

# Urban metabolism, urban ecological distribution conflicts

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# SUSTAINABILITY AND URBANIZATION

- Urban areas are becoming the main habitat for a majority of the global population. The growth of cities not only entails a fundamental change in human settlement patterns but it comes together with a great change of the social metabolism.
- Thus, urban areas and their development are at the centre of discussions on sustainability or Green Transitions.

Marta Dinarès, ICTA UAB, Urban Metabolism: A review of recent literature on the subject, *Doc. d'Anàlisi Geogràfica*, 2014,60/3.

# Sustainable cities?

- An oxymoron, I agree. The issue here is to discuss means to achieve less unsustainable cities. Plan of the talk:

- 1) The rapidly increasing social metabolism of India.
- 2) Urban metabolism (e.g. the BUMP).
- 3) Some countertrends in cities (preserving compact form; valuing ecosystem services; recycling materials...).
- 4) Increased urbanization and ecological distribution conflicts at different scales.

In the Conclusion: Ecological distribution conflicts and the EJAtlas

# 1) SOCIAL METABOLISM

# SOCIAL METABOLISM

- By social metabolism we refer to the interaction of human society and the natural environment, in terms the flows of energy and materials (including water), from extraction to transport and use, and to waste disposal. (M. Fischer-Kowalski and H. Haberl, *Social Metabolism: A Metrics for Biophysical Growth and Degrowth*, in J. Martinez-Alier and R. Muradian, *Handbook of Ecological Economics*, E. Elgar, Cheltenham, 2015).
- The industrial economy is not circular, it is entropic. It draws largely on fossil fuels (photosynthesis of the distant past) for energy. Oil, coal or gas cannot be recycled. There is a daily need for “fresh” supplies.
- The industrial economy produces large amounts of waste (including GHG).

# METHODS FOR STUDY OF SOCIAL METABOLISM

## Energy accounting:

- Endosomatic energy use: food per person/day, approximately 2400 kcal = 10 MJ, per person/year 3650 MJ, 3.65 GJ.
- Exosomatic energy use: depends on economic growth (and other factors) – may vary from 10 GJ per person/year to 200 GJ or more per person/year (as an average for very rich countries).

# METHODS FOR STUDY OF SOCIAL METABOLISM

## Material flows:

- Divided into a) biomass, b) metal ores and industrial minerals, c) sand and gravel, d) fossil fuels.
- There are trends – India in 2008 at a level of about 5 tons per person/year, Spain in 2007 at 20 tons/person/year (building bubble) – Spain has gone down to a European normal level of 12 or 14 tons per person/year.
- India's materials flows must be increasing at a rate of 5 to 7 % per year.

## Trends in the social metabolism of India

- More than India as a whole, it would make more sense to talk of the metabolism of different states, comparing also the “sacrifice zones” to metropolitan areas.

Sources: a) Social metabolism and environmental conflicts in India, J. Martinez-Alier, L. Temper, F. Demaria, Occasional Paper, Nehru Memorial Museum and Library, New Delhi, also chapter 3 in N. Ghosh et al. (eds.), *Nature, Economy and Society*, INSEE/Springer, Delhi, 2015.

b) India's biophysical economy, 1961–2008. Sustainability in a national and global context, S.J. Singh, F. Krausmann, S. Gingrich, H. Haberl, K-H. Erb, P. Lanz, J. Martinez-Alier, L. Temper, *Ecol. Economics*, 2012, 76: 60-69 (open access).



## The HANPP (human appropriation of net primary production)

- This is an indicator of loss of biodiversity.
- We calculate first the potential production of biomass, then the changes due to land use, then the part of the biomass production remaining in the field. We compare (in %) the part taken away to the potential production.
- Very detailed studies and maps by Haberl et al. India comes on top among large countries in % of HANPP (both because of high population density and intensive use of biomass).
- Note that in a city, particularly a paved city, the HANPP is extremely high, near 100%.

# Marx, social metabolism and the “metabolic rift”

- Marx regarded urbanization as a process leading to “metabolic rift” (Foster, 2000). Under industrial capitalism, humans took no longer care of fertility of the soil, nutrients were lost because of the growth in long-distance trade in food and clothing.
- Marx quoted Liebig and Moleschott on the “metabolic rift”.
- The focus here is on links between environmental conditions and the historical and spatial patterns of inequality that manifest themselves within the city (Castán Broto et al., 2012) and on links between city, hinterland, and wider environment.
- However, Marxist scholars (in India and elsewhere) scarcely contributed to studies of social metabolism before the 1990s.

# Ecological footprint, a popular index

- The “ecological footprint” was developed by ecologist W. Rees in 1992 in Vancouver (BC), a professor of urban ecology, and card-carrying ecological economist.
- Popularized by his student, M. Wackernagel.
- Adds up land actually used (for food, feed and wood) and “virtual” land that would absorb through photosynthesis the carbon dioxide emissions from fossil fuels.
- In Vancouver, 4 hectares per person. In Bangalore, still less than 1 ha? Going up?

# Growth in the social metabolism

- There is a convergence in industrial economies towards of common pattern of use of energy and materials per person.
- This varies according to population density in the country, and other variables (the main one, GDP per capita).
- There is no decoupling between industrialization / growth of GDP per capita / increased social metabolism.

## 2) URBAN METABOLISM

# The forward march of Urbanization

- What defines the city and its conurbation? Population densities of over 50, 70, 100 persons per hectare.
- We can favour urban agroecology, permaculture – however the city cannot feed itself.
- We can favour solar energy in roofs – the city needs nevertheless energy inputs coming from outside.
- Instead of 'smart cities', shall we talk of unavoidably 'stupid cities' from an ecological viewpoint? (see from Barcelona **stupidcity.net**)

# Early studies of urban social metabolism

- Urban growth, in the 19th and 20th centuries in Europe and America, was a result of the spread of industrialization and the associated increase in the use of fossil fuels. It is now a common trend all over the world (Girardet, H. (1996). *The Gaia Atlas of Cities. New directions for sustainable urban living*. Gaia books limited. cit. by M. Dinarès).
- We now compare the social metabolism of countries, regions and cities. We build on work on the metabolism of cities since Wolman (1965), Boyden (1981 – study of Hong Kong).
- Patrick Geddes before them (outside India and in India) – he inspired Lewis Mumford (who criticized Le Corbusier as urban planner).

## Economic explanation of the increase in urbanization and industrialization

- As productivity per hour of work increases in agriculture (productivity is here measured in economic terms, not in energy terms), and due to the fact that the demand for agricultural products as a whole has low income- elasticity,
- therefore the agricultural sector loses active population to the benefit of the other sectors of the economy.
- This is the process of economic growth or economic development. The more of this, the better.
- So much for the economists.



# Urbanization, metabolism and delusions of “green growth”

- The UNEP’s 2013 report entitled "**City-Level Decoupling: Urban Resource Flows and the Governance of Infrastructure Transitions**" makes the case for examining cities not only from a socio-economic but also from a material flow perspective, presenting the city as a “living” organism (but actually the city is not making photosynthesis).
- It is a dissipative structure - one could say-, with a continuous flow of material and energy inputs and outputs as the components of its metabolism. (UNEP 2013)
- Notice the expectation in this UNEP report of “absolute decoupling”, of “green transitions” in cities. This is not happening.

Away from economic praise for urbanization, and also from hopes of  
“green growth”: e.g. the **BUMP**  
(Bangalore Urban Metabolism Project)

- Analyzes the metabolism of this urban area, focusing on inequalities.
- As regards **Water use**, it explains the **Hydro-Social Cycle**, accounting for the inequities in domestic household water consumption patterns in Bangalore.
- Anthropogenic drivers of **groundwater hydrology** in Bangalore dominate background biophysical drivers. Unequal spatial distribution of piped water infrastructure is the principal driver of groundwater hydrology in Bangalore.
- In fact, not only urban hydrology also rural hydrology (witness the dams in the Himalaya) is social hydrology.

Source: Metabolic Urbanism and Environmental Justice: The Water Conundrum in Bangalore, India, by V. K. Mehta, R. Goswami, E. Kemp-Benedict, S. Muddu, and D. Malghan, *Environmental Justice* (2014).

### 3) COUNTER-TRENDS?

## Counter trends?

### 3.1) Compact city vs Urban sprawl

- Urban form and the ecological footprint. A compact city has (for the same number of inhabitants) a smaller ecological footprint, because of less paved area, less travel by car.
- *Suburbanization* is the growth of areas on the fringes of cities - the US pattern of urban sprawl.
- The word “urban sprawl” introduced for Los Angeles in 1956. There were similar concepts before, going back to Patrick Geddes “conurbation” (used as a nasty term).
- Urbanization is linked to increased social metabolism – but the form of the city, and the related mobility systems, have some influence on the dimensions of the social metabolism.

## There are no environmentally sustainable cities, but they could become less unsustainable

- You cannot live from the photosynthesis at densities of 50, 70, 100 inhabitants per hectare.
- Less so when you consider the growing metabolic use of energy and materials.
- What we discuss is how to make cities less environmentally unsustainable.
- How to make more compact but also “greener” cities – and how to preserve and enhance ecosystem services provided inside cities.

## However, “from greening to gentrification?”

- GREEN-LULUS, interesting name for a new ERC project at ICTA UAB, Dr. Isabelle Anguelovski, 2016-2020 (perhaps related to “bourgeois environmentalism”, Amita Baviskar).
- No systematic study has been conducted to measure if greener cities (or parts of cities) are less racially and socially equitable.
- “Greenlulus” will analyze whether greening projects tend to increase environmental inequalities in 40 cities, and under which conditions such projects can address equity concerns.
- Who gets the new ecosystems services? We could ask this.
- The study will develop an index to quantify the racial and social impact of greening projects.

## Counter-trend?

### 3.2) Waste management from the bottom up, relevant for Delhi, Pune... and also for Bogota

- The story of Nohra Padilla from Bogota (Goldman Environmental Prize) and the Mayor Gustavo Petro, who supported waste-pickers and re-municipalized waste collection.
- Taking the right side in ecological distribution conflicts, or how resistance to social injustice promotes environmental sustainability.

F. Demaria and S. Schindler, Contesting urban metabolism: struggles over waste-to-energy in Delhi, India. *Antipode*, 2015. (Also in the EPW).

## Countertrend?

### 3.3) Urban ecosystem services, a useful concept for planning, within limits

- Cities appropriate different ecosystem services (productive, regulating, habitat, cultural) from beyond the city boundaries.
- Nevertheless, enhancing ecosystem services in urban areas can reduce the ecological footprint and “ecological debts” of cities while improving health, and quality of life for their inhabitants. Such services are given not only by green areas (parks or food gardens).
- Gomez-Baggethun and Barton (**Classifying and valuing ecosystem services for urban planning, *Ecol. Econ.*, 86, 2013**) explain in detail methods to classify and value ecosystem services for urban planning. They **use DIFFERENT valuation languages** (economic costs, socio-cultural values, resilience ...) that capture distinct value dimensions of urban ecosystem services.



## Counter-trend:

### 3.4) Increasing ecological distribution conflicts at different scales

It might be that the “core” of the conurbation improves in indicators such as green area per person, less SO<sub>2</sub>, less NO<sub>x</sub>..., while in the areas of urban sprawl more land is paved over, aquifers disappears., ozone drifts over (remember the proposal for Green Belts from E. Howard 1902 onwards, and his influence on Patrick Geddes)

and meanwhile the “ecological footprint” of the conurbation increases (in terms of the area needed to supply it with food and raw materials, and also of area virtually required to absorb the GHG).

The following figure is from J. Martinez-Alier, *The environmentalism of the poor* (Oxford U.P. Delhi, 2005, chapter 7).

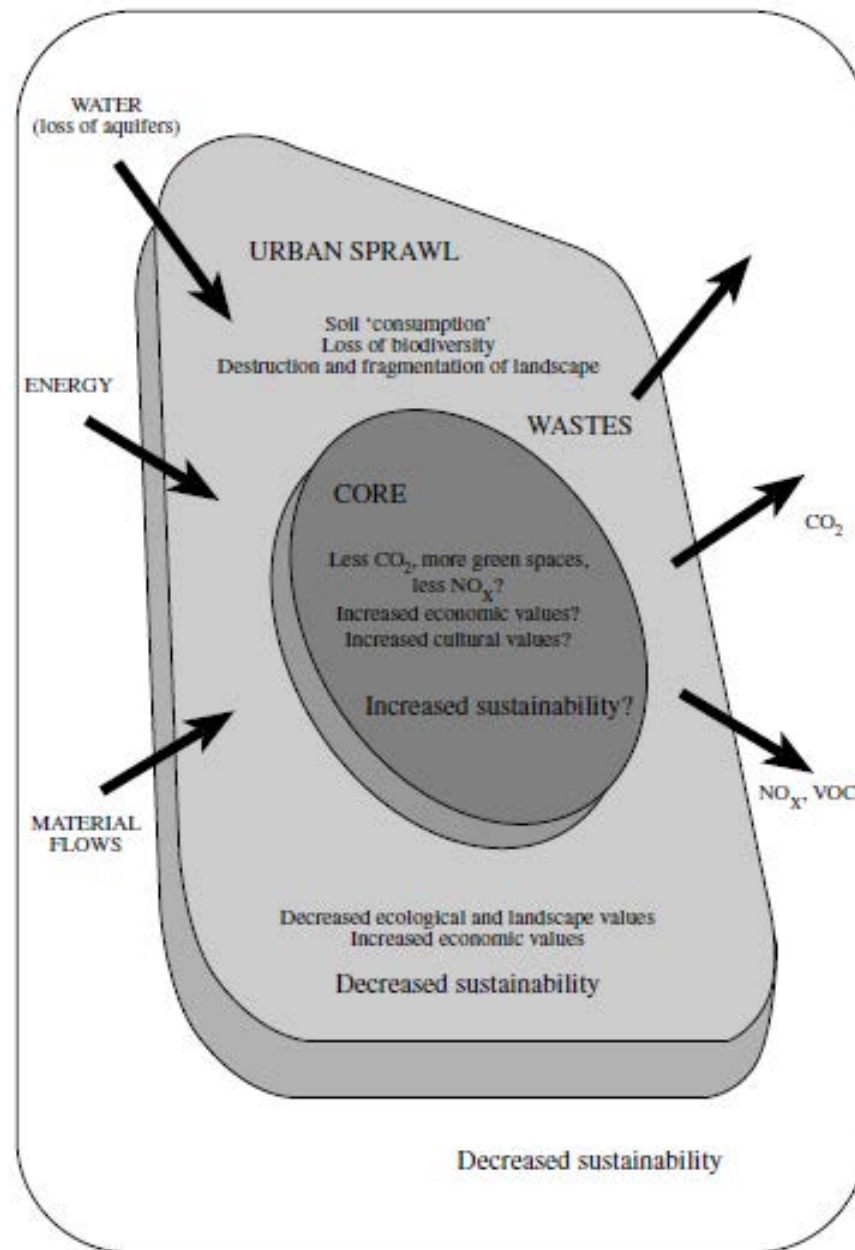
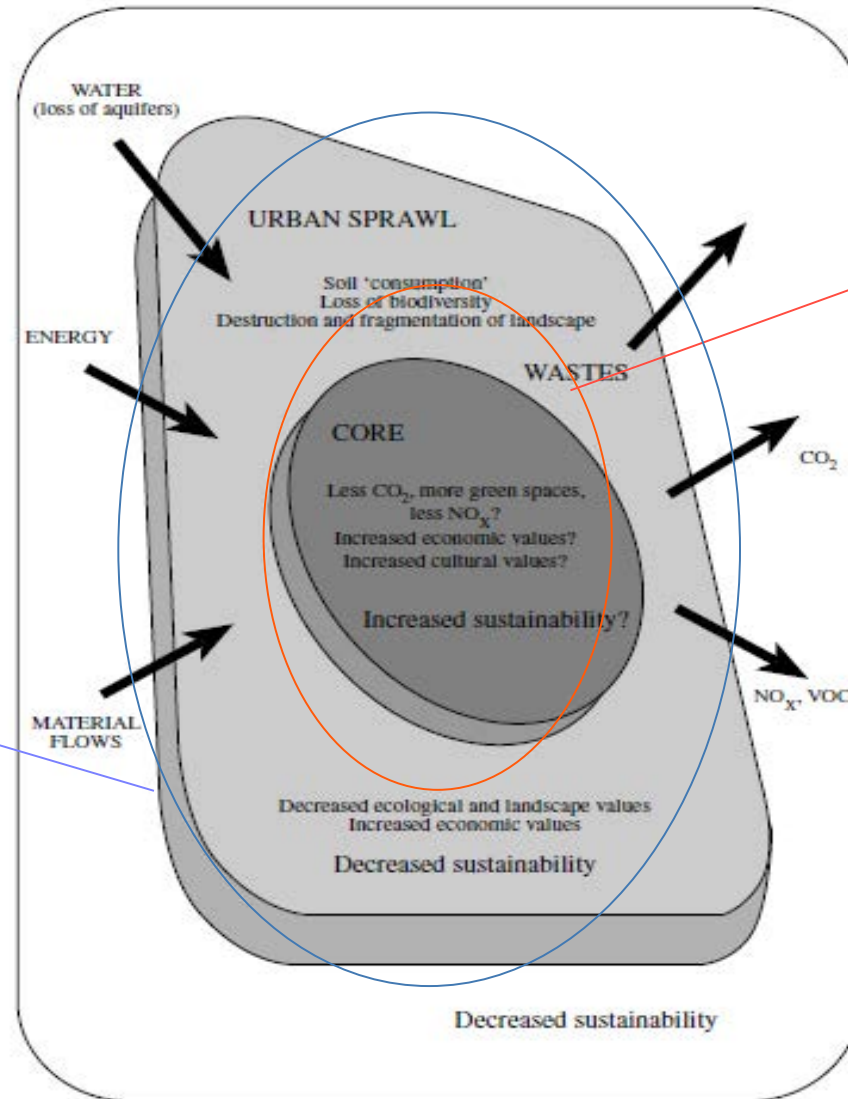


Figure 7.1 Urban (un)sustainability on different scales – European model

# Conflicts at different scales

Ecological  
Distribution  
Conflicts at distant  
scales



Urban Ecological  
Distribution Conflicts

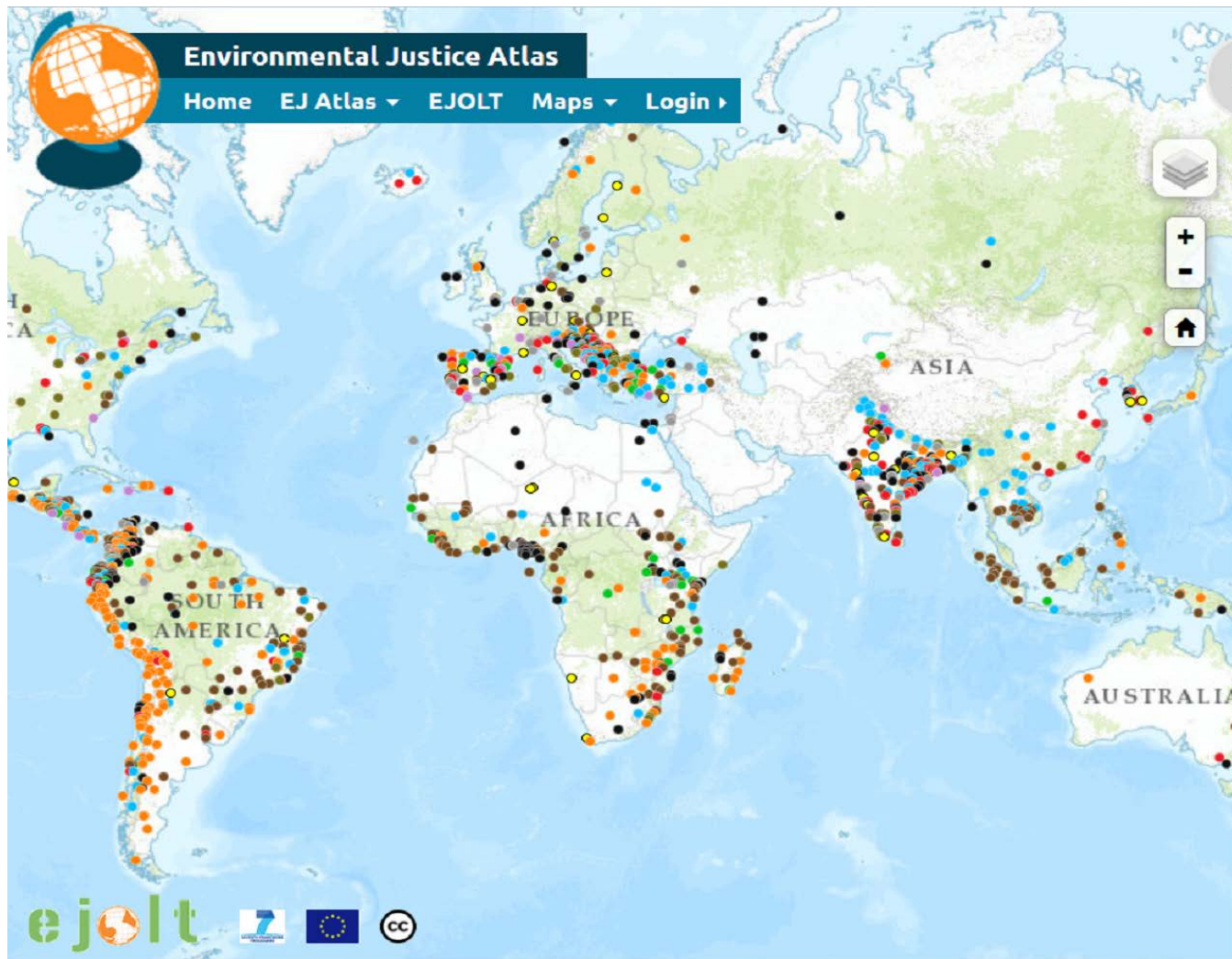
Figure 7.1 Urban (un)sustainability on different scales – European model

## 4) ECOLOGICAL DISTRIBUTION CONFLICTS: the EJAtlas ([www.ejatlasing.org](http://www.ejatlasing.org))

For each conflict

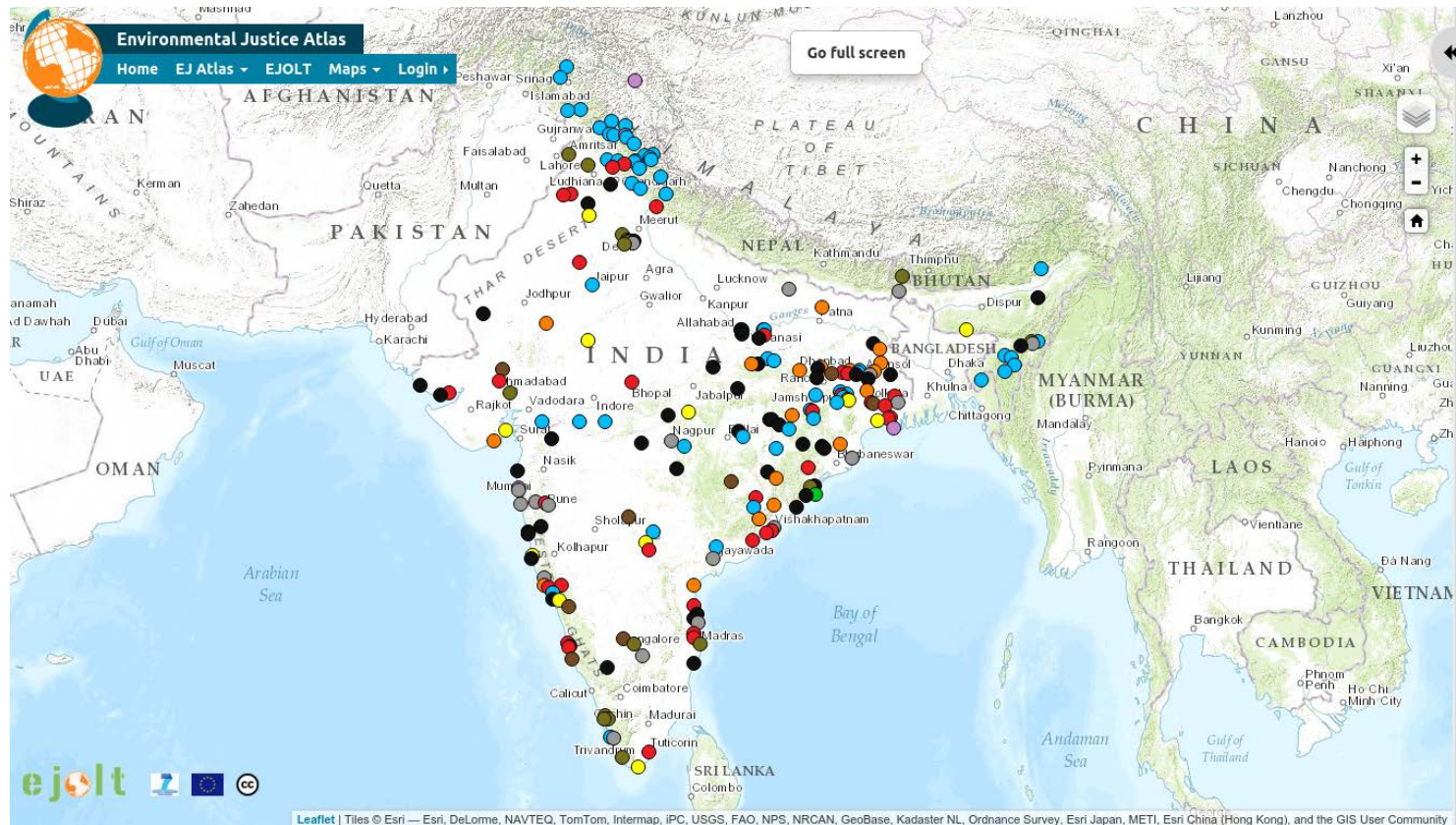
- Description
- Basic information
- Source of conflict
- Project details and actors
- Mobilization
- Impacts
- Outcome
- Sources and Materials

The **EJAtlas** of ecological distribution conflicts:  
rural, periurban, urban ([www.ejatlas.org](http://www.ejatlas.org)).  
1700 cases by January 2016.





# Ej Atlas: India (219 cases)



# Ej Atlas: Indian Urban conflicts (29 cases)

The screenshot displays the Environmental Justice Atlas (Ej Atlas) web application. The main map shows India with 29 urban conflict cases marked by red dots. The interface includes a navigation menu at the top left with links to Home, EJ Atlas, EJOLT, Maps, and Login. A notification box at the top center states "You have gone full screen. Exit full screen (F11)". The right sidebar contains a legend and a filter panel. The filter panel has a "Population Type" section with buttons for "Unknown", "Urban", "Semi-urban", and "Rural". Below this, there is a "Filter" section with a dropdown menu showing "Country: India" and "Population Type: Urban". The bottom of the page features the Ejolt logo and a list of data sources: Leaflet, Esri, DeLorme, NAVTEQ, TomTom, Intermap, IPC, USGS, FAO, NPS, NRCAN, GeoBase, Kadaster NL, and Ordnance.

Environmental Justice Atlas

Home EJ Atlas EJOLT Maps Login

You have gone full screen. Exit full screen (F11)

World Map

Legend

Filter

Basic Data

Name

Success Level

Population Type

Country

Region

Category

Project

Conflict

Resistance

Impacts

Outcomes

Meta

Population Type

Unknown

Urban

Semi-urban

Rural

Apply Clear

Country: India

Population Type: Urban

AND

OR

NOT

Browse maps

Get Involved

Leaflet | Tiles © Esri — Esri, DeLorme, NAVTEQ, TomTom, Intermap, IPC, USGS, FAO, NPS, NRCAN, GeoBase, Kadaster NL, Ordnance

A few examples of urban /periurban ecological distribution conflicts in India that we have in EJAtlas

- Water
- Waste
- Transport
- Industry
- Infrastructure
- Development of built environment
- ... BUT... Many more in the real world!



# Waste: Waste-to-Energy (Delhi)

Private companies

VS

Waste-pickers and citizens



Wastepickers demonstration (2012).

Social and environmental concerns



Dr. Ramesh meets the citizens at Okhla (2012).

See:

<http://ejatlas.org/conflict/okhla-waste-to-energy-plant-india>

# Transport: Ban on Cycling (Kolkata)

West Bengal government  
and police argue that  
non-motorized transport  
slows down traffic.

*Non-motorized vehicles vs  
Cars and motor cycles*



Transport infrastructure for whom?

See:

<http://ejatlas.org/conflict/ban-on-cycling-in-kolkata-west-bengal-india>

# Infrastructure: Manori to Marve Sea Link (Mumbai)

For the sake of tourism and higher speed, coastal habitats and fisherfolk's livelihood are put at risk.

Real Estate Developers  
and public authorities

VS

Fisher-folk and environmentalists. See:

<http://ejatlas.org/conflict/manori-marve-sea-link-mumbai-india>



# Energy: Simhadri thermal power plant Andhra Pradesh

Fisher folk and villagers

VS

Private company



See: <http://ejatlas.org/conflict/simhadri-thermal-power-plant-andhra-pradesh-india>

<http://www.thehindu.com/business/gandhian-way-of-protest-impresses-shinde/article2446562.ece>

# Industry: Industrial environmental judicial policy making (Delhi, 1990s)

As described in *The Environmentalism of the Poor* (chapter 7) in the 1990s there were pollution struggles in Delhi, with decisions by the Supreme Court (judge Kuldeep Singh) against tanneries, fertilizer factories, steel and paper mills – they were to be displaced outside the NCR.

Shiv Visvanathan (1999) quoted from a textile employee: “In this world the divide is between rich and poor and it is the poor who have to die for they are cheaper. We will have to shift to Tonk (the new site) for the law is of the rich man ... The management is powerful, the government is of the rich. This is an attempt to throw the poor out of the city. Pollution in the city is vehicular, not industrial...”



**Development of built environment: Sand mining** – The conflicts are so widespread that in India they have given rise to a new term in the world vocabulary of environmental injustices: “sand mafias”

- Awaaz Foundation vs Sand mafia;
- Swami (hunger strike) vs Uttarakhand State;
- Narendra Kumar (IPS Officer) vs Sand Mafia (Madhya Pradesh);
- Women and activists vs Sand Mafia (Cauveri river in Tamil Nadu)

*(cases from EJOLT reports)*



# In the EJAtlas

We list the main Actors in each case: Public authorities, Private companies, Environmental Justice Organizations (EJOs), Informal workers, Citizen groups, Religious groups, Indigenous groups...

We list the Valuation Languages deployed: Livelihood, Environmental values, Job creation, Sacredness... We state whether the case is one of success in environmental justice, or failure, or “not sure”.

We do comparative, statistical political ecology. Recent articles:

Is there a Global Movement for Environmental Justice? by J. Martinez-Alier, Leah Temper, Daniela del Bene, Arnim Scheidel, J. of Peasant Studies, 2016.

Mapping the frontiers and front lines of global environmental justice: the EJAtlas, by L.Temper,D. del Bene,J.Martinez-Alier,J.of Pol. Ecology, 22, 258-274,2015

# CONCLUSIONS

Cities are environmentally unsustainable

There are ways to make them somewhat less unsustainable: urban form (compact cities), support urban recyclers (against incineration), give value to urban ecosystem services (e.g. shading trees) ...

And also support those fighting for the environment in ecological distribution conflicts at different scales – they are often the poor and indigenous in rural areas. And in urban areas?