although socio-economic decline is not a desirable scenario, this presents opportunities for biodiversity renewal. The perforating land use pattern that accompanies urban decline leads to fragmentation, which in turn poses opportunities for enhancing biodiversity. Most obviously, this can be thought of in terms of brown field sites of disused factories or surplus housing units as was common in cities of the former East Germany. Around one third of Detroit's 376,000 vacant lots are being used as a resource to regenerate the city by investing in the scale-up of urban agriculture (Huffstutter, 2009). Skilful navigation of this area to maximise the triple bottom line could provide frameworks for future urban sustainability.

Besides farming, sustainable aquaculture and proper urban fisheries management represent another key instrument for cities' positive contribution to biodiversity. By providing local sources of nutritious foods, cities can not only improve local food security, and create jobs and spaces for technological innovation, but they can also significantly reduce their ecological footprints (Costa-Pierce, et al., 2005). Urban aquaculture is especially relevant within the context of the developing world, especially in South and South East Asia. Aquaculture development in cities are direct effects of job creation and food security among poor urban households, yet major challenges related to waste management and financial investment should not be neglected (Little and Bunting, 2005).

In addition to aquaculture, traditional sustainable management practices of aquatic biodiversity can also be integrated into successful policy instruments for biodiversity friendly city governance. For instance, the case of *satoumi*, or traditional fisheries management in Japan, illustrates the importance of taking into account traditional knowledge when planning coastal urban areas. While *satoumi* is associated to small village type of human settlement, its ecological management model can provide valuable insights for modern day city planning (Yanagi, 2005).

Box 6: Productive landscapes in Tokyo - managing diversity, reducing footprints

Pictures: Two snap shots of Adachi Agricultural Park.

Tokyo, the biggest city in the world, is well-known as a financial hub and for its intricate public transportation infrastructure. Yet the city also hosts vast array of agricultural activities. With around 8 thousand hectares of cultivated land area and almost 14 thousand agricultural households (BILA, Bureau of Industry and Labor Affairs), Tokyo urban agriculture provides multiple ecological and social benefits, which directly or indirectly contribute to foster biodiversity conservation and sustainable use within the city and beyond. Perhaps the most straightforward contribution of urban farming is the reduction of the city's **ecological footprint**. BILA (2010) estimates that, in 2005, Tokyo's vegetables and fruit production supplied the equivalent to 680,000 people's consumption. Furthermore, urban production provides opportunities for minimising **pollution-related** impacts on biodiversity, such as those resulting from eutrophication or agro-chemicals. In Musashino district, for instance, a resident's association has set up a local waste management scheme which allows for organic domestic waste to be collected and transformed into compost later used by local farmers (Aramaki, et al., 2001). Likewise, agrochemical pollution is significantly reduced across Tokyo's farms: because they are adjacent to residencies, safety is a primary concern, so producers engage in organic agriculture or at least significantly reduce the use of (BILA). Moreover, urban production also contributes to the preservation of **agricultural germplasm**. For instance, Nerima district, with the largest farm area of Tokyo, grows the renowned Nerima radish, which is a traditional variety celebrated in local festivities. Tokyo-udo, a variety of a soft perennial of the Araliaceae family (nanpaku-udo in Japanese) is cultivated underground in the western part of the city. The Tokyo variety is greatly appreciated because of its crunchy texture, ideal for tempura. Tokyo's farms also play a crucial role in raising **awareness** about biodiversity conservation and its sustainable use among city dwellers. A survey conducted by the Tokyo Metropolitan Government in 2009 shows that 86% of citizens prefer to have farmland in the urban landscape in order to secure food provision and local biodiversity preservation. This preference is nicely materialized in **Adachi** district. In 1980, the local government founded a park to promote sustainable agriculture and interaction between farmers and urban residents. Located between the Arakawa River and a busy elevated highway, the park comprises 5 hectares including a rice paddy with multiple traditional varieties and more than 70 different agricultural varieties/species being cultivated all year round; in addition, there is a greenhouse with over 100 medicinal plant species and a 300 year old traditional farm house; fresh organic seasonal produce is daily sold at affordable prices. Under the motto "Playing, learning and living with nature" the park, which follows organic agriculture principles, receives around 300,000 visitors a year, and offers a six month training program on urban organic growing.

Sources:

Aramaki, T., Suzuki, E. and Hanaki, K., 2001. Supply and demand analysis of compost for effective use of various organic wastes in Aichi prefecture [Japan]. *AFFRC*, 14(4), pp. 367-371.

BILA, 2010. Multiple Statistics. Bureau of Industrial and Labor Affairs, Department of Agriculture, Forestry and Fisheries, Tokyo Metropolitan Government. [online] Available at: <http://www.metro.tokyo.jp> [Accessed 12 July 2010].

Nerima City Office, 2010. [online] Available at: <www.city.nerima.tokyo.jp/manabu/nogyo/taikennoen.html> [Accessed 12 July 2010]

Box 7: The *Satoyama* initiative in Japan: traditional landscapes for sustainable cities

More than three thousand species of plants and animals are officially threatened with extinction in Japan, where urbanisation and industrialisation have recently played a major role in habitat loss. Paradoxically, the abandonment of traditionally managed rural environments also poses a serious threat to the country's biodiversity. The intricate mosaic of rice fields, agriculture, meadows, coppice forests, and coastal systems which have coevolved within human settlements over millennia across the archipelago are recognised by many experts not only as models of sustainable land use but also as biodiversity hotspots. *Satoyama* and *satoumi* are the Japanese terms referring, respectively, to these traditional terrestrial and coastal human-nature coupled systems- also referred to as "socio-ecological production landscapes". The Satoyama Initiative, a joint endeavour of the Ministry of the Environment and the United Nations University Institute of Advanced Studies is a multifaceted endeavour to better comprehend these "dynamic mosaics of managed socio-ecological systems that produce a bundle of ecosystem services for human well-being" (Japan SGA, 2010).

Yet what can modern metropolis learn from these traditional, sustainable natural resource management systems? On 22 May 2010, "International Biodiversity Day", an International Symposium on Cities and Satoyama Landscapes was organised by the Japanese Institute of Landscape Architecture was held in Nagoya (Japan) in order to explore the significance of *satoyama* for sustainable urban development. According to the experts, there are multiple ways in which the satoyama concept can contribute to the design of more sustainable cities. For instance, *satoyama* landscapes in urban fringes can be fundamental areas for ecological restoration, particularly within the context of cities with declining populations. By revitalising these productive landscapes, cities can foster new development opportunities involving local governments, civil society organizations, and the business community while contributing to biodiversity's sustainable use. One of the main conclusions of the event was that "rethinking peri-urban landscapes from the satoyama perspective focusing of producing resources and energy for modern urban needs is fundamental for the construction of the 21st Century sustainable societies".

Ishikawa prefecture is one fruitful example of efforts looking for solutions to achieving sustainability by designing policies which contribute to the revitalisation of local, traditional production methods to serve modern needs, such as charcoal and salt making. Moreover, urban planning and design can also benefit from a *satoyama* perspective by re-conceptualising cities not as mere spaces of economic growth dependant of faraway resources, but as centres of knowledge creation and local natural resources management –a sort of an urban satoyama, in which residents can live in conjunction with biodiversity in managed forests, green spaces, and agricultural activities.

Source:
Japan Satoyama Satoumi Assessment, 2011 (forthcoming). Japan Satoyama Satoumi Assessment. Tokyo, UNU Press.

4.4 Improvements in public transportation and more compact cities

Urbanisation processes have serious implications regarding biodiversity and greenhouse gas (GHG) emission levels. To successfully delink high income levels from high GHG emission, climate-related policies should encourage energy-efficient building and urban forms which do not depend on the use of automobiles (Hardoy, et al., 2001). Multi-functional land uses and compact cities well connected by public transportation would lead to more sustainable and liveable cities. However, the applicability of "smart growth" principles has been questioned in the past because of its limited results in certain contexts due to striking differences between countries in political regimes, population density, and land use (e.g., Kenworthy and Hu, 2000). For example, recent growth patterns in urbanising China follow

rather unsustainable development paths characterised by falling urban densities, large-scale consumption of farmland and open space, decreasing mix in land use, prioritising of automobile transportation, and finally, loss of the sense of place (Knaap and Zhao, 2009). This development stands in stark contrast to some of the main principles of smart growth and sustainable development, including the preservation of natural resources, reduced automobile-reliance in the area of transportation, increased density in housing development, and mixed land use zoning in planning (Ye, et al., 2005). In the developing world, where urban spaces are expanding more rapidly, efforts should be concentrated on urban design and planning which leads to energy efficient and compact cities.

Changing urbanisation patterns with respect to the location of residential developments and public transportation availability are complementary instruments which can help reduce emissions considerably; therefore, mitigating the threat of climate change on biodiversity. It is suggested that more compact cities with advanced public transportation services can reduce GHG emissions considerably. For instance, in New York, it has been estimated that suburban development causes more than 300 times more damage in carbon dioxide emissions than central city development (Glaeser, 2008). Likewise, studies including multiple cities across developed countries show that emissions can be reduced by 30% if public transportation options are implemented in substitution of private car use (UITP, 2006). By setting up emissions targets and reorienting housing developments in compact, central areas, cities can make significant contributions to cut emissions and decrease land consumption. A variety of successful experiences exist in different cities across the world. For example, the city of San Francisco (USA) recently approved a comprehensive ordinance establishing Climate Change Goals and Action Plan setting ambitious greenhouse gas reduction targets for the city: 25% below 1990 levels by 2017, 40% below 1990 levels by 2025, and 80% below 1990 levels by 2050 (San Francisco City and County Government, 2008).

4.5 Increasing awareness among urban dwellers and decision-makers

Instruments to foster environmental awareness can target both the reduction in consumption and the planning of more biodiversity friendly cities. Urban dwellers are generally non-acceptant of attempts made by planners and scientists to protect nature in urban environments (Breuste, 2004). Lack of environmental awareness generally brings the development and implementation of erratic and contradictory policies such as draining of wetlands or usage of them for waste disposal purposes (Pauchard, et al., 2006). Therefore, special attention has to be paid to educate and inform citizens and policy-makers about the merits of biodiversity preservation and nature protection. McKinney (2002) states that well-informed public can act as the most important means of promoting effective conservation of native species. In this respect, urban citizens need to be made aware of the ecosystem services provided by nature and of the contributions they make to the quality of life in cities (Bolund and Hunhammar, 1999).

Education programmes for the general public and school age children, together with awareness-raising campaigns could contribute to informing people about the necessity and benefits of biodiversity preservation. For instance, Montreal (Canada) uses nature museums and educational activities about biodiversity conservation as a means to raise awareness. However, these means should not be limited only to these programmes and campaigns. Increased community participation and active involvement of citizens in the decision-making and implementing process for biodiversity preservation in urban areas are also

necessary (Breuste, 2004). City governments should develop and implement relevant ways to include urban dwellers and their associations in nature conservation, urban planning, and management processes.

It should also be noted that lack or inadequacy of awareness is not a problem limited to citizens and urban dwellers. In many cases, decision-makers and even professionals are not well aware of the merits of biodiversity preservation; therefore, in the same manner, awareness among all stakeholders needs to be increased. Key local actors in decision-making and decision-implementation have to be well-informed about the means and importance of effective biodiversity conservation.

4.6 Stronger links with national and international networks

The establishment of a variety of networks in which city governments and international organisations come together to design policy mechanisms for urban spaces as biodiversity preservation can be an effective instrument for cooperation, knowledge sharing, critical debate, monitoring and evaluation (indicators), and incentives (awards). Examples of current partnerships include the IUCN Countdown 2010 working towards the 2010 biodiversity target; ICLEI and IUCN's Local Action for Biodiversity (LAB) programme[9], which works intensively with a growing number of cities and local authorities (currently 28); the Metropolis Association, which includes more than 90 cities across the globe; the Urban Biosphere Group constituted under the UNESCO Man and Biosphere programme (MAB), which includes scientists, planners, and policy-makers from six cities (New Orleans, New York, Canberra, Istanbul, Johannesburg, Cape Town); and the Global Partnership for Cities and Biodiversity[10] established in Curitiba and launched in the IUCN World Congress in Barcelona in 2008 with the aim of acting as an implementation mechanism of the CBD. The Sustainable Urban Development Network (SUD-Net) coordinated by UN-HABITAT includes global partners and networks to promote a multi-lateral and inter-disciplinary approach to sustainable urban development.

Crucial for the effectiveness of partnerships is the development of monitoring and evaluation mechanisms. For example, UN-HABITAT works together with a variety of partners in the development of indicators of good urban governance. Such indicators aim to helping local governments identify governance priorities and assess their progress towards improving urban quality of life. Performance indices are also essential in facilitating city governance efforts towards sustainable development. Recently, Singapore and other cities have tested the City Biodiversity Index (CBI)[11], which may be available soon. Another example is the global Good Urban Governance Index which assesses the state of urban governance in the world. The results of the index are published in the UN-HABITAT *State of the World's Cities* report and the UNDP *Global GEO Cities*. The GEO Cities Assessments methodology has been prepared to guide cities in conducting integrated environmental assessments, focusing on the state of the local environment and the impacts of cities on the local, national, and global environment. International awards can also be a successful mechanism for fostering changes in urban governance leading to improving the impacts of biodiversities in cities. One example is Kigali (Rwanda), which was awarded the 2008 Habitat Scroll of Honour Award for innovations in building a modern city with zero tolerance for plastics, improved garbage

[9] See more at ICLEI-LAB page at: <http://www.iclei.org/lab>
[10] See more at: <http://www.cbd.int/authorities/Gettinginvolved/GlobalPartnership.shtml>
[11] See more at SCBD page: <http://www.cbd.int/authorities/gettinginvolved/cbi.shtml>

collection, and a substantial reduction in crime. Starting from 1998, Kigali's government targeted garbage collection, improved the sewage system, upgraded the slum areas, and banned use of plastic bags. The streets and pavements were improved, and the public transportation system was upgraded.

5. Cities, the CBD and the Governance Challenges

Even though most of the international agreements aiming at protecting the global commons are signed by national governments, most of the implementation is left to sub-national governments, including city governments. As the world becomes more urbanised, cities have strong influence and large responsibilities regarding the outcome of international treaties as city governments in many countries have direct input on key policies such as land-use, energy, and transportation. However, to put in practice the instruments analysed in the section above, there are considerable governance challenges to overcome.

City governments are not sole actors that influence policy implementation at the local level. Companies, individuals, and civil society groups are also fundamental to shape local policies as their actions determine the outcomes of policies. Thus, policies should go beyond government and public administration to deliver effective results. The governance at the city level, which indeed delivers the effective implementation of international treaties, is composed of governmental and non-governmental actors. The key point in the governance structure is not only the capacity of individual organisations but the strength of coordination among them.

For effectiveness, the governance structure should also connect the different levels of governance (multi-level governance). Cities and local governments have limitations of their authority over certain issues, which vary from country to country or within countries[12]. Good interactions with higher levels of government, or even at the international level, determine the capacity of local governments to act (Puppim de Oliveira, 2009). The same applies to local non-governmental groups. The connections among themselves and with groups at the different levels of governance strengthen their capacity to influence policy-making and act. Finally, governance is crucial for the coordination at the same level in different jurisdictions; local governments need each other for learning lessons and generating common solutions.

Many cities have directly and indirectly been engaged with the CBD process. In the policy-making process, cities can influence their national governments to adopt certain positions in the CBD discussions. In particular, large cities are key stakeholders nationally as they represent important constituencies at the national level. Cities have also been involved in international policy-making process through their own international organisations. ICLEI – Local Governments for Sustainability and IUCN coordinate the Local Action for Biodiversity programme, which among other things facilitates local authorities' participation in the CBD Conference of Parties. During the 2008 COP 9 in Bonn, ICLEI and others worked with the City of Bonn to organise the Mayors Conference on Biodiversity that released the Bonn Declaration, which was followed up by the launch of the Global Partnership on Cities and Biodiversity at the IUCN World Congress in October, 2008. In January 2010, the CBD Secretariat and other partners led the Second Curitiba Meeting on Cities and Biodiversity, following up on the first meeting in 2007 when 34 mayors around the world signed the Curitiba Declaration on Cities and Biodiversity (ICLEI, 2010). During CBD COP 10 in Nagoya, the City Biodiversity Summit 2010 will be held.

[12] Some countries, like Japan, have different kinds of local governments with different autonomy and authority.

Cities are also key in the implementation of CBD through their national policies. CBD requires the development of a National Biodiversity Strategy and Action Plan (NBSAP) by each party to the Convention, and provides a framework for its implementation. The second CBD Conference of Parties (COP 2) in 1995 provided the guidelines for the NBSAPs and their implementation, and parties are responsible to update and periodically reassess their biodiversity strategy plans. In tune with the governance concept, NBSAPs should be developed and implemented with the participation of different stakeholders in society, including local governments, as they are crucial to provide information and determine the outcomes of the plans.

Besides the inclusion of local governments in the CBD decisions, sub-national governments, including cities and civil society are important actors in NBSAPs as they are responsible for many factors that influence the outcome of the implementation process. Sub-national governments in many countries, such as Ecuador, India, and South Africa, have already introduced aspects of the CBD in their own policies (Pisupati, 2007). The SCBD is also developing the "Plan of Action on Cities, Local Authorities and Biodiversity 2011-2020".[13] Sometimes cities go ahead of the national governments in the adoption of biodiversity policies. Even in countries that have not supported the CBD, such as the United States, there are cities engaged in the CBD process through their own initiatives.

However, even though cities are important institutional actors to achieve the objectives of the CBD, there are still many conceptual, institutional, and political obstacles to improve the governance of the CBD process to incorporate cities in the main debates and actions to achieve the CBD goals as we describe below.

5.1 Obstacles to improve the governance of the CBD

5.1.1 Cities are not in the core discussions of CBD

The discussions in CBD have been divided and focused on the different kinds of ecosystems and access to them. This may be important to understand the state of biodiversity in the different ecosystems as well as the main problems they face. However, some of the main underlying indirect drivers as well as the solutions for the problems come particularly from cities, as most of the world's inhabitants and demands come from urban spaces. Cities need to be in the mainstream of the CBD discussions to promote biodiversity policies in cities. This could be done by more prominent involvement of cities in biodiversity discussions, as cities have just recently begun (in the 2000s) engaging in the CBD process.

5.1.2 CBD implementation by national governments is limited

Many national governments have implemented policies to fulfil their commitments to CBD (NSBTA). However, most of the policies focus on the end point, where most of the biodiversity is, resulting in actions like the creation and maintenance of protected areas, biosafety programmes or biodiversity inventories, which are fundamental, but does not tackle many of the underlying causes of biodiversity loss which lies in cities. For example, the deforestation of the Amazon is largely due to demands for products (e.g., timber and agricultural products) from major cities in Brazil and abroad. Just recently, São Paulo has

[13] See more at the SCBD webpage: <http://www.cbd.int/strategicplan.shtml>

adopted measures to control state imports of illegal timber. The lack of focus on city policy may be the reason for limited CBD discussion; however, engagement of cities in the process is also lacking.

5.1.3 CBD is still not mainstreamed in the cities' agenda

CBD related issues are not optimally incorporated in the city policy agendas. The role of cities in the implementation of CBD will depend on how policy-makers prioritise political, human, and financial resources for biodiversity protection within and beyond the city boundaries. Moreover, biodiversity is a cross-sectoral issue. Effective biodiversity policy implementation and biodiversity agenda mainstreaming will involve various sectors of the government structure (e.g., transportation, housing, land use) and civil society, so biodiversity aspects can be considered in the different decisions.

5.1.4 Conceptual clarifications are needed to move the biodiversity agenda

There is very little conceptual understanding between the relationship of cities and biodiversity. Many policy-makers limit the relationship of city and biodiversity to the promotion of green areas, which may help protect biodiversity but falls short from addressing the main aspects of the city-biodiversity relationship, including the influence of cities beyond city borders. This is a key issue, particularly as cities develop economically, their impacts become more widespread and reach farther places. Another aspect is how to promote urban biodiversity, whether cities should use local species or opt for exogenous species.

5.1.5 Citizens lack awareness of the importance of biodiversity and ecosystem services

Citizens can be a driving force to push the biodiversity agenda in cities, both for policy-making and implementation. Civil society can induce governments to introduce coherent policies and also participate actively in the policy process as individuals or collective whole. However, citizens have limited awareness of the biodiversity challenges and particularly their role in fulfilling the CBD objectives. Even though many citizens may be informed of the threats in faraway ecosystems, they do not relate those issues with their lives in the city and their indirect influence on biodiversity loss.

5.1.6 There is a lack of proper instruments to deal with biodiversity at the city level

There is very limited number of comprehensive instruments to deal with biodiversity and cities, and when they do exist, there is little coordination to put them into practice. Without adequate instruments, it is difficult for cities to implement the CBD even when they have the political motivation and resources. Incorporation of biodiversity concerns in existing practices, such as urban design projects or redevelopment plans, is still almost unheard of. ICLEI-LAB is developing a guide to help practitioners in local government to plan for and manage their local biodiversity (Berrisford, Patrickson and Mader, 2010). Lack of proper biodiversity indicators for cities, such as the initiative of the Singaporean government (CBD, 2010), is key but the results will take time to affect policy. Instruments for controlling the impact of cities on faraway ecosystems are in the very early stages of development. Many of those instruments will involve the coordinated action of more than one locality.

Economic instruments to deal with the protection of biodiversity, which can be applied at the city level, are still being tested, such as payment for ecosystem services and its use for forest preservation in Costa Rica (Chomitz, et al., 1998). Change the planning process to incorporate biodiversity issues is still a major challenge.

5.1.7 Lack of coordination among different levels of government and among local governments for joint action

Individual cities alone have limited influence on biodiversity beyond its administrative borders, as the final result on biodiversity conservation in some places will depend on how adjacent localities act as well. If one city acts to protect biodiversity, for example by controlling alien species and the others do not, the overall results may be ineffective. Thus, more effective coordination among cities is necessary to implement CBD (even though not sufficient). Moreover, cities and local governments may not have the autonomy or the capacity to effectively implement policies towards CBD among themselves. On the other hand, national governments need local governments to effectively implement policies as in many countries, international treaties are de facto implemented by local governments.

Governance arrangements among national, local, and sub-national governments are complex. Within the 193 Parties in the CBD, sub-national governments (municipalities, provinces, States) have differing roles related to biodiversity issues (sometimes directly implicated, sometimes only as conduits for federal guidelines and policies), and local governments also play different roles depending on the degree of decentralisation of mandates, budget and population size, tax allocations, and capacity. Political alliances and compatibilities further add to the complexity of relationships among the national and local levels. Additionally, there are distinct governance arrangements for overseas entities, relatively autonomous regions and/or territories under indigenous or tribal stewardship. Thus, due to this given nature of institutional diversity, it is hard to find the best coordination mechanisms[14].

5.1.8 Differences in the challenges among cities

Cities are diverse and differ on the kind of challenges they face towards the implementation of CBD. Therefore, solutions, instruments, and governance mechanisms need to have flexibility to adapt to the different contexts. Some cities possess incredible biodiversity within their limits and surroundings and need to protect it; others have little and would need to begin from generating biodiversity. As cities develop, they tend to move their impacts from being directly on ecosystems within and surrounding it to affect life supporting ecosystems in faraway ecosystems (MA, 2005). As biodiversity varies among cities, it may be difficult to find consensus among the cities on how to act jointly to move the CBD agenda towards implementation.

[14] Tasker-Brown (2010, forthcoming) will address how national governments can involve local authorities in the implementation of CBD.

5.1.9 Political resistance for change at various levels

The implementation of CBD at the city level will affect the interests of certain actors at the local level and create resistance to change. For example, many actions to protect biodiversity within the city and its surroundings will have the resistance of some developers and property owners who would have to sacrifice their individual interests for the greater good. The imposition of any taxes or economic restrictions on imports, trade, or commerce will also face opposition. Many will argue that cities are constrained and their influence limited on biodiversity, particularly if other stakeholders do not support its protection. On the other hand, cities consume large amounts of ecosystem services from other regions and pay little in return. Although there are voluntary initiatives in place, there will likely be great resistance from citizens when asked for compensation of these services.

5.2 Opportunities to move the CBD agenda forward

Although there are several obstacles for improving governance towards the implementation of CBD, many opportunities exist for cities to move the CBD agenda forward.

5.2.1 Cities as an efficient body to protect biodiversity

The impact on biodiversity and ecosystem services is greater when city dwellers live in less compact forms with unsustainable consumption patterns. Cities put pressure on ecosystems; however, cities are relatively efficient spaces to settle a large population. However, efficiencies in cities are offset by high consumption patterns, as cities tend to have higher income than rural areas, and consequently, larger consumption power. With rampant urbanisation in developing countries, sustainable urban consumption patterns present an opportunity for more sustainable settlements. Efficient cities coupled with low consumption patterns can be an efficient way to protect biodiversity.

5.2.2 Cities' involvement to tackle global problems and development of new instruments

The CBD has a decision to recognise the role of cities and local authorities for the implementation of the agreement, yet cities do not have a relevant role in the CBD process, though they are increasingly getting involved in the discussions in the COPs and other forums. In other international processes such as the UNFCCC, cities are more engaged and becoming influential in the decisions and implementation, and this can help build momentum in the CBD and biodiversity agenda for cities. Moreover, as cities become more involved, new ideas and tools emerge through their own experience in tackling biodiversity issues, facilitating the adoption of the agenda by a larger number of cities. For example, Singapore and other cities are trying to develop a set of biodiversity indicators for cities. Curitiba has a tax incentive to landowners who protect natural forest in their properties.

Box 8: Effective management of urban biodiversity through relevant instruments in the city of Edmonton

City of Edmonton in Canada is known for innovative approaches to protect and manage its biodiversity, especially by means of ecological network approach. The city harbours the largest linear park (7.400 ha.) in North America, namely North Saskatchewan River Valley and Ravines System. Besides, there are also wetlands and forests in the city, all together enabling a diversity of native plants and wildlife species to flourish. The main target of the local efforts in Edmonton is to protect the remaining natural areas (river valley, ravines, wetlands, etc.) as connected ecological network, which refers to a single, integrated natural system. More specifically, the city government attempts to protect core natural areas, and to connect them by linkages in order to conserve plant and wildlife species and ecological functions. Linkages, which are vegetated patches, are the crucial instruments in Edmonton to create green networks and biodiversity corridors. Some of these linkages are natural, such as natural areas and parks, naturalised storm water management facilities. On the other hand, there are also semi-natural linkages consist of recreation parks, cemeteries, school yards, power line corridors, etc.

To these aims, the city employs a range of conservation tools including plans, policies and programs, all of which set strategic directions for effective conservation. Natural Areas Systems Policy (NASP) is one the key local policy frameworks. NASP intends to incorporate environmental and ecological considerations into the economic and spatial considerations. In a similar manner, a new planning tool titled "Ecological Design Report" aims to ensure that ecological principles are integrated into urban development plans to reduce the ecological impacts of urban development. Moreover, City of Edmonton does not rely solely on the introduction and implementation of policies, plans and programs to preserve biodiversity. City government also gives high attention and priority to awareness-raising and involvement of public into decision-making and implementation processes. City of Edmonton engages citizens in the process of biodiversity protection through public consultation, representation on municipal advisory committees, etc.

Results in terms of public participation and community awareness have been remarkable. 50 biodiversity-related initiatives were launched in the city, half of which are led by community groups and by partnerships between citizens and city government. It also noted that Edmonton's local people value nature and natural habitats in the city by recreating in the city parks and river valley and ravines. However, the progress on the actual preservation of biodiversity harbouring patches and areas appears to be slow. The State of Edmonton's Natural Areas Report[1] shows that "for every 2 ha of natural area in Edmonton's tablelands that were protected between 1995 and 2005, 3 ha were lost".

Sources:

ICLEI, 2008. City of Edmonton, Canada: Planning for a functional ecological network. Local action for biodiversity, a series of local cases. [online] Available at: <http://www.iclei.org/fileadmin/template/project_templates/localactionbiodiversity/user_upload/LAB_Files/City_Case-studies/Edmonton_Final.PDF> [Accessed 26 June 2010].

ICLEI, 2008. City of Edmonton, biodiversity report 2008. Local action for biodiversity: An ICLEI initiative, Edmonton, [online] Available at: <http://www.edmonton.ca/environmental/documents/Environment/Edmonton_Biodiversity_Report_2008.pdf> [Accessed 26 June 2010].

Box 9: Taking stock of biodiversity in the city – the city biodiversity index

In order for cities to monitor their level of biodiversity and progress on its conservation, it is necessary to have a framework which can be used to aid planning and governance. The Global Partnership on Cities and Biodiversity has developed a self-assessment tool known as the City Biodiversity Index (CBI) under the leadership of Singapore and the SCBD. The index comprises of indicators split into in three categories which enables cities to (i) monitor their level of biodiversity, (ii) understand the provision of ecosystem services within the city and (iii) develop their capacity to manage these resources within the city. As such it combines a range of physical and biological survey such as number of native species, natural connected areas, green areas, number of alien species in the city and an assessment of governance structure and activity (alignment of local to national policies; number of projects and outreach programs) to come up with a score, which can be used as a reference for future updates.

Given the huge bio-geographical variation in cities and their fundamental level of natural biodiversity, it may not be useful to compare scores in a scientific sense but rather in a relative sense to understand cities' progress in conserving their natural biodiversity and ecosystem services whilst developing policies and strategies to achieve these aims. More details on the CBI including the users' manual on how to conduct the assessment can be found in the source reference.

Source:
Convention on Biological Diversity, 2010. The Singapore Index on Cities' Biodiversity (CBI). [online] Available at: <http://www.cbd.int/authorities/gettinginvolved/cbi.shtml> [Accessed 12 July 2010].

5.2.3 Urban dwellers tend to be more educated and environmentally sensitive

City dwellers are still not sufficiently aware of the biodiversity challenges and their role as citizens to protect biodiversity. However, urban citizens tend to be more educated and inclined to support biodiversity conservation, which can facilitate the process of raising awareness on biodiversity issues, as they also tend to be more politically active. For example, urban dwellers are more supportive of elephant conservation compared to their rural counterparts in Sri Lanka (Bandara and Tisdell, 2003). As many key decision-makers live in cities, education can be the key to change their attitudes and behaviours, both through raising awareness as urban citizens or by political pressure.

5.2.4 Policies can be more effective at the city level because of the scale

As cities are dense in population, scaling up of initiatives such as awareness raising campaigns or law enforcement mechanisms can be an efficient and powerful way to implement CBD initiatives. Awareness raising campaigns would reach a wide audience in cities; the enforcement of legislations is also more effective in cities. Thus, if CBD implementation initiatives have a larger focus on cities, their efficiency and impact can be greater.

5.2.5 Opportunities for win-win situations between biodiversity conservation and other benefits

Biodiversity and preservation of ecosystems present immense benefits for citizens. For example, preserved mangroves or forests in cities can be an effective buffer for floods during heavy rains, reducing risks and losses. A better understanding and more widespread access to information of these benefits and win-win situations can raise interest among cities to implement their biodiversity agenda.

[1] Spencer Environmental Ltd. (2006), State of Natural Areas Report, City of Edmonton.

Box 10: Urban agriculture in Accra, Ghana

Ghana's capital, Accra, is also its largest city and one of the most vibrant metropolises in West Africa. Accra's population is 1,695 million people, and its metropolitan region[1] has over 2.7 million, growing at a rate of 3.36% per year.[2]

Urban agriculture[3] is practiced in Accra for a long time, as European colonisers cultivated vegetables in public spaces and private gardens. Urban farming also helped to supply allied forces during the Second World War (Asomani-Boateng, 2002). There was an estimated 1,000 ha under urban agriculture mostly maize and vegetables, plus thousands of backyard vegetable gardens in mid 2000s. More than 1,000 farmers have their incomes dependent on urban agriculture and many more in the chain (Cofie, et al., 2005). It is well know the benefits of urban agriculture for providing jobs, income and food security to the growing cities in the developing world, particularly in Africa, as well as an opportunity to recycle some of the organic waste (Maxwell, et al., 2000; Drechsel and Dongus, 2010). However, one of the most promising areas urban agriculture can contribute to the sustainability of urban areas is the potential to tackle global problems such as biodiversity loss and climate change. More than that, there are tremendous opportunities to win-win or co-benefits: Urban agriculture can provide the biodiversity and climate friendliness together with all the other economic, social, and local environmental benefits, if carried out adequately. In and around urban agricultural sites there are plenty of biodiversity, such as different kinds of plants, insects, reptiles, birds, and reptiles. Biodiversity can help to enhance strategies for pest control, especially if the agriculture is organic, and help to pollinate crops and other benefits.

As urban agriculture practices grow in cities around the world, it adds to the complexity of cities' landscapes. If it is carried out properly, urban agriculture can contribute to increase the biodiversity of cities, besides providing many other economic, social, and environmental benefits. It can add to the cities' amount to green areas, connecting patches of natural biodiversity (such as parks), with the advantage that agricultural sites are self-maintained by farmers, and reducing the Heat Island Effect.

Sources:

AMA-Accra Metropolitan Assembly, 2010. [online] Available at: <http://www.ama.ghanadistricts.gov.gh> [Accessed13 July 2010].

Asomani-Boateng, R., 2002. Urban cultivation in Accra: An examination of the nature, practices, problems, potentials and urban planning implications. *Habitat International*, 26(4), pp. 591-607.

Cofie, O. et al., 2005. *A narrative on urban agriculture in Accra metropolis*, IWMI, Accra.

Drechsel, P.and Dongus, S., 2010. Dynamics and sustainability of urban agriculture: examples from sub-Saharan Africa. *Sustainability Science*, 5, pp. 69–78.

Maxwell, D. et al, 2000. *Urban livelihoods and food and nutrition security in greater Accra*, Ghana. Washington DC: IFPRI, Ch. 1 and 2, pp.1-25.

[1] Comprising of Accra plus Ga East, Ga West and Tema/Ashaiman

[2] AMA, 2010.

[3] Urban agriculture can be practiced in three basic forms: in the backyard gardens generally for own consumption,or more commercially in larger open allotments or in peri-urban neighbourhoods.

5.2.6 Convergence of the movements on biological diversity and urban planning

The convergence of biological diversity and the urban planning process opens opportunities for both to affect one another – in other words, biological conservation playing an important role in urban planning and vice versa. This facilitates dialogues between the two policy spheres and support for implementation of the CBD agenda. However, a more detailed conceptual grasp on how to integrate both agendas and the development of tools are necessary, for policy-makers at different levels could put them into practice.

Box 11: Effective management of urban biodiversity through relevant instruments in the city of Cape Town

The City of Cape Town is one of the only three cities in the world designated as a biodiversity hotspot. The city is the home for unique biodiversity and for two UNESCO world heritage sites; one of them is a national park. The City of Cape Town is located within the Cape Floral Kingdom, which is the smallest of only six floral kingdoms in the world.

The importance of the City of Cape Town in terms of biodiversity is not only limited to the existence of biodiversity harboring sites within the city. Cape Town is also known for its active role and local strategies and actions to ensure adequate biodiversity conservation.

Cape Town is suffering from the loss of habitat due to certain urban processes, such as urban development and sprawl. Therefore, the major challenge for biodiversity conservation in Cape Town is to avoid urban footprints over the unique vegetation types and habitats. Integrated Management Environmental Policy adopted in 2001 and Biodiversity Strategy adopted in 2003 are the two major policy frameworks for the current biodiversity-related actions and strategies in City of Cape Town. Urban planning has given a special place and attention within these policy frameworks and actions. The city government applied "scientific conservation planning techniques" to give a priority to the preservation of remaining biodiversity sites, and to produce a conservation plan, known as the Biodiversity Network.

As for the administrative dimension of conservation actions, conservation planning and management were consolidated under the Biodiversity Management Branch, which is a part of Environmental Resource Management Department of the city government. The intention behind such an administrative reorganisation is to overcome the obstacles to effective conservation of biodiversity and to facilitate the implementation of the local strategies and policies. Another aim of this move is to mainstream biodiversity-related issues into city governance.

The City of Cape Town also recognises the importance of partnerships among local, national and international stakeholders and actors to define the objectives, methods and tools of biodiversity conservation. In this respect, the city is one of the major founders of Cape Action for People and Environment (CAPE), which is a public-private partnership programme to ensure the conservation of biodiversity in a way to deliver benefits to local people. Furthermore, as an active member of ICLEI, the City of Cape Town initiated the ICLEI's Local Action for Biodiversity Project. The city is also the host to the ICLEI Africa Secretariat and to several other offices of international organisations, such as International Union for Conservation of Nature (IUCN).

Sources:
ICLEI, 2008. City of Cape Town, South Africa: World heritage within a city border. Local action for biodiversity, a series of local cases. [online] Available at: <http://www.iclei.org/fileadmin/template/project_templates/localactionbiodiversity/user_upload/LAB_Files/City_Case-studies/CapeTown_Final.PDF> [Accessed 26 June 2010].

ICLEI, 2008. City of Cape Town, biodiversity report 2008. Local action for biodiversity: An ICLEI initiative, City of Cape Town, South Africa, [online] Available at: <http://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Biodiversity%20Report%20CCT-LAB%202008.pdf> [Accessed 26 June 2010].

6. Conclusion

Cities are fundamental players if we want to achieve the objectives of the CBD, as most of the world population lives in cities today and many of the important decisions that affect cities are made in cities. Cities are also some of the biggest beneficiaries of biodiversity and ecosystem services, as most of their citizens and economic activities depend on those services from faraway areas. However, their involvement in the CBD process is still limited in comparison to their potential contribution and amount of benefits they get from biodiversity and ecosystem services. There are many conceptual underpinnings and governance obstacles to overcome; there is a need to create new and adapt existing city planning and management instruments to properly deal with biodiversity.

From an ecological perspective, there are two different, yet interrelated kinds of instruments through which cities can make positive contributions to the CBD. First are those aiming at reducing cities' ecological footprints, and second are those aiming at restoring urban ecosystems. Although deeply interconnected, the former does not necessarily include the latter, and vice versa. For example, reduced consumption levels or increased recycling reduces ecological footprints, but these can be achieved without making any significant local environmental improvements. Likewise, cities can improve the local biodiversity by creating new urban parks for leisure activities using local species, however at the same time, if the per capita consumption of meat is increased, the ecological footprint in the regional or global scale is not reduced. Yet in certain cases, both types of instruments go hand-in-hand. For instance, in transportation-related impacts, improving urban mobility systems contribute both to improved local ecosystems and to reduced global atmospheric impacts. Given the complexity of tackling ecological causes of diversity loss by urban governance mechanisms, efforts should be directed toward designing and implementing synergetic instruments, in other words, developing mechanisms which contribute to both the reduction of ecological footprints of cities while improving the ecology of the urban fabric.

In addition to the ecological dimensions, managing social and cultural aspects is also of paramount importance for creating successful instruments. Equity, transparency, accountability, security, civic engagement, and citizenship must be integrated in any governance transformation aiming at contributing to the CBD. In this respect, the inclusion of civil society and stakeholder group in local governmental policy initiatives is vital for effective biodiversity management (Elander, et al., 2005). Furthermore, since interest groups and local stakeholders have a direct influence in biodiversity management through their own land use and management practices of green spaces (Barthel, et al., 2005), policy mechanisms should be designed and implemented in conjunction with social initiatives to create adaptive and polycentric networks.

Urban planning can serve as an effective instrument to reduce the adverse impacts of urbanisation on the natural environment and facilitate such change and improvement. Nevertheless, it is not enough to rely on the current approaches and practices of urban planning as they generally lack deep ecological understanding and knowledge. Baseline information of physical properties and biotic characteristics of biotope patches in and around cities (Niemela, 1999) would provide the sound scientific knowledge base for urban planning decisions. City governments can greatly benefit from an urban planning approach mainstreamed with an ecological understanding in addressing biodiversity related problems.

There is growing participation of local governments and city representatives in the CBD process and an increasing recognition of the importance of cities for the effective implementation of CBD. However, there is room for improvement, as biodiversity policies in sub-national governments in cities are still very much lagging. Even though there is considerable effort on the part of some cities to mainstream biodiversity, the engagement of cities is still low compared to other global issues, such as climate change. Moreover, if we consider the three levels of interaction between cities and biodiversity (urban biodiversity, regional biodiversity, and global biodiversity), much of the efforts have been put or limited to urban biodiversity, which sometimes is mixed with green areas. The influence on regional biodiversity has been the concern of some cities in their policies to avoid sprawl, but most of the time for different reasons, such as the need to revitalise city centres. Finally, the global influence on biodiversity is still in its early stages of conceptualisation at the local level. Nevertheless, the interest of cities in the biodiversity agenda is moving fast, and there are ample opportunities to bring cities as effective actors in the implementation of CBD. This will also require a large effort for collective action for results; we will need the cooperation of a large number of cities, and/or greater support at other levels of governance.

Urbanisation is ambiguous to biodiversity. The globalised nature of agriculture and supply chains means that threatened ecosystems could exist at land or sea, far away from any city. To achieve the aims of CBD, it is crucial to understand the systemic levers of our governance and institutions. This could take the form of enlightened city planning or strengthened enforcement of institutions (e.g. tracking of criminal networks and prohibiting the trade and transfer of endangered species to restaurants and health centres).

Cultural issues related to consumption can be an underlying factor that drives these changes. Modern cities are not only ecologically unsustainable but socially constructed as spaces "outside of nature". Many city residents only experience very humanised environments throughout their life, so there is the perception that cities can function with little regards to the environment outside of the city. Despite the fact that the sustainability of human life ultimately depends on the Earth's ecosystems and the services they provide, people's perception about the impact of increasing urbanisation and biodiversity loss may not go beyond what is happening to certain emblematic species (e.g. pandas). This cultural paradigm of the city as defeating nature is also shaping the minds of planners, decision-makers, mass media, etc. Only by deconstructing this cultural notion, effective instruments can be designed.

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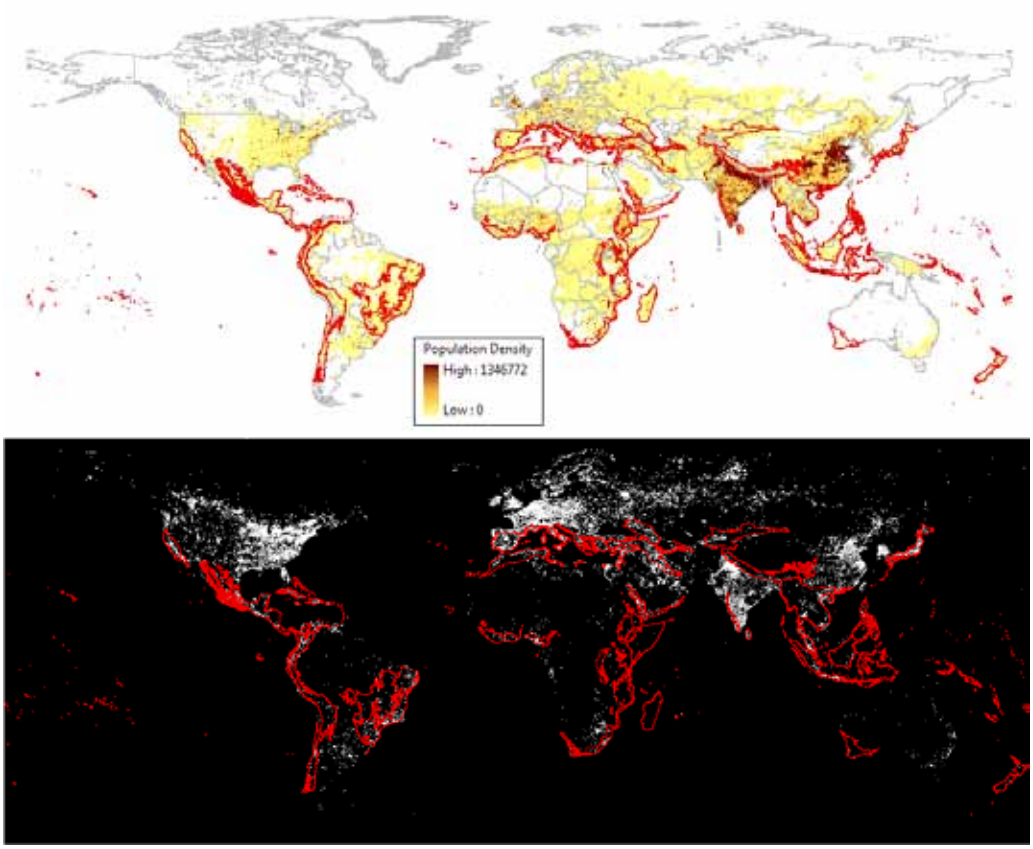
Figure 1: The biodiversity hotspots of the world (red outlines) from Conservation International (Conservation International, 2007) overlaid on the distribution of global population (top Center for International Earth Science Network's Global Rural-Urban Mapping Project; CIESIN, et al., 2004) and on the distribution of night-time lights (DMSP-OLS from NOAA-NGDC, 2010)



UNU-IAS Policy Report

Cities, Biodiversity and Governance: Perspectives and Challenges of the Implementation of the Convention on Biological Diversity at the City Level

Jose Antonio Puppim de Oliveira, Osman Balaban, Christopher Doll, Raquel Moreno-Penaranda, Alexandros Gasparatos, Deljana Iossifova, and Aki Suwa

Urbanisation creates new challenges for biodiversity conservation. As large part of the concentration of the world's population gradually moves from rural to urban areas, there are changes in the link between human activities and biodiversity, and consequently to the way we should think about biodiversity conservation policies. Scarce attention has been given to understand how to make cities more biodiversity friendly, not only within, but particularly in faraway places.

Understanding how cities can create better governance mechanisms to effectively help in the preservation of the biodiversity within and beyond the city boundaries is the key to implement the directives of the Convention on Biological Diversity (CBD). This report argues the need to study the conceptual underpinnings of the relationships among city, governance, and biodiversity to create the basis for policies at the global, national, and local level, as well as provide some practical insights on the way to move the biodiversity agenda in cities forward.

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