



ARCHIVIO ISTITUZIONALE DELLA RICERCA

Alma Mater Studiorum Università di Bologna Archivio istituzionale della ricerca

More nature in the city

This is the final peer-reviewed author's accepted manuscript (postprint) of the following publication:

Published Version:

More nature in the city / Capotorti G.; Bonacquisti S.; Abis L.; Aloisi I.; Attorre F.; Bacaro G.; Balletto G.; Banfi E.; Barni E.; Bartoli F.; Bazzato E.; Beccaccioli M.; Braglia R.; Bretzel F.; Brighetti M.A.; Brundu G.; Burnelli M.; Calfapietra C.; Cambria V.E.; Caneva G.; Canini A.; Caronni S.; Castello M.; Catalano C.; Celesti-Grapow L.; Cicinelli E.; Cipriani L.; Citterio S.; Concu G.; Coppi A.; Corona E.; Del Duca S.; Del V.E.; Di Gristina E.; Domina G.; Faino L.; Fano E.A.; Fares S.; Farris E.; Farris S.; Fornaciari M.; Gaglio M.; Galasso G.; Galletti M.; Gargano M.L.; Gentili R.; Giannotta A.P.; Guarino C.; Guarino R.; Iaquinta G.; Iiriti G.; Lallai A.; Lallai E.; Lattanzi E.; Manca S.; Manes F.; Marignani M.; Marinangeli F.; Mariotti M.; Mascia F.; Mazzola P.; Meloni G.; Michelozzi P.; Miraglia A.; Montagnani C.; Mundula L.; Muresan A.N.; Musanti F.; Nardini A.; Nicosia E.; Oddi L.; Orlandi F.; Pace R.; Palumbo M.E.; Palumbo S.; Parrotta L.; Pasta S.; Perini K.; Poldini L.; Postiglione A.; Prigioniero A.; Proietti C.; Raimondo F.M.; Ranfa A.; Redi E.L.; Reverberi M.; Roccotiello E.; Ruga L.; Savo V.; Scarano P.; Schirru F.; Sciarrillo R.; Scuderi F.; Sebastiani A.; Siniscalco C.; Sordo A.; Suanno C.; Tartaglia M.; Tilia A.; Toffolo C.; Toselli E.; Travaglini A.; Ventura F.; Venturella G.; Vincenzi F.; Blasi C.. - In: PLANT BIOSYSTEMS. - ISSN 1126-3504. - ELETTRONICO. - 154:6(2020), pp. 1003-1006. [10.1080/11263504.2020.1837285]

This version is available at: <https://hdl.handle.net/11585/777951.2> since: 2020-11-05

Published:

DOI: <http://doi.org/10.1080/11263504.2020.1837285>

Terms of use:

Some rights reserved. The terms and conditions for the reuse of this version of the manuscript are specified in the publishing policy. For all terms of use and more information see the publisher's website.

(Article begins on next page)

This is the final peer-reviewed accepted manuscript of:

Capotorti, G., Bonacquisti, S., Abis, L., Aloisi, I., Attorre, F., Bacaro, G., . . . Blasi, C. (2020). More nature in the city. *Plant Biosystems*, 154(6), 1003-1006

The final published version is available online at
<https://dx.doi.org/10.1080/11263504.2020.1837285>

Rights / License:

The terms and conditions for the reuse of this version of the manuscript are specified in the publishing policy. For all terms of use and more information see the publisher's website.

This item was downloaded from IRIS Università di Bologna (<https://cris.unibo.it/>)

When citing, please refer to the published version.

Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology

Official Journal of the Societa Botanica Italiana

ISSN: 1126-3504 (Print) 1724-5575 (Online) Journal homepage: <https://www.tandfonline.com/loi/tplb20>

More Nature in the City

G Capotorti, S Bonacquisti, L Abis, I Aloisi, F Attorre, G Bacaro, G Balletto, E Banfi, E Barni, F Bartoli, E Bazzato, M Beccaccioli, R Braglia, F Bretzel, MA Brighetti, G Brundu, M Burnelli, C Calfapietra, VE Cambria, G Caneva, A Canini, S Caronni, M Castello, C Catalano, L Celesti-Gradow, E Cicinelli, L Cipriani, S Citterio, G Concu, A Coppi, E Corona, S Del Duca, E Del Vico, E Di Gristina, G Domina, L Faino, EA Fano, S Fares, E Farris, S Farris, M Fornaciari, M Gaglio, G Galasso, M Galletti, ML Gargano, R Gentili, AP Giannotta, C Guarino, R Guarino, G Iaquina, G Iriti, A Lallai, E Lallai, E Lattanzi, S Manca, F Manes, M Marignani, F Marinangeli, M Mariotti, F Mascia, P Mazzola, G Meloni, P Michelozzi, A Miraglia, C Montagnani, L Mundula, AN Muresan, F Musanti, A Nardini, E Nicosia, L Oddi, F Orlandi, R Pace, ME Palumbo, S Palumbo, L Parrotta, S Pasta, K Perini, L Poldini, A Postiglione, A Prigioniero, C Proietti, FM Raimondo, A Ranfa, EL Redi, M Reverberi, E Roccotiello, L Ruga, V Savo, P Scarano, F Schirru, R Sciarrillo, F Scuderi, A Sebastiani, C Siniscalco, A Sordo, C Suanno, M Tartaglia, A Tilia, C Toffolo, E Toselli, A Travaglini, F Ventura, G Venturella, F Vincenzi & C Blasi

To cite this article: G Capotorti, S Bonacquisti, L Abis, I Aloisi, F Attorre, G Bacaro, G Balletto, E Banfi, E Barni, F Bartoli, E Bazzato, M Beccaccioli, R Braglia, F Bretzel, MA Brighetti, G Brundu, M Burnelli, C Calfapietra, VE Cambria, G Caneva, A Canini, S Caronni, M Castello, C Catalano, L Celesti-Gradow, E Cicinelli, L Cipriani, S Citterio, G Concu, A Coppi, E Corona, S Del Duca, E Del Vico, E Di Gristina, G Domina, L Faino, EA Fano, S Fares, E Farris, S Farris, M Fornaciari, M Gaglio, G Galasso, M Galletti, ML Gargano, R Gentili, AP Giannotta, C Guarino, R Guarino, G Iaquina, G Iriti, A Lallai, E Lallai, E Lattanzi, S Manca, F Manes, M Marignani, F Marinangeli, M Mariotti, F Mascia, P Mazzola, G Meloni, P Michelozzi, A Miraglia, C Montagnani, L Mundula, AN Muresan, F Musanti, A Nardini, E Nicosia, L Oddi, F Orlandi, R Pace, ME Palumbo, S Palumbo, L Parrotta, S Pasta, K Perini, L Poldini, A Postiglione, A Prigioniero, C Proietti, FM Raimondo, A Ranfa, EL Redi, M Reverberi, E Roccotiello, L Ruga, V Savo, P Scarano, F Schirru, R Sciarrillo, F Scuderi, A Sebastiani, C Siniscalco, A Sordo, C Suanno, M Tartaglia, A Tilia, C Toffolo, E Toselli, A Travaglini, F Ventura, G Venturella, F Vincenzi & C Blasi (2020): More Nature in the City, *Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology*, DOI: [10.1080/11263504.2020.1837285](https://doi.org/10.1080/11263504.2020.1837285)

To link to this article: <https://doi.org/10.1080/11263504.2020.1837285>



Accepted author version posted online: 15 Oct 2020.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

More Nature in the City

Capotorti G¹, Bonacquisti S^{*2}, Abis L³², Aloisi I⁹, Attorre F¹, Bacaro G¹¹, Balletto G²⁰, Banfi E⁴², Barni E²⁵, Bartoli F²⁸, Bazzato E²⁶, Beccaccioli M¹, Braglia R¹⁴, Bretzel F³⁷, Brighetti MA¹⁶, Brundu G¹², Burnelli M¹⁹, Calfapietra C³⁵, Cambria VE⁸, Caneva G²⁸, Canini A¹⁴, Caronni S²³, Castello M¹¹, Catalano C³⁴, Celesti-Grapow L¹, Cicinelli E²⁸, Cipriani L²¹, Citterio S²³, Concu G³¹, Coppi A¹⁵, Corona E⁴¹, Del Duca S⁹, Del Vico E¹, Di Gristina E²⁹, Domina G²⁹, Faino L¹, Fano EA¹⁰, Fares S⁶, Farris E¹⁷, Farris S⁴, Fornaciari M¹⁹, Gaglio M¹⁰, Galasso G⁴², Galletti M²¹, Gargano ML²², Gentili R²³, Giannotta AP²¹, Guarino C²⁷, Guarino R³⁰, Iaquina G⁹, Iiriti G⁵, Lallai A³, Lallai E²⁶, Lattanzi E¹, Manca S²⁶, Manes F¹, Marignani M²⁶, Marinangeli F⁷, Mariotti M²⁴, Mascia F⁴, Mazzola P³⁸, Meloni G¹⁹, Michelozzi P¹⁸, Miraglia A¹⁶, Montagnani C²³, Mundula L²⁰, Muresan AN¹⁰, Musanti F⁴, Nardini A¹¹, Nicosia E³⁹, Oddi L²⁵, Orlandi F¹⁹, Pace R³⁵, Palumbo ME²⁶, Palumbo S²⁶, Parrotta L⁹, Pasta S³⁶, Perini K¹³, Poldini L¹¹, Postiglione A²⁷, Prigioniero A²⁷, Proietti C¹⁹, Raimondo FM³⁸, Ranfa A¹⁹, Redi EL¹⁴, Reverberi M¹, Roccotiello E²⁴, Ruga L¹⁹, Savo V²⁸, Scarano P²⁷, Schirru F⁴⁰, Sciarrillo R²⁷, Scuderi F¹⁴, Sebastiani A¹, Siniscalco C²⁵, Sordo A⁴, Suanno C⁹, Tartaglia M²⁷, Tilia A¹, Toffolo C³³, Toselli E¹¹, Travaglini A¹⁶, Ventura F¹⁹, Venturella G²⁹, Vincenzi F¹⁰, Blasi C².

¹Department of Environmental Biology, Sapienza University of Rome, Rome, IT

²Centro di Ricerca Interuniversitario "Biodiversità, Servizi ecosistemici e Sostenibilità" (CIRBISES), Roma IT

³Assemini, Cagliari IT

⁴Cagliari, IT

⁵Centro servizi Hortus Botanicus Karalitanus, Università di Cagliari, Cagliari IT

⁶Consiglio Nazionale delle Ricerche, Istituto per la BioEconomia, Rome IT

⁷CREA, Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria, Centro di Ricerca Politiche e bio-economia, Perugia IT

⁸Department Land, Environment, Agriculture and Forestry, Università degli Studi di Padova Padova, IT

⁹Department of Biological, Geological and Environmental Sciences, University of Bologna, Bologna IT

¹⁰Department of Life Sciences and Biotechnology, University of Ferrara, Ferrara, IT

¹¹Department of Life Sciences, University of Trieste, IT

¹²Dipartimento di Agraria, Università degli Studi di Sassari, Sassari IT

¹³Dipartimento di Architettura e Design (DAD), Università degli Studi di Genova, Genova IT

¹⁴Dipartimento di Biologia, Orto Botanico, Università degli Studi di Roma "Tor Vergata", Roma IT

¹⁵Dipartimento di Biologia, Università degli studi di Firenze, Firenze IT

¹⁶Dipartimento di Biologia, Università di Roma Tor Vergata, Roma IT

¹⁷Dipartimento di Chimica e Farmacia, Università degli Studi di Sassari, Sassari IT

¹⁸Dipartimento di Epidemiologia del Servizio Sanitario Regionale, ASL Roma 1, Regione Lazio, Roma IT

¹⁹Dipartimento di Ingegneria Civile e Ambientale, Università degli Studi di Perugia, Perugia IT

²⁰Dipartimento di Ingegneria Civile, Ambientale e Architettura, Università di Cagliari, Cagliari IT

²¹Dipartimento di Lettere e Filosofia, Università degli studi di Firenze, Firenze IT

²²Dipartimento di Scienze Agro Ambientali e Territoriali (DiSAAT), Università degli Studi di Bari "Aldo Moro", Bari IT

²³Dipartimento di Scienze dell’Ambiente e della Terra, Università di Milano-Bicocca, Milano
IT

²⁴Dipartimento di Scienze della Terra dell’Ambiente e della Vita (DISTAV), Università degli
Studi di Genova, Genova IT

²⁵Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università di Torino, Torino IT

²⁶Dipartimento di Scienze della Vita e dell’Ambiente, Università degli Studi di Cagliari,
Cagliari IT

²⁷Dipartimento di Scienze e Tecnologie, Università degli Studi del Sannio, Benevento IT

²⁸Dipartimento di Scienze, Università degli Studi di Roma Tre, Roma, IT

²⁹Dipartimento Scienze Agrarie, Alimentari e Forestali (SAAF), Università di Palermo,
Palermo IT

³⁰Dipartimento STEBICEF, Università di Palermo, Palermo IT

³¹Dolianova, Sud Sardegna IT

³²Elmas, Cagliari IT

³³Faculty of Science, University of South Bohemia, České Budějovice, CZ

³⁴Institut für Umwelt und Natürliche Ressourcen, Zürcher Hochschule für Angewandte
Wissenschaften, Wädenswil CH

³⁵Institute of Research on Terrestrial Ecosystems, National Research Council, Porano (TR),
Italy IT

³⁶Istituto di Bioscienze e Biorisorse (IBBR), Consiglio Nazionale delle Ricerche (CNR),
Palermo IT

³⁷Istituto di Ricerca sugli Ecosistemi Terrestri, Consiglio Nazionale delle Ricerche (CNR),
Pisa IT

³⁸PLANTA Centro di Ricerca Documentazione e Formazione, Palermo IT

³⁹Regione Liguria, Settore Tutela della Salute degli Ambienti di Vita e di Lavoro, Genova IT

⁴⁰San Basilio, Sud Sardegna IT

⁴¹Sestu, Cagliari IT

⁴²Sezione di Botanica, Museo di Storia Naturale di Milano, Milano IT.

* Corresponding author email: sandro.bonacquisti@gmail.com

Abstract

According to projects and practices that the Italian botanists and ecologists are carrying out for bringing “*more nature in the city*”, new insights for a factual integration between ecological perspectives and more consolidated aesthetic and agronomic approaches to the sustainable planning and management of urban green areas are provided.

Keywords Ecosystem services, Human well-being, Green infrastructure, Urban green areas, Urban biodiversity.

Introduction

Biodiversity strategies are increasingly focused on ecosystems and their services (IPBES 2019). In Europe, the MAES (Mapping and Assessment of Ecosystems and their Services) process has been expressly designed for addressing these targets and also provides essential knowledge for the deployment of Green Infrastructure (GI). Actually, GI is defined as “*a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services*” that, on land, concerns rural as well as urban areas (EC 2013). Especially in cities, one of the main Ecosystem Services (ES) demands that GI is claimed to address is the improvement of citizen health with respect to environmental pollution. To this aim, the increase of vegetation cover has been prompted by the Italian Committee for Green Public Development as an effective solution to be adopted across Italian cities and metropolitan areas (CVP 2018). The vision of the Committee consists of three main actions: i) significantly improve the coverage of plant

communities, including woodlands but also shrublands and grasslands, ii) remove asphalt and concrete, in order to recover pervious surfaces, and iii) bring back forests to the cities. Forests were adopted as a benchmark because they represent complex systems, with a high species richness and marked structural, functional and temporal variability (Marchetti et al. 2010), just as complex, rich and variable are the urban green areas (FAO 2016). Consequently, in order to properly design and manage the urban green, a new and factual integration between ecological perspectives and more consolidated aesthetic and agronomic approaches is needed. Planning processes should increasingly become interdisciplinary and take into account important principles, such as a clear definition of the ES to be provided (e.g., improvement of air quality through PM removal) by “the right plant in the right place” (consistently with the potential vegetation of the site and with the varying performance of different species, e.g., deciduous vs evergreen ones) and avoiding potential disservices (e.g., those caused by the introduction of non-native species) (Celesti-Grapow and Blasi 2004). Knowledge on plant biology, auto- and syn-ecology, and on the varying performance of single taxa and communities in providing desired services should, therefore, be deepened and disseminated. The present work is aimed at facilitating this process, by showing to the international scientific community the more recent advances made by Italian botanists and ecologists in bringing “*more nature in the city*”.

More Nature in the City under a botanical and ecological perspective

A collection of different activities that are being carried out in Italy for promoting sustainable, effective and efficient improvement of urban green areas was made available by the symposium “More Nature in the City”, within the 115th Congress of the Italian Botanical Society (AA.VV. 2020). The present overview is based on the research keywords and concepts adopted in the 26 contributions to the symposium (Figure 1) and is organised around

the topics of Urban Biodiversity, Green Infrastructure and Ecosystem Services, and Human Health and Well-being (see the Appendix 1 in the Supplemental Materials).

Urban biodiversity

The topic of Urban Biodiversity was especially addressed in terms of native/non-native species, plant diversity - ecological functions - ecosystem services - human well-being chain, ecological connectivity and typology of green areas. The emerging issues relate to: (i) sustainable use of non-native trees and the need for global guidelines for enhancing their utility while reducing risks of invasion and damages (Brundu et al. 2020); (ii) identification of ecosystem services and disservices related to varying composition of street trees across different cities, including the cultural values facilitated by the reconnection between community gardens and the local territory, history and traditions (Caneva et al. 2020a); (iii) innovative ways of measuring the quality of life with respect to environmental and botanical features, such as the *sentiment analysis tool* (Ladle et al. 2016; Schwartz et al. 2019); (iv) the pivotal role that public green spaces, such as university and botanical gardens, tree-lines and residual natural forests, may exert in terms of native species conservation, ecological connectivity, natural and cultural heritage valorisation and citizen well-being (Bressan and Poldini 2007; Poldini 2016); (v) the contribution of micro-habitats, such as those joined to transportation networks, in guaranteeing refuge for native plant diversity (Plowes et al. 2007).

Green Infrastructure and Ecosystem Services

The topic of GI and ES was addressed in terms of biodiversity conservation and multi-disciplinary planning, urban forest restoration, compensation measures, green-grey solutions, and supply, flow, synergies and trade-offs of ES. Specifically, the contributions provided original hints on: (i) how to integrate floristic, vegetation and landscape scales approaches for

supporting biodiversity conservation in planning processes (Capotorti et al. 2017; Capotorti et al. 2019) and how to deploy multidisciplinary approaches for enhancing multi-functionality; (ii) methods for enhancing the success of forest restoration and promoting related investments by means of compensation measures; (iii) selection of suitable species and habitat templates for designing sustainable and efficient green roofs (Catalano et al. 2016; Catalano et al. 2018; Nardini et al. 2012; Oberndorfer et al. 2007); (iv) development and application of eco-physiology approaches for enhancing supply and flow of regulating ES, such as air and soil pollution removal, local climate regulation (Maragno et al. 2018), flooding prevention and carbon sequestration (Cristaldi et al. 2017; Manes et al. 2016; Pace et al. 2018); (v) development of urban green management strategies for supporting climate change adaptation and mitigation (Ferrini et al. 2020; Marando et al. 2019; Perini et al. 2017; Tsitsoni et al. 2015).

Human Health and Well-being

The topic of Human Health and Well-being was addressed in terms of synergic relationships between urban green and health, recreation, social cohesion, food security, as well as potential trade-offs in terms of health hazards or risk (Lorenzini 1999). Specific contributions relate to: (i) education of new generations to road safety and environmental and health culture by means of participative projects (Domina et al. 2020); (ii) tools for planning and management of historic gardens in order to combine aesthetic and religious values with educational fruition; (iii) models for improving social and environmental conditions by means of new technologies applied to urban farming (Braglia et al. 2016; Caneva et al. 2020b); (iv) formulation of reliable indicators for assessing and mitigating the allergenic potential of urban

green areas while valorising the phyto-resources for respiratory well-being (Cariñanos et al. 2014; Hruska 2003; Marinangeli and Fares 2020).

Concluding remarks

In keeping with the growing strategic attention to urban sustainability (UN Habitat 2019), an overview is provided on the more recent advances in scientific knowledge and implementation activities carried out by Italian botanists and ecologists. The report presents an inventory of research projects and good practices that is useful at a national level, but is also likely to be of interest to an international audience. Actually, by means of the varied contributions relating to urban biodiversity, GI planning, and ES and associated benefits to human health and well-being, it allows to move forward with respect to pilot studies, such as those developed within the framework of the European EnRoute (Enhancing Resilience of Urban Ecosystems through Green Infrastructure) Project (Maes et al. 2019). Many of the inputs are feeding the design of a national plan on GI, which is intended to combine ecoregional and local approaches (Blasi 2018) in order to activate urban resilience and respond to many of the challenges posed by the COVID-19 pandemic (e.g. by improving air quality in the cities). It is hoped that this plan will inspire a proper use of the Disaster Resilience and Recovery Fund towards the sustainable and inclusive growth prompted by the European Green Deal.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

AA.VV. 2020. 115° Congresso della Società Botanica Italiana. Volume degli abstract [In Italian]; [accessed 2020 Sept 15].

http://www.societabotanicaitaliana.it/115/img/Volume_115_Congresso_SBI.pdf

Blasi C, Capotorti G, Copiz R, Mollo B. 2018. A first revision of the Italian Ecoregion map. *Plant Biosystems* 152(6):1201-1204.

Braglia R, Redi EL, Scuderi F, Canini A. 2016. Il Ruolo Sociale degli Orti Botanici in Orti Botanici Eccellenze Italiane. Nuove Direzioni ed. Città di Castello (PG), 129-133.

Bressan E., Poldini L. 2007. La biodiversità nel Friuli Venezia Giulia e la sua integrazione nel paesaggio. *Agribusiness Paesaggio & Ambiente*, 10(3)(2006):202-208.

Brundu G, Pauchard A, Pyšek P, Pergl J, Bindewald AM, Brunori A, Canavan S, Campagnaro T, Celesti-Grapow L, Dechoum M de S, Dufour-Dror J-M, Essl F, Flory SL, Genovesi P, Guarino F, Guangzhe L, Hulme PE, Jäger H, Kettle CJ, Krumm F, Langdon B, Lapin K, Lozano V, Le Roux JJ, Novoa A, Nuñez MA, Porté AJ, Silva JS, Schaffner U, Sitzia T, Tanner R, Tshidada N, Vítková M, Westergren M, Wilson JRU, Richardson DM. 2020. Global guidelines for the sustainable use of non-native trees to prevent tree invasions and mitigate their negative impacts. *NeoBiota* 61: 65-116.

<https://doi.org/10.3897/neobiota.61.58380>

Caneva G, Bartoli F, Zappitelli I, Savo V. 2020a. Street trees in Italian cities: story, biodiversity and integration within the urban environment. *Rendiconti Lincei. Scienze Fisiche e Naturali*, 1-7.

Caneva G, Cicinelli E, Scolastri A, Bartoli F. 2020b. Guidelines for urban community gardening: Proposal of preliminary indicators for several ecosystem services (Rome, Italy). *Urban Forestry & Urban Greening*, 126866.

Capotorti G., De Lazzari V., Alós Ortí M. 2019. Local Scale Prioritisation of Green Infrastructure for Enhancing Biodiversity in Peri-Urban Agroecosystems: A Multi-Step Process Applied in the Metropolitan City of Rome (Italy). *Sustainability* 11(12):3322.

Capotorti G, Del Vico E, Anzellotti I, Celesti-Grapow L. 2017. Combining the conservation of biodiversity with the provision of ecosystem services in urban green infrastructure planning: Critical features arising from a case study in the metropolitan area of Rome. *Sustainability* 9(1): 10.

Cariñanos P, Casares-Porcel M, Quesada-Rubio JM. 2014. Estimating the allergenic potential of urban green spaces: A case-study in Granada, Spain. *Landscape and Urban Planning* 123:134–144. <https://doi.org/10.1016/j.landurbplan.2013.12.009>

Catalano C, Marcenò C, Laudicina VA, Guarino R. 2016. Thirty years unmanaged green roofs: ecological research and design implications. *Landscape and Urban Planning* 149:11-19.

Catalano C, Badalucco L, Laudicina VA, Guarino R. 2018. Some European green roof norms and guidelines through the lens of biodiversity: Do ecoregions and plant traits also matter? *Ecological Engineering* 115:15-26.

Celesti-Grapow L, Blasi C. 2004. The Role of Alien and Native Weeds in the Deterioration of Archaeological Remains in Italy¹. *Weed Technology* 18(1):1508-1513.

Cristaldi A, Oliveri Conti G, Jho EH, Zuccarello P, Grasso A, Copat C, Ferrante M. 2017. Phytoremediation of contaminated soils by heavy metals and PAHs. A brief review. *Environmental Technology & Innovation* 8:309-326. ISSN 2352-1864
<https://doi.org/10.1016/j.eti.2017.08.002>

CVP (Comitato del Verde Pubblico - Italian Public Green Committee). *Strategia Nazionale del Verde Urbano*. 2018; [accessed 2020 Sept 15].
http://www.minambiente.it/sites/default/files/archivio/allegati/comitato%20verde%20publico/strategia_verde_urbano.pdf

Domina G, Di Gristina E, Scafidi F, Calvo R, Venturella G, Gargano ML. 2020. The urban vascular flora of Palermo (Sicily, Italy). *Plant Biosystems* 154(5):627-634.

EC (European Commission). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions ‘Green Infrastructure (GI)—Enhancing Europe’s Natural Capital’ (COM(2013) 249 Final of 6 May 2013). 2013; [accessed 2020 Sept 15]. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2013:0249:FIN:EN:PDF>

FAO. 2016. Guidelines on urban and peri-urban forestry. by Salbitano F, Borelli S, Conigliaro SM, Chen Y. FAO Forestry Paper No. 178. Rome. Food and Agriculture Organization of the United Nations.

Ferrini F, Fini A, Mori J, Gori A. 2020. Role of Vegetation as a Mitigating Factor in the Urban Context. *Sustainability* 12:4247. DOI:10.3390/su12104247

Hruska K. 2003. Assessment of urban allergophytes using an allergen index. *Aerobiologia (Bologna)* 19:107–111. <https://doi.org/10.1023/A:1024450601697>

IPBES. 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Brondizio ES, Settele J, Díaz S, Ngo HT (editors). IPBES secretariat, Bonn, Germany.

Ladle RJ, Correia RA, Do Y, Joo GJ, Malhado ACM, Proulx R, Roberge JM, Jepson P. 2016. Conservation culturomics. *Front Ecol Environ* 14:269-75. <https://doi.org/10.1002/fee.1260>

Lorenzini G. 1999. Le piante e l’inquinamento dell’aria. Edagricole, Bologna. 335 pp.

Maes J, Zulian G, Günther S, Thijssen M, Raynal J, 2019. Enhancing Resilience Of Urban Ecosystems through Green Infrastructure. Final Report, EUR 29630 EN. Publications Office of the European Union, Luxembourg. doi:10.2760/689989, JRC115375.

Manes F, Marando F, Capotorti G, Blasi C, Salvatori E, Fusaro L, ..., Munafò M. 2016. Regulating ecosystem services of forests in ten Italian metropolitan cities: air quality improvement by PM10 and O3 removal. *Ecological indicators* 67:425-440.

Maragno D, Gaglio M, Robbi M, Appiotti F, Fano EA, Gissi E. 2018. Fine-scale analysis of urban flooding reduction from green infrastructure: an ecosystem services approach for the management of water flows. *Ecological Modelling* 386:1-10.

<https://doi.org/10.1016/j.ecolmodel.2018.08.002>

Marando F, Salvatori E, Sebastiani A, Fusaro L, Manes F. 2019. Regulating ecosystem services and green infrastructure: assessment of urban heat island effect mitigation in the municipality of Rome, Italy. *Ecological Modelling* 392:92-102.

Marchetti M, Tognetti R, Lombardi F, Chiavetta U, Palumbo G, Sellitto M, ..., Barbati A. 2010. Ecological portrayal of old-growth forests and persistent woodlands in the Cilento and Vallo di Diano National Park (southern Italy). *Plant Biosystems* 144(1):130-147.

Marinangeli F, Fares S. 2020. Bosco polmone urbano: calendario dei servizi e disservizi del verde arboreo in un parco sanitario a Perugia per una fruizione funzionale. 115° Congresso della Società Botanica Italiana onlus, on line. VII International Plant Science Conference (IPSC).

Nardini A, Andri S, Crasso M. 2012. Influence of substrate depth and vegetation type on temperature and water runoff mitigation by extensive green roofs: shrubs versus herbaceous plants. *Urban Ecosystems* 15:697–708.

Oberndorfer E, Lundholm J, Bass B, Coffman RR, Doshi H, Dunnett N, Gaffin S, Köhler M, Liu KKY, Rowe B. 2007. Green Roofs as Urban Ecosystems: Ecological Structures, Functions, and Services. *BioScience* 57(10):823–833.

Pace R, Biber P, Pretzsch H, Grote R. 2018. Modeling ecosystem services for park trees: sensitivity of i-Tree Eco simulations to light exposure and tree species classification. *Forests* 9(2):89. <https://doi.org/10.3390/f9020089>

Perini K, Ottel  M, Giulini S, Magliocco A, Roccotiello E. 2017. Quantification of fine dust deposition on different plant species in a vertical greening system. *Ecological Engineering* 100:268-276. DOI: 10.1016/j.ecoleng.2016.12.032

Plowes RM, Dunn, JM, Gilbert LE. 2007. The urban fire ant paradox: Native fire ants persist in an urban refuge while invasive fire ants dominate natural habitats. *Biological Invasions* 9:825-836. DOI:10.1007/s10530-006-9084-7

Poldini L. 2016. Flora e vegetazione quali indicatori dello stato dell'ambiente e strumenti di pianificazione delle risorse naturali, Il caso studio del Carso dinarico nel Friuli Venezia Giulia. *Mem. Accad. Lunigianese Sci. "G. Capellini"*, 82-83(2013-2013):27-47, La Spezia.

Schwartz AJ, Dodds PS, O'Neil-Dunne JPM, Danforth CM, Ricketts TH. 2019. Visitors to urban greenspace have higher sentiment and lower negativity on Twitter. *People Nat.* 1:476-485. <https://doi.org/10.1002/pan3.10045>

Tsitsoni T, Gounaris N, Kontogianni AB, Xanthopoulou-Tsitsoni V. 2015. Creation of an Integrated System Model for Governance in Urban MTEs and for Adapting Cities to Climate Change: Preliminary Results. *Ecologia mediterranea* 41(2):33-44

UN HABITAT. 2019. Flagship Programme 5. SDG Cities; [accessed 2020 Sept 15]. <https://unhabitat.org/sdg-cities>

