



Urban Environments

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Editorial

A healthy urban habitat

Half the world's population live in cities. By 2050, the total number of urban dwellers is expected to nearly double, rising from 3.3 billion to 6.4 billion¹. How do we accommodate urbanisation while ensuring good quality of life and health? How do we minimise environmental damage but still develop our cities? This thematic issue provides a window into the research evidence that can help us create healthier urban environments and more sustainable urban policies.

Transdisciplinary research is needed to develop approaches that integrate the complexity of urban challenges, otherwise it is easy to lose sight of how issues interact. 'Transport and land use planning: integrating shared strategies' illustrates how this approach can lead to more sustainable transport outcomes.

Similarly, the impacts of climate change have to be integrated with other strategies designed to improve urban living. 'Flexible approaches to managing air pollution' stresses the importance of an interdisciplinary approach to managing air pollution and climate change effects.

Improving urban waste management could help with the search for alternative energy sources and overcome a shortage of land while ensuring resources are used more sustainably (see: 'What is the best way to manage urban waste?').

Vibrant urban areas demand both new construction and a continual reworking of existing structures. This leads to opportunities to erect new eco-friendly buildings, designed for climate change mitigation and healthier lifestyles. In response, we need construction technologies which minimise impact on the environment and human health (see 'Encouraging construction companies to think green').

Motorised transport is of particular concern in urban areas and has multiple health and environmental ramifications. But perhaps the urban form itself is often the real culprit, or more specifically, the way we have quietly allowed land uses to arise in locations, and in configurations, which generate the traffic we then condemn. The article, 'Estimating exposure to excessive noise in cities', examines the extent to which traffic noise affects human health.

Research has shown that access to natural environments promotes health and creates a sense of well-being. Good urban policies are needed to ensure all citizens share in these benefits (see 'Living near parks can improve health').

Future land use planning needs to take into account the impact on sustainability and health in how we locate city functions. These aspects are as important as economic considerations, for in the long term we may have to pay a high price for unsustainable urban living.

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¹ See the UN report 'World Urbanization Prospects The 2007 Revision': http://www.un.org/esa/population/publications/wup2007/2007WUP_ExecSum_web.pdf

Contents

Page

Transport and land use planning: integrating shared strategies 2

A recent study describes a new approach to help transport and land use planners reach mutual goals.

Flexible approaches to managing air pollution 3

Air pollution management has come a long way in recent decades. Researchers discuss its development and future.

What is the best way to manage urban waste? 4

Urban waste is a significant blight on our environment. Ways of reducing its impact are discussed in a recent study.

Encouraging construction companies to think green 5

Experts have devised an environmental impact assessment method specific to the construction industry.

Estimating exposure to excessive noise in cities 6

Urban noise levels have been mapped in a step towards reducing the damaging health impacts of noise pollution.

Living near parks can improve health 7

The health gap between richer and poorer residents is halved in areas with access to green spaces, according to a recent study.

Related articles 8

A selection of recent articles from the Science for Environment Policy News Alert.



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Transport and land use planning: integrating shared strategies

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Theme(s): Land use, Sustainable mobility,
Urban environment

“Greater integration of land use and transport planning will lead to more sustainable transport systems and reduce ecological impact.”

Incorporating land use and transport planning in the early stages of a development project can lead to improved strategies for urban planners. A recent study suggests that a mediated process is successful in supporting shared decisions about land use and transport.

Greater integration of land use and transport planning will lead to more sustainable transport systems and reduce ecological impact. A lack of collaboration between the two parties can lead to conflicting outcomes, for example, a car-dependent development or an unprofitable public transport system. However, if land use and transport planners collaborate early on in a development, the project can benefit from the innovative ideas and shared concepts and visions of participants. Mediated Planning Support can facilitate such collaboration.

Mediated Planning Support is based on a series of processes, which can be repeated and modified as a project progresses. The main elements of this approach include:

- The assessment of problems by all participants, especially land use and transport planners, to ensure early integration of transport and land use strategies
- A process protocol to develop a planning support system used to build a planning product
- An information protocol to identify information in a form that can be understood by all participants to support the process protocol
- A final planning support system which is tested by the participants in the development of the prototype
- The ‘products’, i.e. an effective planning support system and integrated land use and transport strategy

This approach was used to support an integrated land use and transport process in the early phases of regional planning in the Greater Region of Amsterdam, The Netherlands. Participants in the development included: transport modellers, transport planners, municipality and regional land use planners, the Dutch Railway Company and scientists.

Bottlenecks to the integration of land use and transport plans were identified in the problem assessment stage. In addition, alternatives for the development of future infrastructure for housing, job creation and transport systems were discussed. During development of the process protocol, land use and transport planners worked together to promote shared strategies. Alternative land use options were analysed, taking into account restrictions, such as ecological considerations. In the next stage, the information protocol focused on selecting the type and presentation of information needed by all the participants to make informed decisions. This included the initial use of spatial maps and moving from simple, descriptive data to more complex modelled data as the process progressed.

The process generated a list of realistic choices for future land use and transport systems and awareness by participants of the greater possibilities offered by cooperation. Key benefits of the approach are: a better fit between existing transport models and specific demands for land use and transport strategy development, overcoming bottlenecks which led to better argued land use and transport insights, a better fit with the planning process and improvements in the support provided for the generation of alternatives.

Source: te Brömmelstroet, M. and Bertolini, L. (2008). Developing land use and transport PSS: Meaningful information through a dialogue between modelers and planners. *Transport Policy*, 15: 251-259.



Flexible approaches to managing air pollution

Managing air quality has become an increasingly complex partnership between regional, national and local bodies in Europe¹. A recent study explores the development and achievements of urban air quality management over recent decades, from controlling emissions at source to new, flexible approaches, based on managing risks associated with health and environmental impacts. The future of air quality management is also discussed.

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“It is important to develop win-win policies where a balance is achieved between improvements in air quality and the management of carbon emissions.”

Researchers used the UK as a case study to illustrate the principles and practice involved in air quality management. All Member States work within the Air Quality Framework Directive² and the study highlighted some of the challenges EU nations face in managing air quality. A major area of concern is urban air quality³, which is particularly affected by significant increases in road transport and industrial development.

In the UK, the government implemented the Local Air Quality Management (LAQM) framework through the Environment Act in 1995⁴. The LAQM integrated technology-based controls with a risk management approach based on human exposure to pollutants, and complies with the Air Quality Framework Directive. The Air Quality Strategy (AQS) published in 1997 (amended in 2007) also considers ecosystem protection from the pollutants SO₂ and NO_x, as well as protection of human health.

Both the Environment Act and the AQS, provide the framework for the government and local authorities to jointly manage air quality. Local authorities are responsible for assessing local levels of pollution and identifying areas of poor air quality in need of remedial action. While identifying these areas has been a successful process, implementing action plans to remedy air pollution has been slow. For its part, the government offers guidance and support to local authorities, for example, by developing national monitoring networks.

Further developments in LAQM include reducing exposure to fine particles (PM_{2.5}) in areas where significant improvements to public health can be achieved. This initiative should particularly benefit more deprived communities, who often live in highly polluted areas of cities. Better communication within local authorities and between stakeholders is another priority and should result in greater efficiency in implementing action plans to clean up air. Involvement in the consultation process is expected to result in greater social acceptance of decisions made under the LAQM system.

Critical to the further development of AQM policy across Europe, will be to ensure effective integration between air pollution and climate change strategies. It is important to develop win-win policies where a balance is achieved between improvements in air quality and the management of carbon emissions.

Source: Longhurst, J.W.S., Irwin, J.G., Chatterton, T.J., *et al.* (2009) The development of effects-based air quality management regimes. *Atmospheric Environment*. 43: 64-78

¹ See: <http://ec.europa.eu/environment/air/legis.htm>

² See: http://ec.europa.eu/environment/air/quality/legislation/existing_leg.htm

³ See: http://ec.europa.eu/environment/urban/home_en.htm

⁴ See: http://www.opsi.gov.uk/acts/acts1995/Ukpga_19950025_en_1



What is the best way to manage urban waste?

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Urban Environments, Waste

“The data reveal that even incinerating waste is a better option than landfill.”

Towns and cities generate huge volumes of waste that are often disposed of as landfill. In a new study, researchers explain that sorting urban waste into organic and inorganic streams, which can be turned into energy and fertiliser, offers a much more efficient and environmentally friendly solution.

Each year, 1.3 billion tonnes of waste is thrown away in the EU¹. In several European countries, the main way of disposing of this waste is in landfill sites. In Greece, Portugal, the UK, Ireland, Finland, Italy and Spain more than half of all waste ends up as landfill. Aside from the negative environmental impacts of landfill, including heavy metal leaching and slow release of greenhouse gases, landfill sites are in short supply. Alternative waste management strategies are therefore urgently required.

Using the city of Rome as a case study, landfill was compared with three alternative waste management options:

1. landfill without biogas treatment
2. landfill with collection of biogas to burn for electricity production
3. direct incineration of waste with electricity recovery
4. a scheme where waste is sorted into organic and inorganic streams at landfill sites, and ferrous metals are recycled

In each case, the researchers calculated how much new waste was generated by the waste disposal process itself, how much energy the process required and how much it generated, and the estimated global and local emissions. The results suggest landfill represents the worst waste management strategy both in terms of environmental impacts and energy performance. The data reveal that even incinerating waste is a better option than landfill.

Separating organic and inorganic waste, proved most effective in terms of reducing environmental impacts and energy performance. In this case, organic waste is turned into biogas and fertiliser, and inorganic waste is converted to Refuse Derived Fuel (RDF) which is burned to generate electricity. This scenario could lead to an 80 per cent reduction in the amount of waste sent to landfill. In terms of global warming potential, this scenario has a positive effect on net greenhouse gas emissions (because the electricity and biogas produced can replace fossil fuels). For comparison, under the landfill alone scenario, one year's worth of waste from Rome produces an estimated global warming potential equivalent to 1910 kt CO₂ (mainly in the form of greenhouse gases emitted from the landfill site). If the waste is separated into streams, there is a net reduction in global warming potential equivalent to 345 kt CO₂ from one year's worth of waste.

Although none of the options evaluated provide a full solution to the waste disposal problem, the researchers suggest that the fourth scenario is currently the most viable. This scheme produces twice as much energy as the direct incineration scheme and is the most energy efficient. From an environmental perspective, the same scheme offers the best solution, as the only remaining waste to enter landfill is burnt inorganic waste, which will not decompose further after disposal. In contrast, organic waste directly disposed of in landfill will continue to decompose for thousands of years, releasing greenhouse gases.

Source: Cherubini, F., Bargigli, S. and Ulgiati, S. (2008). Life Cycle Assessment of Urban Waste Management: Energy Performances and Environmental Impacts. The Case of Rome, Italy. *Waste Management*. 28: 2552-2564.

¹ See: <http://ec.europa.eu/environment/waste/index.htm>

Additional information: LIFE has funded a number of innovative projects designed to improve the sustainability of waste management. For project details, please download: http://ec.europa.eu/environment/life/themes/urban/documents/urban_waste.pdf



Encouraging construction companies to think green

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“Increased efforts are needed to encourage the construction industry to catch up with the environmental practices of many other industries.”

Researchers have developed a new evaluation method that could encourage construction companies to adopt environmental management systems and processes. This could reduce the impact of construction projects on local urban environments, as well as on the environment more generally by reducing fuel consumption and greenhouse gas emissions.

Many organisations follow standards and guidelines for environmental performance under the EN ISO 14000 series¹ or participate in the EU's Eco-Management and Audit Scheme (EMAS)², which promotes ongoing monitoring and evaluation of the environmental performance of an organisation. However, according to the study, costs and technological difficulties have hindered the ability of construction companies to embrace such environmental practices. As building projects have significant environmental impacts, increased efforts are needed to encourage the construction industry to adopt such measures and catch up with the environmental practices of many other industries.

A panel of environmental and construction industry experts was assembled to help develop a method to assess the environmental impact of construction projects. These experts assessed various environmental impacts of the construction process, including land contamination, waste generation and greenhouse gas emissions. Each impact was assessed in terms of the scale or extent of the impact - local, national or international, the duration of the impact and the probability of the impact occurring.

These three factors are combined to give an overall significance. For example, noise pollution during the construction process is local and short term, but very likely to occur. In this case, the rating for the third factor makes the greatest contribution to the overall significance. For each impact, environmental indicators were also proposed. The number of construction workers on-site, for example, could be used as an indicator of the amount of municipal waste likely to be generated during the construction process. In order to establish limits on the different impacts of construction projects, a statistical analysis of environmental indicators of 55 new-build construction projects was carried out. Four of these projects are described in more detail as case studies to demonstrate how the method could be used to suggest new eco-management measures. For example, analysis of the case study with the highest environmental impact score highlights the following areas and suggestions for mitigation strategies:

- Greenhouse gas emissions – establish a procedure to review environmental quality of construction equipment, machinery and vehicles, select energy efficient equipment
- Waste generation – establish procedures such as waste minimisation, recycling and reuse, transfer waste management duties to the building contractors
- Water consumption – establish water saving strategies, such as leak detection
- Local issues – establish a complaint management system, e.g. if dirtiness is highlighted, establish procedures to minimise dirtiness and keep vehicles clean
- Emergency situations – fires in areas storing flammable and combustible materials were identified as a risk and measures could be established proactively to deal with emergency situations

Eventually the system could be developed into a web-based tool and further refined with use to take greater account of the characteristics of specific locations, such as residential or industrial sites.

Source: Gangoells, M., Casals, M., Gasso, S. *et al.* (2008). A methodology for predicting the severity of environmental impacts related to the construction process of residential buildings. *Building and Environment*. 44: 558-571.

¹ See: http://ec.europa.eu/environment/emas/tools/faq_en.htm#iso14001

² See: http://ec.europa.eu/environment/emas/index_en.htm



Estimating exposure to excessive noise in cities

The 2002 Environmental Noise Directive¹ seeks to provide a uniform basis for measuring and addressing noise pollution, one of the most important urban environmental issues for the EU. New research has assessed city-dwellers' exposure to noise and proposes traffic management strategies to reduce harmful levels.

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“Clear evidence is growing for wide-ranging negative health effects of noise pollution”

Clear evidence is growing for wide-ranging negative health effects of noise pollution, including emotional responses such as anger, anxiety and depression, learning difficulties, motivation and attention problems (particularly in children) and heart disease. All may be related to sleep disturbance, which has measurable psychological and physiological effects. In order to design effective noise reduction measures, it is important to understand exposure to noise pollution.

The study centred on one square kilometre in the centre of Dublin, Ireland. This is a relatively quiet area surrounded by roads with very heavy traffic, believed to be representative of urban areas across the EU. The EU Harmonoise² model was used to predict road traffic noise. This model is expected to become the standard EU model by 2012. Traffic was characterised as light/medium/heavy vehicles, as obtained from recorded traffic flow data made available by Dublin city council. Geographic Information System (GIS) data, which provides a special map of the area including details of building height and road profiles, were then used to map populations and noise levels at different times.

Of particular concern, the study found that 90 per cent of residents in central Dublin were affected by night-time noise exceeding World Health Organisation guidelines³. Furthermore, 53 per cent of workers and 28 per cent of residents exceeded daytime noise guidelines.

WHO guideline levels for daytime exposure to noise are 70 decibels (dB), compared with 45dB for night-time levels. The daytime population of the area studied, including workers, is around 10 times greater than the overnight population. Therefore although the proportion of the population exceeding the guidelines is higher at night, excessive noise affects a greater number of people during the day.

The researchers also modelled the effects of simple traffic management measures, such as diverting traffic from residential areas at night. They found that the number of residents exposed to high levels of noise (60-70 dB) at night could be reduced considerably (from an estimated 3500 residents to around 2700). They suggest that night time noise reduction measures should focus on preventing traffic from travelling along inner city links where there are high numbers of residents. Good urban design with coherent traffic management plans could therefore have positive health benefits, even with little or no change to existing infrastructure or environment.

¹ <http://ec.europa.eu/environment/noise/directive.htm>

² <http://www.imagine-project.org/>

³ <http://www.who.int/docstore/peh/noise/guidelines2.html>

Source: Murphy, E., King, E.A. & Rice, H.J. (2009). Estimating Human exposure to transport noise in central Dublin, Ireland. *Environment International*. 35 (2), 298-302.

Additional information: The CALM BlueBook is an online resource of data from noise reduction projects across Europe. To view, please visit: www.calm-network.com/index_bluebook.htm. CALM II (Coordination of European Research for Advanced Transport Noise Mitigation) was funded by the European Commission under the Sixth Framework Programme.



Living near parks can improve health

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Theme(s): Environment and Health, Urban environments

“In the 20 per cent of the population with the greatest exposure to green space, an estimated 1328 lives were saved per year.”

The health gap between richer and poorer residents is halved in areas with access to green space such as parks, river corridors and playing fields, according to new research. Mortality rates were clearly linked to levels of exposure to green space in this large scale study.

The researchers investigated records on more than 360,000 deaths from all causes in England, in the period 2001-2005. Deaths among those above retirement age (60 for women and 65 for men) were excluded. Income-related deprivation and access to green space was assessed via area of residence. Access was defined as the proportion of green space in a resident's local area, excluding gardens and income was stratified into quartiles, with the study concentrating on income quartiles 2-4 (middle income to lowest income groups).

The results revealed links between levels of income and the degree of exposure to green space in relation to deaths from all causes. The link was particularly strong for deaths from circulatory diseases, such as heart disease.

In the 20 per cent of the population with the greatest exposure to green space, an estimated 1328 lives were saved per year in the three income groups that form the focus of this study when compared with the 20 per cent of the population in the same income groups but with the least exposure to green space.

According to the researchers, green spaces benefit health by encouraging local residents to undertake physical activities, such as walking or sports. There is also evidence that being in green environments can reduce blood pressure and relieve stress. While not everyone has equal access to green spaces, those who do have access tend to use them, regardless of socioeconomic status.

The study demonstrates that substantial differences in health inequality can exist between populations who are exposed to the same welfare state, health service and national income distribution, but who live in different types of physical environment.

The authors conclude that physical environments that promote good health could be crucial in the fight to reduce socioeconomic health inequalities and that this should be taken into account when planning urban areas in the future.

Source: Mitchell, R. and Popham, F. (2008). Effect of exposure to natural environment on health inequalities: an observational population study. *The Lancet*. 372(9650): 1655-1660.



A selection of articles on Urban Environments from the *Science for Environment Policy* News Alert

Protecting valuable urban soil (18/12/08)

Soil provides multiple services, ranging from food production, water-filtering and carbon capture, to green park areas in towns and cities, important for human well-being. However, increased urbanisation is leading to a loss of soil resources. Researchers have developed an online evaluation.

Poorest are worst affected by urban expansion (6/11/08)

Rapid expansion of cities has a greater negative impact on poorer inhabitants who cannot afford to move to the outskirts where the air is cleaner, according to a recent study which examined the effects of urban sprawl.

All green roofs are not equal (2/10/08)

Green roofs, covered with growing vegetation, help conserve energy and water by cooling temperatures inside buildings in hot weather and containing storm water runoff. New research shows striking differences in the ability of different types of green roof to retain water.

Balancing urban expansion with biodiversity conservation (2/10/08)

In developing countries economic growth is linked with expansion of urban areas and changes in land-use, including conversion of forests to agricultural land. An investigation of the impacts of two neighbouring cities in central Panama has revealed that continued expansion is likely to cause future habitat loss, which in turn could lead to a decline in species diversity.

Congestion charging: possible impacts of different schemes (25/9/08)

Many European policymakers consider road-pricing as a credible instrument to tackle urban congestion. New research shows that in Paris, lower income motorists would benefit from schemes that include rebates for 'greener' vehicles or seek to combine greater reductions in vehicle numbers with faster journey times on public transport.

Silencing nuisance noise with an acoustic cloak (11/9/08)

Noise pollution is a key issue facing policy makers in urban areas. In a recent development that might help town planners, researchers have proposed a design for a new sound-proofing device, an acoustic 'cloak', that could be 100 per cent effective. This suggests that, one day, buildings could be adapted to fully protect their inhabitants from external noise.

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