

# **Saving Our Oceans-An Urban Challenge<sup>1</sup>**

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Photo: USGS

## **Cities and Oceans Inexorably Linked**

The oceans are in jeopardy. At no time in the span of human civilization have we faced such extreme and global threats to our marine ecosystems<sup>2</sup>. Pollution levels in coastal habitats are reaching alarming levels. Heavy metal contamination is yielding some commercial fish stocks unsafe, and many species are exploited to the brink of collapse. Estuaries, the nurseries of the oceans, are being destroyed on a daily basis. Wetlands are filled and mangroves are bulldozed for urban development. The 20<sup>th</sup> century alone saw the destruction of 50% of the world's mangrove forests<sup>3</sup>. The very chemistry of the ocean itself is threatened with acidification as the release of green house gases explodes and carbon dioxide levels skyrocket<sup>4</sup>.

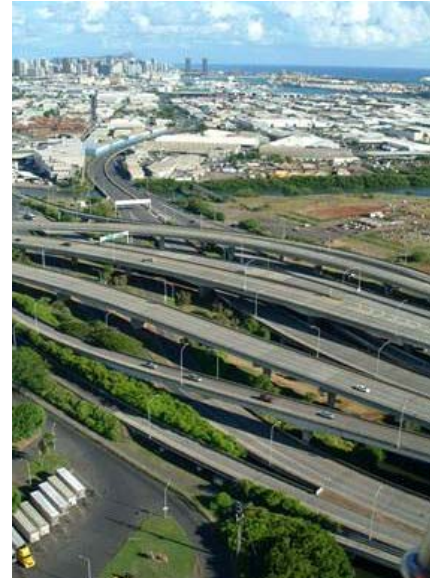
Coral reefs, critical centers of biodiversity that provide habitat for one quarter of all marine life, are in serious decline worldwide. Of the 109 countries around the world that have significant coral reef ecosystems, 93 are exhibiting significant damage<sup>5</sup>.

To respond to these assaults on our ocean ecosystems, scientists and NGOs around the world have mounted an impressive array of research and environmental initiatives. For instance, Marine Protected Areas (MPAs) have been established to protect special areas of biological importance, and targeted research programs have been established to better understand the science associated with the ocean's deterioration. Managers of marine ecosystems are trained in the establishment and management of specially protected areas, and national governments have been lobbied to adopt more stringent fishery and environmental legislation.

While all of these initiatives are vitally important, they alone will not save our oceans. In fact, the single biggest contributor to the destruction of our global marine environment has gone largely unaddressed. That destructive force is unsustainable urban development.

## Threatened Oceans - An Urban Problem

The world has now entered the 'Urban Era' with over half of the global population now living in cities. This trend is accelerating with urban areas growing by 60 million people a year<sup>6</sup>. As people move to the cities they dramatically increase their consumption of products and services, using more natural resources and generating more waste. When people become urbanites they increase their consumption of meat and fish protein and their energy usage skyrockets. Meanwhile, cities are ill-equipped to deal with this onslaught. Most urban infrastructure,- water, waste treatment, transportation, etc,- is inadequate to deal with current population levels, let alone rapidly growing ones.



This unsustainable urban development is having a profound impact on our ocean environment. Global warming, water pollution, marine habitat destruction are all urban problems. Not unexpectedly, this is alien territory for most of the marine conservation and research community. Marine scientists and organizations are more comfortable dealing with what they know and understand. Dealing with cities is often outside their comfort zone and area of expertise. However, if our oceans are to be saved we must first save our cities, by addressing issues of energy, pollution, fisheries, and the adequate integration of management, all at the municipal or regional level.

### Energy

Global warming is the greatest threat to coral reefs worldwide, in part because increasing surface ocean temperatures cause both coral bleaching and stress through ocean acidification<sup>7</sup>. Scientists estimate that 16% of the world's coral reefs were destroyed by bleaching episodes in 1998 alone. The primary cause of global warming is, of course, the release of greenhouse gases (GHG) through the combustion of fossil fuels.

Most of the focus on reducing greenhouse gas emissions has been at the national level, and in the United States it has been completely unsuccessful. However, denial and inaction by irresponsible national leaders does not mean that the effort to control greenhouse gases is lost. It is the cities that are consuming the bulk of fossil fuels, not national governments, and it is the cities that have the ability to reverse the nation's failed energy policy. Cities can dramatically reduce energy consumption by promoting energy efficiency, developing distributed energy systems, and shifting to renewable energy sources.

Much of the energy that is wasted in cities is a result of the energy inefficient 'built environment'. Most of our homes, factories, and offices were designed and built without any consideration for the energy they consume for lighting, heating, and cooling. The energy that goes into manufacturing the building materials themselves was also never considered in the era of cheap energy.

City governments have direct control over this energy wastage. By passing 'Green Building' codes, local governments can mandate the use of both energy efficient design and materials. The American Institute of Architects (AIA) has recognized that as designers of the 'built environment'

they have a major responsibility in this area. The AIA has established an aggressive yet achievable international campaign to have all buildings carbon neutral by the year 2030. In the future, buildings will be energy producers instead of energy consumers.

Major energy savings can be immediately achieved in cities by conducting energy audits and by instituting building upgrades. Such efficiency upgrades can often reduce a building's energy consumption by 20-25% overnight. ESCOs, companies specializing in energy efficiency, are available to finance and implement such upgrades for building owners. This can be done at no cost to the owner, since ESCOs receive their payment from the energy savings they deliver<sup>8</sup>.

Local government tax policy can be a major driver for reducing energy consumption in cities. By providing rebates for citizens who purchase water and energy efficient appliances, low flow toilets and shower heads, and solar water heating systems, government can dramatically reduce energy and energy intensive water usage while at the same time reducing the need for costly infrastructure expansion.

City governments should themselves be models for energy efficiency. 'Energy Star' purchasing programs can be initiated mandating energy efficiency for all city purchases. Traffic signals can be illuminated with light emitting diodes instead of incandescent bulbs and parking lots can be lit with light fixtures powered by photovoltaic cells and miniature wind turbines. Simple initiatives such as this can stop the waste of millions of kilowatt hours of electricity each year in a typical city.

Promoting and developing distributed energy systems and renewable energy sources are other approaches that cities can take to reduce fossil fuel energy consumption. Government buildings can be powered by co-generation systems that use waste syngas<sup>9</sup>. Wells can be drilled into old landfills to tap methane generated from organic waste decomposition and sewage treatment plants can be outfitted to capture methane generated from the sewage treatment process. Cities can also develop district cooling and heating systems that utilize renewable energy sources such as cold ocean or lake water to reduce reliance on fossil fuels.

Local government decisions on the development of power-plants can have an enormous impact on the release of carbon dioxide and other greenhouse gases. By providing tax advantages and other incentives, cities can encourage the development of renewable energy systems, and regulations can be adopted by local governments to discourage the proliferation of antiquated fossil fuel power-plants. In fact, cities themselves can build power-plants that generate electricity from their non-recyclable solid waste.

Transportation is responsible for much of our fossil fuel consumption. Once again it is cities that are driving transportation decisions. By adopting land use plans that promote urban sprawl, cities have necessitated the development of transportation systems that require the use of fossil fueled automobiles.

To reduce this consumption, local governments need to redesign cities using 'Smart Growth' principles that reduce the need for mobility by having higher density mixed use communities<sup>10</sup>. By building cities where people can live, work, shop, and go to school within a short radius, the need for automobile based transportation will be dramatically reduced. When this urban design principle is coupled with the development of efficiently operated public transit systems powered by renewable energy sources and the promotion of bio-fuels and electric and hybrid vehicles, the role of transportation in the generation of greenhouse gases can be substantially eliminated. Since the bulk of greenhouse gas emissions that are causing global warming are generated by cities, they can only be reduced by taking action at the city level.

## Pollution

While global warming presents the greatest threat to coral reef ecosystems and some other highly valued marine systems, localized pollution from a variety of sources also threatens coral reefs and near shore marine habitats. Cities and local governments are also extremely well- positioned to cope with this challenge. Both agricultural and urban runoff increases the nutrient load on reefs and embayments causing eutrophication, which in turn affects marine pathogen growth and spread<sup>11</sup>. Poor land use practices dramatically increase the rate of erosion which increases sedimentation on the reef, killing coral colonies outright or reducing their resistance to disease. Local governments can halt these assaults on marine ecosystems with better land use laws and improved urban infrastructure and public education.



Cities, with their large areas of impermeable surfaces<sup>12</sup>, generate enormous volumes of storm-water runoff. This urban runoff carries with it a wide variety of contaminants and sediment onto coral reefs and into coastal wetlands. Large volumes of hydrocarbons, household hazardous wastes, and a wide array of other toxic agents are poured down catch-basins each day in urban areas, flushing out into estuaries and reef ecosystems at the first rain. The agricultural hinterlands surrounding urban areas further burden the marine environment with the runoff of topsoil, herbicides and insecticides.

The impact of this storm-water on near shore ecosystems could be substantially reduced with the proper design and maintenance of catch-basins and urban drainage systems. To further reduce urban runoff, cities need to adopt strict regulations that control the grading of land. In many cases this responsibility also extends to agricultural operations in the city's hinterland. Such regulations can limit the maximum area of land that can be cleared at any one time, and can require the use of retention and detention ponds around construction sites to contain sediment laden runoff.



Solid waste management at the local level also impacts coastal waters and marine ecosystems. Typically, cities and towns in developing countries dispose of their solid waste in dumps located in the coastal zone, often using the waste as landfill material for filling wetlands and lagoons. In many cases, no lining is provided for these landfills, allowing contaminated leachate to filter through the waste, carrying nutrients, heavy metals, and other toxins into coastal waters.

Many city leaders are not focused on these non-point source pollution issues. With a better understanding of how pollution affects marine ecosystems, local government policy makers would be better able to design and maintain the city's infrastructure to avoid these problems.

At the same time, point source pollution that affects important coastal ecosystems such as reefs and estuaries is also within the control of cities and local governments. Both government and industry are often guilty of this 'end of the pipe' pollution. Industries discharge industrial wastes into rivers and streams that carry their pollution load directly into near-shore marine habitats. Lipid soluble heavy metals from polluting industries gets concentrated in marine food chains, resulting in dangerously high levels of pollutants in the tissue of top predators.

Coastal communities frequently dump or spill their sewage effluent into bays and wetlands, adding further nutrient load to reefs and estuaries. Unusually high nutrient levels in these habitats can harm corals directly with enhanced pathogen growth or promote explosive algal growth which can destabilize marine ecosystems.

Point source pollution such as this is theoretically the easiest type of pollution for local government to control since it can be dealt with through strictly defined regulations and monitored at the 'end of the pipe'. However, regulating an industry that is frequently the principle employer in the community often provides political problems for local government leaders, and avoiding accidents and spills of polluting waste is extremely difficult in an urban setting.



### Coastal Fisheries

Over-fishing and destructive fishing techniques are also taking their toll on coral reefs and coastal marine resources near growing urban centers. These near shore fisheries often suffer from the 'tragedy of the commons' affect and are heavily over-fished by local communities that rely on these fisheries for their food supplies. As coastal fish populations diminish, more draconian fishing methods are often deployed to pursue the reduced stocks. The use of destructive trawls, or dynamite, bleach, and rotenone to poison and stun fish for easy harvesting has a severe impact on marine ecosystems<sup>13</sup>. The rapid growth of the aquarium fish industry has added yet another stressor to many coral reef communities. The use of sodium cyanide by irresponsible collectors to stun fish kills coral colonies and damages whole ecosystems.

Once again, local governments are best positioned to deal with these problems through improved management policies and enhanced enforcement efforts. Local public education campaigns can effectively limit the violation of fish and game laws, and economic development programs can reduce over-fishing by subsistence fishermen.

### Coastal Zone Management

In many areas, fragile yet ecologically important coastal marine habitats are being physically destroyed with the urbanization of the coastal zone. A lack of understanding of marine ecosystems and coastal processes on the part of local government leaders often results in improper coastal development. Dredging activities, coastal land filling, sand mining, and the construction of groins and seawalls all contribute to the loss of marine habitat and the disruption of near shore ecosystems.

Local governments can avoid many of these destructive practices by adopting strict coastal zone management laws that regulate construction activity in the coastal zone and which require the environmental impact of proposed actions to be carefully evaluated. Many coastal cities in the developing world currently lack the technical capability and trained personnel to properly evaluate and regulate this type of coastal development.

### **The Challenge for Cities**

While it is clear that building sustainable cities is necessary to halt the deterioration of the oceans, the challenges that cities face in this effort are enormous. The scope of the transformation that is needed in urban infrastructure, land use, transportation, energy policy, and waste management systems for urban sustainability is daunting, but these challenges are well understood and the technology to meet them is largely available. The most critical challenges that cities face in the struggle for sustainability are those of capacity building, leadership development and infrastructure financing. While these efforts are fundamental in the battle to build sustainable cities, they are the most neglected.

#### Capacity Building

For a city to successfully transition to sustainability, a substantial amount of education, training, and capacity building is needed at the community, government employee, and political leadership levels. All involved need to understand the concepts of sustainability and the rationale for applying those concepts to city management. Once the basic concepts are understood, public education campaigns can begin to change community behavior, training programs can upgrade the technical capability of government staff, and elected leaders can knowledgeably evaluate policy changes to improve urban sustainability.

For urban leaders to transition their cities to a sustainable future, they need to articulate a sustainable urban vision. However, that vision cannot be developed through a top-down process. Sustainability requires a fundamental transformation in attitude and behavior at the personal level as well as at the governmental level. Developing the vision and its implementing plan must be a community based process that involves all stakeholders.



Mayors that have recognized the advantages of an educated and empowered citizenry have enjoyed considerable success. In the early 1990's the Naga River in the Philippines was little more than an open sewer. Concerned citizens launched a "Save the River Movement" and in 1995 the Naga City People's Council formed a 'shadow government' to empower its citizens to work with the city to clean up the river and work for sustainable development. The Mayor of Naga relied heavily on the input and political clout of involved citizens. As a result of this community

empowerment, Naga City has made great strides in cleaning its river, improving the handling of its solid waste, and setting the city on a more sustainable course.

While capacity building and training in sustainability are woefully inadequate, a number of successful models do exist. A fine example is provided by the Mayors Asia/Pacific Environmental Summit (MAPES) Program, established in 1998 to assist mayors and local government leaders in the Asia/Pacific region to make their cities more sustainable. This initiative is sponsored by organizations such as the Sustainable Cities Institute, the Asian Development Bank, USAID, ICLEI, the Royal Institute of Technology in Stockholm, and others. Under this program, local government leaders in the region convene every two years to work with and learn from leading experts in the various fields relating to sustainable urban development. To date, MAPES has focused on the issues of water and wastewater treatment, land use planning, sustainable urban energy systems, solid waste management, and sustainable tourism development.

At MAPES, each leader is assisted in framing sustainable plans for their city. Leaders then participate in the Mayor's Commitment Program, where they make quantifiable commitments to advancing their city towards sustainability. Commitments such as building sewage treatment plants, improving water quality and reducing fossil fuel energy consumption are examples of the commitments that mayors have made and achieved through the MAPES process. In some cases, after the commitments are made, technical assistance is provided to attending cities to help leaders accomplish their stated goals. The mayor's progress in achieving the commitments is monitored and those that are successful are acknowledged and rewarded.

Partnering with MAPES, the Royal Institute of Technology (KTH) in Stockholm, Sweden has developed a certificate program to train mayors and city managers in the basics of urban sustainability. Under this program, Institute faculty will go to participating cities to train local government leaders in an intensive three day program of workshops. Topics in this program include energy efficiency, renewable energy, sustainable transportation, land use planning, wastewater management, enterprise-wide GIS systems, and sustainable tourism development. City leaders who successfully complete this program receive a Certificate in Urban Sustainability from the Royal Institute.

In addition to understanding the principles of sustainability, city governments also need assistance in crafting strategies for sustainable economic development that involve, educate, and motivate citizens. The Cities Alliance City Development Strategy (CDS) program provides the ideal methodology for city mayors to follow in developing a sustainable vision for their city and a strategy to achieve it. The CDS program involves all of the stakeholders in the community. Under this program, once the community has developed its sustainable vision, strategy and action plans are developed to bring that vision to fruition.

Utilizing this Cities Alliance CDS program, city mayors can bring together the knowledge, information, and expertise to begin the sustainable transformation of their cities. They can educate and motivate their constituencies and create hope and optimism within their communities. The strategic plans that emerge from the CDS process can serve as the framework to guide and direct all future city investments and donor contributions to improve the quality of life in the city.

### Resources and Financing for Sustainability

Building sustainable cities cannot be done by city governments alone. It requires governments to work in partnership with civil society, NGOs, the business community, and community organizations, all sharing a vision for the city's future and all willing to dedicate effort and resources to the task. Partnerships such as this are important, not only for the political

leverage they bring to the table, but also for the resources that they can muster. In many cities the financing of sustainable infrastructure may require both public and private capital. Third party financing may be used to finance urban infrastructure that can generate cost savings to the city.

Cities have the ability to establish fees for many municipal services, such as water and sewer, and they have the legal authority to mandate fee collection. The stream of revenue from such fee-for-service operations can be used to form the basis of debt service payments to third party financiers who may be better able to debt finance those infrastructure improvements than is the city government.

Human resources as well as financial resources can be mobilized through city/civil society partnerships. NGOs often have specialized expertise that may not be available within city government. In some cases, such experts can be 'seconded' to the city for a specified period of time to raise the capacity of the city staff.

Regional partnerships between local governments also play an important role in environmental sustainability. Environmental issues are inherently regional in nature. A river may serve as the open sewer for one city and pollute the estuary of the city downstream. By working together on regional integrated resource management programs that develop multi-jurisdictional regulatory schemes and joint financing initiatives, cities can help rather than hurt each others sustainability efforts.

All city governments face the same challenges. Issues of sustainable planning, transportation, service delivery, and waste management may differ in scope from one city to the next, but are essentially the same in cities all around the world. Rather than city leaders repeating mistakes that have been made in other jurisdictions, cities should be encouraged to form partnerships internationally and share best practices.

Exchange programs that allow key city personnel to trade places with counterparts in another city for a specified period of time help build capacity and provide an ideal opportunity for the sharing of ideas. International leadership and capacity building programs, such as the Mayors Asia/Pacific Environmental Summit, provide a framework for mayors to learn from each other and to form partnerships to deal with regional environmental issues.

The challenges of urban sustainability are so monumental and universal that they can only be met through the building of partnerships and the sharing of information and resources at the local, regional, national, and international levels.

### Leadership

The developed world, which represents twenty percent of the earth's population, has heavily urbanized in the last 100 years and now enjoys a standard of living unmatched at any time in human history. That prosperity has come at a high price. It has been achieved by the developed world consuming vast amounts of the world's resources, and generating a flood of environmental waste that now threatens the oceans and the biosphere itself. In its quest for prosperity, the rapidly urbanizing developing world is adopting the same failed paradigm of consumption and waste. If the developing world continues to follow this same calamitous approach, we will soon pass the global environmental tipping point.

There is a better way, a sustainable way, for all of the earth's citizens to achieve a healthy, prosperous quality of life. The developed world must begin by leading by example and changing its glutinous behavior. We must all cease to be consumers and become re-users of resources. We must

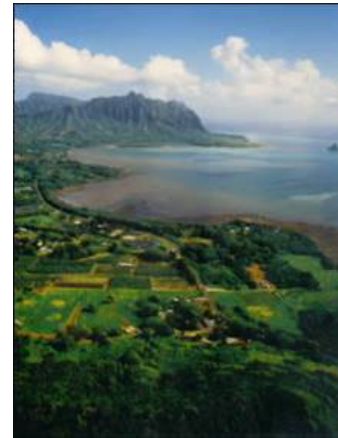
change our fundamental relationship with the biosphere of this planet and we must recognize that cities, currently the cause of many of our environmental problems can become the instruments of our salvation.

The challenge of building sustainable cities is fundamentally not a technical challenge or a management challenge. The technology and management techniques to run cities sustainably are all available. The greatest challenge to building sustainable cities is the challenge of leadership. Bringing about the fundamental changes that are necessary to achieve a new urban paradigm will require a generation of new urban leaders who can inspire us and who have the vision and the political courage to confront conventional wisdom and to chart a new sustainable course for the world's cities.

If we are to effectively deal with the many assaults that threaten our oceans, we must support these urban leaders with resources, training, and capacity building assistance.

### **The Path Forward**

To draw international attention to the nexus between urban sustainability and the health of our oceans, and to kick-start the process of assisting cities with training and capacity building, nongovernmental environmental organizations and multilateral funding organizations should join together to convene a global summit conference on Urban Ecosystems and the Marine Environment. Such a summit could bring together local government policy leaders, marine scientists, NGOs, multilateral organizations and others to discuss urban issues that effect marine resources, and to conduct training and capacity building sessions for city managers.



By modeling this conference after the Mayors Asia/Pacific Environmental Summit, mayors could be assisted in developing concrete plans to reduce their city's impact on the marine environment, and they could be encouraged to make specific commitments with definitive timelines to implement those plans. Such a summit conference could begin to define the scope of the urban challenges that affect our oceans and it could help establish the partnerships between local governments, non-governmental organizations, and the scientific community that are necessary to meet those challenges.

Civilization is at a critical juncture. The unsustainable urbanization of the 20<sup>th</sup> century with its destructive paradigm of consumption and waste has placed not only our oceans in peril, but our entire planet. Now, the fate of our oceans and our world is in the hands of our cities. Our city leaders should be made aware of their precious stewardship role, and supported in it by us all.

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<sup>1</sup> Portions of this article were produced under contract for the World Bank and the Cities Alliance

<sup>2</sup> Millennium Ecosystem Assessment, 2006. Ecosystems and Human Well-Being. Vol. Current States and Trends. Chapter 19 Coastal systems. pp513-550. Island Press, Washington DC

<sup>3</sup> UNEP 2006

<sup>4</sup> See [The World Ocean Observatory Ocean Acidification Web Page](#)

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<sup>5</sup> Goldberg, J. and C. Wilkinson, Global threats to coral reefs: coral bleaching, global climate change, disease, predator plagues, and invasive species. Pp 67-92 In C. Wilkinson [ed.] 2002. Status of Coral Reefs of the World. AIMS, Townsville, Australia. Also available at [www.grcmn.org](http://www.grcmn.org)

<sup>6</sup> *The State of the World 2007: Our Urban Future*. Worldwatch. Report available at: <http://www.worldwatch.org>

<sup>7</sup> [Falling pH causing a rising tide of alarm](#). Ocean Observer by Tundi Agardy, PhD., November 2006, The World Ocean Observatory.

<sup>8</sup> <http://www.escoinst.com/>, <http://www.neep.org/boc/index.html>, <http://www.ase.org/>, <http://oee.nrcan.gc.ca/corporate/incentives.cfm>

<sup>9</sup> Synthesis gas made by waste-to-energy gasification of carbon containing fuels

<sup>10</sup> See <http://www.smartgrowth.org/about/principles/default.asp>

<sup>11</sup> MA 2005

<sup>12</sup> Impermeable surfaces include roads, pavements, buildings, and other man-made surfaces through which water does not percolate.

<sup>13</sup> For example, Dayton, P., S. Thrush, and F. Coleman 2002. Ecological effects of fishing on marine ecosystems in the United States. National Academy of Sciences Press