

Abstract

Density is a tool used by planners to predict, describe and control land use. Some national governments also support density through policy, such as Planning Policy Guidance 3 in the UK, which had a minimum target for dwelling density of 30 dwellings per hectare in new developments. Such targets may help promote more efficient use of land, reduce private transportation use and increase the mix of uses in an area. However, decision-makers often are unsure of how these targets translate in-practice to development sites as well as how increasing or decreasing density impacts on other sustainability issues, now and in the future. This paper examines one such development site in Lancaster called Luneside East. The note begins by explaining the information available about density from local authority policy and guidance, both at the site and local scale. Missing policy information is discussed next, followed by an exploration of interdependencies between density and other sustainability issues. The paper ends with an examination of the conditions required for a density-related sustainability solution to function and whether or not this solution is resilient to whatever the future holds.

DRAFT

Briefing note: Density**Introduction**

Luneside East is a 6.6-hectare, brownfield regeneration site just north-west of Lancaster city centre (see *Figure 1*). The local authority has attempted to develop the site over several years in collusion with developers, but the recent economic recession has called into question the viability of their plans, as outlined in the development brief (Lancaster City Council, 2004) and, in over-arching terms, the city's Core Strategy (Lancaster City Council, 2008). As part of these plans, discussions around a sustainable built density—in the form of number of dwellings per hectare—have taken place and have helped shape the design and function of the Luneside East proposals. Thus, the aim of this paper is to examine how Lancaster City Council has approached the issue of density for the Luneside East site and to discover whether or not a particular, density-related sustainability solution would be resilient for the development, whatever the future holds. The paper begins by describing what information relating to density is present in local authority policy and guidance pertaining to Luneside East. Next, information not found in policy, but which may help clarify potential tensions between relevant decision-makers as they develop the site (e.g., local authority planners and developers) and/or reveal new relationships between density and other issues, is described. Further interdependencies between density and other sustainability issues that could impact site design and development are discussed. The paper concludes with an examination of the conditions required for a density-related sustainability solution to function and illustrates the possibility that one sustainability solution, high dwelling density, may be resilient for the Luneside East site via an assessment of its necessary conditions.

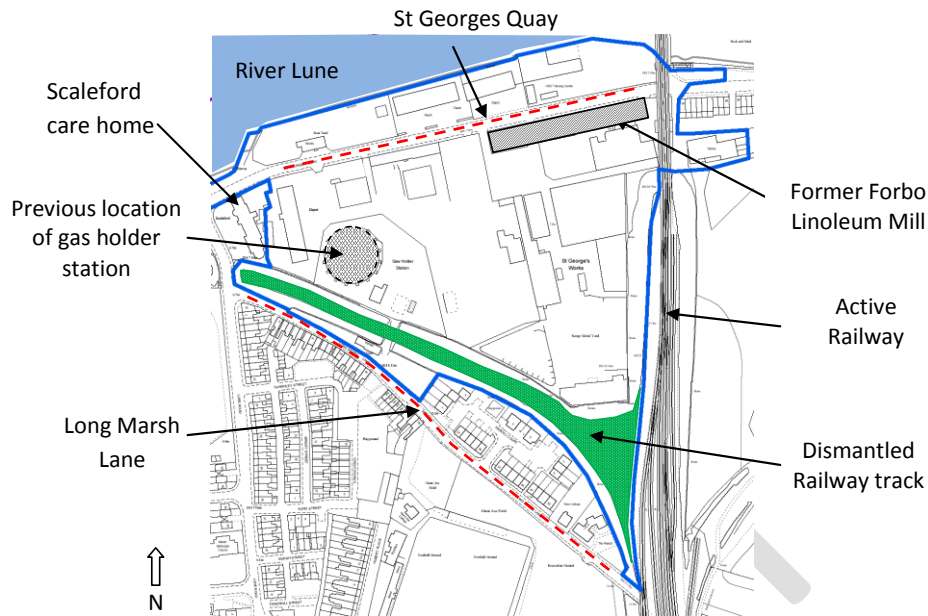


Figure 1. Plan view of Luneside East (outlined in blue), Lancaster, UK. Source: Dexter Hunt (2011).

Local authority policy and guidance on density

At the scale of the city, Lancaster City Council mentions density in its key Local Development Document, the Core Strategy (Lancaster City Council, 2008). In it, the Council states that it supports the national minimum density of 30 dwellings per hectare for all new developments, set forth by the Labour government in 2000 (ODPM, 2000).¹ The Core Strategy also promotes densities greater than the national minimum where appropriate, particularly in areas of previously developed land. Moreover, as part of a drive to ensure more efficient use of land, the local authority asserts that at least 95% of developments of five dwellings or more completed between 2003 and 2021 will be greater than 30 dwellings per hectare, and that at least 30% of these developments will have more than 50 dwellings per hectare.

At the scale of the Luneside East site, Supplementary Planning Guidance (also known as the development brief) states that a key requirement for the site is to achieve a high density of mixed-use (Lancaster City Council, 2004). Within the brief's design checklist, high densities also are mentioned, intimating that density is an essential design principle from a building design and sustainability perspective. Furthermore, with respect to one of the existing buildings on-site, the St. George's Works Mill building, the

¹ This national target was abolished in June 2009, not to be replaced by another target, when the coalition Conservative-Liberal Democrat government was elected into power.

brief suggests that there is potential for residential units to be added by extending the building vertically, albeit only if sensitively designed. Finally, although the brief does not set out an explicit dwelling density for the site, a gross dwelling density may be calculated using the original plans of having 350 dwellings at Luneside East² in the numerator and the size of the development — 6.6 hectares in the denominator, hence: 350 dwellings/6.6 hectares = approximately 53 dwellings/hectare. This result is commensurate with Lancaster’s Core Strategy objective of having a residential development proposal with more than 5 dwellings at the edge of the city centre meeting or exceeding 50 dwellings per hectare (see *Table 1*).

Table 1. References to density in city- and site-specific policy and guidance.

City- and site-specific policy and guidance	Content of policy and guidance
Core Strategy [p. 28] §4.47 (city)	Lancaster City Council fully supports the national indicative minimum of 30 dwellings per hectare and will continue to promote densities in excess of 30 dwellings per hectare where appropriate. The urban concentration strategy, which directs development to previously developed land will help ensure that high-density development continue to be achieved
Core Strategy [p. 108] Appendix 8, §1.3d and §1.3e (city)	Efficiency in the Use of Land: At least 95% of residential development proposals of 5 dwellings or more completed between 2003 and 2021, shall be completed at a density of more than 30 dwellings per hectare (§1.3d); At least 30% of residential development proposals of 5 dwellings or more completed between 2003 and 2021, shall be completed at a density of more than 50 dwellings per hectare (§1.3e)
Supplementary Planning Guidance [p. 29] §7.1 (site)	Key requirement: achieve as a whole a high density of mixed use development
Supplementary Planning Guidance [p. 31] §7.7 (site)	Sustainability: High densities should be achieved. There may be scope to create additional residential units by extending [St George’s Works Mill building] vertically, if sensitively designed
Supplementary Planning Guidance [p. 51] (site)	Design checklist- Building Design: high densities
Supplementary Planning Guidance [p. 52] (site)	Design checklist- Sustainability: high density, mixed use development

Missing policy information

² According to guidance by the Homes and Communities Agency at the time, the Luneside East site should have a maximum of 350 dwellings, although that number now has been reduced due to a poorer economic climate (personal communication, Julian Inman, 9 December 2010).

Through its local and site-specific policies and guidance as well as information from the Homes and Communities Agency, Lancaster City Council has provided a density target for Luneside East; that is, the development should have more than 30 dwellings per hectare but not more than 50 dwellings per hectare. This range gives developers, wishing to create a site masterplan, some flexibility in terms of how many and what type of dwellings to put onto the development. However, the impacts to the surrounding area of adding a significant amount of dwellings to a site that currently does not have any dwellings are not discussed critically in policy. Rather, it is assumed that decision-makers, such as architects and developers, will be able to successfully integrate the site within the wider area through good design. Moreover, many of the dwellings in the area are terraced or semi-detached homes at a lower density than what is proposed on the site (see *Figure 1*). Allowing for higher densities means a consequent addition of new housing forms, predominantly in the form of flats, which, while potentially more profitable for developers (HATC, 2010) may not be socially acceptable to the existing community who prefer lower-density living.

In addition, all of Lancaster City Council's policies and guidance on density relate to residential development. Other types of density and density-related issues exist that may need to be explored in more depth, such as population density (i.e., the number of people per hectare), employment density (i.e., the number of employees per hectare), the density of tree covers, the density of shops, the density of traffic, the density of uses of public space, perceptions of crowding and the intensity of people converging on and around the site on weekend evenings. Each of these density-related issues has impacts on people's quality of life as well as local environmental and economic performance. Obtaining calculations for these other forms of densities as well as consulting people about their perceptions of different densities and their consequent impacts and geolocating densities on spatial maps would be useful for planners and decision-makers to make more informed decisions about the sustainability, both now and in the future, of Luneside East.

Interdependencies between density and other sustainability issues

Density is an issue that touches many other sustainability issues. For example, national, local and site-based policies and guidance point to the strong connections between density and good design, suggesting that a well-designed development allows for higher densities, which in turn bring vitality and viability to a place (DETR, 2000). Higher densities also help to shape an area by influencing the design of streets, spaces and the placement of services and amenities in a sensitive manner (DETR, 2000, 2001; Llewelyn-Davies, 2000). In addition, policies demonstrate that density is related to maintaining an existing residential area's character, reducing travel, affordable housing and efficient use of land (DETR, 1998).

Table 2 presents some relationships between density and other sustainability issues that are relevant to the context of Luneside East. For example, the developed site,

containing 53 dwellings per hectare, would increase the residential density in the surrounding area. According to the cited study below, this would be expected to have a negative impact on indicators of biodiversity potential, such as patch size or tree cover. With this information, planners and other decision-makers could ask how best to mitigate these effects through other strategies while still maintaining the level of dwelling density sought.

Table 2. Interdependencies between density and other Urban Futures sustainability themes.

Urban Futures sustainability themes	Interdependency with density
Biodiversity	Denser urbanised areas often have poorer ecosystem quality than lower-density areas, seen in smaller habitat patch sizes and lower predicted carbon sequestration (Tratalos <i>et al.</i> , 2007)
Air quality	Higher traffic densities positively correlated with increased releases of heavy metals in residential and commercial areas (Ewan <i>et al.</i> , 2009) as well as particulate matter and NO ₂ (see Pugh <i>et al.</i> , this issue)
Water and waste water	Increases in urban density may exacerbate stormwater runoff due to an increase in impervious surfaces (Skinner, 2006)
Sub-surface built environment, infrastructure and utility services	A strong positive relationship exists between the density of septic tanks and aqueous NO _x concentrations in urban areas (Hatt <i>et al.</i> , 2010)
Surface built environment and open spaces	High-density layouts between buildings may reduce heat loss, but there is often a consequent loss in solar and daylight availability (Steeimers, 2003); dense urban forms (i.e., buildings and spaces) are strongly associated with less social interaction and satisfaction with open spaces and parks within the area (Dave, 2010)
Organisational behaviour and innovation	Concentrating people and businesses together in dense distributions may increase productivity in cities through rates of innovation and creativity (Knudsen <i>et al.</i> , 2007)
Social needs, aspirations and planning policy	Neighbourhoods with higher dwellings densities and affordable housing types are more likely to have more affordable rental units than low-density neighbourhoods with single-family dwellings (Aurand, 2010)

Conditions necessary for high dwelling density as a density-related sustainability solution to function

High dwelling density is a solution proposed by Lancaster City Council in an effort to enhance the sustainability of Luneside East. For high dwelling density to be successful on the site and within the surrounding area, a number of conditions must be satisfied. These include:

- Implementation of policies that maintain low levels of private vehicle use/on-street parking
- Strong and widespread willingness by those living, working and recreating to use alternative modes of transport other than a private vehicle
- Maintaining public transportation that is clean, safe and affordable
- Mechanisms to protect high dwelling density in the future
- Mechanisms to prevent property speculators from buying, yet failing to let, properties
- Implementation of policies that support a mix of uses and tenures, including affordable housing
- Close proximity of the site to other uses perceived as useful/important to those living, working and recreating in the area
- Strong and widespread willingness to live, work and recreate in the area, thus creating a critical mass for amenities and services to survive
- Amenities in the area that people will want to use
- Amenities that stay open long enough to suit the needs of the people living, working and recreating in the area without causing undue environmental, physical and mental harm
- Maintaining policies that ensure rights to light and prevention of overshadowing
- Clever, efficient and inexpensive spatial design requirements at the building, street and neighbourhood scales to allow for privacy
- Clever, efficient and inexpensive spatial design requirements at the building, street and neighbourhood scales to promote better sound insulation
- Clever, efficient and inexpensive spatial design requirements at the building, street and neighbourhood scales to provide households with adequate, quality outdoor space
- Creating and maintaining buildings and spaces that are perceived as safe
- Resources for adequate site maintenance
- Perceptions that the development is not too crowded in terms of the spaces within the building and/or the number of people within the building
- Perceptions that the high-density development will be contextually compatible with the surrounding developments and/or people living, working and

recreating in the area see the benefit of having high-density development in the area

The next step is to assess the resilience of high density as a sustainability solution via its conditions.

Comment [b1]: Perhaps it would make more sense to have a sub-section here about whether or not LCC considered any of the above conditions in their SPG...?

The future resilience of high density as a sustainability solution

Using the Urban Futures methodology (see Boyko *et al.*, forthcoming), the local conditions for the high-density sustainability solution may be tested against four different futures for the Luneside East site. The methodology involves reading through and understanding the futures—using statements about different issues in the futures, called *characteristics*—and then making assumptions and/or deductions about what would happen to the local conditions. This is done to better understand whether or not the solution is, indeed, resilient, no matter what the future holds. The four scenarios are:

- *Market Forces (MF)*: the self-correcting logic of the market predominates, with individualism and materialism as core human values
- *Policy Reform (PR)*: government action is promoted in an attempt to reduce poverty and social conflict although behaviour change is slow
- *New Sustainability Paradigm (NSP)*: an ethos of ‘one planet living’ pervades and a fundamental questioning of progress emerges in light of sustainability goals
- *Fortress World (FW)*: powerful actors safeguard their own interests and resources at the expense of an impoverished majority who must live in ghettos (Boyko *et al.*, forthcoming)

Table 3 demonstrates whether or not each of the local conditions for the high-density sustainability solution would be present across the four futures. Information about the futures’ characteristics, used to ascertain the performance of the local conditions, originates from Hunt *et al.* (forthcoming).

Table 3. Assessing the future resilience of high density as a sustainability solution by determining the presence of conditions.

Local condition	MF	PR	NSP	FW
Implementation of policies that maintain low levels of private vehicle use/on-street parking	☒	☑	☑	☒
Strong and widespread willingness by those living, working and recreating to use alternative modes of transport other than a private vehicle	☒	☒	☑	☑ For ‘have-nots’ only
Maintaining public	☒	☒	☑	☒

transportation that is clean, safe and affordable				
Mechanisms to protect high dwelling density in the future	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Mechanisms to prevent property speculators from buying, yet failing to let, properties	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Implementation of policies that support a mix of uses and tenures, including affordable housing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Close proximity of the site to other uses perceived as useful/important to those living, working and recreating in the area	?	?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> For 'have-nots' only
Strong and widespread willingness to live, work and recreate in the area, thus creating a critical mass for amenities and services to survive	?	?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> For 'have-nots' only
Amenities in the area that people will want to use	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Amenities that stay open long enough to suit the needs of the people living, working and recreating in the area without causing undue environmental, social/psychological and economic harm	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Maintaining policies that ensure rights to light and prevention of overshadowing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> For 'haves' only
Clever , efficient and inexpensive spatial design requirements at the building, street and neighbourhood scales to allow for privacy	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Clever, efficient and inexpensive spatial	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

design requirements at the building, street and neighbourhood scales to promote better sound insulation				
Clever, efficient and inexpensive spatial design requirements at the building, street and neighbourhood scales to provide households with adequate, quality outdoor space	☒	☒	☑	☒
Creating and maintaining buildings and spaces that are perceived as safe	☒	☒	☑	☒
Resources for adequate site maintenance	☒	☒	☑	☑ For 'haves' only
Perceptions that the development is not too crowded in terms of the spaces within the building and/or the number of people within the building	☒	☒	☑	☑ For 'haves' only
Perceptions that the high-density development will be contextually compatible with the surrounding developments and/or people living, working and recreating in the area see the benefit of having high-density development in the area	☒	☒	☑	☒

Notes. MF= Market Forces, PR= Policy Reform, NSP= New Sustainability Paradigm, FW= Fortress World. A '☑' is given where a local condition is expected to be supported in a particular future. A '☒' is given where a local condition is unlikely to be supported in a particular future. A '?' is given where it is unclear whether or not a local condition will be supported in a particular future.

Based on *Table 3*, only one of the local conditions—amenities that people will want to use—is resilient to each of the four futures, followed by one other local condition—policies that support a mix of uses—which is resilient in three futures. Six of the 18 conditions for high density work in both Policy Reform and New Sustainability Paradigm, and in both New Sustainability Paradigm and Fortress World (with three of

them working well for the 'have-nots' only and three for the 'haves' only). Thus, high density only appears to be reliable as a sustainability solution if fundamental changes are experienced in societal values or policies. Future success of this solution is reliant on a mix of uses and tenures that 'make sense' for that the local area; safe, reliable and affordable public transport; positive perceptions that high density is appropriate for the area and; policies and mechanisms that continue to support high density and the maintenance of the built form. Therefore, high density may be more resilient as a sustainability solution if decision-makers were to carefully consider what is needed in the area in terms of mix of uses and tenures before creating a development brief (e.g., by undertaking a needs assessment for the area). In addition, decision-makers should attempt to ring-fence funding so that public transportation is amenable to the local community (both existing and in-coming) as well as consult with local communities about their perceptions of density before masterplans are created (e.g., using a density visualisation tool that illustrates relationships between different types of densities and other issues, such as air quality, biodiversity and noise, may help people understand the realities of living at certain densities). Finally, local decision-makers should try to work with national policy-makers to ensure that density—dwelling and other types—is enshrined in policy and that stricter guidelines about the management and maintenance of developments and the wider area are introduced prior to site development.

Discussion and conclusions

In creating plans for Luneside East, Lancaster City Council has considered what they believe is a 'sustainable' dwelling density, based on national targets. However, current policies and guidance do not stipulate how these densities might integrate with the lower densities in the surrounding area. Moreover, other types of densities, such as population density, employment density and the density of traffic, have not been taken into account in policies and guidance. These density types have been examined in the academic and practitioner literature and have been shown to both positively and negatively affect people, buildings and neighbourhoods (for a review of density and its impacts, see Boyko & Cooper, forthcoming; Churchman, 1999). Thus, thinking about density beyond the number of dwellings per hectare may result in a more sustainable plan for Luneside East.

Furthermore, due to the nature of many policies and development briefs (i.e., written at a general level and are, therefore, less specific to allow developers an opportunity to design projects that are feasible from a number of angles), many of the conditions that relate to high density as a sustainability solution were not considered by Lancaster City Council. For example, a necessary condition for high-density developments to work—one that overlaps with improving social sustainability—is that appropriate amenities and services need to be made available. These amenities and services may differ, depending on location, but their relevance is crucial to the sustainability of an area. These issues were not addressed in local authority policies, guidance and the SPG, thus leaving a gap in ensuring the sustainability of this regeneration site.

Finally, Lancaster City Council introduced high density as a sustainability solution for the Luneside East site, which was then tested against four different futures to understand if, indeed, it was resilient to the future. High density was seen as a good solution for Luneside East because it fit with existing policies that encouraged high density. Using the Urban Futures methodology for testing the resilience of sustainability solutions (see Boyko *et al.*, forthcoming), it was found that the conditions required for high density to deliver their intended functions did not occur across the four futures, thereby rendering high density vulnerable to the future. The next step would be to reconsider some elements of this solution and/or consider alternative solutions for density that would enable a more sustainable future.

References

- Aurand, A. (2010). Density, housing types and mixed land use: Smart tools for affordable housing? *Urban Studies*, 47 (5), 1015-1036.
- Boyko, C. T., & Cooper, R. (forthcoming). Visualising and re-conceptualising density for more holistic and sustainable decision-making. *Progress in Planning*.
- Boyko, C. T., Gaterell, M. R., Barber, A. R. G., Brown, J., Bryson, J. R., Butler, D., Caputo, S., Caserio, M., Coles, R., Cooper, R., Davies, G., Farmani, R., Hale, J., Hales, A. C., Hewitt, C. N., Hunt, D. V. L., Jankovic, L., Jefferson, I., Leach, J. M., Lombardi, D. R., MacKenzie, A. R., Memon, F. A., Pugh, T. A. M., Sadler, J. P., Weingaertner, C., Whyatt, J. D., & Rogers, C. D. F. (forthcoming). Benchmarking sustainability in cities: The role of indicators and future scenarios. *Global Environmental Change*.
- Churchman, A. (1999). Disentangling the concept of density. *Journal of Planning Literature*, 13 (4), 389-411.
- Clarke, C. (1951). Urban population densities. *Journal of the Royal Statistical Society*, 114, 110-116.
- Dave, S. (2010). High urban densities in developing countries: A sustainable solution? *Built Environment*, 36 (1), 9-27.
- Department of the Environment, Transport and the Regions (DETR) (1998). *Planning research programme: The use of density in urban planning*. London: TSO.
- Department of the Environment, Transport and the Regions (DETR) (2000). *By design: Urban design in the planning system: Towards better practice*. London: TSO.
- Department of the Environment, Transport and the Regions (DETR) (2001). *Better places to live by design: A companion guide to PPG3*. London: TSO.
- Ewen, C., Anagnostopoulou, M. A., & Ward, N. L. (2009). Monitoring of heavy metal levels in roadside dusts of Thessaloniki, Greece in relation to motor vehicle traffic density and flow. *Environmental Monitoring and Assessment*, 157, 483-498.

- HATC (2010). *Room to swing a cat? The amount and use of space in new dwellings in London & the South East*. Ilkley, West Yorkshire: HATC Limited.
- Hatt, B. E., Fletcher, T. D., Walsh, C. J., & Taylor, S. L. (2004). The influence of urban density and drainage infrastructure on the concentrations and loads of pollutants in small streams. *Environmental Management*, 34 (1), 112-124.
- Hunt, D. V. L., Lombardi, D. R., Atkinson, S., Barber, A., Barnes, M., Boyko, C., Brown, J., Bryson, J., Butler, D., Caputo, S., Caserio, M., Coles, R., Farmani, R., Gaterell, M., Hale, J., Hales, C., Hewitt, N., Jankovic, L., Jefferson, I., MacKenzie, R., Memon, F., Pugh, T., Rogers, C. D. F., Smith, D., Whyatt, C. and Weingaertner, C. (2010). Using scenarios to explore urban UK futures: A review of futures literature from 1997-2010. Urban Futures Working Paper Series (No. 1). University of Birmingham, Birmingham.
- Johnston, R. J., Gregory, D., Pratt, G., & Watts, M. (2000). *The dictionary of human geography* (4th Ed.). Oxford: Blackwell.
- Knudsen, B., Florida, R., Gates, G., & Stolarick, K. (2007). *Urban density, creativity, and innovation* (Working paper). Toronto, Canada: University of Toronto, The Martin Prosperity Institute.
- Lancaster City Council (2004). *Supplementary Planning Guidance Note 4- Luneside East Development Brief*. Lancaster: Lancaster City Council.
- Lancaster City Council (2008). *Core strategy (2003-2021)*. Lancaster: Lancaster City Council.
- Llewelyn-Davies (2000). *Urban design compendium*. London: English Partnerships.
- Office of the Deputy Prime Minister (ODPM) (2000). *Planning Policy Guidance 3: Housing*. London ODPM.
- Skinner, C. J. (2006). Urban density, meteorology and rooftops. *Urban policy and research*, 24 (3), 355-367.
- Stemers, K. (2003). Energy and the city: Density, buildings and transport. *Energy and Buildings*, 35, 3-14.
- Tratalos, J., Fuller, R. A., Warren, P. H., Davies, R. G., & Gaston, K. J. (2007). Urban form, biodiversity potential and ecosystem services. *Landscape and Urban Planning*, 83, 308-317.