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Urban Ecologies & Transition:

New Frontiers for Cities in India and Elsewhere

**National Seminar on Developing Harmonious and Sustainable
Cities in India for a Better Urban Future**

20-21 March 2009, India Habitat Centre New Delhi, India

Etymology

ur-ban:

Of, relating to, or located in a city.

Characteristic of the city or city life.

[*Latin urb nus, from urbs, urb-, city.*]

e-col-o-gy:

The science of the relationships between organisms and their environments. Also called bionomics. The relationship between organisms and their environment.

The branch of sociology that is concerned with studying the relationships between human groups and their physical and social environments. Also called human ecology.

The study of the detrimental effects of modern civilization on the environment, with a view toward prevention or reversal through conservation. Also called human ecology.

Greek oikos, house; in Indo-European Roots + German -logie, study (from Greek -logi, -logy)

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Background

Urbanisation, growth, environment and complexity

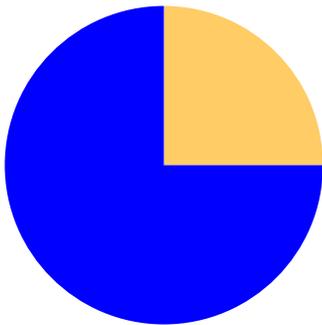
- The long expected transition to an urban dominated world has already happened (faster than expected!!)
- Global trends show 2 billion more people will migrate to cities by 2025; almost all of these dramatic changes will occur in developing countries
- Further increases in size and rates of growth will undoubtedly (over-) stress already impacted environments, especially in the Asia-Pacific
- Urban environmental challenges in developing countries have been divided into two categories: inefficient modes of resource use, such as in the water supply, housing, or energy, and limited absorptive capacity (such as, e.g., of pollution and flooding)
- The ever increasing challenges are ALSO getting more and more **complex**.

Many faces of complexity

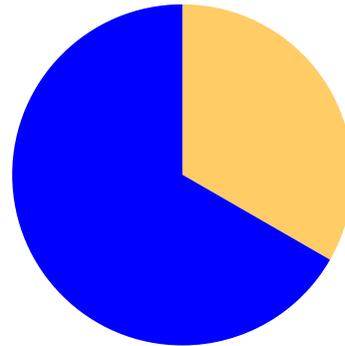
- Impacts of contemporary industrial processes, toxicity of many materials used are not completely known -- *environmental impacts/risks evolve in time, and necessarily make every decision a “long-term” one/gamble (not short-term which humans are evolutionary programmed to take)*
- Economic & cultural transitions at an astounding (historical) pace; varied environmental challenges of low, middle, and high-income societies simultaneously -- *many-world” challenges introduce a new dynamic for the growth of the urban form – often what’s good for one world is resisted by others*
- Drive for decentralization is leading to the transfer of responsibilities – *creates groundwork for private and non-local global partnerships, that leave the polity (potentially) prey to corporate or global priorities (rather than local ones)*
- Multiple urban environmental decision making frameworks -- *increasingly complex institutional situations.*

Modern impact of the human built environment on natural systems

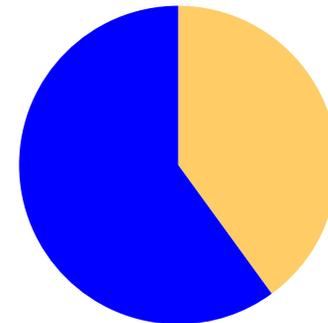
**One quarter of the world's
timber harvest**



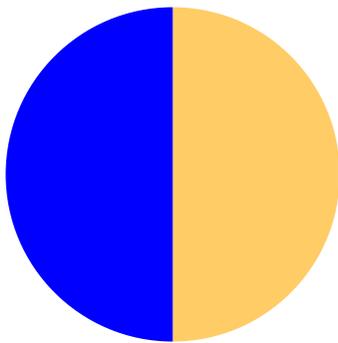
One third of the world's energy



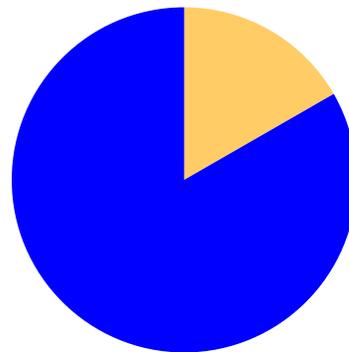
**Two-fifths of the world's
material resources**



**One half of the world's
greenhouse gases**



**A sixth of worldwide freshwater
withdrawals**



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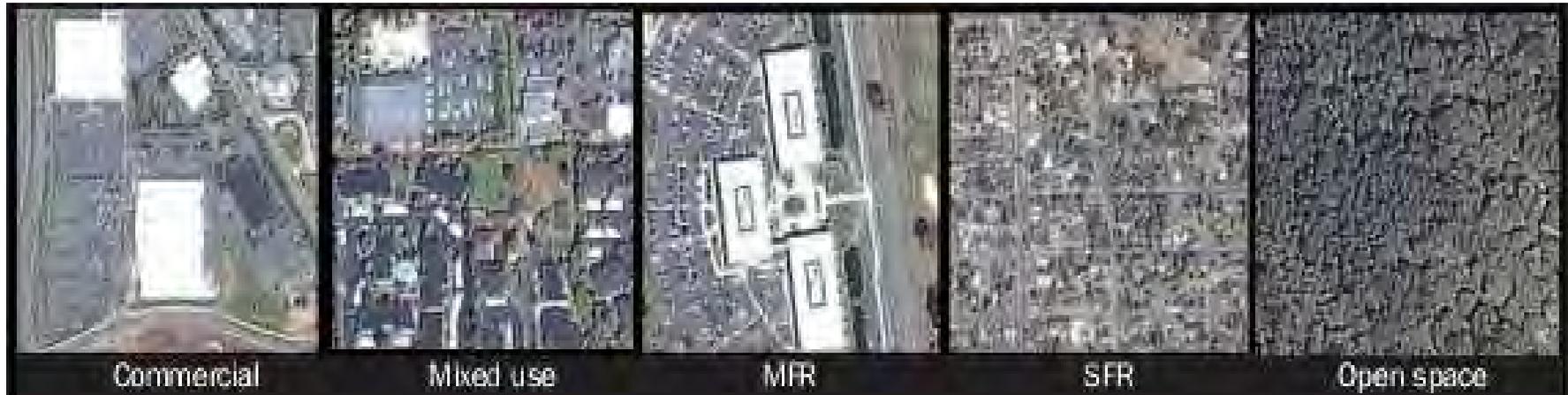


What are Urban Ecologies?

Cities are urban ecosystems

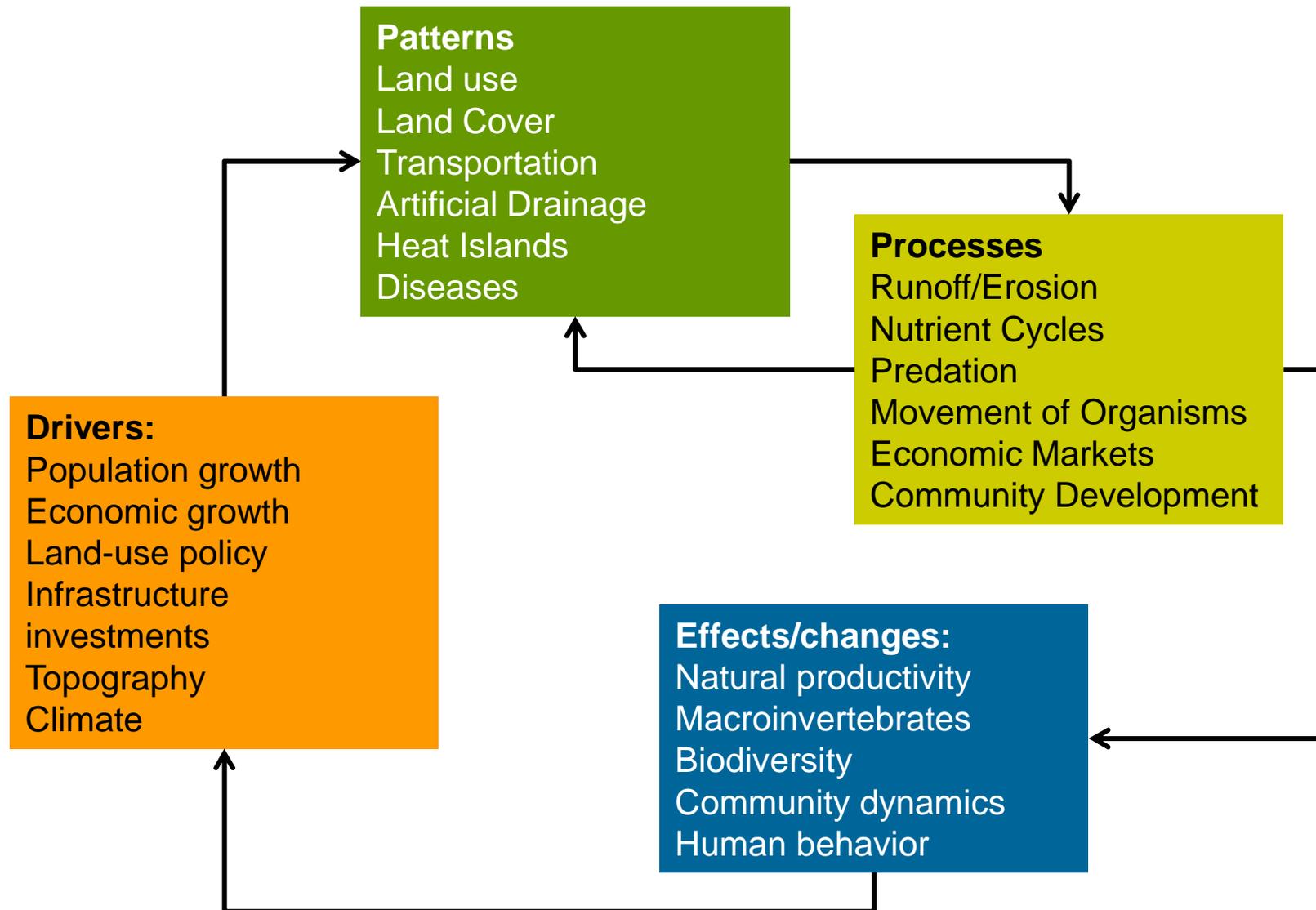
- A city is as much an ecosystem as an wilderness area – only much more non-linear (and thus complex)
- Like other ecosystems, cities are not the sum of their constituents; each component contributes to but does not control the form and behaviour of the whole.
- Traffic congestion, air pollution, and urban sprawl emerge from local-scale interactions among variables such as topography, transportation infrastructure, individual mobility patterns, real estate markets, and social preferences
- Cities evolve as the outcome of myriad interactions between the individual choices and actions of many human agents (e.g., households, businesses, developers, and governments) and bio-physical agents such as local geomorphology, climate, and natural disturbance regimes.

Cities are urban ecosystems



- These choices produce different patterns of development, land use, and infrastructure density ;
- They affect ecosystem processes both directly (in and near the city) and remotely through land conversion, use of resources, and generation of emissions and waste;
- Those changes, in turn, affect human health and well-being.

Simplified interaction model



Ecologies of urban metabolism

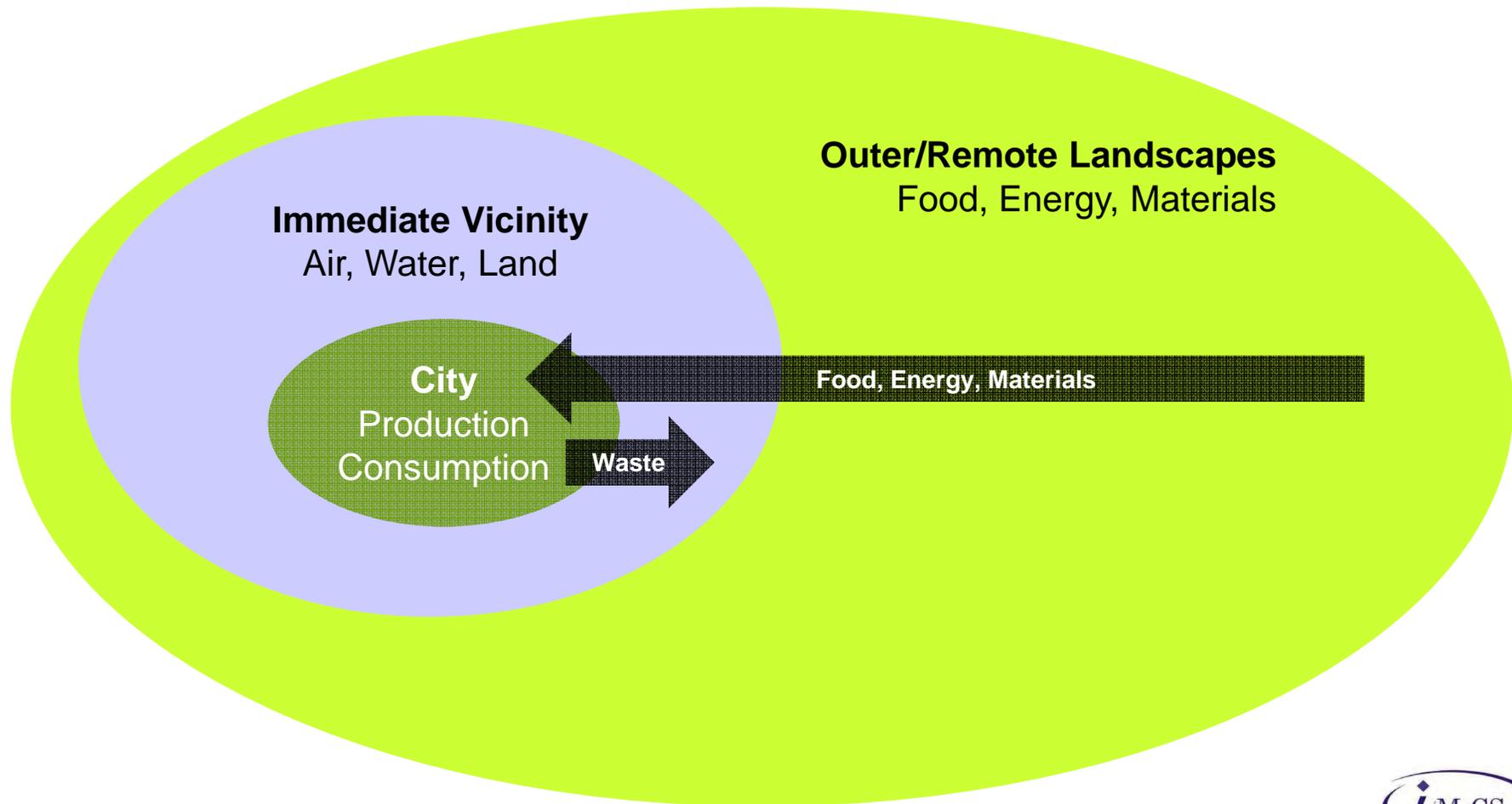
- **Cities have metabolisms!**
- Many materials that enter a city may be used once and then discarded to join a pile in a landfill. Other materials – such as human food – enter the city, enter the humans, exit the humans (in a somewhat smellier form), and then exit the city via a sewage system
- More than 75% of resources used by humans are by people in urban ecosystems. **In a typical city, much more material comes in than goes out each year.** This means that cities actually accumulate mass as time goes by
- Many natural ecosystems accumulate mass as well. Periodically, many forests experience fires that burn off the dead material and sometimes even the living trees, and this in turn sparks of a regenerative renewal.
- **Modern cities do not however regularly experience this kind of renewal !!!**

Ecologies of urban metabolism

- Cities metabolisms are heterotrophic -- cities and towns depend heavily on the food web, materials and energy from outside its boundaries -- in contrast to autotrophic ecosystems (such as in green plants), where most of the energy that powers the system is fixed inside the system
- However, the implications of this heterotrophic-ness are profound!!
It encourages the illusion that humans are independent from nature. Unfortunately, this illusion leads to some of the problems of modern cities (and the outback they are dependent on)
- As transportation networks changed, so did the flow-paths of materials into and out of cities. One of the big patterns of human history has been the punctuated nature of transportation technology.

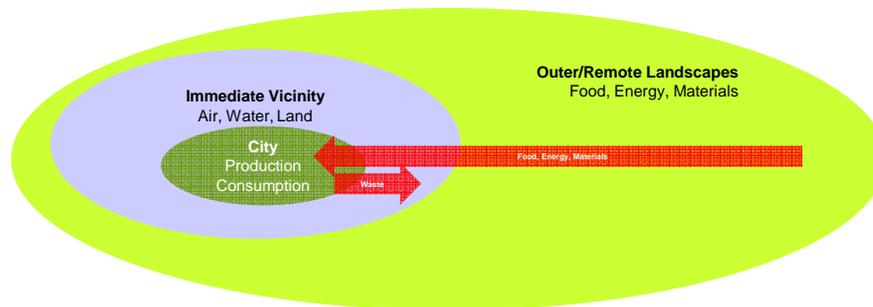
Ecologies of urban metabolism

- Flows proceed from sources in the outer landscape, to production and consumption in the city, to waste sinks in the air, water, and land, often in, around, and over the immediate vicinity of the city.



Ecologies of urban metabolism

- Among the **sources** are farms, forests, mines, oil fields, and large areas of the oceans; **Sinks** are in both the upper and lower atmosphere, where the by-products of combustion tend to accumulate; in lakes and bays, where we usually put our sewage wastes; and in the land, where we bury garbage and chemical and nuclear wastes
- Altogether, the sources and sinks include virtually the entire Earth



- We can clearly see that inward flow-paths in are long, outward flow-paths out are short, and often, with serious ecological consequences.

Ecologies of urban metabolism

- Cities of the industrial era have consciously **excluded** natural processes
- Rather than using solar energy, they dissipate it as excess heat; they import vast quantities of concentrated energy in various forms (e.g., petroleum coaxed from the ground in distant landscapes)
- They let rain falling on the roofs out through concrete pipes and channels into the nearest bay or river and, at the same time, bring water in from distant landscapes through similar concrete channels runoff
- *Sources are continuously depleted and have few means of regeneration because the materials that might otherwise replenish them are going into distant sinks.*
- *The sinks are continually overfilled because their natural capacity to assimilate energy and materials is far exceeded by the concentrated quantities being put out from the cities.*

The need for new frontiers of understanding and design

- As hotspots of resource consumption, large cities affect environmental conditions locally and beyond their boundaries. *Ensuring that urban areas develop sustainably will require a solid understanding of how they function as ecosystems at several spatial scales*
- We need to better understand the complex biogeochemical processes underpinning urban environment quality. *How can urban areas be managed to maximise ecosystem services and provide a healthy environment for all?*
- We need to understand the complex economic and environmental interactions between urban and peri-urban areas. *How can urban systems be organised to minimise environmental damage beyond their boundaries and prevent conflicts between urban and rural areas?*
- Can we harness urbanization to improve global sustainability?

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Creating Integrated Eco-Cities

A Vision for the Future

Creating integrated eco-cities

- Cities through history have evolved tangibly (and intangibly) by humans for themselves first
- This premise holds, of course, also in order to transform or develop an integrated eco-city -- however, the urban form of the city will transcribe the acknowledged “human dimensions” of the city *in its own fashion in synchrony with the cities’ landscape*
- If we concern ourselves with the materials of primary life support - water and nutrients - the medium for recycling in the city, as in nature, is the landscape. *In cities of the future, the working landscape becomes the unifying, integrating network of urban form, rather than a decorative addition as in the industrial city.*

Connecting with the land

- The working landscape also processes water - both sewage and water polluted by contact with roofs or streets - filtering it through plants in ponds and wetlands.
- Plants and microorganisms assimilate nutrients and other materials, recycling them through the landscape and in many cases eliminating the need for a mechanical treatment system.
- The same working landscape that filters, assimilates, and stores water and nutrients also serves to filter, cool, and direct the flow of air.
- Masses of trees are located around heavily travelled streets, industrial plants, and other sources of air pollution, where they assimilate some pollutants, such as carbon dioxide, and produce oxygen. They also create micro-climates within the city
- Food production also becomes an important part of the urban landscape.

Regenerative buildings

- In regenerative cities, buildings will be elements of the landscape like hills or lakes or groves of trees, **rather than discrete objects standing apart from the landscape**
- Within the green matrix, they will cluster more tightly together than the buildings of industrial cities. **Structures within each cluster will be close enough together to avoid wasting land and to minimize circulation routes, but far enough apart to allow for sunlight and air movement. The buildings in a particular locale will have similar forms, reflecting the climate and landscape**
- In every climate, rooftops can be fertile and productive. Their walls can be sheathed in living green as well. In most climates, buildings will turn transparent faces towards the sun, with a variety of adjustable shading devices moving and casting shadows that vary through the seasons.

Urban heritage & conservation

- Conserving urban heritage - historical buildings, festivals, art forms, dance, music, sculpture etc. - may seem less of a priority compared to more pressing issues such as infrastructure development, poverty alleviation or job creation. **But effective conservation of heritage resources not only helps in revitalizing the local economy of cities, but also brings about a sense of city identity and belonging to its residents**
- We are now gradually moving away from simply making an inventory of heritage resources, to an integrated and interlinked approach to heritage management. **Heritage is more than a record of the past - it is becoming an integral part of the urban identity now, and for the future.**

Distinctiveness of the urban form in the knowledge economy

- Development towards the KE is an inescapable trend -- urban areas are focal points of the knowledge economy in many respects; **the best cards seem to be in the hands of internationally connected metropolitan areas that have a diversified economy, a strong knowledge base, and a high quality of life**
- The KE has to have a social basis. Cultural and social amenities and good infrastructure are prerequisites for a flourishing urban (and knowledge) economy.
- Cisco recently launched the global **“Intelligent Urbanization”** initiative from Bangalore and signed a MoU with the local government to develop a roadmap for an intelligent and sustainable Bangalore City
- Is part of Cisco’s global ‘Intelligent Urbanisation’ initiative designed to help cities around the world use the **network as the fourth utility** for integrated city management; initiative initially focused on intelligent, sustainable solutions for public safety & security, transportation, buildings, energy, health care & education.

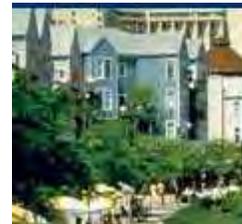
Towards new frontiers

- Within the green urban matrix, cities will spread over the landscape, they can be designed to embrace the ecology of the landscape rather than obliterating it. Nature's processes can continue to function in concert with human culture. **In such a future, the conflicts between nature and culture that characterized the industrial era will no longer exist**
- While there is no single formula for the ideal "ecocity," **it would certainly include a vigorous local democracy, a sense of community, high density, green areas, wildlife corridors, efficient recycling and renewable energy, bike and pedestrian paths, and good public transportation**
- While reducing resource consumption and avoiding damage to the natural environment is a major focus of sustainable environmental design, **an equally important challenge is designing a built environment that enhances and enriches the human experience of natural processes, serving as a basis for physical, emotional, intellectual, and even spiritual development.**

Where do we go from here? Six actions towards an urban ecology



✓ **Advancing fundamental knowledge and understanding of urban ecosystems**



✓ **Advancing the practice of sustainable environmental design for the urban landscape**



✓ **Fostering the positive experience of natural systems among urban residents**



✓ **Examining the relationships, impact and demands of urban watersheds**



✓ **Initiating community based land stewardship and resource management**



✓ **Teaching interdisciplinary urban science and policy widely**



Thank You