

Cities as mediators of cross-scale connections in social-ecological systems

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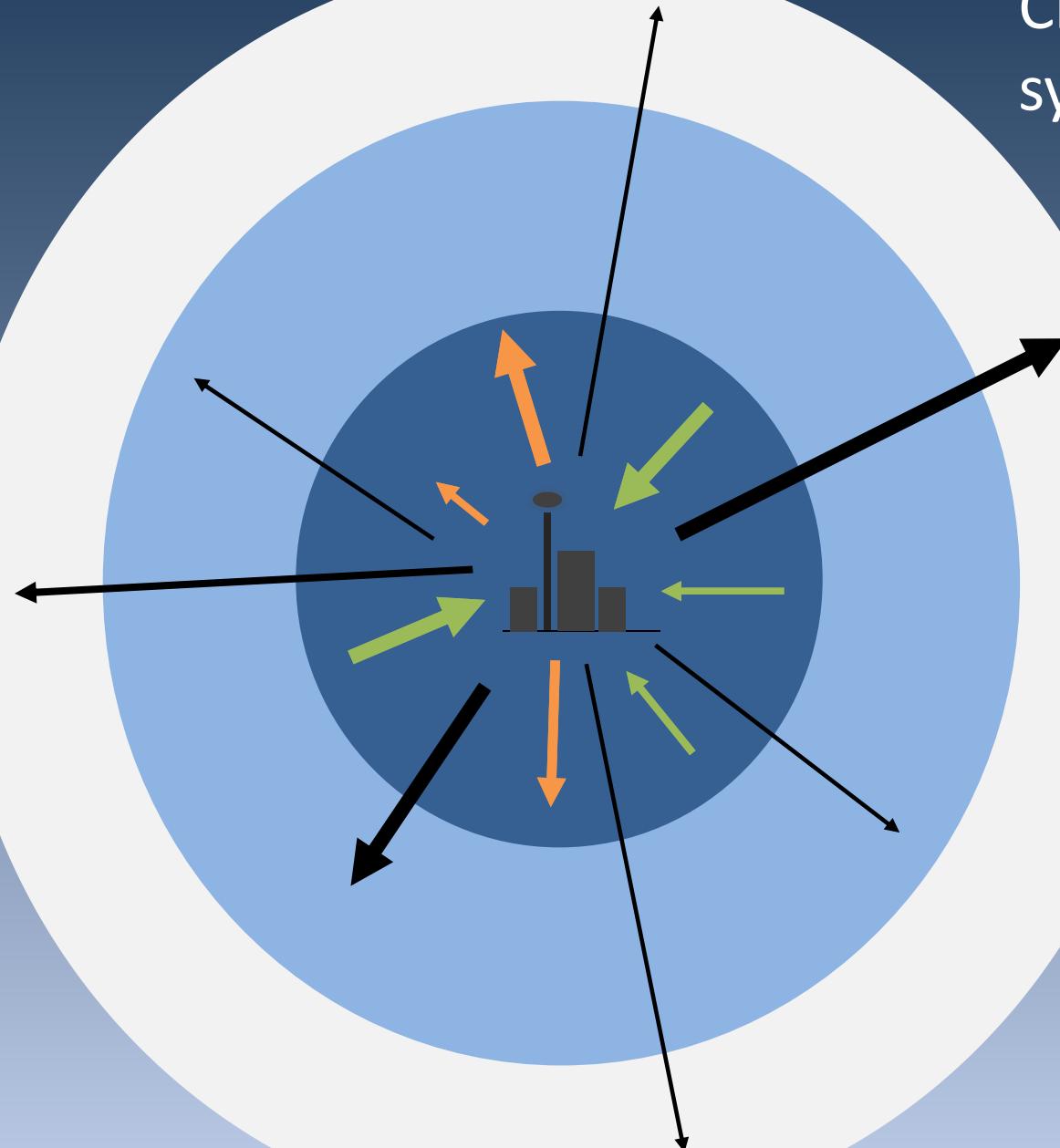
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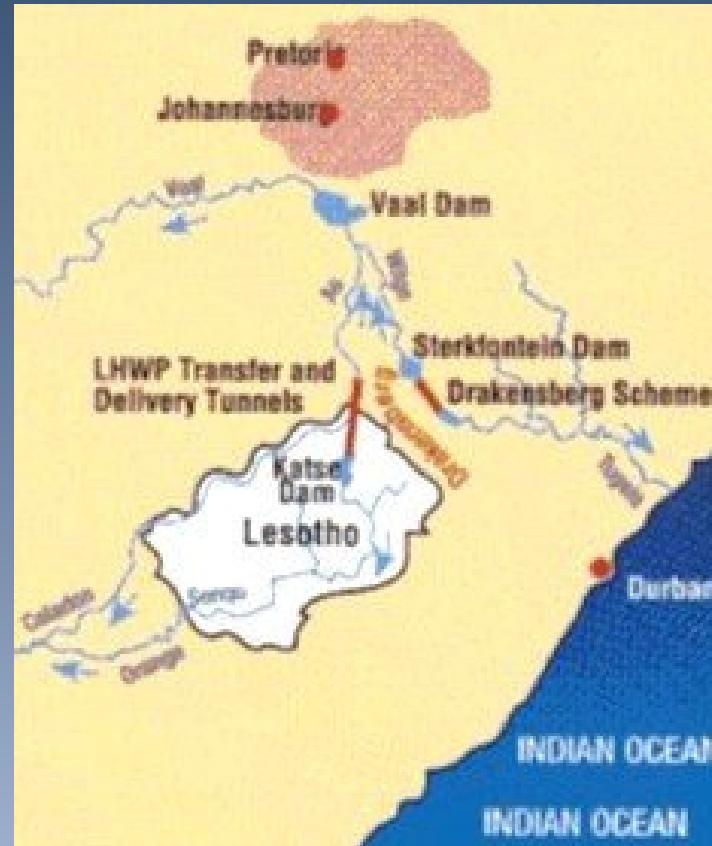
City-hinterland system



Example: water supply to Johannesburg

Lesotho:

- Infrastructure (roads, houses, power lines)
- Hydropower
- Income
- Resettlement
- Ecological impacts (rivers, flooded land)
- Reduced water supply to Orange River



Indirect effects:

- Materials and equipment e.g. cement
- Multinational companies
- Tourism

Johannesburg:

- Enables mining & industry
- Export of virtual water
- Ecological changes (urban forest)
- Opportunities for urban growth
- In-migration



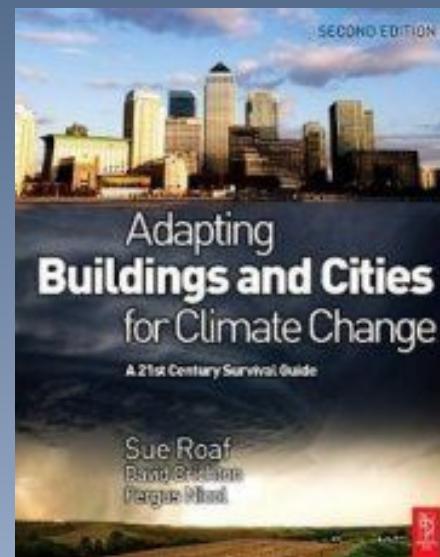
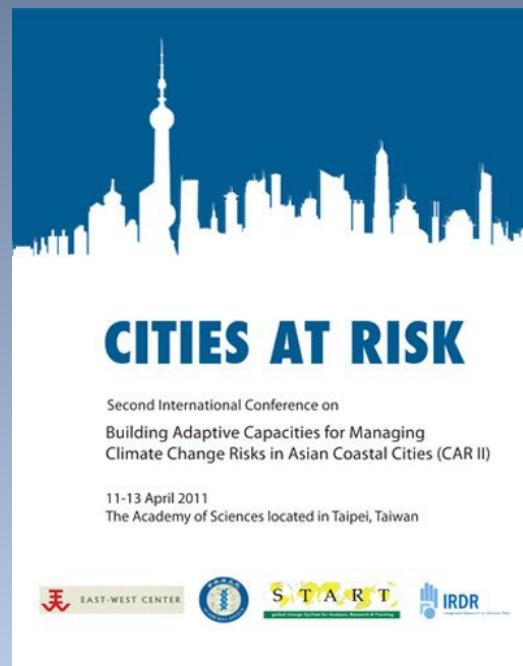
Features of city-hinterland connections

- Complex web of interlinked connections
- Transdisciplinary – social and biophysical interwoven
- Direct and indirect effects in many different locations
- Cross-scale, many different scales
- Many very long-range connections (teleconnections)
- Dynamic – change over time
- Mediated by people but responsibility shared by many different agents
- Many connections invisible to city residents and authorities

Challenging to measure, understand, manage and change!

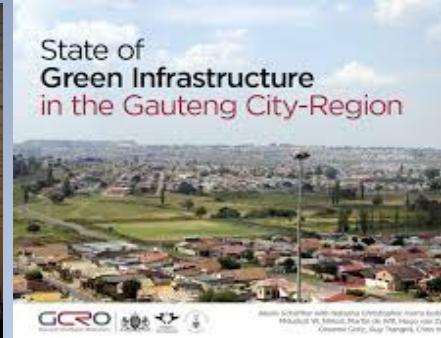
Why are cross-scale connections important?

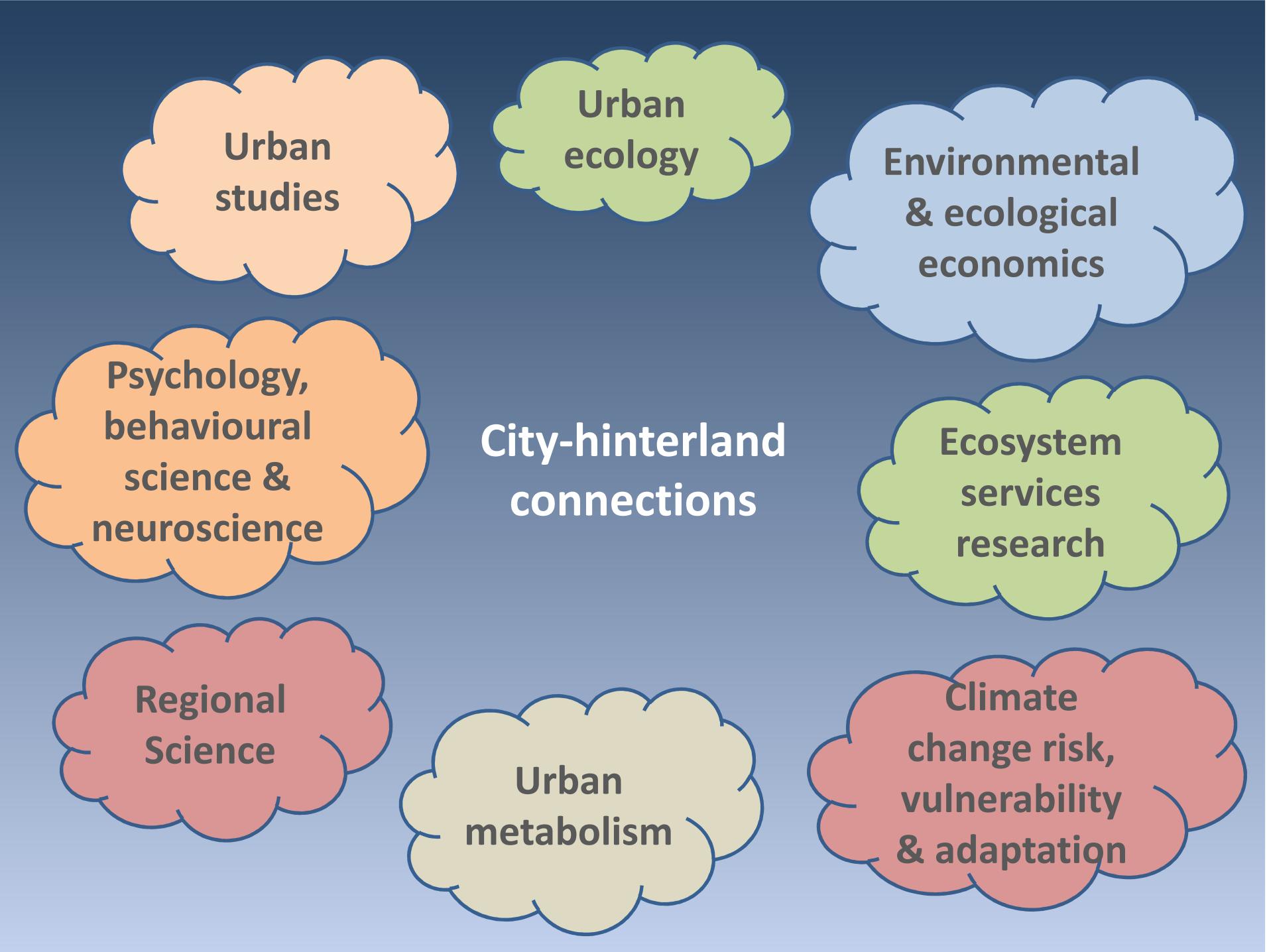
- Working systemically requires us to engage with them
- Risks and opportunities that affect sustainability and resilience of cities



What makes cities such powerful mediators of cross-scale connections?

- They are open systems
 - Centres of production and consumption – motivating force behind many cross-scale connections
 - Centres of innovation and creativity
 - Transport/infrastructure hubs
 - Centres of social and economic diversity





Within city	City	Region	National	International/ global
				Individual wellbeing Behaviour & motivation ----- “lock in”
				Place-making Human-nature connections Urban ecology Green infrastructure & spatial planning Sustainable urban design Industrial symbiosis Urban metabolism Life cycle analysis

Summary

- Disciplinary barriers have been broken down to some extent.
- BUT there is still a duality between cities and hinterlands (scale barriers) – need for a systems approach.
- The theoretical framework of complex social-ecological systems can help to develop a systems view of city-hinterland connections.

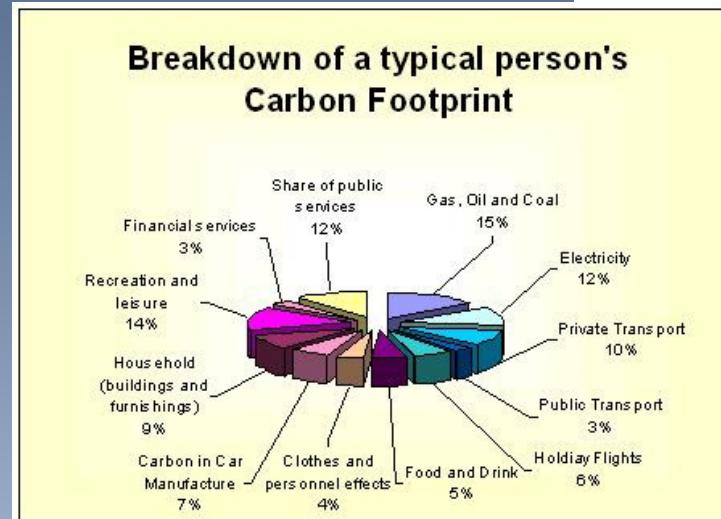
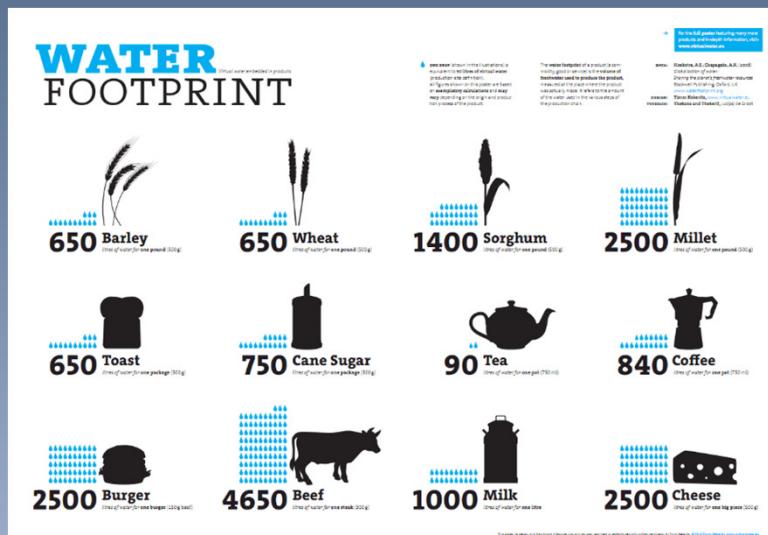
For those working in cities:

- Find ways to make city-hinterland connections more visible among citizens, business, government (all risks and opportunities arising from cross-scale connections, not just for climate change).
- Find ways of extending the rich understanding of interactions between people, pattern/form, process and meaning within cities to include cross-scale connections.
- Ensure governance systems do not ignore cross-scale connections but apportion responsibility appropriately to allow for action.



Useful tools: the Footprint Family

- Ecological footprint (biosphere)
- Water footprint (hydrosphere)
- Carbon footprint (atmosphere)



**What you eat
+ What you buy
+ What you use**

YOUR WATER FOOTPRINT

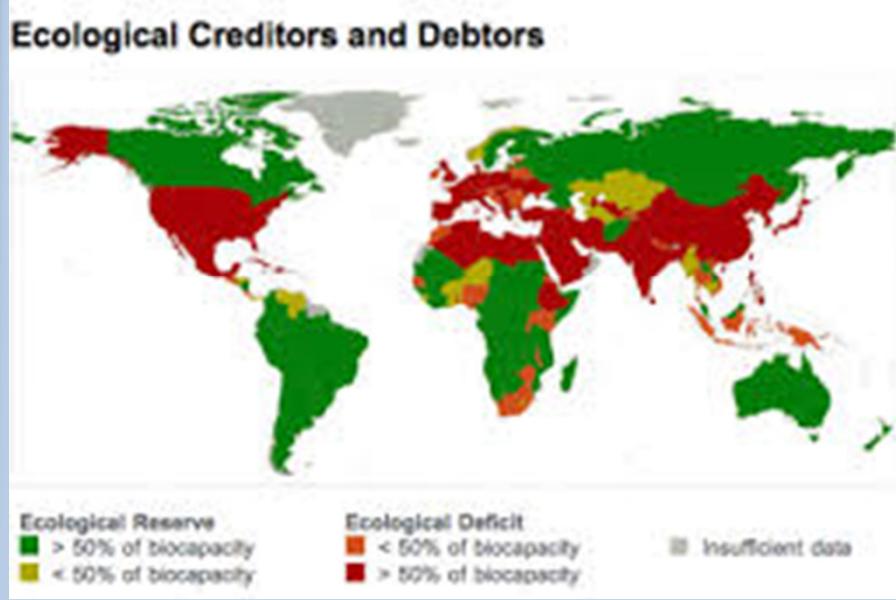
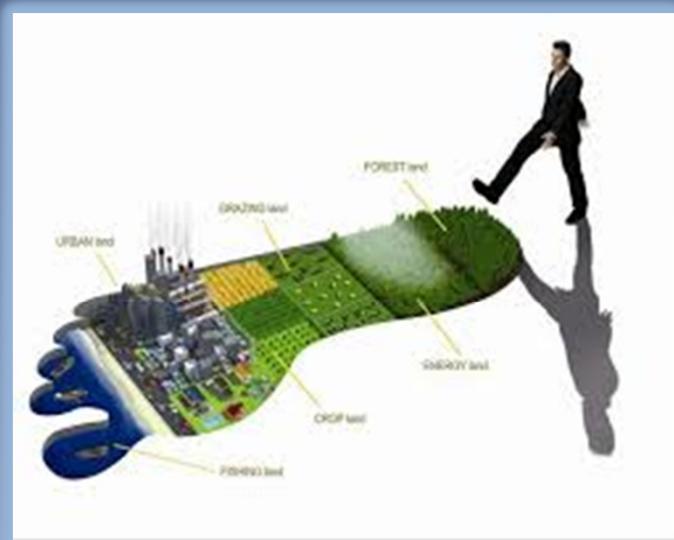


Recent developments

- Use of ecological, water and carbon footprints in combination (Galli *et al.* 2012)
- Increasing use of footprinting for individuals, products and industrial processes
- Combination of EF and input-output analysis to calculate footprints of socio-economic groups and lifestyles (Wiedmann *et al.* 2006)
- Efforts to allocate responsibility fairly between producers and consumers (Lenzen *et al.* 2007)
- New data-collection technologies using smartphones (e.g. Carbon Diem)



The screenshot shows the Carbon Diem website homepage. At the top, there's a navigation bar with links for Home, About, Products, News, Contact, and Sign in. Below the navigation, a main heading reads "Measure your carbon footprint on the move". A subtext explains that Carbon Diem is a revolutionary new smartphone application that quantifies the impact of travel choices. It highlights that the app is automatic, comprehensive, and respects individual privacy. In the center, there's a graphic featuring a smartphone displaying "102.3Kg CO₂ in 70kms" and a silhouette of a person holding a suitcase. To the right, three sections are listed: "Business" (with icons for Cell Phone Location, CarbonDiem App, GPS Location, and a group of people), "Branded" (with icons for Build brand equity, Offer bespoke app to customers, and Market directly to customers), and "Web services" (with icons for Submit your raw GPS traces, Receive detailed travel report, and Sell value added services). At the bottom, a footer note states: "Transport represents a third of global green house gas emissions. New legislation, reporting requirements and pressure from a range of stakeholders, are raising demands for better environmental reporting. Carbon Diem helps businesses, governments and individuals to make smarter choices about their travel."



For those working above the city scale on ecosystems or SES:

- Do not ignore cities!
- Find ways of accounting for the effects of social heterogeneity within cities on cross-scale processes.
- Incorporate social science perspectives on the importance of context and history when describing and quantifying connections.

