

NATURVATION
cities – nature – innovation



How are the characteristics of Nature-based solutions clustered in European cities?

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Introduction

Through the management and use of nature, the Nature-based solutions aim to:

- co-produce ecosystems services that not only allow cities to mitigate and adapt against the effects of climate change and increased urbanisation,
- improve quality of life through the reduction of public health challenges (WHO, 2016, 2017; Hartig et al 2014; Kabisch et al, 2017)
- stimulate economies to improve inequity in cities (Nesshover et al, 2017)

Using data from the Urban Nature Atlas this paper examines how the differing characteristics of these solutions are clustered and how the characteristics of these clusters relate to different social, economic and health factors that influence quality of life in our cities.





Evidence linking NBS and social inqualities

- Michell et al (2015) and Northridge et al (2003) claim greenspace provided by NBS could help to mitigate socio-economic adversity and interrupt the upstream determinants of health.
- Citizens with greater access to greenspace are less likely to be deprived than those groups with little or no access (Crawford *et al.* 2008; Koohsari, 2011)
- Access is stratified based on income, ethno-racial characteristics, age, gender and (dis)ability (Jennings *et al.* 2016; Wolch, *et al.* 2014) leading to unequal distribution (Kuta *et al.* 2014; Coomber *et al.* 2008; Kabisch & van de Bosch, 2017; Barbosa, 2007).
- Vulnerable groups with limited access are at higher risk of exposure to the effects of climate change (Kabisch & van den Bosch, 2017; Richardson *et al.* 2013; Martuzzi, *et al.* 2010).



Evidence linking health & greenspace

- Improving relaxation, restoring mental health, social cohesion & the functioning of the immune system (WHO, 2017, Hartig *et al.* 2014; Kabisch *et al.* 2017; Mitchell & Popham, 2008).
- Three domains of bio-psychosocial pathways: restorative & resilience building capacities or reducing harm through mitigation by acting as a buffer (Bratman, *et al.*, 2012; Hartig *et al.* 2014; Dalton *et al.* 2016, Markevych *et al.* 2017).
- Magnitude of health effect influenced by presence, accessibility, proximity and 'greenness' (Arets *et al.* 2018)
- Landscape aesthetics, sense of place & place attachment (Norton *et al.* 2011; Chan *et al.* 2012; Jennings *et al.* 2016).

Data variables

Characteristics of NBS recorded by the Nature Urban Atlas (www.naturvation.eu)

Information on the objectives, goals, targets, monitoring etc.

Sustainability challenges based on SDGs

Ecological domain

Scale of the intervention

Ecosystem services

Primary beneficiaries

Power distribution

Key actors

Main drivers

Total cost, source & type of funding.

Type of innovation

Quantitative indicators for quality of life in cities published by Urban Audit (www.Eurostat.eu)

Social indicators – average size of dwelling, lack of amenities, type of housing

Health outcome indicators including all-cause mortality, death due to respiratory or heart disease, infant mortality

Vulnerable groups such as lone pensioners & households with dependants

Material deprivation – households at risk of poverty due to low income or part-time work

Economic indicators such as average income or disposable income.

Education attainment



Methodology:

Multiple Factor Analysis , a multivariate method for summarising and visualising complex datasets (Le Josse & Hudson, 2008; Pages, 2015)

Analysis is a two staged process completed using FactoMineR package in R software:

a) Global analysis principal component analysis (PCA) of the principal dimensions of variability of cities and groups of NBS characteristics

b) Followed by a Multiple Correspondence Analysis of the representation of correlation between each of the sub categories

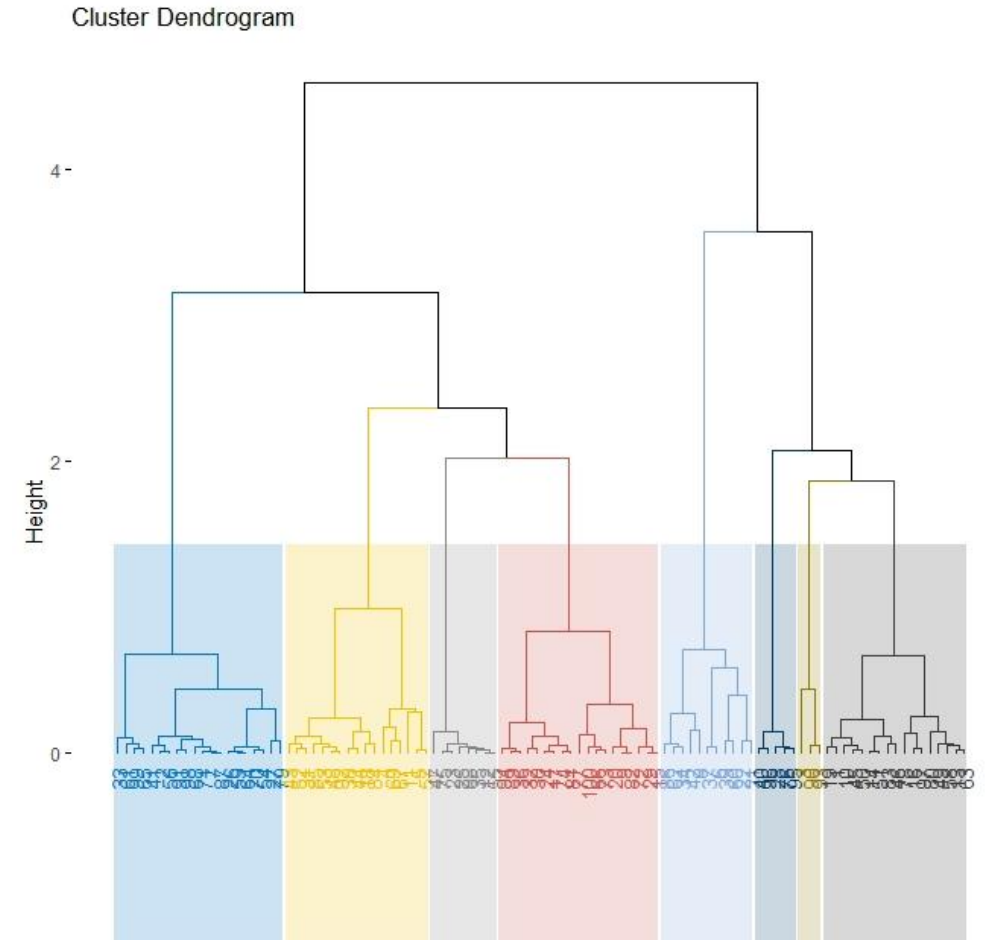
1				j				J			
1				k				K			
Groups				Ecosystem Services				Key actors			
Ecological Domains											
Urban Parks	Lakes & wetlands	External green walls	Green Playgrounds	Food production	Climate regulation	Recreation, physical exercise, mental health	Habitats for species	Local government	Business	Communities	NGOs
1	0	1	0	0	0	1	1	1	1	1	1
2	1	0	1	1	1	1	2	1	1	1	1
1	0	0	0	0	2	1	0	1	0	1	1
1	1	1	0	0	1	1	1	1	0	1	1
1	1	0	0	1	1	1	1	1	0	1	1
1	1	0	0	1	1	1	1	1	0	1	1
1	0	0	0	1	1	0	1	1	0	1	1
0	1	0	1	0	1	0	1	1	0	1	1
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1	0	1	1	2	0	0	1	1	1	1	1
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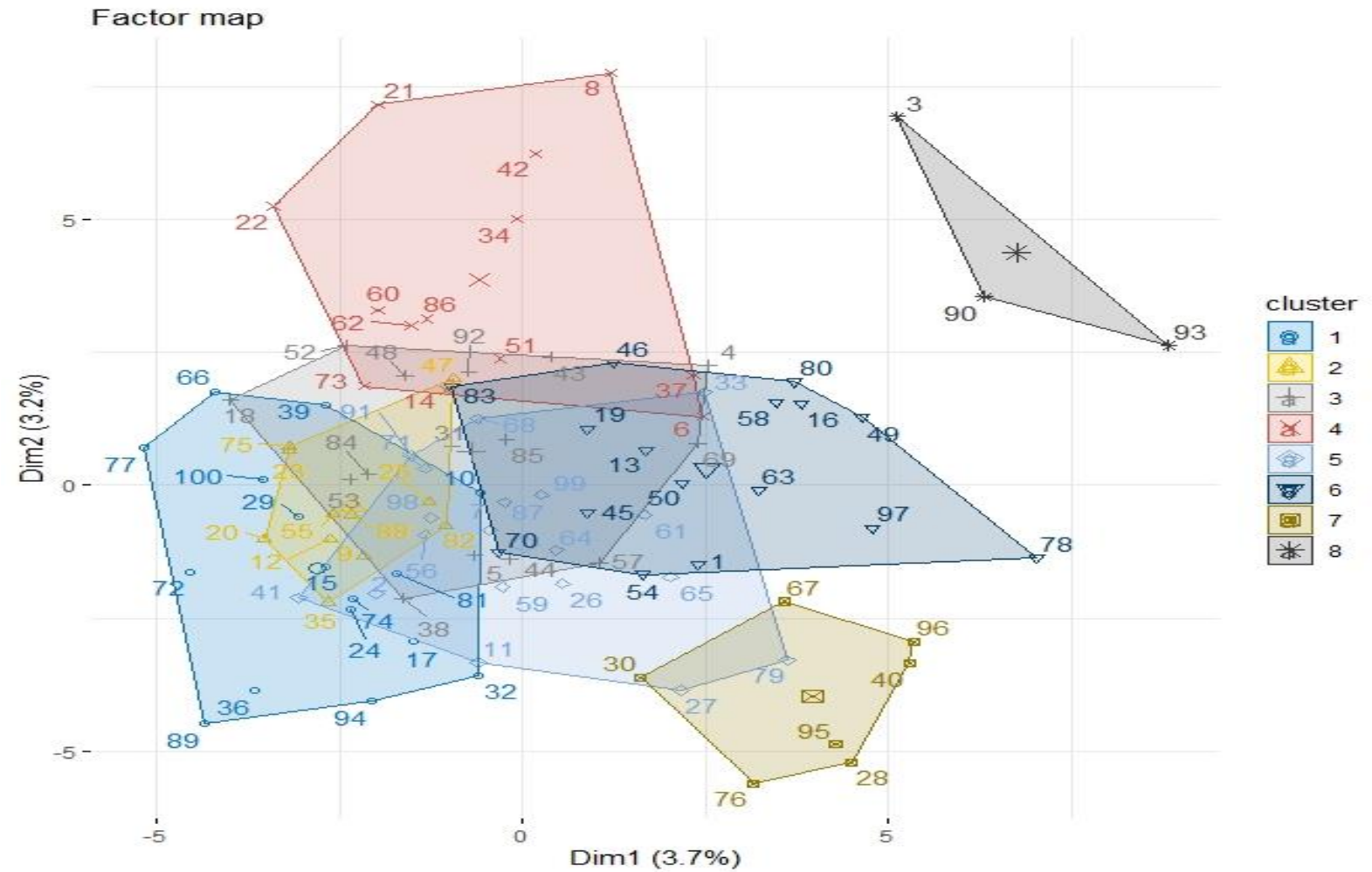
Hierarchical cluster analysis

- Extension of multiple factor analysis (Le Dien & Page, 2003)
- Balances the role of the group variables at each node in the hierarchy
- Allows over structure of the data matrix (consisting of variables from Urban Nature Atlas and Urban Audit) to be interpreted.
- So what does this tell us.....





Hierarchical clustering

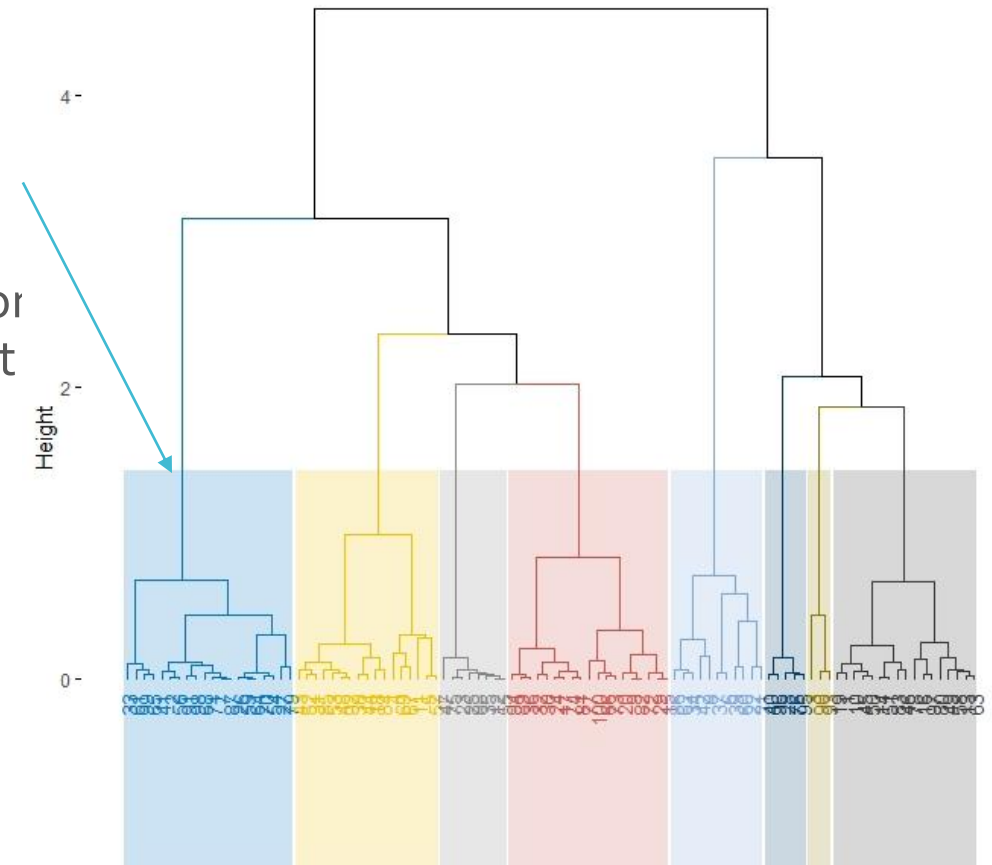




Cluster one - Leveraging European Investment in NBS for Urban Revival

- Private foundations initiating NBS governed by research institutions and community groups to help address SDG for coastal protection and health and well-being.
- Participatory governance seek to influence state – society relationships by guiding (and in some cases empowering), decision making through co-planning, consultation and joint management of NBS
- Despite evidence of deprivation (Marmot, 2010; Flisi, et al, 2015) and measures of low access or availability of environmental resources such as greenspace (Galobardes et al 2006), disadvantaged groups are excluded.
- Focus on place-making human-nature interactions may lead to power being orchestrated in such a way that risk exclusion of disadvantaged groups or lead to reproduction of existing structural inequalities.

Cluster Dendrogram

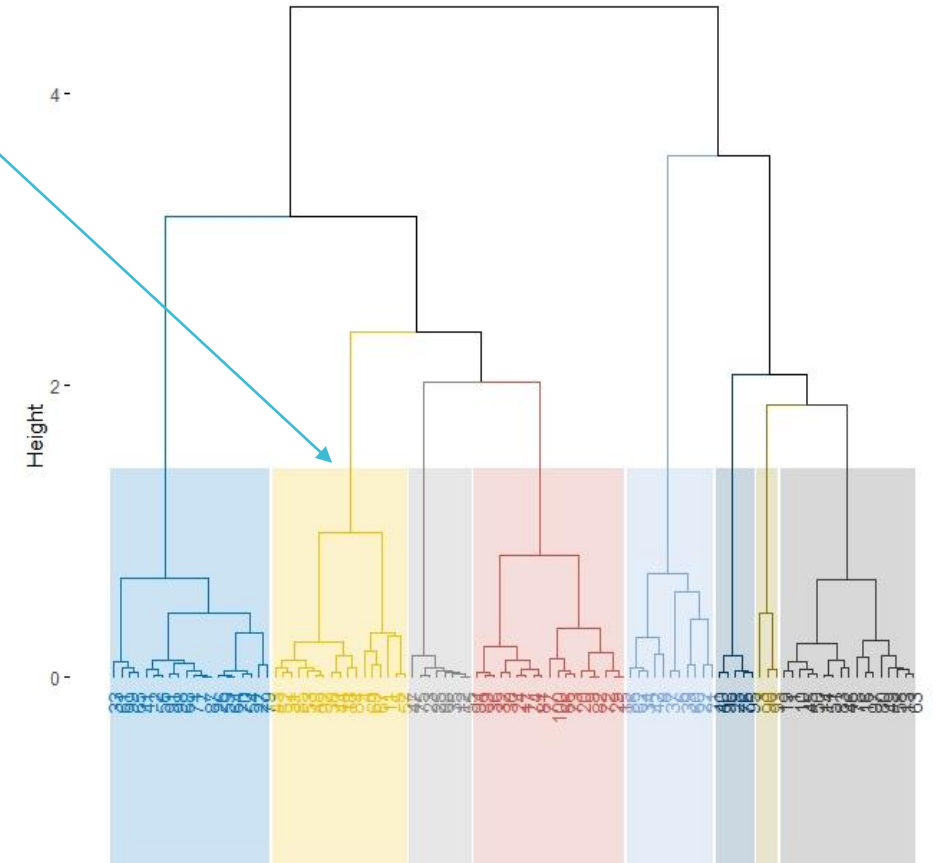




Cluster two - Nature-based investment to rejuvenation post-socialist cities

- place-making participatory governance (including civic crowd sourcing or budgeting, co-planning) and dissemination of information or education
- Distinct lack of agency through citizen management or stewardship through civic ecologies.
- Local government actors are the primary beneficiaries influenced by the early legacy of the fall of socialism and deregulation of urban spatial planning, where urban nature is seen as a barrier to development (Kronenberg, 2015; Hasse, et al 2019).
- Association with social, education and vulnerable groups suggests vulnerable elderly residents that live in decaying parts of shrinking cities are being displaced by wealthier middle class residents able to afford to reside in private housing through the process of gentrification .

Cluster Dendrogram





References

- Anguelovski, I, 2015, Healthy Food Stores, Greenlining and Food Gentrification: Contesting New Forms of Privilege, Displacement and Locally Unwanted Land Uses in Racially Mixed Neighborhoods, IJURR, 39, 6, pp1209-1230.
- Escofier B, Pagès J, 1998, Analyses Factorielles Simples et Multiples. Dunod
- Flisi, V, Goglio, E, Meroni, E, Vera-Toscano, 2015, Skills beyond education. An analysis of cognitive skill evolution and its implications for employment chances.
- Friel, S, Akerman, M, Hancock, T, Kumaresan, J, Marmot, M, Melin, T, Vlahov, D, 2011, Addressing the social and environmental determinants of urban health inequality, Journal of Urban Health, 88, 5, pp.860–874.
- Galobardes, B, et al, 2006 . Indicators of socioeconomic position (part 1), J Epidemiol Community Health 60, 7–12
- Haase, D., et al, 2017, "Greening cities – To be socially inclusive? About the alleged paradox of society and ecology in cities." Habitat International 64: 41-48.
- Hartig, T. and P. H. Kahn, 2016, "Living in cities, naturally." Science 352(6288): 938-940.
- Hartig, T., et al, 2014, Nature and health. Annual Review of Public Health. 35: 207-228
- Husson, F & Lê, J, Pages, S, 2010, Exploratory multivariate analysis by example using R, Chapman & Hall/CRC Computer Science & Data Analysis, CRC Press
- LeDien S, Pagès J (2003b). "Hierarchical Multiple Factor Analysis: Application to the Comparison of Sensory Profiles." Food Quality and Preference, 14, 397–403.
- Le, S, Josse, J, & Husson, F, 2008, FactoMineR for Multivariate Analysis, Journal of statistical software, 25, 1, pp1-18
- Marmot M, Allen J, Goldblatt P et al, 2010, Fair society, healthy lives: strategic review of health inequalities in England post 2010. London: Marmot Review Team
- Mitchell, R., & Popham, F., 2008, Greenspace, urbanity and health: relationships in England, Journal of Epidemiology & Community Health, 61, 8, pp. 681-683.
- Mitchell, R.J., Richardson, E.J., Shortt, N.K., Pearce, J.R., 2015 Neighborhood Environments and Socioeconomic Inequalities in Mental Well-Being, Am J Prev Med, 49, 1, pp.80–84
- Nesshöver, C., et al, 2017, "The science, policy and practice of nature-based solutions: An interdisciplinary perspective." Science of the Total Environment 579: 1215-1227.
- Northridge, ME, Sclar, ED, & Biswas, P, 2003, Sorting out the connections between the built environment and health: a conceptual framework for navigating pathways and planning healthy, Journal of Urban Health 80, 4, pp.556-568



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