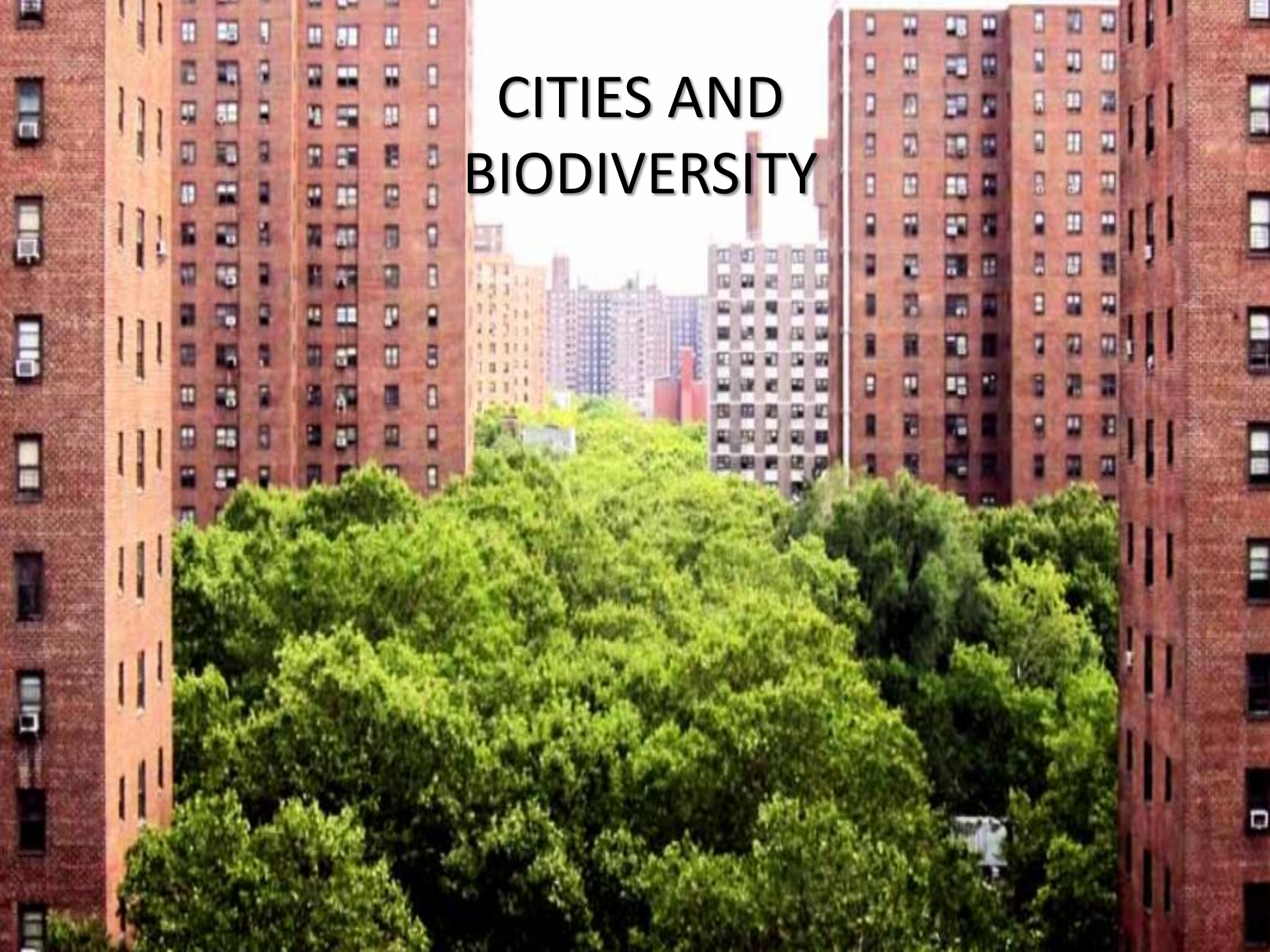


CITIES AND BIODIVERSITY

Master Study Program Urban Agriculture
Teaching Material/ 2021

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Global urbanization and biodiversity hotspots

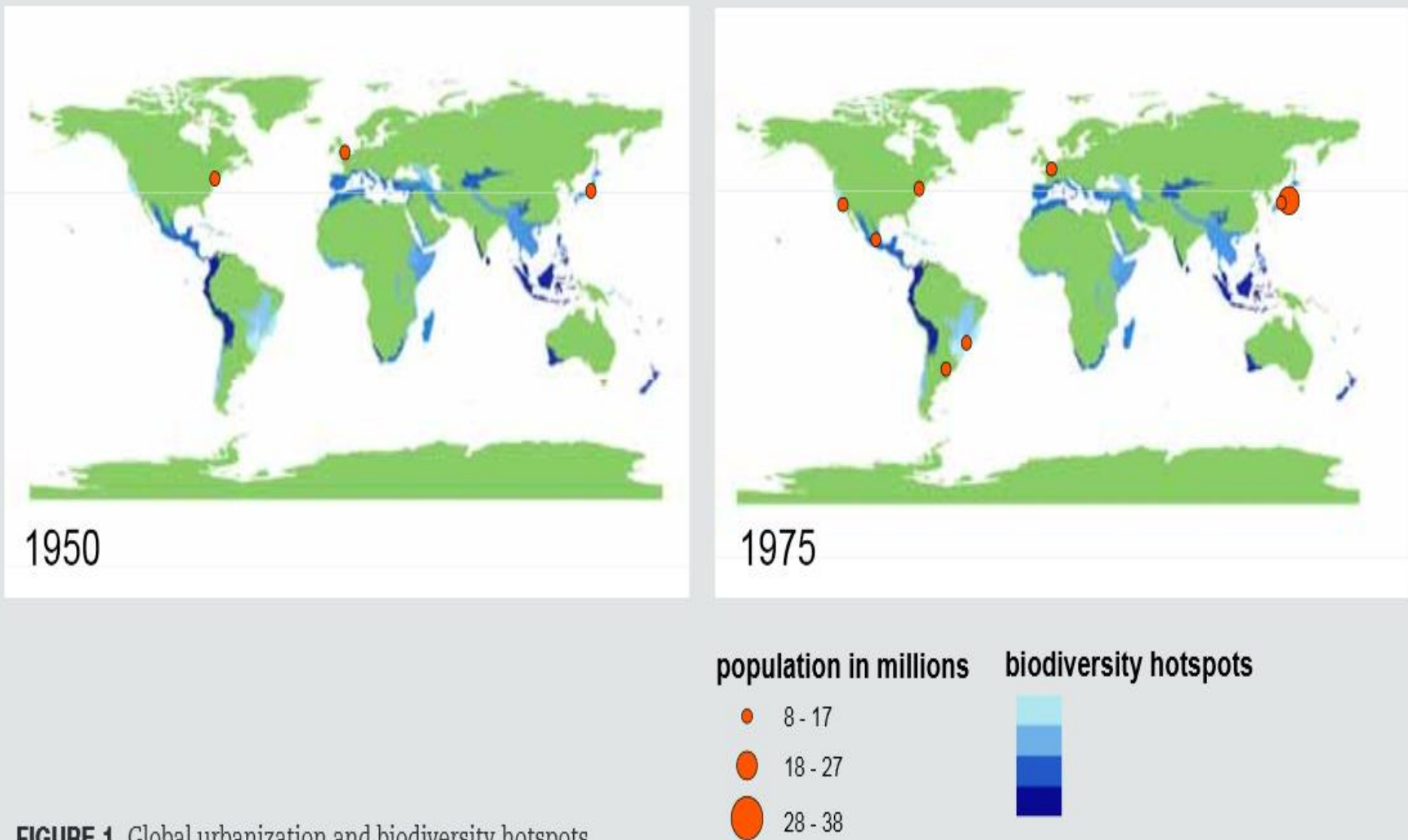


FIGURE 1. Global urbanization and biodiversity hotspots, 1950–2025. For explanation of biodiversity hotspots see p. 22.

Urbanization and the effects of biodiversity

Urban biodiversity represents the diversity and richness of living organisms (including genetic variations), as well as the diversity of habitats found in human settlements.

This biodiversity is represented from the peripheral parts to the very centers of urban areas.

At the level of landscape and habitat includes:

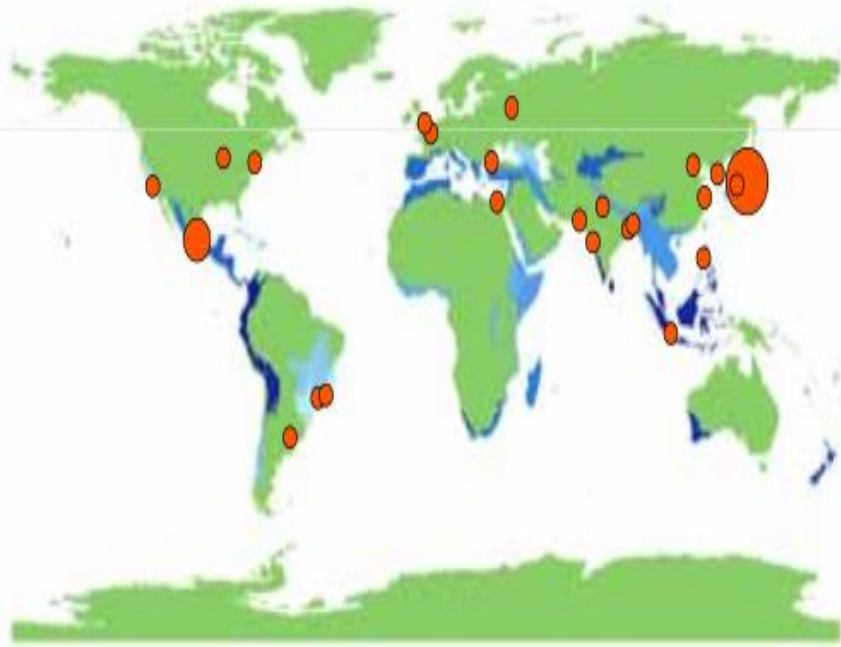
Remains of natural landscapes (eg forests)

Traditional agricultural landscape (eg meadow, pasture, arable land)

Urban-industrial landscape (city center, residential area, industrial park, etc.)

Urbanization and the effects of biodiversity

- Diversity of plants and animals in urban areas shows interesting trends:
- The number of plant species in urban areas correlates with the size of the human population - more than with the size of the city
- The age of the city has an impact on the richness of the species; large, older cities have more plant species than large newer cities.
- Diversity can be correlated with economic well-being.
- For example, in Phoenix, USA, the diversity of plants and birds in the urban environment shows a significant positive correlation with the average income of the individuals living there.
- 20% of all bird species and 5% of vascular plant species live in cities.
- On average, 70% of plant species and 94% of bird species living in urban areas are native to neighboring regions.



2000



2025

Data sources: UN, Conservation International
Map maker: Femke Reitsma (femke.reitsma@canterbury.ac.nz)

If current trends in population density continue, by 2030 the urban zone will expand globally by about 800,000 to 3.3 million km², representing a twofold to fivefold increase over the year 2000.

Changes in abiotic factors

- Alteration of abiotic factors: solar radiation, humidity, precipitation, wind speed and direction, soil characteristics, water diversion and availability, etc.
- In cities, an increase in ambient air temperature, which is often 2–5 °C higher than the surroundings, which is known as urban heat island (URT).
- Increasing the concentration of CO₂, methane, and ozone in the atmosphere and increasing nitrogen deposition.
- In cities, there is often an accumulation of phosphorus, nitrogen and metals, which can infiltrate surface and groundwater.
- Water that flows from urban areas carries pollutants from wastewater, vehicles and fertilizers, and enters watercourses and leads to eutrophication.

Changes in biotic factors

- The rate of natural succession is changing, and urban ecosystems are often maintained in the early to middle stage with significantly altered disturbance regimes.
- The trophic structure is often altered, with a lack of superior carnivores and a dominance of omnivores

Changes in biotic factors

Organisms that have survived these changing conditions in urban areas have succeeded for two reasons:

(1) They evolved rapidly.

(2) They have been largely adapted to such environmental conditions.

For example, tolerance to toxic substances and heavy metals in plants, such as tolerance of lead in roadside habitats in buckthorn (*Plantago lanceolata*).

And among insects, there are many cases of rapid evolution in urban areas.

The most famous example is the case of industrial melanism among moths and butterflies in the UK, when insects became darker in color in response to elevated levels of air pollution.

This phenomenon has also been documented in the United States; Canada, and elsewhere in Europe.

Parks and green areas are often very fragmented, leading to rapid genetic differentiation in less mobile species, e.g., the *Peromyscus leucopus* mouse species in New York City.

Ecosystem services in cities

Ecosystem services are a direct or indirect contribution of ecosystems to human well-being.

Cities depend on ecosystems inside and outside the urban environment, due to the great service necessary for economic, social and environmental sustainability.

Ecosystems in cities have the potential to regulate climate, to protect against risk, to meet energy needs, to support agriculture, to prevent soil erosion, and they also offer opportunities for recreation and cultural inspiration.

In most urban areas, especially on unused urban areas, there are opportunities to create new functional ecosystems that generate services that improve the well-being of residents.

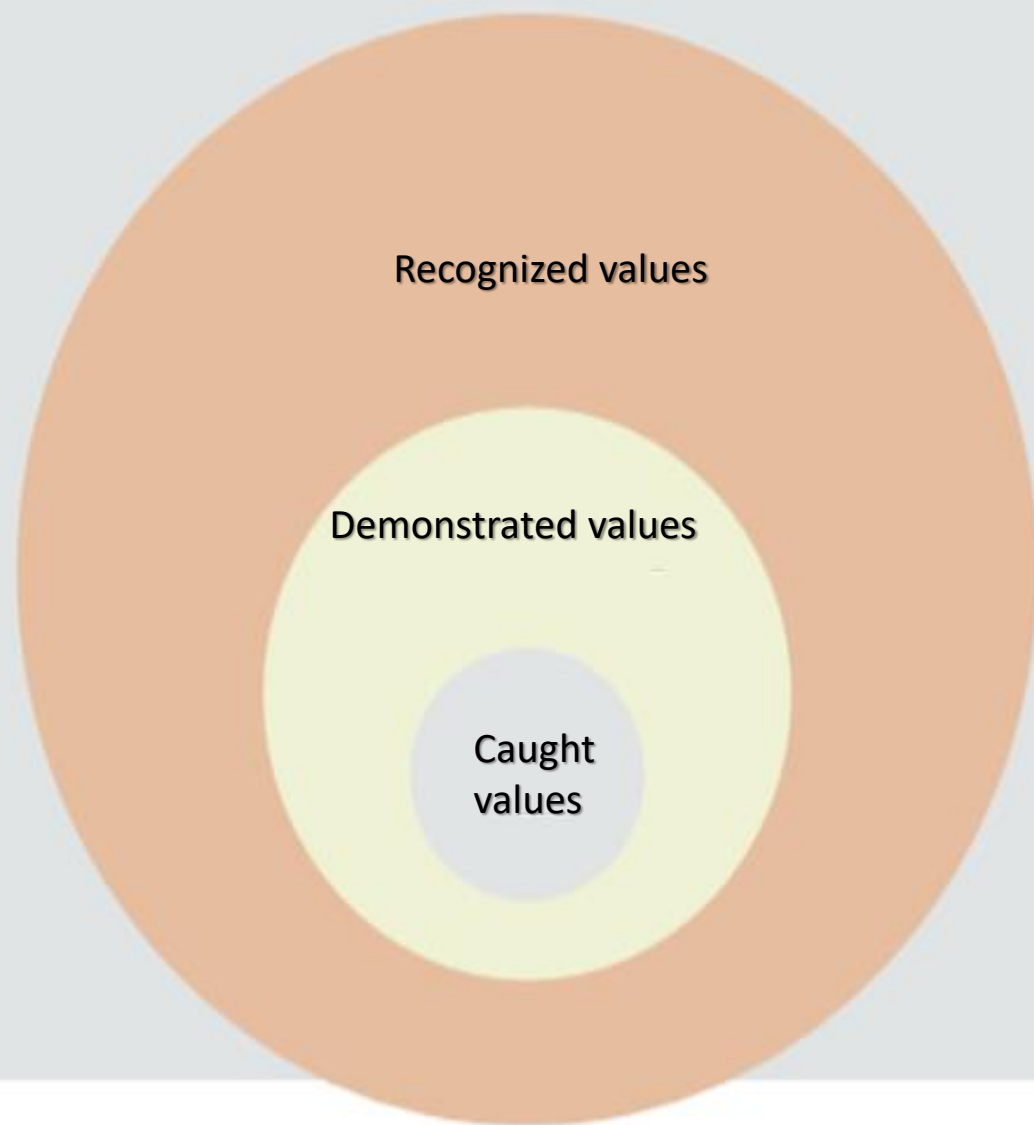
The value of ecosystem services can be expressed as:

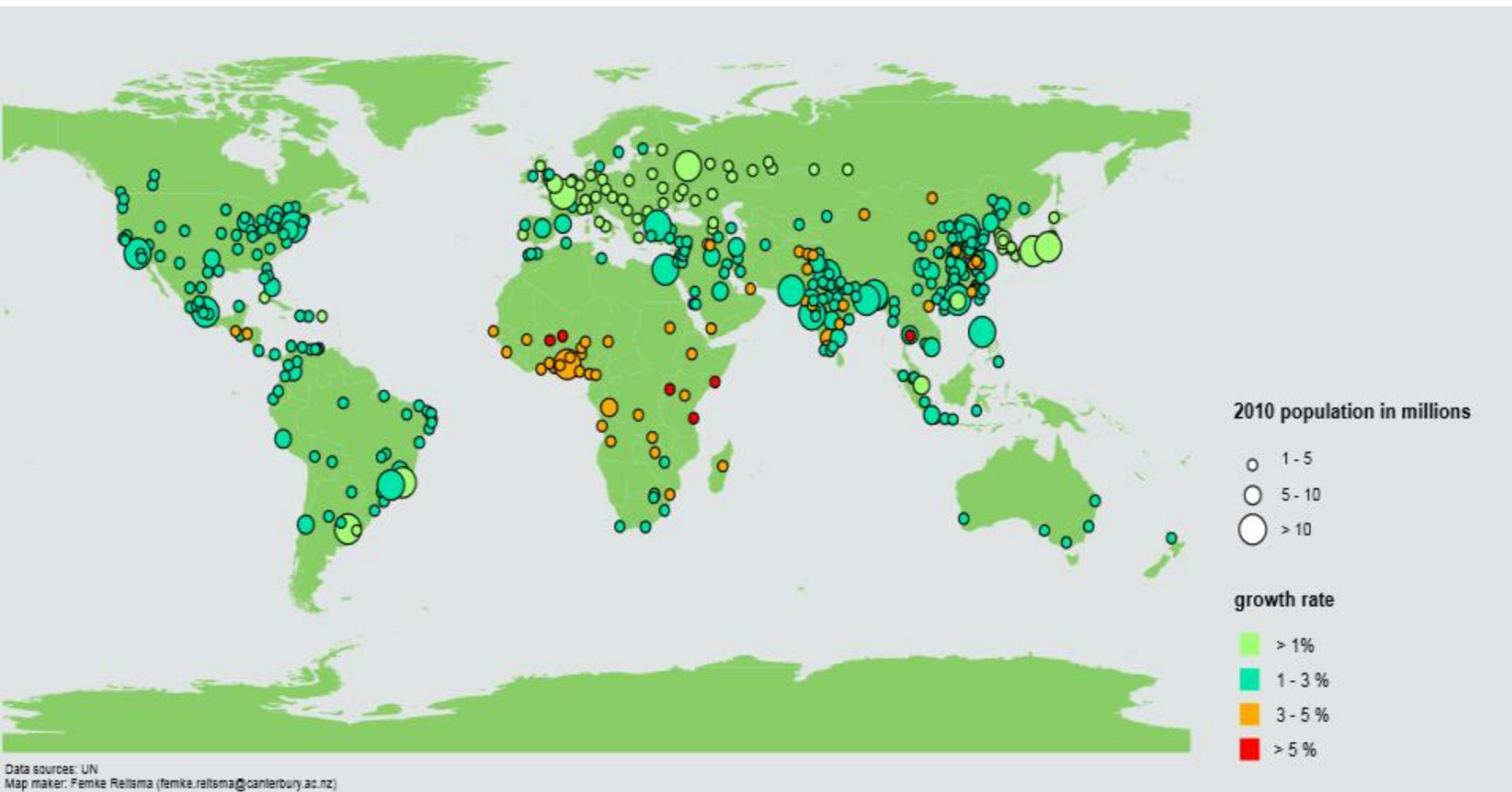
Recognized values, which include cultural and aesthetic values that can often only be expressed in non-Monterian terms;

Demonstrated values, when it is possible to calculate potential substitution costs in monetary terms; and

Captured values, when the market determines value, are often expressed in money (water, food, etc.)

Source: TEEB, 2010

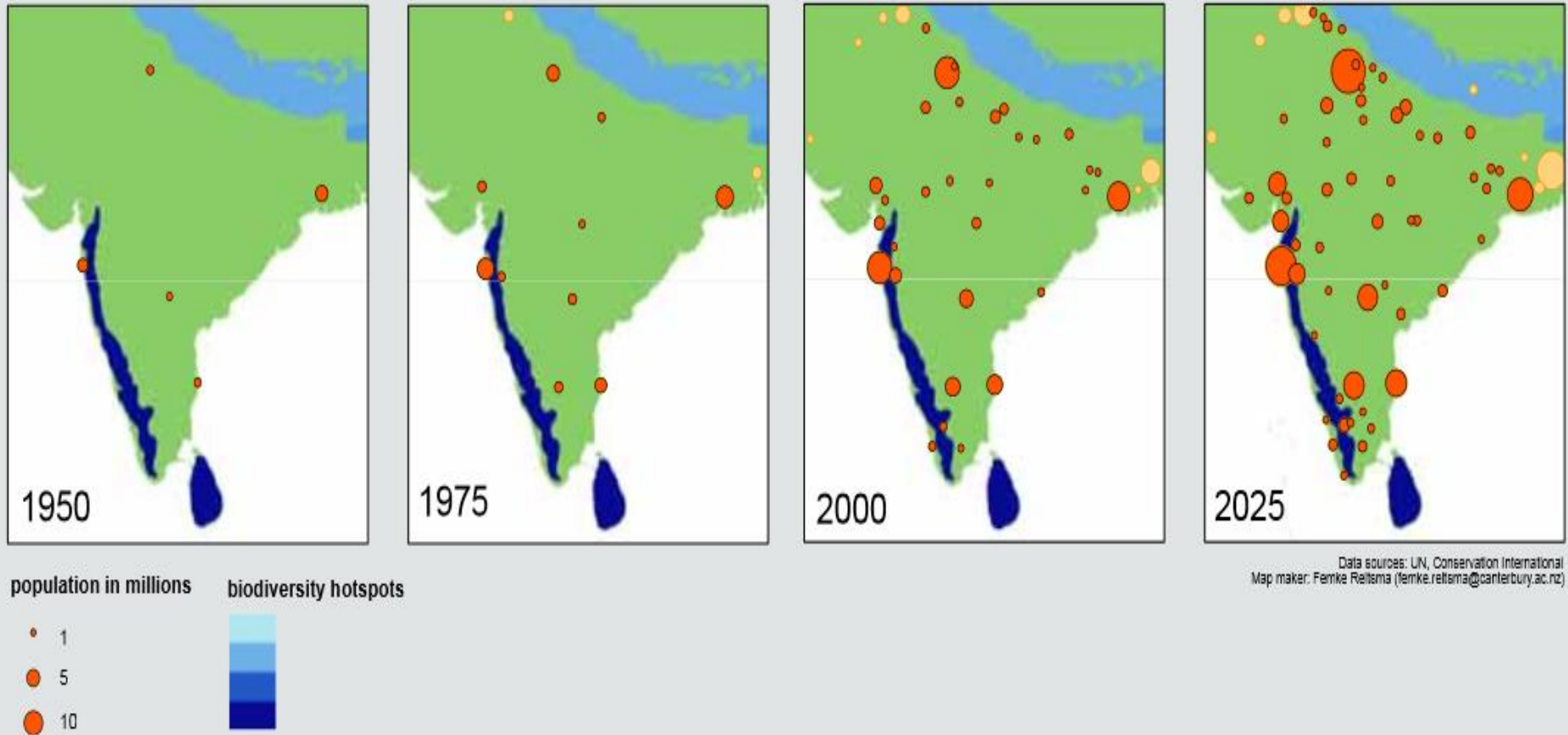




Predicted urban growth from 2010 to 2025 for cities with a population of more than one million inhabitants in 2010

Asia

- Asia is home to 60% of the world's population.
- There are large variations in the region here in terms of the level of urbanization and the rate of growth of urban areas.
- Some countries have a predominantly urban population (Singapore 100%; Malaysia 72%, Japan, 67%; Indonesia, 54%), others have a predominantly rural population (Bangladesh, 28%; Vietnam 29%; India, 30%, Thailand, 34%).
- Despite these variations, three features define this region.



Urban population centers and biodiversity hotspots in India (1950-2025).
Yellow circles represent centers outside India.