The role of biodiversity in urban landscapes

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IUCN – International Union for Conservation of Nature

Vision: *a just world that values and conserves nature.*

Mission: *to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.*

Countdown 2010

A network of active partners

"*To achieve by 2010 a significant reduction in 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*"

(UN CBD 2002)

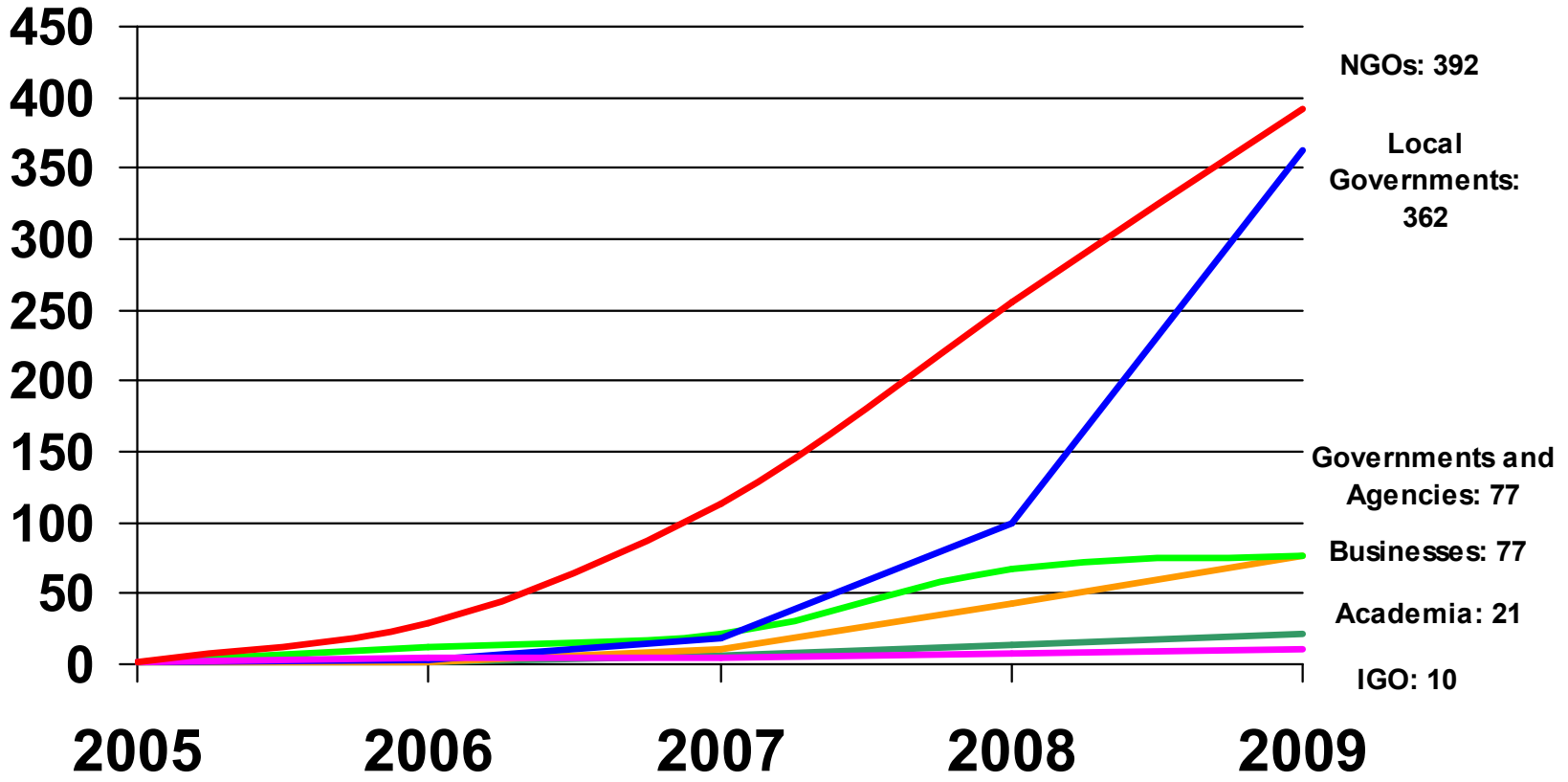
Countdown 2010 objectives:

Gain maximum public attention for the challenge of saving biodiversity by 2010;

Encourage and support the full implementation of all the existing binding international commitments and necessary actions to save biodiversity;

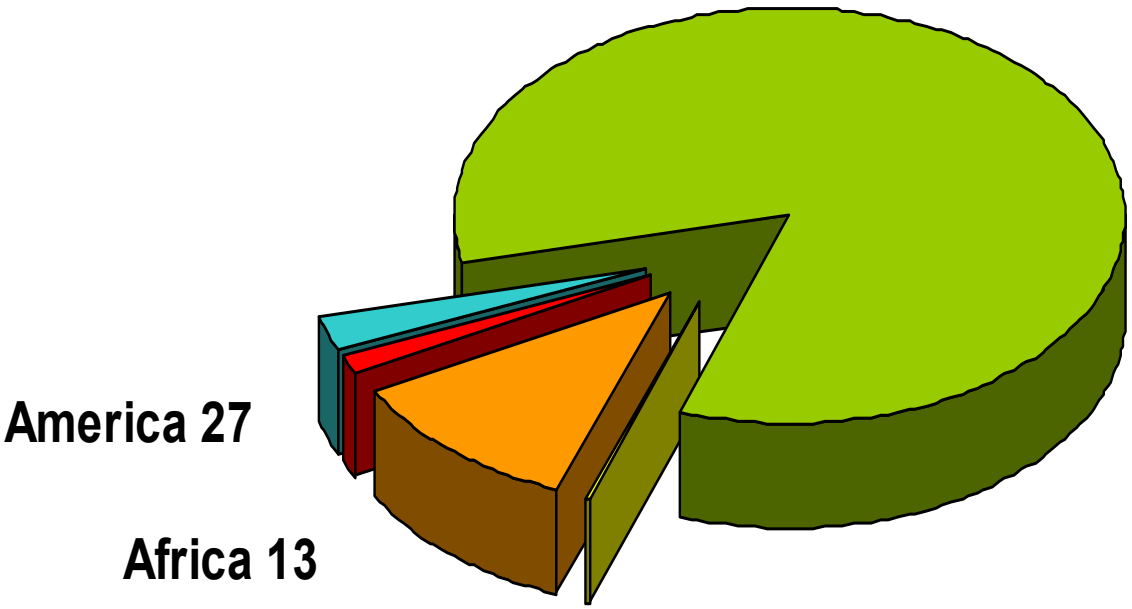
Demonstrate clearly what progress the world makes in meeting the 2010 Biodiversity Target.

Countdown 2010 Partners Increase



As of October 2009

Geographical Distribution



Total: 943

as of October 2009

Outline

- Biodiversity – the issues
- Urbanisation and biodiversity
- Linking lifestyles with biodiversity
- Benefits of urban biodiversity
- Motivations for conservation and enhancement of urban biodiversity
- Human perceptions
- Planning and development
- European Capitals of Biodiversity
- Singapore Index for Cities' Biodiversity

Biodiversity – the issues

6th major extinction event in the history of life

30% increase in **atmospheric CO_2** in three centuries

Doubled concentrations of **atmospheric methane**

Rapid **climate change**

Doubled the rates of terrestrial **fixation of gaseous Nitrogen**

Agricultural runoff inflicts **drastic changes** in estuarine ecosystems

Transformed over 50% of the world's ice-free land area

We **dominate** 1/3 of net primary productivity on land

We **harvest** fish that account for 8% of ocean productivity

We use 54% of **available freshwater**

We have facilitated the **spread of species**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Agricultural
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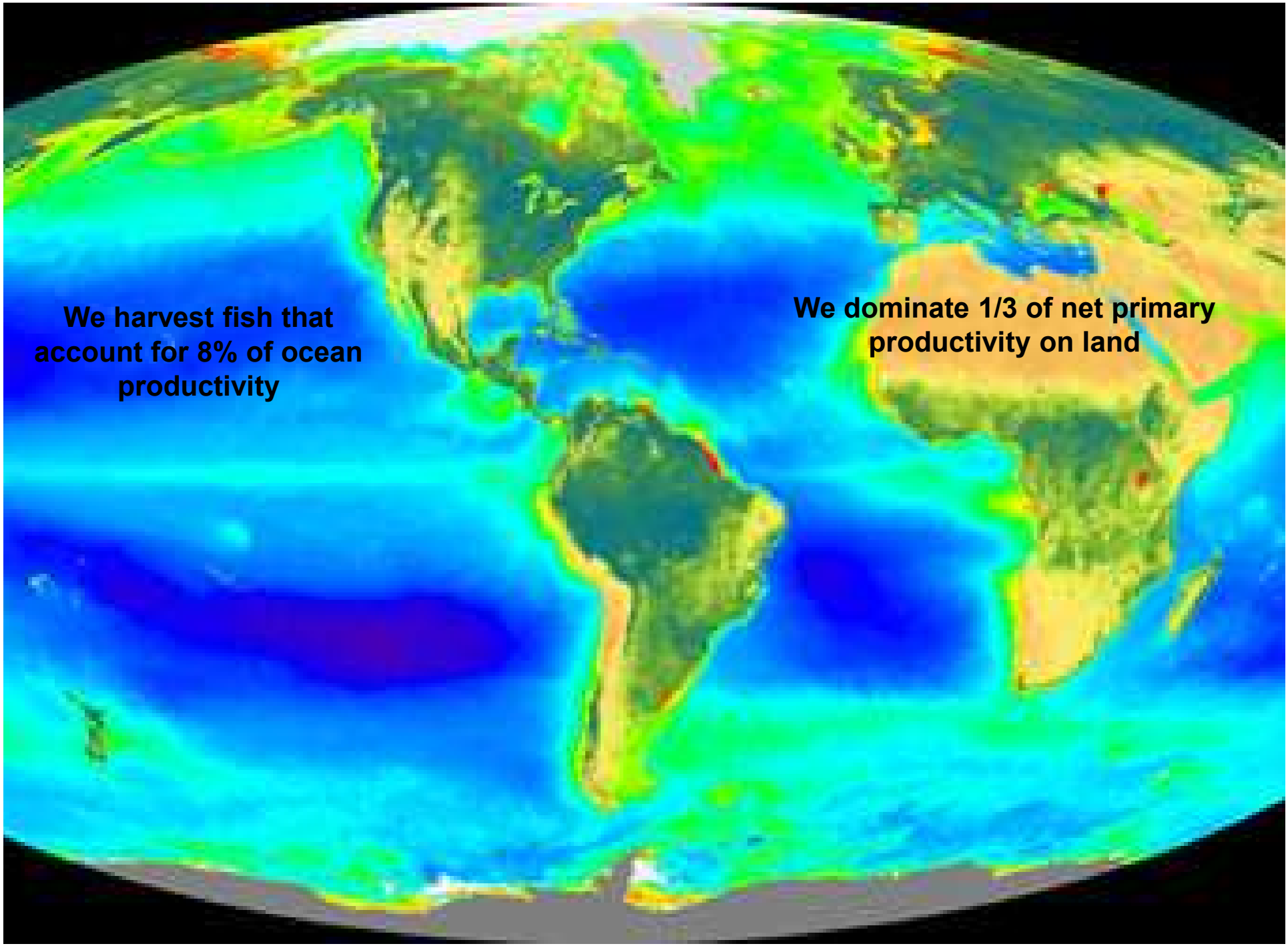
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Biodiversity - the issues

Extinction is a natural process but is occurring at rates 100-1000 times faster than pre-human rates.

In some taxonomic groups we have caused 5-20% species extinction

Biodiversity - the issues

Projected drivers of biodiversity loss till 2100:

1. Land-use change
2. Climate change
3. Nitrogen deposition
4. Species introductions
5. Increased atmospheric carbon dioxide concentrations

Consequences of changing biodiversity

- Species richness
- Species composition
    - Availability of limiting resources
    - The disturbance regime
    - The climate
- Species interactions
- Resistance and resilience to change
- Resistance to invasions


Species richness

Species composition:

Availability of limiting resources

Species composition:

Disturbance regime


Species composition:
The climate

Species interactions


Resistance & resilience
to change

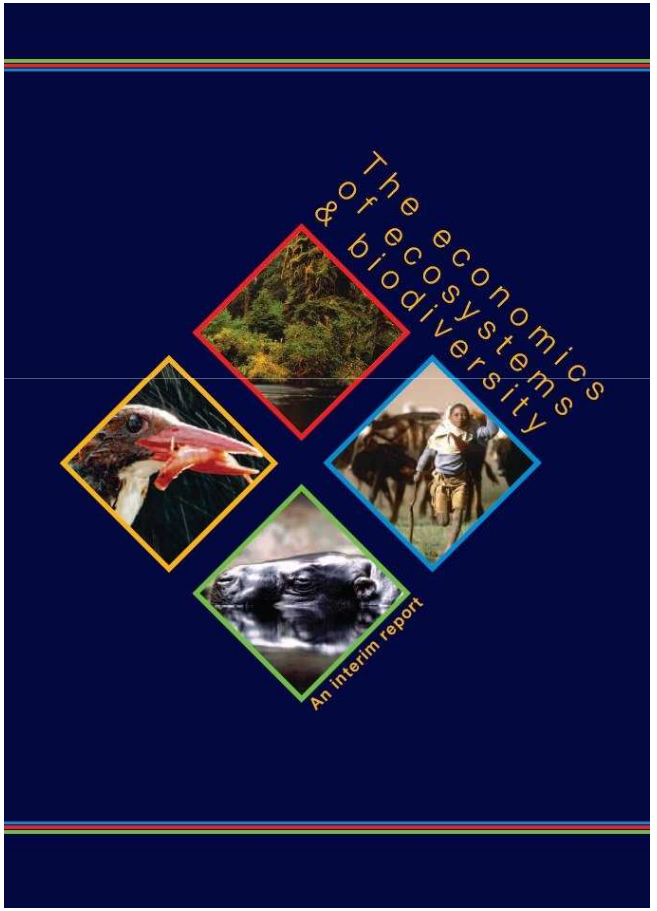
Resistance to invasions


Resistance to invasions

Consequences of changing biodiversity

Societal consequences...

Economic consequences...



Urban biodiversity

Urban

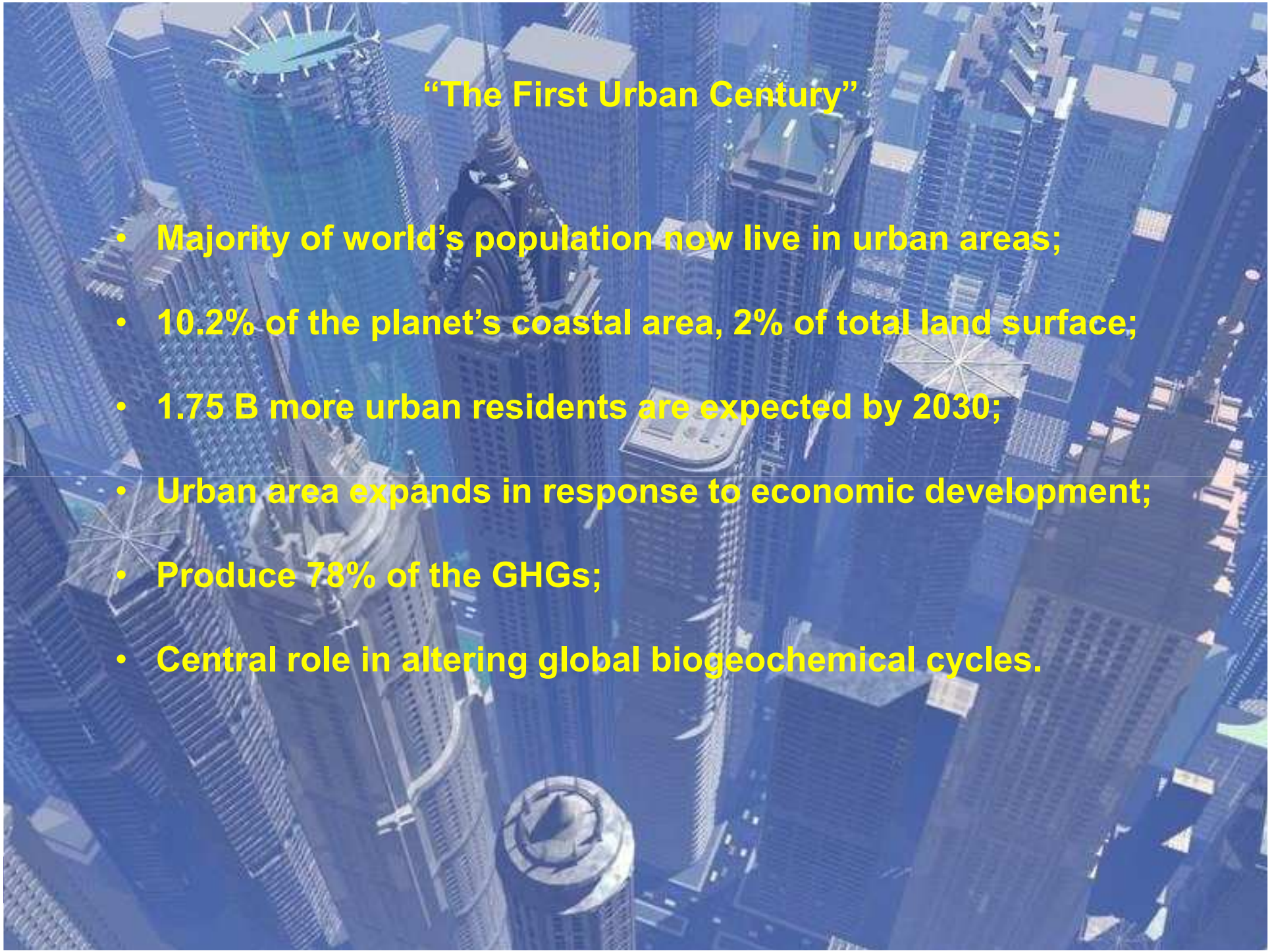
"*known human settlements with a population of 500 or more, with boundaries delineated by observing persistent night-time lights or by inferring aerial extent in cases where such observations are absent*"

(MEA 2005)

Urban biodiversity

"*the variability among living organisms from all sources and ecosystems within an area of increased density of human-created structures in comparison to the areas surrounding it*"

(Petersen *et al.* 2007)



"The First Urban Century"

- Majority of world's population now live in urban areas;
- 10.2% of the planet's coastal area, 2% of total land surface;
- 1.75 B more urban residents are expected by 2030;
- Urban area expands in response to economic development;
- Produce 78% of the GHGs;
- Central role in altering global biogeochemical cycles.

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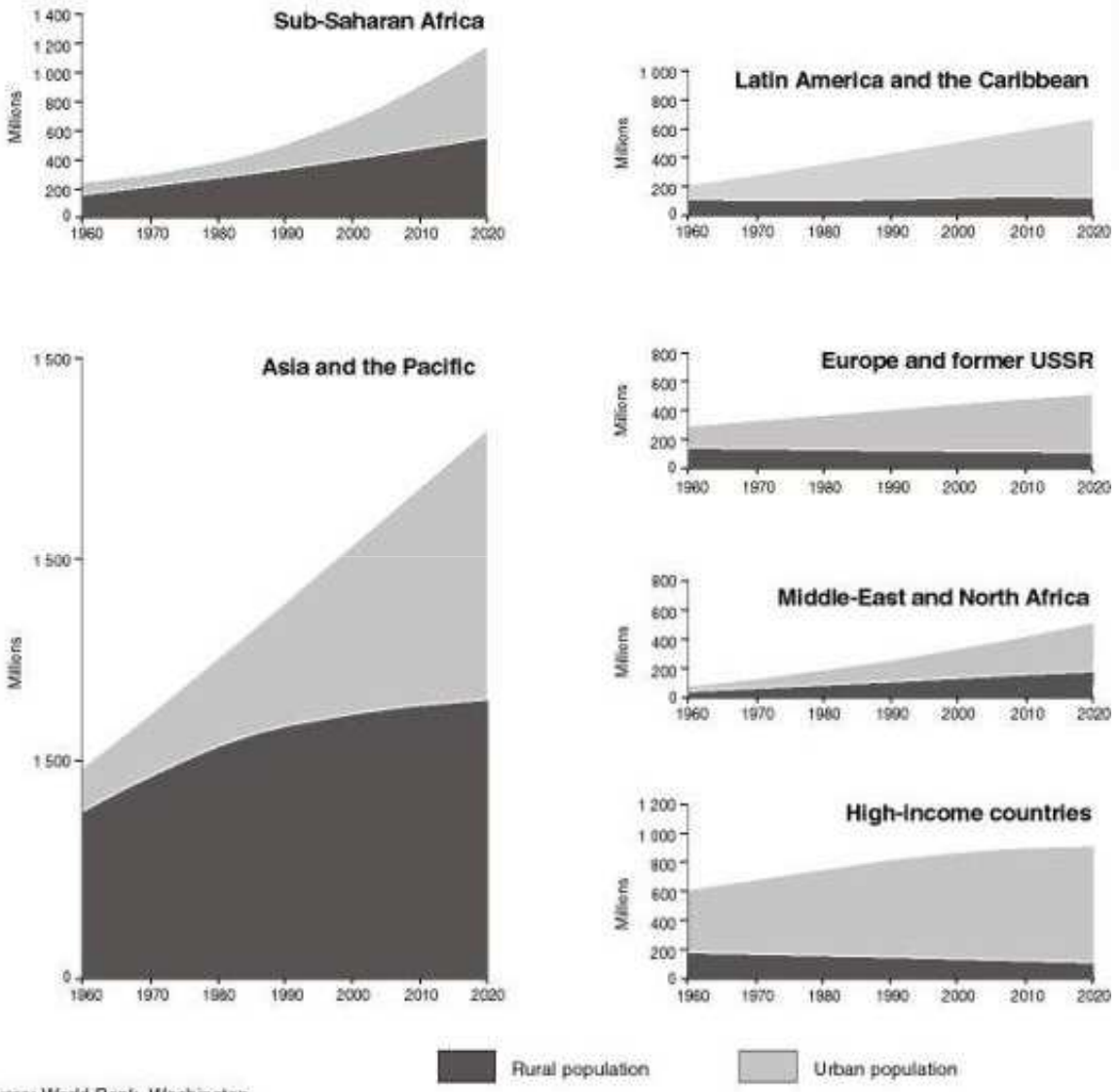
FIGURE 12

Rural and urban population in developing regions and high-income countries, 1960-2025



Source: World Bank, Washington.

“The First Urban Century”

Cities can no longer be ignored by ecologists

Physical impacts of urbanisation

Increase in spatial variability of:

- Soil temperature and moisture levels
- Solar radiation and humidity
- Wind speed and direction

Urban rural gradient physical changes

Road density;

air and soil pollution;

average ambient **temperature**; soil compaction;

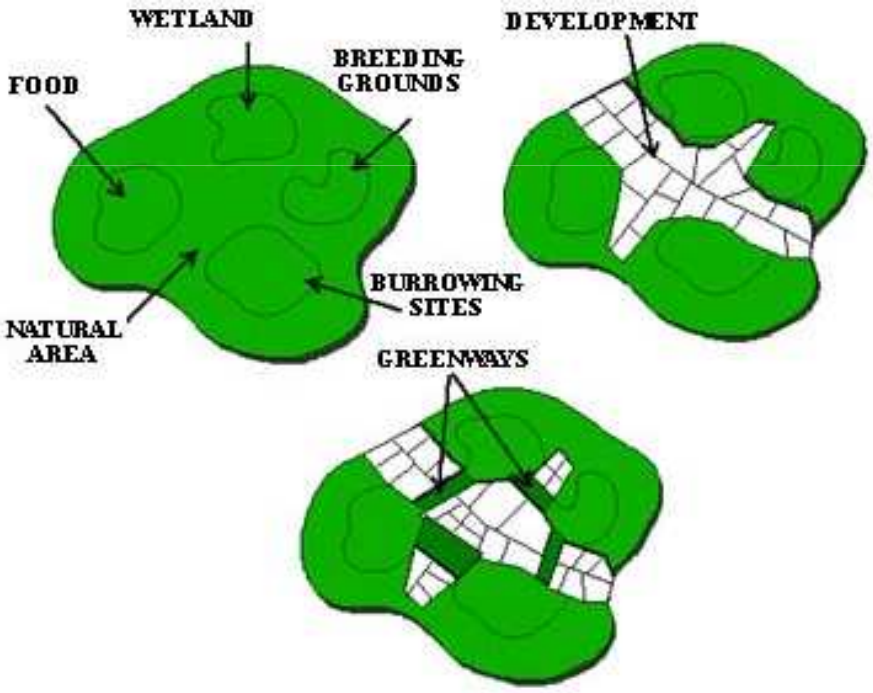
soil alkalinity due to leaching;

impervious surface coverage;

import of resources

Impact of urbanisation on biodiversity

- Altered physical environment;
- Fragmentation and isolation of habitats;
- Land disturbance and conversion;
- Loss of native species;
- Increase in non-native species
  - Temporally
  - Spatially




NYC
Temporally:
lost 43% of native species
...and gained 411 non-natives


Plzen:
lost 368 native species
...and gained 238

Temporally:

Singapore was half urban by 1990

and lost ¾ of its native species

Spatially:

Berlin's non-native plant species...

surroundings: 6%

suburbs: 25%

centre: 54%


Spatially: Non-native species in Polish villages: 30%
..... Polish towns: 40-50%
..... Polish cities: 50-70%


Godefroid (2001):
60 yrs of observations in Brussels
Drastic decline in diversity of native plants
... and rise in aliens
Due to: changes in soil alkalinity, heat, light availability, drought, nitrogen tolerance

Homogenisation of urban biodiversity

Evidence (McKinney 2006):

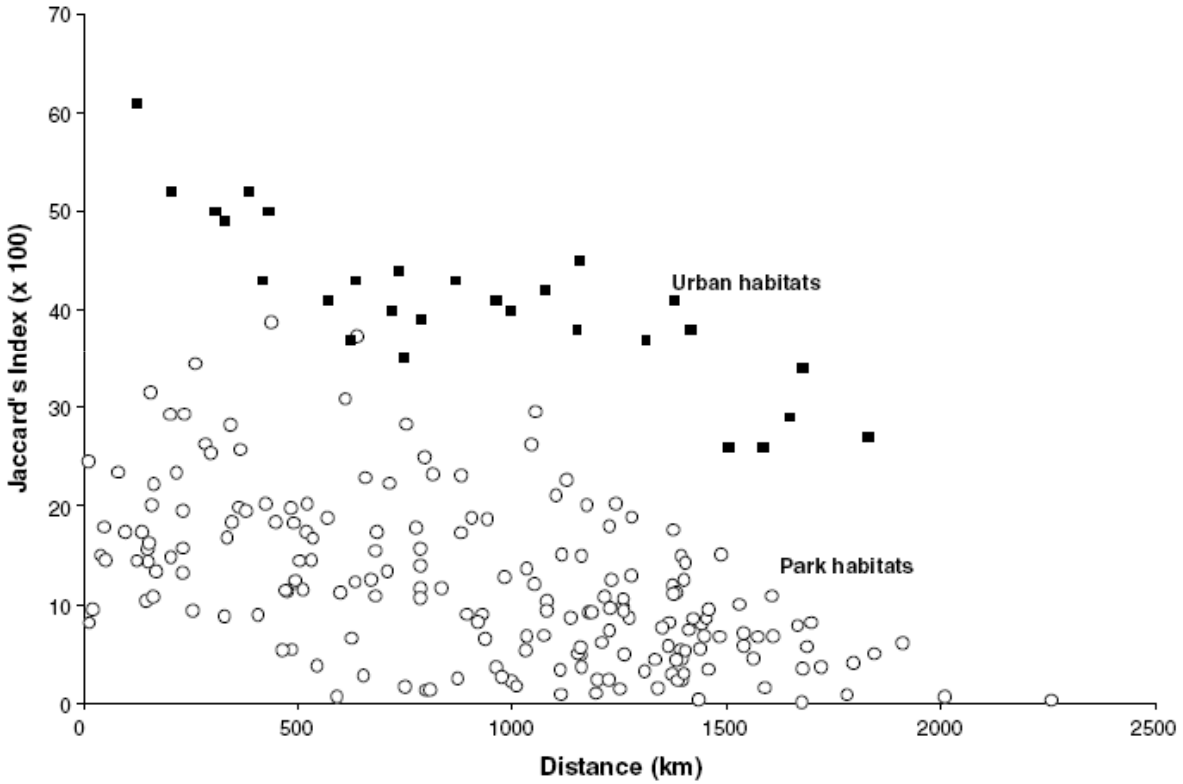


Fig. 1 – Jaccard's Index for plant communities in park habitats compared to urban habitats. Parks refers to relatively undisturbed state and national wildlands.

Homogenisation of urban biodiversity

Why?

A) Importation of non-natives

B) Favourable habitat for non natives

- Resources
- Natural enemies
- Physical environmental alterations

C) Homeostatic properties of cities

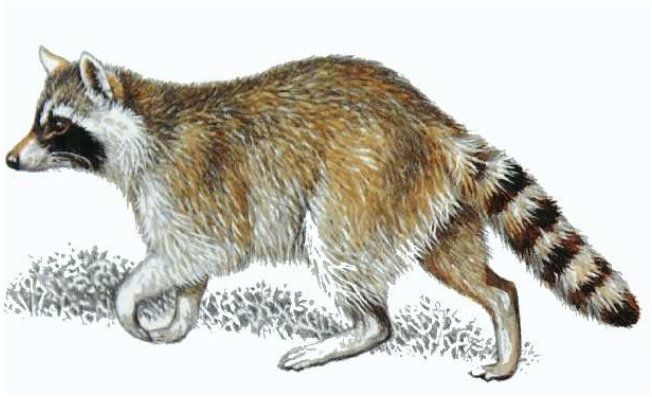
Homogenisation of urban biodiversity

Why?

A) Importation of non-natives

Homogenisation of urban biodiversity

Why?



B) Favourable habitat for non natives

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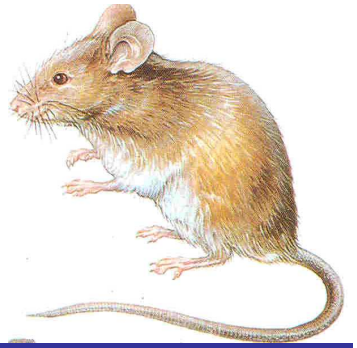


Homogenisation of urban biodiversity

Why?

C) Homeostatic properties of cities

Urban-rural gradient ecological changes

Increasing:

native species richness

biotic interactions

ecosystem complexity

Decreasing:

abundance

ecosystem reliance on imported resource subsidies

biomass

abiotic influences on species abundance

What about your cities?

Copenhagen


Helsinki

Zagreb

Linkages between lifestyle and biodiversity

Lifestyle refers to the way that we use resources

Three dimensions of the concept:

1. Social status or class
2. Attitudes and preferences
3. Practice and behaviour

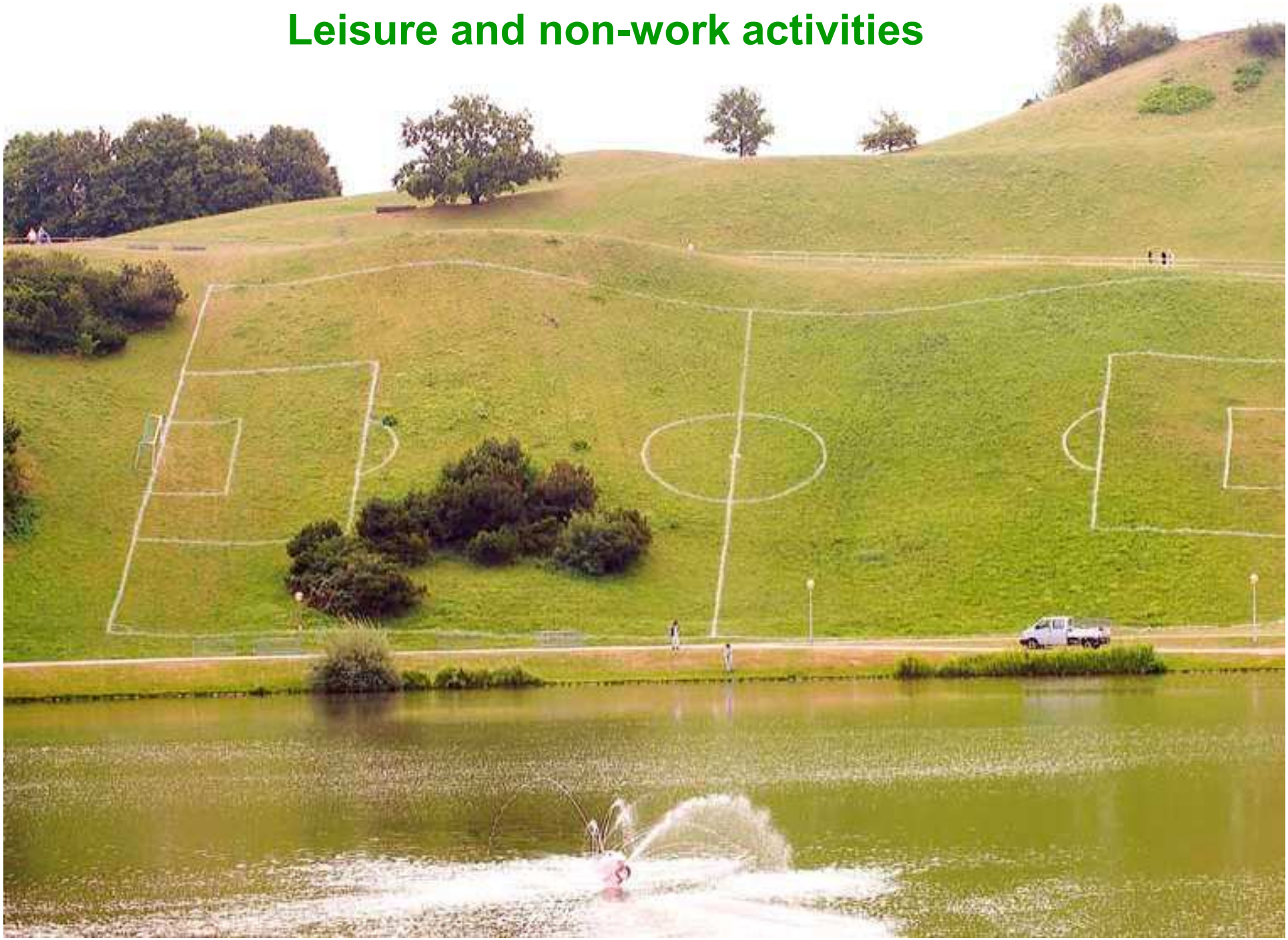
Linkages between lifestyle and biodiversity

- Housing
- Garden
- Leisure and non-work activities
- Consumption

Housing


Garden

Leisure and non-work activities



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Consumption

Benefits of urban biodiversity

Environmental

Economic benefits

Social benefits

Benefits of urban biodiversity

Environmental....

Provisioning services
Products obtained from ecosystems

- food
- fresh water
- fuelwood
- fiber
- biochemicals
- genetic resources

Regulating services
Benefits obtained from regulation of ecosystem processes

- climate regulation
- disease regulation
- water regulation
- water purification
- pollination

Cultural services
Nonmaterial benefits obtained from ecosystems

- spiritual and religious
- recreation and ecotourism
- aesthetic
- inspirational
- sense of place
- cultural heritage

Supporting services
Services necessary for the production of all other ecosystem services

- soil formation, nutrient cycling, primary production

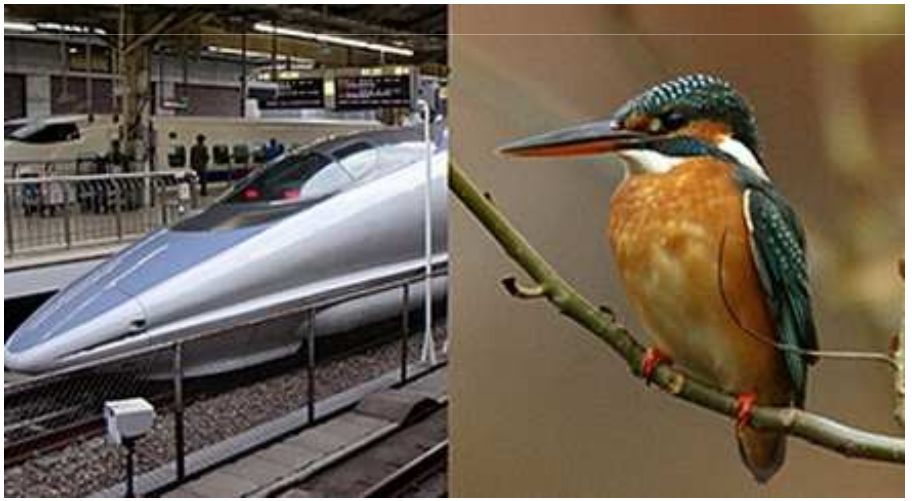
Benefits of urban biodiversity

Environmental....

Benefits of urban biodiversity

Economic benefits

- Attracting high quality professionals
- Property prices
- Creative thinking



Benefits of urban biodiversity

Social benefits

- Psychological benefits
- Physical health benefits
- Community cohesion

The conservation dilemmas of urbanisation

How much of a fixed budget should be spent on conservation in urban versus non-urban landscapes?

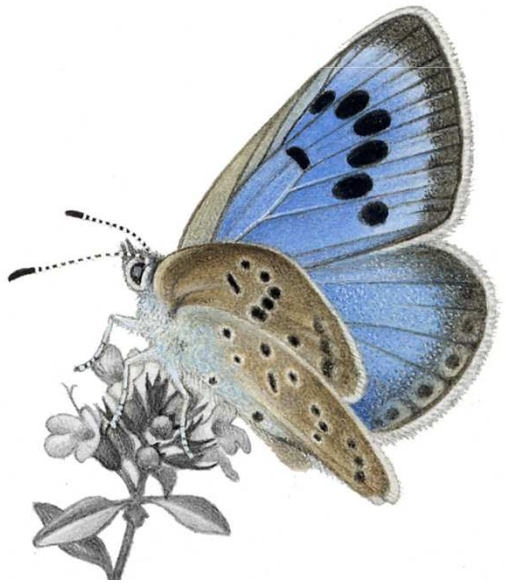
How to value exotic species in an urban area, given that there are so many?

Motivations for conserving urban biodiversity

1. Preserve important local biodiversity in an urbanising environment

Motivations for conserving urban biodiversity

2. Create stepping stones or corridors for natural populations



Motivations for conserving urban biodiversity

3. Understand and facilitate species' responses to environmental change

Motivations for conserving urban biodiversity

4. Connect people with nature and provide environmental education

Motivations for conserving urban biodiversity

5. Provide ecosystem services

Motivations for conserving urban biodiversity

6. Fulfil ethical responsibilities

Motivations for conserving urban biodiversity

7. Promote human well-being

Landscapes

Refuge

Fascinating

Relaxing

Soundscapes

- Familiarity with the different types of green space
- Age
- Personal experiences
- Culture
- Geographical origin
- Media exposure?

Human perceptions

Negative perceptions of biodiversity:

- Aesthetic issues
- Safety issues
- Health issues
- Economical issues
- Mobility issues

Aesthetic issues

Safety issues

Human perceptions

Health issues

Human perceptions

Economical issues


Mobility issues

Planning urban biodiversity

Four major constraints for urban biodiversity planning:

1. Logistical problems
2. Ecological processes and challenges that species face in urban environments are very different from wilderness
3. Restrictions on conservation management tools
4. Urban areas are centres of human diversity

Planning urban biodiversity

Several dimensions to be considered:

1. Ecological dimension
2. Cultural dimension
3. Social dimension
4. Economical dimension
5. Geographical dimension

Planning urban biodiversity

Stakeholder participation – involving local people in biodiversity

Citizens' values can be incorporated into planning by:

1. Consultation
2. Negotiation
3. Consensus building

Planning urban biodiversity

Benefits of participatory planning

- Increased public interest
- Exchange of knowledge and experiences
- Increased public understanding and acceptance
- Reduced conflict or opposition
- Creates sense of community ownership of problems and solutions

Planning urban biodiversity

Planning to ensure biologically diverse and socially functional areas:

1. Identify quality of nature and potential
    - Selection of relevant indicators
    - Determine state of biodiversity
    - Potential for protection and improvement
2. Identify demands for social uses of biodiversity
3. Determine the conflicts
4. Search for possible resolutions and win-win scenarios through the design and maintenance of green structure

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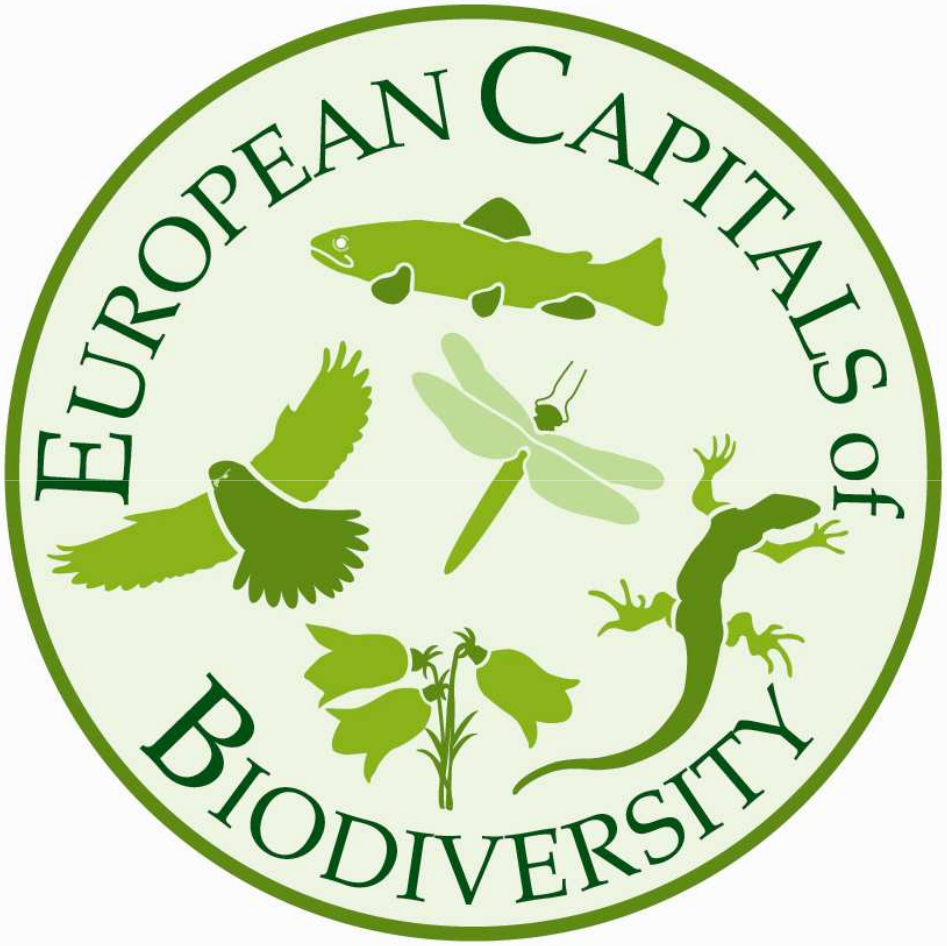

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