PROTOCOL

Types and characteristics of urban green & blue spaces having an impact on human mental health and wellbeing

Knowledge assessment and synthesis

This EKLIPSE-protocol is prepared by the EKLIPSE Expert Working Group on Biodiversity and Mental Health to provide recommendations for the conservation, planning, design and management of urban green blue infrastructure

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Opportunity to Comment

Your comments on this draft protocol are welcome.
The Expert Working Group, in consultation with the Knowledge Coordination Body will be free to decide on the inclusions of comments.

Please, send your comments via the Google Form that can be found here:
https://goo.gl/forms/5r491JYvE7j2cBrG2

Summary

Based on a request made by the French Ministry in charge of the Environment (MTES), an EKLIPSE Expert Working Group (EEWG) was formed to answer the following questions:

"Which types of urban and suburban blue and green spaces and which characteristics (components) of such spaces have a significant impact on human mental health and well-being?"

The EEWG will try to answer these questions as comprehensively as possible based on the scientific literature and the resources available. No new primary research will be conducted. The answers will be interpreted and discussed in the light of climate change.

Given that the EEWG has very limited resources (for up to three meetings of the EWG only) and its experts will not be compensated for the time they put in, the original intention of the EEWG was to conduct a rapid evidence assessment (REA).

Recently, the EEWG has agreed with the WHO to perform a full systematic review (SR) on this topic. WHO will provide a budget to have skilled librarians conduct a structured literature search for the EEWG to work on.

Therefore, this EKLIPSE protocol, which describes the activities to be undertaken by the EEWG to answer the request (this document), is based on performing a SR. It includes discussing the implications of the results of the SR for how climate change may affect the future provision of the ecosystem service of mental health promotion.

This SR will rather unique in that it focuses on the type of green (and blue) space and its other characteristics. Previous reviews have been mainly focused on research on the local amount and availability of, or access to green (and to a much lesser extent) blue space, and not on its qualities.

It may also be noted that the issue of the type and characteristics of green and blue space is a much broader issue than that of the level of biodiversity of such spaces, alone.

Based on the above, the EEWG assumes that, since both type and characteristics of green and blue space, as well as mental health and well-being are broad ranging concepts, that may necessitate a wide search to begin with (many different search terms), with relatively few of the initially identified articles satisfying inclusion criteria upon closer inspection.

It is especially with regard to the initial stages of the full SR that additional funding by WHO is needed to be able to perform a SR. A meta-analysis will be conducted, but only if both the studies satisfying the inclusion criteria for the SR and the available resources allow the EEWG to do so.

Introduction

To reduce negative mental health effects of environmental degradation and climate change, functional and healthy ecosystems are a necessity, also in cities (WHO, 2016). Or perhaps better: especially in cities. At the moment, in Europe 74% of the population already lives in a city.[1] A number of scientific studies have already been conducted on the relationship between exposure to the natural environment and human health and wellbeing. At the same time, the heterogeneity of objectives, theoretical frameworks, and research methods make the comparison and the establishment of robust results difficult (Hartig et al., 2014; Zufferey, 2015). However, most studies thus far confirm the existence of a significant association between the local presence of green and/or blue spaces and physical - but also mental - health (Gascon et al., 2015; Van den Berg et al., 2015). Such associations are not only observed for self-reported overall mental health, but also for the prevalence of specific common mental disorders such as depression and anxiety disorders. The converging results were found using different measures: diagnostic interviews (De Vries et al., 2016), diagnoses as recorded in general practices (Maas et al., 2009), the use of anti-depressants (Taylor et al., 2015; Helbich et al., 2018).

Research on the relationship between urban green and blue space and human health and wellbeing thus far has mainly focused on aspects such as the presence and availability of, or access to green and/or blue space, without much regard for the type of green or blue space, its components, characteristics and qualities (Van den Berg et al., 2015). In 2007, Velarde et al. noted that in most experimental studies only a crude distinction was made between natural and urban landscapes. According to the research agenda recently proposed by Frumkin et al. (2018), things have not changed much, as they conclude that "standard exposure measures are not grounded in the ecological elements most relevant to human health and well-being". For example, the quantity of greenery is often measured using aerial photography or remote sensing techniques. Such data offer little information on the quality of the landscape view from the ground level, and other attributes, which may be important in terms of generating positive health outcomes.

The only characteristic of green space for which reviews seem to be available, is its level of biodiversity, with outcomes still being inconclusive (Lovell et al., 2014; Korpela et al., 2018). More knowledge on the importance of the type of urban green or blue space, its components and characteristics may help to unlock its potential to contribute to human health. Using this potential will contribute to making success out of nature-based solutions for the challenges facing an ever urbanizing world (Van den Bosch & Sang, 2017).

We propose to conduct a systematic review which, as one of the first of its kind, takes into consideration the influence of types and characteristics of green and blue spaces on mental health and well-being in cities and sub-urban areas in an interdisciplinary way. The objective of this synthesis is to review and analyse the scientific literature on the effects of different types and characteristics of urban and sub-urban green and blue spaces on mental health and well-being, mainly in Europe. This review aims to inform and provide recommendations to decision makers in several domains, such as health promotion, nature management, spatial policy, urban planning and design.

[1] https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html , accessed on 28 August 2018.

Background

EKLIPSE in March 2017 called for expertise to assess and share existing cross-disciplinary knowledge following up a request initially put to EKLIPSE by the Expert Working Group Biodiversity & Health, 3rd National Plan on Health and Environment (PNSE3) – Ministry in charge of the Environment (MTES), France, aiming at providing recommendations for the "conservation, creation, design and management of natural spaces that would benefit urban citizens, by maintaining or enhancing their mental health and wellbeing", as well as promoting systematic, interdisciplinary, and cross-cultural research**.**

After a preliminary scoping, it was agreed to give priority to literature and knowledge comparing the effects of different types of urban and peri-urban natural open spaces and/or that of variations in components of green/blue components (before/after studies or control *versus* treatment, but also cross-sectional or exposure studies).

For the purpose of this work, the EKLIPSE Expert Working Group on "Mental health and green-blue urban open spaces" (EEWG) defined 'green/blue spaces': "Green Infrastructure: Green (land) and blue (water) spaces that can improve environmental conditions and therefore citizens' mental health and quality of life. It also supports a green economy, creates job opportunities and enhances biodiversity (European Commission, 2016). In accordance with the Request, a broad definition of 'urban green spaces' will be adopted in this report, to include a range of urban green, blue landscapes, including urban forests, gardens, parks, allotments and tree-lined walkways.

The EWG met in person in Paris on 13th and 14th November 2017 and had additional exchanges afterwards. After receiving background knowledge to the EKLIPSE project and the scope and purpose of the project, the EWG identified a structured process for organising the work tasks. This document outlines the nature of the request, choice of methodologies, details of selected methodologies and expected outcomes.

The Request

EKLIPSE, via its Call for experts (No. 2/2017), invited to develop a **knowledge synthesis** in order to answer the main question:

"Which types of urban and suburban blue and green spaces and which characteristics (components) of such spaces have a significant impact on human mental health and wellbeing?"

This request, as said, was put to EKLIPSE by Expert Working Group Biodiversity & Health, 3rd National Plan on Health and Environment (PNSE3) – Ministry in charge of the Environment (MTES), France.

The aim of the request is to **provide guidelines and recommendations** to policy makers, practitioners and researchers regarding the planning, design, construction and management of natural spaces in urban or sub-urban areas in order to promote mental health and wellbeing of urbanites.

The **knowledge assessment** will focus at collating, assessing, and synthesizing the evidence with regard to mental health effects related to all types of urban and peri-urban green/blue spaces and habitats: and related features: green roof, living wall, garden, street trees, allotment garden, urban orchard, park, urban forest, water bodies, agricultural areas.

The knowledge assessment focuses on the influence of the type and design of green and blue spaces, and in principle will not look at the effect of the amount of green and/or blue space as such.

However, this issue is dependent on the spatial scale of a study. Beyond the level of a single green area, the distribution of green space, whilst keeping the total amount the same, is considered a relevant planning aspect. For example, this distribution (how the total amount of green space is divided up and the spatial configuration of the green areas) may affect amount as well as type of exposure, which is assumed to be relevant for the mental health and wellbeing effects the green space produces.

The results of the systematic review will be also discussed with regard to how climate change may affect the provision of the ecosystem service of mental health improvement by green and blue spaces, as well as by the whole urban green infrastructure as a whole.

Selected Methodological Approach

- ***Systematic Review (SR)***

A systematic review (SR) is well suited for topics on which a substantial volume of studies has been conducted, as is expected to be the case for green space and mental health. A systematic review will integrate a body of literature by methodically extracting data from a set of qualifying papers, resulting from a systematic, unbiased literature search (Hunt, 1997). Overarching patterns or problems that are not normally discernible among individual studies may emerge.

EWG's systematic review will follow six crucial stages that conform to the established protocols for this type of knowledge synthesis: (A) the population, or 'universe', of studies about which the review aims to generalise will be defined by strict eligibility criteria; (B) the papers fitting in that universe will be retrieved from the literature through a logical and systematic search strategy; (C) essential information from each eligible item will be extracted and coded; (D) individual studies will be critically appraised[2], (E) outcomes of the different studies will be synthesized and explanations for heterogeneity in outcomes explored, and (F) the methods, results and theoretical implications of the analysis will be reported and discussed. If the results of the first three steps indicate this is feasible, and the resources allow it, the SR may include a meta-analysis (an addition to step 5).

The following steps will be taken:

1. Define the eligibility criteria for the structured literature search according to PICO/PECO terms (see below), and possible additional criteria; PICO stands for Population, Intervention, Comparators and Outcomes. PECO is the same, except that the E stands for Exposure. PECO is added because we want to include cross-sectional, epidemiological studies (despite that such studies do not allow firm conclusions regarding the causality of observed associations).
2. Develop a check-list for the first step, the structured literature search (i.e. papers that this search should retrieve anyway). This check-list is based on papers contributed by members of the EWG and on which we agree that they are indeed highly relevant (and of course satisfy the eligibility criteria, as defined in step 1).
3. Define search terms (including required combinations) and databases to be searched.[3]
4. Conduct a preliminary structured search and process a random sample of the hits of this preliminary search (up till making sure that required PICO/PECO elements are present and other eligibility criteria are satisfied; but not reading full papers)
5. Adjust and/or refine search terms if necessary, based on the following two questions:
    a. are the articles we think are highly relevant (see check-list) included in the hits?

[2] For example, by using an instrument described in http://www.prisma-statement.org.

[3] A separate document contains first ideas regarding search terms. Databases suggested thus far are: Scopus, PubMed/MEDLINE, PsycINFO Web of Science, ScienceDirect.

b. are there not too many 'false' hits (irrelevant papers)?

6. Define what will be abstracted from each eligible paper, how it will be coded, how the assessment/critical appraisal of a study will be conducted and how the synthesis will take place. Existing instruments might be used to do so. See e.g. http://www.prisma-statement.org.
7. Write the definite SR-protocol and get it published.[4]
8. Conduct the definite structured literature search, based on the revised search terms and their combinations.
9. Process the results of the definite search
10. Write the EKLIPSE-report (required) and possibly a scientific paper (optional)
11. Otherwise disseminate the outcomes of our efforts

As for the processing of the results of a structured literature search (steps 4 and 9), the following sub-steps will be taken:

a: screen paper on title

b: screen paper on abstract (PICO/PECO elements present? Other eligibility criteria satisfied?)

c: download paper and determine whether required PICO/PECO elements are indeed present. Reading of methodology/materials section only.

If step 5.c of the preliminary search still results in too many hits, the most relevant subsets of/themes in the literature could be identified and assessed systematically, in order to provide an answer to the request that is limited to some specific aspects.

For processing results of definite search only (step 9): if a paper is still seen as fulfilling PICO/PECO (and other) requirements after 9.c, the full paper will be read and classified according to detailed protocol for classification.

NB: in a systematic review every one of the three sub-steps, 9.a to 9.c, requires duplication by another reviewer and comparison of conclusions, if not of all, then at least of a random sample of the publications. Normally kappa analysis on a 10% (or greater %) of search material at each of the filter stages suffices.

- ***Causal chain analysis***

To assess and synthesise relevant knowledge related to the types and characteristics of urban green blue spaces having a significant impact on human mental health and wellbeing, the EWG will be looking at existing conceptual frameworks, such as that developed by Hartig et al. (2014), Markevych et al. (2017) and Zhang et al. (2017). If it is concluded that the existing frameworks do not fit either the purpose of the EWG or its findings, the EWG may decide to propose an adapted or completely new version of such a framework, based on an own causal chain analysis. It should be noted that the framework is not a purpose in itself, but a tool to assist the knowledge synthesis**,** to structure the results of the literature search, and reporting of its outcomes. Such a framework may also help to explain heterogeneity in outcomes of studies, e.g. because of differences in confounders that were taken into account, in population segment studied, etc.

[4] NB: the SR-protocol should be distinguished from the present document, the EKLIPSE-protocol, especially in its present form. The SR-protocol will need to be more detailed. Possible journals (known to publish SR protocols) are the Journal for Environmental Evidence (https://environmentalevidencejournal.biomedcentral.com/) and BMJ Open (http://bmjopen.bmj.com/) ; other journals may be considered.

Preliminary definition of the parameters of the structured literature search

The EEWG will use the PICO-approach to defining the parameters of the literature search: People, Intervention, Comparators, Outcomes. However, the experts will combine this with the PECO-approach: many studies in the field of nature and health are not interventions studies but cross-sectional studies. These studies are also deemed relevant. PECO stands for: People, Exposure, Comparators, Outcomes.

Population of interest

The request concerns human beings of all ages, gender, nationality, educational background and income, living in urban areas.

Interventions

When it comes to intervention studies, we will focus/limit ourselves to *environmental* interventions. That is, interventions that change the physical environment, more specifically with regard to the natural (broadly interpreted), green or blue parts of this environment (see also key definitions). The focus is not on changing the amount of green or blue space, but on its design and its characteristics. The notion of 'amount' pertains to the surface of green areas etc. This also holds for vertical green surfaces (walls): the focus is on the type of green wall, and not on the size of the green wall. Within a green area, the amount of vegetation may change (e.g. replacing grass by trees); this type of change is to be included.[5]

At a larger spatial scale than that of an individual green area, the distribution of green spaces, or the configuration of the green infrastructure, may still be relevant. For example, relevant questions could be: is it better to have several small parks in an urban district, or to have one large park (keeping the total surface of green space the same)? Is it important that the different green areas are connected by green corridors, or does that not matter at all? Connectivity is usually considered important from an ecological perspective, but it is unclear if this is also true for mental health and wellbeing effects.

Therapies are also interventions, but fall outside the domain that is considered relevant for this study. Intervention studies involving therapeutic gardens are considered relevant only when they pertain to the *design* of the therapeutic garden, and not if they (only) pertain to the therapy conducted in this setting. In the latter case, it is the type of therapy, the skills of the therapist and the relationship between client and therapist that are likely to be the major factors that determine the success of the therapy, all of which are not central to our study.[6] Note that the design of an area includes the amenities and facilities present in a green (or blue) area, as these may influence accessibility, affordances and attractiveness, and thereby exposure, as well as type of contact. The management regime for an area, on the other hand, is excluded, as this is not a design aspect.

Moreover, the focus of the study is more on prevention of mental health problems and improvement of quality of life in everyday life, than it is on cure. Therefore, studies focussing on treatments of people with a mental disorder will be excluded. Studies on (contact with) nature helping to prevent disorders of becoming worse and/or make them more manageable (higher quality of life) *outside* specific therapeutic settings and not involving a therapist could still be included.

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[5] Note that the frequently used average value of the Normalized Difference Vegetation Index (NDVI) as a measure for the amount of greenery in principle would be affected by such a change (NDVI-value of trees, when in leaf, is higher than that of grass), whereas a measure such as the percentage of green space would not.

[6] If it proves to be too difficult to make the distinction between the effect of the therapy as a whole and that of the design of the therapeutic garden as such (e.g. based on a scoping exercise), it may be decided to drop studies involving therapeutic settings altogether.

Exposure

Any sort of exposure to an outdoor green/blue space in the urban and peri-urban environment, whether planned or accidental. Keniger et al. (2013) propose a typology of indirect, incidental and intentional interactions with nature. In the category of indirect interactions, they include viewing representations of nature, as well as viewing nature through a window. Viewing representations of nature will be excluded here, as this would make contact with nature 'foot loose': it would not need to be physically present for this type of contact.

Comparators

Given that the focus is on design, types and characteristics of green and blue space, the comparison or reference situation is another type of green space, blue space or green/blue element, or the same type with other characteristics, e.g. a comparison of tree species. It may also be about a different spatial configuration of green and blue spaces (keeping the total amount the same, or controlling for this). Urban or built-up environments containing no or less nature are not deemed suitable as comparator. To make sure that it really is the type or characteristics of the green/blue space that is responsible for observed difference in mental health or wellbeing, other aspects should be/remain the same as much as possible.

Outcomes

To start with, the literature search will include a wide range of outcome measures with regard to mental health and mental wellbeing. This ranges from the prevalence and/or severity of professionally diagnosed mental disorders (e.g. schizophrenia) and self-reported mental health (e.g. GHQ-12, MHI-5), to life satisfaction and quality of life. Studies with (only) momentary mood assessments as outcome measures will be excluded, as will be studies looking (only) at environmental preferences.

For mental disorders, the WHO classification will be adhered to. Given that there is a large number of specific mental disorders that may be distinguished, we may need to narrow our focus on the prevalence of (a) the most common mental disorders that (b) have an aetiology that makes an intervening effect of (exposure to) nature plausible. Preliminary ideas regarding mental disorders to focus on: Stress, Dementia, Anxiety, Depression, Schizophrenia, Developmental disorders, Hyperactivity, Autism.

Depending on the number of 'hits', i.e. publications that satisfy the search criteria, in second instance a narrower selection could be made, based on ordering of different types of outcomes, e.g.: prevalence of professionally diagnosed mental disorders > self-reported mental health > life satisfaction/quality of life > momentary mood assessment. This argument can be extended to studies with end points that stop at known risk or preventive factors, such as high chronic stress levels or social capital/cohesion, rather than include a direct mental health measurement.

Additional inclusion criteria (beyond those based on PICO/PECO)

Methodological criteria

Laboratory experiments may also be considered to involve some kind of intervention, i.e. the experimental factor(s). However, they are usually conducted in an indoor setting and use representations of outdoor nature, rather than employing exposure to actual outdoor nature. They also tend to focus on short-term effects. If so, they will be excluded. Qualitative studies satisfying the criteria may be included.

Region where the study was conducted

The criterion is that the study should be relevant for the European context. Studies conducted in Europe qualify by definition. Studies conducted in other regions may still be relevant, depending on the region and theme of the study. E.g. studies that are very specific for tropical conditions are less likely to be relevant. More clear criteria will be developed before the literature search.

Type and language of publication

We will start with peer-reviewed articles, published in English. Depending on results of the first phase of the literature search (how many hits that need reading the full article) and available resources, a second step is to include peer-reviewed articles published in other languages, giving that at least two members of the EWG are able to read this language well. A possible third step, again depending on still available resources (and timetable), is to include grey literature, once again with the proviso that at least two members of the EWG are able to read this language well. In principle, there will be no limit on how far back we go in time in the literature search.

Meta-analysis based criteria

If the outcomes of the SR and the resources available allow it, a meta-analysis will be conducted. When reading the full publication, it will be recorded whether or not the study could be included in a meta-analysis. Inclusion criteria for the meta-analysis still have to be formulated.

Expected outcomes of the project and format of reporting

The requester aims at providing peer-reviewed recommendations regarding the design and creation of natural spaces in urban and suburban areas in order to promote health of urbanites. Such recommendations will be tailored to various practitioners (e.g. landscape architects, urban planners, city managers, etc.) and will be developed in a form to be possibly taken into account by the French Code de l'Urbanisme et Code de l'Environment, in accordance with European regulations already in practice or under development. Gaps and possible future research will also be discussed. Results will be discussed also with regard to the implications of climate change for the provision of this ecosystem service. The main (required) method of reporting will be that of an EKLIPSE-report. Dissemination of the report will be primarily handled by the EKLIPSE bureau.

Other envisioned outcomes are peer-reviewed scientific publications, as well as oral presentations on the outcomes of the knowledge synthesis, for a diversity of target groups, ranging from policy-makers to practitioners and students. These activities aim to inform and provide recommendations to (future) decision makers in several domains, such as health promotion, nature management, spatial policy, urban planning and design.

Project timeline

Nr.	Activity
1	Write EKLIPSE protocol (definite version of this document)
2	Open review of protocol according to EKLIPSE procedure
3	Develop checklist for systematic literature search
4	Develop search terms for systematic literature search
5	Develop procedure for critical appraisal of eligible studies
6	Revise EKLIPSE protocol (and 3 to 5) based on open review
7	Write and submit article on SR-protocol for selected journal
8	Conduct systematic literature search (librarians)
9	Present outcomes thus far at Proof of Concept conference
10	Screen search results (eligibility)
11	Perform systematic processing of eligible publications
12	Write narrative synthesis of outcomes (draft EKLIPSE report)
13	Open review of EKLIPSE report
14	Publish revised EKLIPSE report
15	Write and submit article on systematic review outcomes

Note that activities are not performed sequentially; in most cases they will start (have started) before the previous activity has been finished

Scope of work's limitations

There are many variables that influence the effectiveness of green/blue urban spaces and their components to promote mental health and wellbeing, besides those relating to the design of the green/blue space and their spatial configuration. They will be listed and critically examined by the EEWG (as possible confounders) and specifically highlighted in the dissemination of findings.

Accessibility, cultural and geographical aspects, age, sex, and other variables will be taken into account instrumentally, in order to better answer to the request (e.g. by explaining heterogeneity in results).

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