The impact of green and blue spaces in European cities on the risk of depression in adults: a systematic review

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Abstract

***Background**:* Depression is a common mental health disorder that can have an important negative impact on individuals and society. Urbanization has been identified as a risk factor for depression. However, green and blue spaces in cities may have a possible protective effect on physical and mental health.
Objective: To investigate the impact of green and blue spaces in European cities on the risk of depression in adults.
Methods: A systematic search of electronic databases (Pubmed, Embase, Web of Science: Core collection & Biosis, Scopus, CINAHL and Greenfile) was conducted to find relevant studies published until February 8, 2022.
***Results**:* Eighteen articles were included in the review. Due to heterogeneity of the results, we refrained from performing a meta-analysis. A trend towards lower risk of depression with more residential green space was observed, however not always significant. For blue spaces, we did not find any significant outcomes.
***Conclusions**:* Our review showed limited evidence that more urban greenness might diminish the risk of depression. Clinicians should be aware of this protective factor.

Samenvatting

Achtergrond: Depressie is een vaak voorkomende psychische aandoening. Depressie kan gepaard gaan met heel wat negatieve effecten voor patiënten en hun omgeving. Urbanisatie blijkt een risicofactor te zijn voor het ontwikkelen van depressie. Nochtans zou groene en blauwe ruimte in steden een beschermend effect hebben op allerlei fysieke en mentale aandoeningen.
***Doelstelling*:** De impact onderzoeken van de mogelijke beschermende effecten van groene en blauwe ruimte op depressie.
Methoden: Er werd elektronisch gezocht in verschillende databases (Pubmed, Embase, Web of science: core collection & Biosis, Scopus, CINAHL en Greenfile) naar relevante artikels die gepubliceerd werden tot en met 8 februari 2022.
Resultaten: Er werden achttien artikels geïncludeerd in deze review. Omwille van heterogeniteit in de gevonden studieresultaten, voerden we geen meta-analyse uit. Onze resultaten suggereren dat groene ruimte een beschermend effect heeft op depressie. Nochtans kunnen niet alle studies dit verband aantonen. Voor blauwe ruimte vonden we geen significante verbanden.
Besluit*:* Er is beperkte evidentie dat groene ruimte beschermend werkt op depressie. Het is belangrijk dat gezondheidsmedewerkers op de hoogte zijn van deze beschermende invloed.

Introduction

Our planet has experienced unprecedented rapid urbanization over the past century.(1, 2) In 1800, only 3% of the world population lived in urban areas.(2) Now more than half of the global population lives in a city.(1, 3) In 2050 it is expected that this proportion will be around 70%.(1) Nowadays most humans have moved from rural to urban environments.(2) Accordingly, the city is now officially the main habitat of the human being.(3)

Street noise, polluted water, soil and air are consequences of urbanization and are associated with public health risks.(2) Despite the favourable aspects of an urban lifestyle, evidence has shown that living in an urban area carries a higher risk of cardiovascular disease, hypertension, obesity, diabetes and asthma.(2) This is mediated by different factors, for example lower physical activity and more air pollution. Moreover, urbanization seems to be associated not only with worse physical health, but also with poorer mental health, such as a higher risk of psychological distress, depressive symptoms, anxiety and a higher need for mood disorder treatment.(4, 5) Depression is characterized by low mood, lack of energy, sadness, insomnia and inability to feel pleasure. It can cause severe psychosocial dysfunction and diminishes quality of life.(6, 7)

It is increasingly evident that green and blue spaces in cities are beneficial for physical and mental health.(8) Green and blue spaces are commonly defined as the presence and quality of nature in addition to the access to it, measured by 1) subjective perceptions, 2) vegetation indices (spectral imaging transformations to define the vegetation properties) or 3) distance to the nearest parks.(5) Several cross-sectional and a few longitudinal studies show protective effects of green spaces on mental health.(9-12)

Different mechanisms play their part in the protective effects of green spaces, such as: the encouragement of physical activity, social cohesion and the reduction of environmental hazards, such as pollution, street noise and heat stress.(1, 8) A few studies have already shown that individuals living in cities with more green space, have reduced levels of stress and improved levels of wellbeing compared to those with poorer availability of green space.(13, 14) Therefore, it is a desirable and great challenge to provide enough green and blue areas to improve public health.

The purpose of this systematic review is to look at the reported incidence and risk ratios of depression in people living in a city with accessibility to green or blue spaces, compared to those without this accessibility. We only focused on cities in Europe to obtain more accurate information about this risk in various European cities. We expected to find a reduced risk of depression in people with more accessibility to green or blue spaces, as has already been shown for cardiovascular disease.(15)

Methods

Search strategy and data search

We identified relevant studies by searching electronic databases. Two researchers (MS and JC) systematically searched Pubmed, Embase, Web of Science: Core collection, Web of Science: Biosis, Scopus, CINAHL (through EBSCO) and Greenfile (through EBSCO). The search terms are attached in Supplementary A.

Study selection

The inclusion criteria were as follows: (I) Adults (18+) (II) People living in a European city with availability to green/blue space (III) the following outcome was reported: risk of depression.
Exclusion criteria included: (I) age under 18 years (II) language of published study is not in English or Dutch (III) study was not conducted in a European city (IV) narrative reviews.
Two researchers (MS and JC) independently selected potentially eligible studies for inclusion. Disagreements between researchers were settled by consensus.

Data extraction

The following data were collected from the included studies (I) Name of first author, (II) publication year, (III) study design, (IV) location of the study, (V) study sample size, (VI) mean age, minimum and maximum age of study participants, (VII) proportion of female participants, (VIII) used definition of depression/depressive symptoms, (IX) used definition of green space, (X) period of follow-up, (XI) outcome measures and (XII) covariates.
Due to the heterogeneity of the results and the tools used, we did not perform a meta-analysis.

Assessment of risk of bias

Quality assessment of the articles was performed for each included study using the JBI critical appraisal tools.(16) The choice for the applied checklist was based on study design. We applied the checklists for cohort studies and cross-sectional studies on each article (see Supplementary B). Low risk of bias translates to an overall rating of good quality. Thus, the greater the risk of bias, the lower the overall quality rating of the study.

Results

Literature search results

All studies were imported into Endnote and duplicates were removed. We found a total of 15,879 articles, 8,039 after removing duplicates. These 8,039 articles were screened on title and abstract and 7,963 articles were excluded. Thereafter, we screened 76 full-text articles for inclusion. In total, 58 articles were excluded: 48 articles were removed as they did not meet the inclusion criteria, two studies were not observational, one article was written in Spanish, two studies were not conducted in Europe and the full text was not available for five articles. Finally, 18 studies were included in our systematic review. No additional articles were found after screening the reference lists of the included articles. An overview of this search strategy is given in Figure 1.

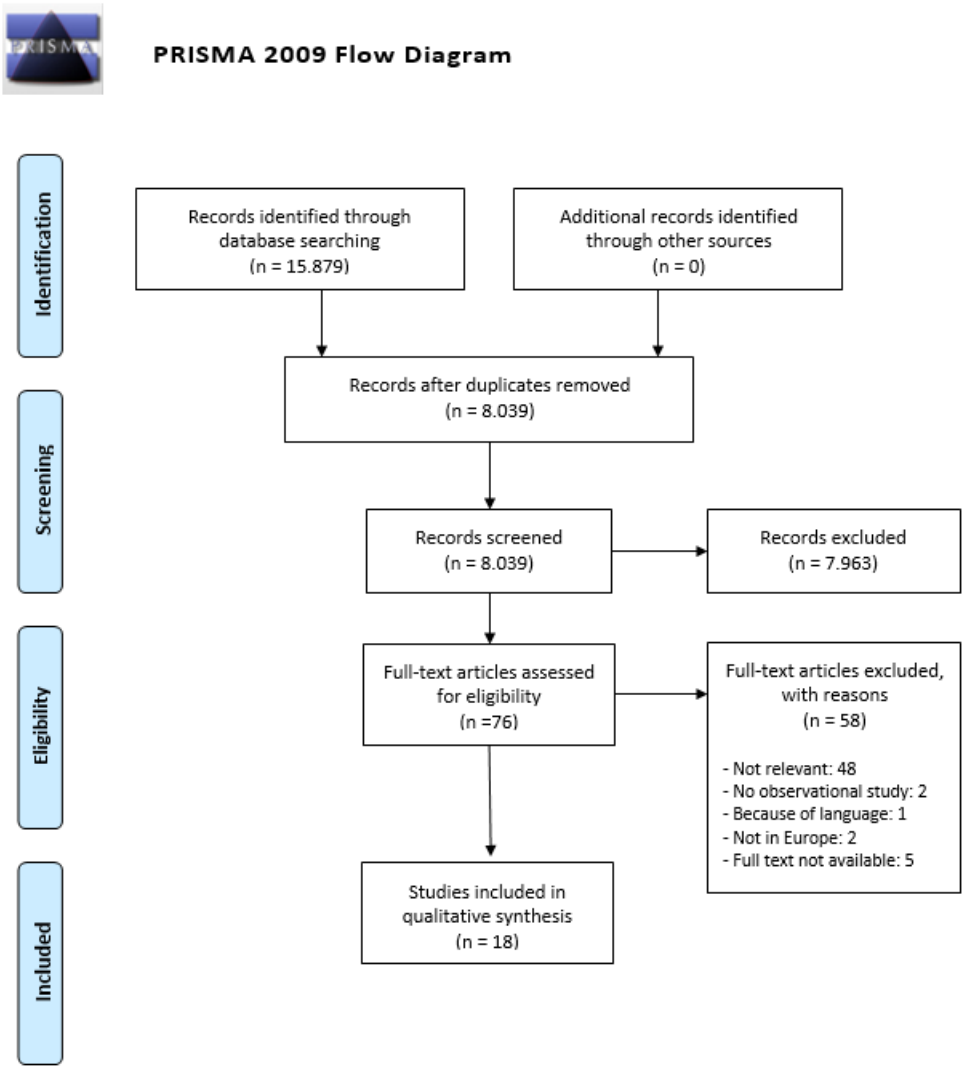


Figure 1: PRISMA flowchart(17)

Study characteristics

An overview of the main characteristics of the included studies is shown in Table 1. Most studies were published in 2020 or 2021. The earliest publication only dates back to 2013. The majority of the articles (n=14) are cross-sectional studies and four studies have a longitudinal study design.

Table 1: Table of findings.

Study (first author)	Publication year	Study design	Location	Sample size	Mean age (range) in years	Women (%)	Description of depression	Description of green/blue space	Period of follow-up	Outcome
Braçe O.(18)	2020	cross-sectional	Carmona (Spain)	479	43 (18-64)	50.1	Hospital Anxiety and Depression Scale (HADS) score ≥ 11	Answer to the question: 'Are you able to see any green space from your home? (parks or gardens?)' or frequency of green space visits (daily/not daily)	February to May and September to November 2018	Prevalence of depression (HADS ≥ 11)
Djeudeu D.(19)	2020	longitudinal	Bochum, Essen and Mülheim in the metropolitan Ruhr Area (Germany)	4,814	NS (45-75)	NS	15-item questionnaire of the Center for Epidemiologic Studies Depression Scale (CES-D) score ≥ 17	satellite imagery and NDVI	Participants were invited three times each after 5 years. T0: 2000-2003, T5: 2006-2008, T10: 2011-2015	Estimated risk of depression (CES-D ≥ 17)
Mears M.(20)	2020	cross-sectional	Sheffield (England)	293	NS	NS	The count of diagnoses of depression from GP registry data	green cover (percent green space cover), tree density (locally around residential address),	2011 to January 2017	Estimate of diagnoses of depression from GP registry data

Study (first author)	Publication year	Study design	Location	Sample size	Mean age (range) in years	Women (%)	Description of depression	Description of green/blue space	Period of follow-up	Outcome
								garden size and green space accessibility (proportion of addresses within 300 m of a green space)		
Melis G.(21)	2015	cohort	Turin (Italy)	547,263	NS (20-64)	50.2	consumption of antidepressants	availability of gardens, parks and green facilities within an accessible distance	1 January 2004 - 31 December 2006	IRR of consumption of antidepressants
Pelgrims I.(22)	2021	cross-sectional	Brussels (Belgium)	1,325	47 (34–63)	NS	symptom checklist-90-R and GHQ-12	Google street view panorama, vegetation coverage data (high-resolution remote sensing data), urban tree data (UrbIS database 2018), NDVI	2008-2013	OR of depressive disorders

Study (first author)	Publication year	Study design	Location	Sample size	Mean age (range) in years	Women (%)	Description of depression	Description of green/blue space	Period of follow-up	Outcome
Tarkiainen L.(23)	2021	longitudinal	Stockholm (Sweden), Turin (Italy), nine biggest cities in Finland (Helsinki, Turku, Kuopio, Vantaa, Lahti, Tampere, Espoo, Oulu and Jyväskylä)	873,355 (347,647 in Turin, 431,361 in Stockholm and 94,347 in Finland)	65.3 (NS)	55.6	≥ 1 purchase or ≥ 1 prescription of antidepressants during the 6-year follow-up period after baseline (no TCA)	proportion of green area (parks and forests) in the total neighbourhood area (satellite imaging data (UA data)	2001-2007 (Turin), 2011-2017 (Stockholm), 2003-2009 (Finnish cities)	OR of antidepressant use
Triguero-Mas M.(24)	2015	cross-sectional	Catalonia (Spain)*	8,793	48 (34-64)	50.06	self-reported depression and intake of antidepressants	NDVI and access to green and blue (inland and non-inland water bodies) space (300m around residential address)	2010-2012	OR of self-reported depression and OR of consumption of antidepressants
Helbich M.(25)	2021	cross-sectional	Amsterdam (The Netherlands)	441	41 (18-65)	54	PHQ–9	SV images, NDVI: OP and LS imagery per postal code, and 100 and 300 m concentric	survey data between September and December 2018, images taken	PHQ-9 score (between 0 and 27)

Study (first author)	Publication year	Study design	Location	Sample size	Mean age (range) in years	Women (%)	Description of depression	Description of green/blue space	Period of follow-up	Outcome
								and street network buffers at the home address	between May 2016 and July 2019	
Gascon M.(26)	2018	cross-sectional	Barcelona (Spain)	958	56.5 (44–74)	63.9	Participants reported their history of physician-diagnosed depressive and anxiety disorders and intake of medication	NDVI and OP. Blue space included continental waters and beaches	interviews between 2013–2014, exposure assessment in 2009	OR of reported history of physician diagnosed depression and OR of antidepressants use
Generaal E.(27)	2019	cross-sectional	Amsterdam, Hoorn, Oss and Zwolle (The Netherlands)	9,194	53 (18-85)	54	PHQ-9, severe depression: score > 9	Percentage of green and blue space of total land use (calculated using ArcMap version 10.4)	HELIUS: 2011 – 2015 and GIS dataset 2012, HOORN: 2005-2006 and GIS dataset 2006 and LASA: 2005-2006 and GIS dataset 2006	OR of depression (PHQ-9 ≥ 10)
Taylor M. S.(28)	2015	cross-sectional	London (England)	all inhabitants of London	NS	NS	The quantity of antidepressant prescriptions	quantity of street trees (no parks)	prescriptions in 2009 and street	rate of antidepressant prescriptions

Study (first author)	Publication year	Study design	Location	Sample size	Mean age (range) in years	Women (%)	Description of depression	Description of green/blue space	Period of follow-up	Outcome
				(+- 8,000,000) in 2010					trees in April 2010	per 1000 population
Alcock I.(9)	2013	longitudinal	> 5000 UK households	594 people who moved to more urban green space and 470 movers from more to less green space	38.17 (NS)	NS	GHQ scores	Generalized Land Use Database for England (GLUD)	1991-2008	inverse GHQ
Noordzij J.M.(29)	2021	cross-sectional	Eindhoven, Amsterdam, Zwolle, Paris and data from multiple cities in Eastern Europe	16,189	mean age ranges from 50 to 71 years (multiple cohorts)	NS	self-reporting on depressed affect	Distance to nearest green space (using QGIS) and the amount of green space within 800m buffers around residential addresses (data were obtained from the UA dataset)	NS	RR of Self-reported depressed affect
Putrik P.(30)	2014	cross-sectional	Maastricht (The Netherlands)	9,879	55 (46.2-59.1)	48	Self-reported depression (Kessler physiological distress scale)	NS	2010 (survey was taken biannualy)	OR of self-reported depressive symptoms

Study (first author)	Publication year	Study design	Location	Sample size	Mean age (range) in years	Women (%)	Description of depression	Description of green/blue space	Period of follow-up	Outcome
Ruijsbroek A.(8)	2017	cross-sectional	Stoke-on-Trent (United Kingdom), Barcelona (Spain), Doetinchem (Netherlands) and Kaunas (Lithuania)	3,771 (847 in Doetinchem, 1002 in Barcelona, 933 in Stoke-on-Trent, 989 in Kaunas)	51.7 (18-75)	55.6	low score (in %) on MHI-5	subjective amount and quality of neighbourhood green space	May to October 2013	scores on MHI-5
Reklaitiene R.(31)	2014	cross-sectional	Kaunas (Lithuania)	6,944	NS (45–72)	54.7	CeS-D10 scale	distance (<300 m, 300–999 m, ≥ 1 km) to city parks (>1 hectare)	2006-2008	OR of depressive symptoms (CeS-D10 scale ≥ 4)
White M.P.(32)	2021	cross-sectional	14 European countries* (Bulgaria, Ireland, Estonia, Germany, Czech Republic, Greece, Italy, Netherlands, Portugal, Spain, France, Sweden, Finland and	16,307	NS (18+)	50.9	antidepressant use	satellite imagery of a 1000 m buffer and blue space within 1000 m buffer of residential addresses	June 2017 to April 2018	estimates of antidepressants use

Study (first author)	Publication year	Study design	Location	Sample size	Mean age (range) in years	Women (%)	Description of depression	Description of green/blue space	Period of follow-up	Outcome
			the United Kingdom) and four other regions/ countries (Queensland [Australia] California [USA], Canada, and Hong Kong [China]							
Sarkar C.(33)	2018	cross-sectional	United Kingdom*	94,879	56.96 (37–73)	54	self-reported event of probable major depressive disorder (PHQ; binary)	NDVI	29 April 2009 to 1 October 2010	OR of self-reported major depressive disorder

NS = not stated; OR = odds ratio; NDVI = Normalized difference vegetation index; GIS = Geographic information system; IRR = incidence rate ratio; PHQ-9= Patient Health questionnaire; RR = relative risk; SV = street view; OP = orthophotos; LS = Landsat-8; GHQ = General Health questionnaires; UA = Urban Atlas; MHI-5 = mental health inventory; CeS-D10 = Center for Epidemiologic Studies Depression Scale; QGIS = geographical software package; TCA = tricyclic antidepressants; LASA = Longitudinal Aging Study Amsterdam; HOORN = New Hoorn Study; HELIUS = Healthy Life in an Urban Setting study

*Exact location is not mentioned in these articles. We did not exclude these articles, because they presumably contain participants who live in a city.

Several studies were performed in England (n= 6) or the Netherlands (n=6). There were five studies which were conducted in Spanish cities. We only found one study that was performed in Belgium. Three of our included articles did not mention their exact study location.(24, 32, 33) However, these studies may contain participants who live in a city. For example, the study of Triguero-Mas et al. looked at the degree of urbanisation in their results.(24) White M.P. et al. defined a population density ≥150 people per km^2 as an urban area.(32) The study of Sarkar C. et al. contains participants who resided within a 25 mile radius of a United Kingdom (UK) biobank Collection Center, which were located in 22 cities across the UK. For their results they also made stratifications for degrees of urbanicity.(33)

Most studies (n = 12) used questionnaires for the diagnosis of depression. The most frequently used tools are the questionnaire of the Center for Epidemiologic Studies Depression Scale (CES-D), Patient Health Questionnaire (PHQ) and General Health Questionnaire (GHQ). CES-D is a screening tool for measuring depressive symptoms. A higher score on the CES-D translates into more or more frequent depressive symptoms.(31) PHQ is a questionnaire with scores that range from 0 to 27 and GHQ is a 12-items questionnaire for psychological distress. Both indicate more pronounced depressive symptoms with a higher score.(9, 19, 22, 25, 27, 33) One article used the Hospital Anxiety and Depression Scale (HADS). This questionnaire consists of seven questions related to depression and seven questions related to anxiety. A score of 11-21 is indicative of anxiety or depression.(18) Six studies used intake of antidepressants as a definition for depression. Only one study used GP registry data.

Exposure to green space was measured in the majority of studies with at least one objective parameter. Normalized Difference Vegetation Index (NDVI) (n= 5) was the most frequently used objective method. Measured by reflectance and absorbance of red solar radiation, NDVI is a measure of vegetation level. Values can range from -1 to +1. Dense vegetation such as forests have values approaching +1, rooftops and roads have values near 0 and water has values near -1.(19) Some studies used tree density or distance to green space as a definition. A few studies used questionnaires. For example, one study used questions (such as: 'From home, are you able to see any green space?') as a proxy for exposure to green space, along with the frequency of green space visits.(18) Satellite Imagery (SI) was also an objective method used in some studies. Furthermore, the studies adjusted for different covariates in their statistical analysis (Table 2).

Table 2: Table of covariates included in the studies.

Study (first author)	Covariates
Braçe O.(18)	age, educational level, employment status, marital status and sex
Djeudeu D.(19)	set 1: forced-in variables: age, greenness, income / set 2: set 1 + body mass index, multi-morbidity, traffic noise / set 3: set 2 + unemployment % in district
Mears M.(20)	address density, age, air pollution, income deprivation, sex and smoking rates
Melis G.(21)	crime rates, education, employment, housing tenure and social and physical disorder
Pelgrims I.(22)	age, chronic condition, family composition, highest educational level in the household and year, physical activity, reported household income, sex and social support
Tarkiainen L.(23)	age, economic activity, education, household composition, housing tenure, marital status and sex
Triguero-Mas M.(24)	age, birth place, education completed, marital status, neighbourhood, occupation indicators of household, sex, socioeconomic status and type of health insurance

Helbich M.(25)	age, education level, household income, labour market involvement, marital status and sex
Gascon M.(26)	age, air pollution and noise, body mass index, educational attainment, information on whether they were caregivers of people with Alzheimer disease or any other dementia, living alone, marital status, meditation, perceived social support, physical activity, sex, sleep quality, smoking, social support and work category
Generaal E.(27)	age, educational level and sex
Taylor M. S.(28)	claiming job seekers' allowance, indices of multiple deprivation score, mean age, mean income, number of prescribers, percentage smokers and street trees/km
Alcock I.(9)	crime rate index, education, employment and income
Noordzij J.M.(29)	age, employment, partner status, postsecondary education, retirement status and sex
Putrik P.(30)	age, education, income and sex
Ruijsbroek A.(8)	age, employment status, highest achieved educational level, homeownership, household composition, nationality, neighbourhood socioeconomic status and sex
Reklaitiene R.(31)	age, body mass index, education, marital status, smoking and use of alcohol
White M.P.(32)	age, dog and car ownership, education, employment status, household income, long-term illness/disability, marital status, number of adults and children in household, season of data collection, sex, use of the alternative depression/anxiety medication for medication models only and weekly physical activity
Sarkar C.(33)	age, body mass index, cardiometabolic disease, diabetes, employment status, highest educational qualification, household income, neighbourhood socioeconomic status, sex, social activities, street movement density, terrain and traffic-related air pollution

Outcomes

For the description of the results we divided the outcomes (Table 3) into three subdivisions: the associations between 1) green or blue spaces and physician-diagnosed depressive disorder, 2) green or blue spaces and self-reported depression and 3) green or blue spaces and the use of antidepressants.

Table 3: Table of Outcomes.

Study (first author)	Outcome
Braçe O.(18)	Percentage of people with a view of urban green space: - 90.3%: no case of depression - 5.3% borderline case - 4.4%: depression Percentage of people without a view of urban green space: - 90.9%: no case of depression - 6% borderline case - 3.1%: depression p<0.784
Djeudeu D.(19)	Association between greenness and the risk of depression: **set 1: RR = 0.90 (95%CI 0.85- 0.96)** set 2: RR = 0.94 (95%CI 0.88-1.01) set 3: RR = 0.96 (95%CI 0.91-1.02)

Mears M.(20)	Estimate of negative binomial regression model for rate of depression[a]: - tree density: -0.400 (p=0.228) - garden size: **-1.805 (p<0.001)** - any public greenspace accessibility: **0.973 (p<0.001)** - public greenspace cleanliness: **-0.683 (p=0.020)**
Melis G.(21)	IRR of consumption of antidepressants by men in high (versus low) green and pedestrian areas: - 20-34y: 1.03 (95%CI 0.94-1.13) - 35-49y: 0.99 (95%CI 0.93-1.05) - 50-64y: 0.98 (95%CI 0.92-1.04) IRR of consumption of antidepressants by women in high (versus low) green and pedestrian areas: - 20-34y: 0.97 (95%CI 0.90-1.02) - 35-49y: 0.96 (95%CI 0.91-1.01) - 50-64y: 1.00 (95%CI 0.96-1.08)
Pelgrims I.(22)	Adjusted OR of depressive disorders (95%CI): - veg. coverage 1km buffer: 1.40 (0.92-2.13) - view of green: 1.23 (0.97-1.58) - tree density: 0.99 (0.81-1.23)
Tarkiainen L.(23)	OR of antidepressant use and proportion of green areas: - Finnish cities: **0.97 (95%CI 0.95–0.98)** - Stockholm: 0.99 (not significant) - Turin: 0.99 (not significant)
Triguero-Mas M.(24)	Adjusted OR of perceived depression and/or anxiety - and surrounding greenness: **0.81 (95%CI 0.75-0.88)** - and access to green spaces: **0.86 (95%CI 0.76-0.98)** Adjusted OR of intake of antidepressants - and surrounding greenness: **0.80 (95%CI 0.71-0.91)** - and access to green spaces: 0.87 (95%CI 0.72-1.05) Adjusted OR of perceived depression and/or anxiety - and access to blue spaces: 1.13 (95%CI 0.90-1.41) Adjusted OR of intake of antidepressants - and access to blue spaces: 0.84 (95%CI 0.59-1.19) Adjusted OR of perceived depression and/or anxiety in densely populated areas: - and surrounding greenness: 0.88 (95% CI 0.75-1.03) - and access to green spaces: 0.90 (95%CI 0.77-1.06) Adjusted OR of intake of antidepressants in densely populated areas: - and surrounding greenness: 0.91 (95%CI 0.73-1.13) - access to green spaces: 0.96 (95%CI 0.77-1.21)
Helbich M.(25)	Association between greenness (100m concentric buffer) and risk of depression[b]: - SV greenness: 0.146 (95%CI -1.194, 1.486) - OP greenness: -0.331 (95%CI -1.691, 1.030) - LS greenness: 0.977 (95%CI -0.371, 2.325)
Gascon M.(26)	OR of reported history of physician diagnosed depression: - and surrounding greenness (NDVI) 100m: 0.54 (95%CI 0.23-1.24) - and amount of green (land-cover map) 100m: 0.95 (95%CI 0.55-1.63) - and access to major green spaces 300m: **0.18 (95%CI 0.06-0.58)** - and access to blue spaces 300m: 1.28 (95%CI 0.34-4.83) OR of self-reported history of medication with antidepressants: - and surrounding greenness (NDVI) 100m: 1.07 (95%CI 0.81-1.42) - and amount of green (land-cover map): 1.13 (95%CI 0.90-1.43)

	- and access to major green spaces 300m: 0.73 (95%CI 0.39-1.36) - and access to blue spaces 300m: 0.87 (95%CI 0.42-1.80)
Generaal E.(27)	OR of depression and green space: - HELIUS: 0.93 (95%CI 0.81-1.07) - HOORN: 0.91 (95%CI 0.74-1.10) - LASA: **0.79 (95%CI 0.63-0.98)**
Taylor M. S.(28)	Density of street trees and antidepressant prescriptions: -1.38 (95%CI 0.03 - 2.72)
Alcock I.(9)	Association between inverse GHQ and moving to greener urban areas: - one year pre-move: coef = 0.119, p=0.399 - one year post-move: **coef = 0.369, p=0.015** - two years post-move: **coef = 0.378, p=0.016** - three years post-move: **coef = 0.431, p=0.008**
Noordzij J.M.(29)	Relative Risk of depressed affect and the nearest green space: - LASA: 0.99 (95%CI 0.81-1.12) - GLOBE: 1.01 (95%CI 0.94-1.08) - RECORD: 0.97 (95%CI 0.95-1.00) - HAPIEE: 0.98 (95%CI 0.91-1.04) Relative Risk of depressed affect and the amount of green space within 800m: - LASA: 1.01 (95%CI 0.77-1.27) - GLOBE: 0.98 (95%CI 0.91-1.05) - RECORD: 1.01 (95%CI 0.98-1.04) - HAPIEE: 1.01 (95%CI 0.97-1.05)
Putrik P.(30)	OR of self-rated depressive symptoms and the quality and availability of green space: - neighbourhood mean (the mean of scores given by respondents from the same neighbourhood): 0.83 (95%CI 0.62-1.11) - individual perception: **0.92 (95%CI 0.88-0.97)**
Ruijsbroek A.(8)	Multilevel linear regression models of neighbourhood green space on mental health: - Doetinchem: 0.441 (p>0.05) - Barcelona: **1.437 (p<0.05)** - Stoke-on-Trent: 0.655 (p>0.05) - Kaunas: -0.057 (p>0.05)
Reklaitiene R.(31)	OR of men with depressive symptoms who live >300m from the park (compared to men living <300m from the park) - 300-999m distance to the park and park use <4h/week: 0.8 (95%CI 0.56-1.14) - >999m distance to the park and park use <4h/week: 1.36 (95%CI 0.82-2.24) - 300-999m distance to the park and park use >4h/week: 1.06 (95%CI 0.63-1.79) - >999m distance to the park and park use >4h/week: 0.85 (95%CI 0.35-2.07) OR of women with depressive symptoms who live >300m from the park (compared to women living <300m from the park) - 300-999m distance to the park and park use <4h/week: 0.89 (95%CI 0.7-1.13) - >999m distance to the park and park use <4h/week: 0.76 (95%CI 0.52-1.11) - 300-999m distance to the park and park use >4h/week: **1.56 (95%CI 1.09-2.23)** - >999m distance to the park and park use >4h/week: **1.92 (95%CI 1.11-3.3)**
White M.P.(32)	Estimates of antidepressants use and residential exposure within 1000m: - greenspace (Q2 vs Q1): 0.99 (95%CI 0.83-1.19) - greenspace (Q3 vs Q1): 0.85 (95%CI 0.71-1.03)

	- greenspace (Q4 vs Q1): 0.99 (95%CI 0.82-1.19) - inland blue: 0.96 (95%CI 0.83-1.10) - coastal blue: 0.90 (95%CI 0.71-1.15) Likelihood of using depression medication and recreational visit frequency of: - greenspace: **OR = 0.99, p<0.05** - inland blue: OR = 1.01, p>0.05 - coastal blue: OR = 0.99, p>0.05
Sarkar C.(33)	Adjusted OR of major depressive disorder and residential greenness (500 m NDVI): **0.960 (95%CI 0.93-0.99)** OR of major depressive disorder and residential greenness: - Female and urbanicity (high): **0.90 (95%CI 0.84-0.96)** - Male and urbanicity (high): **0.91 (95%CI 0.84-0.98)**

IRR = incidence rate ratios; CI = confidence interval; OR = odds ratio; RR = relative risk; SV = street view; OP = orthophotos; LS = Landsat-8; LASA = Longitudinal Aging Study Amsterdam; HOORN = New Hoorn Study; HELIUS = Healthy Life in an Urban Setting study; GLOBE = Heath and Living Conditions of the Population of Eindhoven and surroundings; RECORD = Residential Environment and CORonary heart Disease; HAPIEE = Health, Alcohol and Psychosocial factors In Eastern Europe; Q = quartile
(a: high values mean a higher risk of depression, b: several other results were available, but the most relevant are listed). Results that were significant at the 95% confidence level are in bold.

Green or blue spaces and physician-diagnosed depression

Two of the included studies investigated the relationship between green space and depression diagnosed by physicians. The first study of Mears M. et al.(20) used GP registry data as a definition for depression. They found that accessibility to public greenspace was associated with higher rates of depression.(20)

The second study that investigated the link between green spaces and physician-diagnosed depression was the study of Gascon M. et al.(26) They reported inverse associations between depression and surrounding greenness (see Table 3). However, most of these associations were not significant. The only reported significant relationship was access to green spaces in a 300 m radius and lower Odds ratio (OR) of self-reported history of a doctor- diagnosed depression (OR=0.18 (95% confidence interval (CI) 0.06-0.58)).(26)

Green or blue spaces and self-reported depression

Twelve of the included studies looked into the association between green spaces and self-reported depression. Eight of these twelve studies did find at least one significant outcome.(8, 9, 19, 24, 27, 30, 31, 33)

The first one is the longitudinal study of Djeudeu D. et al.(19) They explored the effect of greenness on depression by specifically taking into account spatial and temporal variation. Djeudeu D. et al. analyzed three data sets. Dataset two and three adjusted for more covariates than dataset one (see Table 2). By adding more covariates (set 2 and set 3), the association became non-significant.(19).
The second study of Triguero-Mas M. et al.(24) investigated the association between natural outdoor environments (green and blue spaces separately) and depression. They only found significant outcomes for green spaces (surrounding greenness and access to green spaces) and not for blue spaces. In their analyses for highly densely populated areas, they did not find a significant outcome for green spaces.
The study of Generaal E. et al.(27) had a cross-sectional study design. They included data from eight Dutch cohorts. For this review we only focused on three of these eight cohorts; the Healthy Life in an Urban Setting study (HELIUS) cohort, The New Hoorn Study (HOORN), and The Longitudinal Aging Study Amsterdam (LASA), because only these participants lived in a city. Only for the LASA cohort a significant relationship between depression and green space (LASA, OR = 0.79 (95%CI 0.63-0.98)) was seen.(27) Putrik P. et al. researched also the relation between green spaces and depression in a Dutch city. They found an OR of 0.83 (95%CI 0.62-1.11) for depressive symptoms for neighbourhood mean (the mean scores given by respondents from the same neighbourhood). They also looked at individual perception in the neighbourhood and found an OR of 0.92 (95%CI 0.88-0.97).(30).
Furthermore, Ruijsbroek A. et al.(8) investigated the correlation of neighbourhood social environment and green spaces and mental health in four European cities (Doetinchem, Barcelona, Stoke-on-Trent and Kaunas). They only found a significant relationship for green spaces and mental health in Barcelona.(8) Sarkar C. et al.(33), found lower odds of major depressive disorder after adjusting for covariates (adjusted OR 0.960, 95%CI 0.93-0.99) in the United Kingdom. They also found lower OR's for areas with a high degree of urbanicity.
In addition, Alcock I. et al.(9) investigated people who lived in a town and then moved to more or less urban green space. They found that moving to greener urban areas was associated with better mental health.(9)
Moreover, Reklaitiene R. et al.(31) researched the association between residential green space proximity, use of green space (parks) and depressive symptoms. They only found a significant association in women who went to the park >4h/week and the distance to the park >300m (OR 1.56 (95%CI 1.09-2.23). (31)

Four of the twelve studies could not find any significant results.(18, 22, 25, 29)

Green or blue spaces and antidepressants

The use of antidepressants as an outcome was examined in six of our included studies. Three of these six studies did find at least one significant outcome.(23, 24, 32)

Tarkiainen L. et al. investigated the association between antidepressant use and neighbourhood characteristics.(23) Only in the Finnish cities, a higher proportion of green areas was significantly associated with lower odds of antidepressant use (OR = 0.97 (95%CI 0.95–0.98)).(23)
The study of Triguero-Mas M. et al.(24) found that the OR of intake of antidepressants and surrounding greenness was significant (OR = 0.80 (95%CI 0.71-0.91)). They did not make an analysis for antidepressants and highly densely populated areas. There was no significant OR of intake of antidepressant drugs and access to green or blue spaces.(24)
Lastly, White M. P. et al.(32) explored associations between green or blue spaces and mental health by doing surveys in eighteen countries, of which fourteen were European countries. Among others, they investigated the link between antidepressant use and residential exposure of green space, inland blue space or coastal blue space within one kilometer. All the estimates were not significant. However, they did find a barely significant, negative association between the frequency of recreational visits to green space and the likelihood of using depression medication (OR = 0.99, $p<0.05$).(32)

Three of the six studies could not find any significant results.(21, 26, 28)

Quality assessment

For the quality assessment (see Tables 4 and 5), we used the JBI appraisal tools.(16) When we use the criteria for good, fair or poor studies (see Supplementary B), thirteen out of fourteen cross sectional studies are of good quality (93%). Only the study of Putrick P. et al.(30) is a cross sectional study of fair quality (7%). The studies of Djeudeu D. et al.(19) and Tarkiainen L. et al.(23) are the cohort studies of good quality (50%) and the studies of Melis G. et al.(21) and Alcock I. et al.(9) are of fair quality (50%). None of the included studies were of low quality.

Table 4: Assessment of quality: cross sectional studies.

Study (first author)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	overall quality rating
Braçe O.(18)	Yes	Yes	No	Yes	Yes	Yes	No	Yes	**good**
Mears M.(20)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**good**
Pelgrims I.(22)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	**good**
Triguero-Mas M.(24)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	**good**
Helbich M.(25)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	**good**
Gascon M.(26)	Yes	Yes	Yes	No	Yes	Yes	No	Yes	**good**

Generaal E.(27)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	**good**
Taylor M. S.(28)	Yes	No	No	Yes	Yes	Yes	Yes	Yes	**good**
Noordzij J.M.(29)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	**good**
Putrik P.(30)	Yes	Yes	Unclear	Unclear	Yes	Yes	No	Yes	**fair**
Ruijsbroek A.(8)	Yes	Yes	No	Yes	Yes	Yes	No	Yes	**good**
Reklaitiene R.(31)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	**good**
White M.P.(32)	Yes	No	Yes	Yes	Yes	Yes	No	Yes	**good**
Sarkar C.(33)	Yes	Yes	Yes	No	Yes	Yes	No	Yes	**good**

Q = question. We used the JBI critical appraisal tools (see Supplementary B).(16)

Table 5: Assessment of quality: cohort studies

Study (first author)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	overall quality rating
Djeudeu D.(19)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	**good**
Melis G.(21)	Yes	Yes	No	Yes	Yes	Unclear	No	No	Unclear	Unclear	Yes	**fair**
Tarkiainen L.(23)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	No	Unclear	Yes	**good**
Alcock I.(9)	Yes	No	Yes	Yes	Yes	Unclear	No	Yes	Unclear	No	Yes	**fair**

Q = question. We used the JBI critical appraisal tools (see Supplementary B).(16)

Some studies, like Taylor M.S. et al.(28) and White M. P. et al.(32) did not give detailed information about their study population. The study of Putrik P. et al.(30) did not give any description of green space (exposure). In the study of Alcock I. et al.(9) the exposure was different because some people moved to greener areas and others to less green areas. Some studies are at higher risk for confounding because they have limited information about their covariates.(9, 18, 27, 30)

Discussion

In this systematic review, we focused on the relationship between green and blue spaces and depression. Many previous (systematic) reviews focused on mental health, depressive feelings or anxiety.(34-37) To our knowledge, this is the first systematic review which focuses on green/blue spaces and depression in Europe.

We evaluated the current evidence on the impact of green and blue spaces on depression. We found limited evidence that residential greenness is a protective factor for depression. Only a few studies showed significant results.(8, 9, 19, 20, 23, 24, 26, 27, 31-33) The outcomes were highly variable, making it difficult to draw clear conclusions. None of the included studies could find a significant relationship between blue spaces and depression.(24, 26, 32)

Previously published systematic reviews on green and blue spaces and mental health also showed varying results.(38, 39) In general, a slight trend to better mental health with more surrounding greenness was seen.(38) Some included studies in this review also showed a small decrease of depression with more (availability of) green space.
Only one of our included studies found unexpected results of higher rates of depression with more accessibility to public green spaces.(20) This study was conducted in Sheffield: an English town with industrial work sites nearby. Because of unsanitary housing conditions and high levels of air pollutions, urban parks were opened as a public health measure. This was done to potentially improve the public health of the working class living in the town. (20, 40) In spite of these parks, the living conditions were among the worst in these same areas. This can explain their higher rates of depression. The authors also found that people with low accessibility to public green spaces showed a small decrease in risk of depression. Those people lived in more rural areas, so they did not have access to public green spaces and were only surrounded by limited greenness. This could explain why the rural areas were not included in their definition of public green spaces. (20, 33, 41) So although they were not included, it is possible that this limited surrounding greenness had more effect on their mental health than the nearby public green spaces.

Traditionally, the association between green spaces and depression can be explained by various hypotheses. First, more traffic, air pollution and noise causes more stress and leads to impaired mental health.(22) Air pollution exposure may lead to oxidative stress, neuro-inflammation and neurodegenerative pathology.(22, 42) Additionally, an increase in air pollution attributed to traffic volume is associated with several mental disorders.(22, 43-49) Living in greener areas is associated with lower levels of air pollution and lower levels of noise, potentially leading to an improvement in mental health.(43, 50)
Second, (access to) green space can contribute to more physical activity which is protective against depression.(51) Third, urban greenness can be a place for social contacts, which leads to more connectedness. More social activities lower the risk of depression.(51) Finally, exposure to urban green space can reduce stress levels, as natural environments can be a resource for psychological restoration.(50) This restoration may also contribute to stress reduction and increase positive emotions.(52)
Socioeconomic factors can also contribute to the relationship between green spaces and depression.(32, 53) Poor people are at higher risk to develop depression. They have more financial problems, live in more unsanitary conditions and are generally in poorer health.(54, 55) In Europe, houses with a green view, big garden or close to residential greenness are typically more desirable and expensive.(56) Here, the poor are in disadvantage.(32, 53)

Furthermore, there is no standard definition for exposure to green space and for depression.(38) As mentioned above, exposure to green space and depression was defined in multiple ways. Some of the concepts for the definition of green space can overlap and

there is no consensus definition.(38) Many of our studies use the NDVI as an objective measure, which makes it easier to compare the findings of these studies. The *amount* of greenness is more difficult to compare, as criteria can differ between different studies.(38) The cut-offs for the distance to green space also differ between studies. Most studies use a 100 m or 300 m concentric buffer. This cut-off is chosen because 300-400 m is the threshold after which the use of green spaces diminishes quickly.(57) Additionally, the frequency of green space use should be investigated more because frequent recreational visits of greenness can lower the risk of depression.(31, 32) Most of our studies were not able to obtain information on this topic.(8, 9, 18-30, 33) This can be a reason why some of them did not find significant results.

The definition for depression was also highly variable. As mentioned in the Results section, we divided the definition for depression into three groups: 1) self-reported-depression, 2) physician-diagnosed depression and 3) use of antidepressants. Just two of our included studies used physician-diagnosed depression as their definition.(20, 26) A lot of studies used self-reported depression as their outcome measure. (8, 9, 18, 19, 22, 24, 25, 27, 29-31, 33) There were a lot of different questionnaires and surveys used between the different studies for the diagnosis of self-reported depression.
Moreover, questionnaires tend to be snapshots, potentially capturing only a limited period in a respondent's life. The difference in self-reporting of depression is the potential reason why they found a gender difference in the study of Reklaitiene R. et al.(31)
The third definition for depression in our systematic review was the use of antidepressants. (21, 23, 24, 26, 28, 32) This is the most difficult one, as antidepressants like SSRI's are also used to treat anxiety. Furthermore, some people with depression do not take medication but are treated with psychotherapy. Different studies did not take this into account.

The main strength of our systematic review is that this is the first systematic review that focused on the association between green and blue spaces and depression that we are aware of. Other strengths are the large study samples and multiple locations in Europe. We included studies with a clear description of the study objectives and appropriate statistical analysis.
The heterogeneity of the aforementioned definitions, makes them difficult to compare and is the main limitation of this review. Due to the heterogeneity of the study outcomes, we did not perform a meta-analysis. To make the results more comparable, we made subdivisions for the different definitions of depression.
Further, there is a possibility of misclassification in a lot of studies by erroneous self-diagnosis of depression.(8, 9, 18, 19, 22, 24, 25, 27, 29-31, 33) In these studies there is also a high risk for recall bias as they used questionnaires and surveys for the diagnosis of depression. Furthermore, some studies used antidepressant prescriptions as a definition for depression.(21, 23, 24, 26, 28, 32) This can also result in misclassification bias as antidepressants like selective serotonin reuptake inhibitors (SSRIs) can also be used for anxiety. Some studies also did not describe the reasons for drop-out.(9, 19, 21, 23)

Conclusion

Our systematic review showed that more accessibility to residential greenness might lower the risk of depression and antidepressant use. However, the evidence is limited and very heterogeneous. Despite the limited evidence, it can still be useful for public health professionals in developing strategies to promote mental health in ever-growing urban areas. None of our included articles could find a significant association between (the access to) blue spaces and depression. More research is needed with standardized definitions.

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Supplementary

Supplementary A

1. **Pubmed** *(searched on 8 February 2022)*
   - Concept 1: ‘green/blue space’: "Parks, Recreational"[Mesh] OR "Forests"[Mesh] OR “grassland”[Mesh] OR "Fresh Water"[Mesh] OR "Natural Resources"[Mesh] OR "Wilderness"[Mesh] OR "Saline Waters"[Mesh] OR "Gardens"[Mesh] OR "Oceans and Seas"[Mesh] OR “Natural Resource*”[tiab] OR “Wilderness*”[tiab] OR “Saline Water*”[tiab] OR “salt water*”[tiab] OR “fresh water*”[tiab] OR “freshwater*”[tiab] OR Garden*[tiab] OR Forest*[tiab] OR lake*[tiab] OR pond*[tiab] OR “river*”[tiab] OR “green*”[tiab] OR “park”[tiab] OR “parks”[tiab] OR woodland*[tiab] OR “blue space*”[tiab] OR "blue site*"[tiab] OR “wild land*”[tiab] OR “wild space*”[tiab] OR “wild area*”[tiab] OR “natural environment*”[tiab] OR “natural land*”[tiab] OR “natural area*”[tiab] OR “natural space*”[tiab] OR “nature”[tiab] OR “recreation resource*”[tiab] OR “urban land*”[tiab] OR “urban park”[tiab] OR “vegetation*”[tiab] OR “grassland*”[tiab] OR “stream*”[tiab] OR “land suppl*”[tiab] OR “water resource*”[tiab] OR “sea”[tiab] OR “beach*”[tiab] OR “brackish water*”[tiab] OR “ocean*”[tiab] OR “community park*”[tiab] OR “bay*”[tiab] OR “coastal plain*”[tiab] OR “landscap*”[tiab] OR “natural spring*” [tiab] OR “thermal spring*”[tiab] OR “hot spring*”[tiab] OR “volcano*”[tiab] OR “briny water*”[tiab] OR “estuarine water*”[tiab] OR “estuary water*”[tiab] OR “land cover*”[tiab] OR “hydrosphere*”[tiab]
   - Concept 2: ‘depression’: "Depression"[Mesh] OR "Depressive Disorder"[Mesh] OR "Mental Health"[Mesh] OR Depressi*[tiab] OR "Mental Health"[tiab] OR “Dysthymic Disorder*”[tiab] OR “emotional wellbeing*”[tiab] OR “emotional well-being*”[tiab] OR “psychosocial stress*”[tiab] OR “mental stress*” [tiab] OR “mood disorder*”[tiab] OR “psychological wellbeing*”[tiab] OR “psychological well-being*”[tiab] OR “mental disorder*”[tiab] OR “mood disorder*”[tiab] OR “mental hygiene*”[tiab] OR “mental wellbeing*”[tiab] OR “mental well-being*”[tiab] OR “psychosocial wellbeing*”[tiab] OR “psychosocial well-being*”[tiab] OR “dysthymia*”[tiab] OR “dysphoria*”[tiab] OR “melanchol*”[tiab] OR “affective disorder*”[tiab]
   - Concept 3: ‘city’: "Cities"[Mesh] OR "Urban Population"[Mesh] OR "Built Environment"[Mesh] OR “urbanization”[Mesh] OR Cities[tiab] OR “city*”[tiab] OR “built environment*”[tiab] OR town*[tiab] OR urban*[tiab] OR “municipal*”[tiab] OR “built-up area*”[tiab] OR brussels[tiab] OR paris[tiab] OR London[tiab] OR madrid[tiab] OR berlin[tiab] OR rome[tiab] OR bucharest[tiab] OR Kyiv[tiab] OR kiev[tiab] OR vienna[tiab] OR minsk[tiab] OR hamburg[tiab] OR warsaw[tiab] OR budapest[tiab] OR barcelona[tiab] OR munich[tiab] OR milan[tiab] OR prague[tiab] OR sofia[tiab] OR birmingham[tiab] OR oslo[tiab] OR helsinki[tiab] OR rotterdam[tiab] OR amsterdam[tiab] OR stockholm[tiab] OR copenhagen[tiab] OR zagreb[tiab] OR athens[tiab] OR dublin[tiab] OR riga[tiab] OR Luxembourg[tiab] OR leuven[tiab] OR lisbon[tiab] OR ljubljana[tiab] OR bern[tiab]

2. **Embase** *(searched on 8 February 2022)*
   - Concept 1: ‘green/blue space’: ‘recreational park’/exp OR ‘park’/exp OR ‘park’:ti,ab,kw OR ‘parks’:ti,ab,kw OR ‘forest’/exp OR ‘forestland’/exp OR ‘forest*’:ti,ab,kw OR ‘woodland*’:ti,ab,kw OR ‘grassland’/exp OR ‘grassland*’:ti,ab,kw OR ‘fresh water’/exp OR ‘fresh water*’:ti,ab,kw OR ‘freshwater*’:ti,ab,kw OR ‘natural resource’/exp OR ‘natural resource*’:ti,ab,kw OR ‘bay’/exp OR ‘bay*’:ti,ab,kw OR ‘coastal plain’/exp OR ‘coastal plain*’:ti,ab,kw OR ‘hydrosphere’/exp OR ‘hydrosphere*’:ti,ab,kw OR ‘river’/exp OR ‘river*’:ti,ab,kw OR ‘stream (river)’/exp OR ‘stream*’:ti,ab,kw OR ‘landscape’/exp OR ‘landscaping’/exp OR ‘landscap*’:ti,ab,kw OR ‘natural spring’/exp OR ‘natural spring*’:ti,ab,kw OR ‘ocean*’:ti,ab,kw OR ‘pond’/exp OR ‘pond*’:ti,ab,kw OR ‘sea’/exp OR ‘sea’:ti,ab,kw OR ‘beach’:ti,ab,kw OR ‘thermal spring’/exp OR ‘thermal spring*’:ti,ab,kw OR ‘hot spring*’:ti,ab,kw OR ‘vegetation’/exp OR ‘vegetation*’:ti,ab,kw OR ‘volcano’/exp OR ‘volcano*’:ti,ab,kw OR ‘wilderness’/exp OR ‘wilderness’:ti,ab,kw OR ‘brackish water’/exp OR ‘brackish water*’:ti,ab,kw OR ‘briny water*’:ti,ab,kw OR ‘estuarine water*’:ti,ab,kw OR ‘estuary water*’:ti,ab,kw OR ‘salt water’/exp OR ‘salt water*’:ti,ab,kw OR ‘saline water*’:ti,ab,kw OR ‘lake’/exp OR ‘lake*’:ti,ab,kw OR ‘garden’/exp OR ‘garden*’:ti,ab,kw OR ‘land cover*’:ti,ab,kw OR ‘green*’:ti,ab,kw OR ‘blue space*’:ti,ab,kw OR ‘blue site*’:ti,ab,kw OR ‘wild land*’:ti,ab,kw OR ‘wild space*’:ti,ab,kw OR ‘wild area*’:ti,ab,kw OR ‘natural environment’/exp OR ‘natural environment*’:ti,ab,kw OR ‘natural land*’:ti,ab,kw OR ‘natural area*’:ti,ab,kw OR ‘natural space*’:ti,ab,kw OR ‘nature’:ti,ab,kw OR ‘recreation resource*’:ti,ab,kw OR ‘land suppl*’:ti,ab,kw OR ‘water resource*’:ti,ab,kw OR ‘urban park*’:ti,ab,kw
   - Concept 2: ‘depression’: ‘adolescent depression’/exp OR ‘agitated depression’/exp OR ‘atypical depression’/exp OR ‘chronic depression’/exp OR ‘dysphoria’/exp OR ‘dysthymia’/exp OR ‘involutional depression’/exp OR ‘major depression’/exp OR ‘masked depression’/exp OR

'melancholia'/exp OR 'minor depression'/exp OR 'mixed anxiety and depression'/exp OR 'organic depression'/exp OR 'reactive depression'/exp OR 'recurrent brief depression'/exp OR 'seasonal affective disorder'/exp OR 'subsyndromal depression'/exp OR 'treatment resistant depression'/exp OR 'mental health'/exp OR 'emotional well-being'/exp OR 'mental stress'/exp OR 'major affective disorder'/exp OR 'minor affective disorder'/exp OR 'psychological well-being'/exp OR 'mental hygiene'/exp OR 'depressi*':ti,ab,kw OR 'dysphoria*':ti,ab,kw OR 'dysthymia*':ti,ab,kw OR 'melanchol*':ti,ab,kw OR 'mental stress*':ti,ab,kw OR 'affective disorder*':ti,ab,kw OR 'mental health':ti,ab,kw OR 'dysthymic disorder*':ti,ab,kw OR 'emotional wellbeing*':ti,ab,kw OR 'emotional well-being*':ti,ab,kw OR 'psychosocial stress*':ti,ab,kw OR 'mood disorder*':ti,ab,kw OR 'psychological wellbeing*':ti,ab,kw OR 'psychological well-being*':ti,ab,kw OR 'mental disorder*':ti,ab,kw OR 'mental hygiene*':ti,ab,kw OR 'mental wellbeing*':ti,ab,kw OR 'mental well-being*':ti,ab,kw OR 'psychosocial wellbeing*':ti,ab,kw OR 'psychosocial well-being*':ti,ab,kw

- Concept 3: 'city': 'city'/exp OR 'city':ti,ab,kw OR 'cities':ti,ab,kw OR 'Brussels Capital Region'/exp OR 'brussels':ti,ab,kw OR 'built environment'/exp OR 'built environment':ti,ab,kw OR 'urban population'/exp OR 'urban*':ti,ab,kw OR 'urbanization'/exp OR 'city*':ti,ab,kw OR 'urban area*'/exp OR 'built-up area*':ti,ab,kw OR 'town*':ti,ab,kw OR 'municipal*':ti,ab,kw OR 'paris':ti,ab,kw OR 'London':ti,ab,kw OR 'madrid':ti,ab,kw OR 'berlin':ti,ab,kw OR 'rome':ti,ab,kw OR 'bucharest':ti,ab,kw OR 'Kyiv':ti,ab,kw OR 'kiev':ti,ab,kw OR 'vienna':ti,ab,kw OR 'minsk':ti,ab,kw OR 'hamburg':ti,ab,kw OR 'warsaw':ti,ab,kw OR 'Budapest':ti,ab,kw OR 'Barcelona':ti,ab,kw OR 'munich':ti,ab,kw OR 'milan':ti,ab,kw OR 'prague':ti,ab,kw OR 'sofia':ti,ab,kw OR 'Birmingham':ti,ab,kw OR 'oslo':ti,ab,kw OR 'Helsinki':ti,ab,kw OR 'Rotterdam':ti,ab,kw OR 'Amsterdam':ti,ab,kw OR 'Stockholm':ti,ab,kw OR 'Copenhagen':ti,ab,kw OR 'Zagreb':ti,ab,kw OR 'Athens':ti,ab,kw OR 'Dublin':ti,ab,kw OR 'riga':ti,ab,kw OR 'Luxembourg':ti,ab,kw OR 'leuven':ti,ab,kw OR 'Lisbon':ti,ab,kw OR 'Ljubljana':ti,ab,kw OR 'bern':ti,ab,kw

3. **Web of Science: Core collection** *(searched on 8 February 2022)*

- Concept 1: 'green/blue space': TS=("Natural Resource*" OR "Wilderness*" OR "Saline Water*" OR "salt water*" OR "fresh water*" OR "freshwater*" OR Garden* OR Forest* OR lake* OR pond* OR "river*" OR "green*" OR "park" OR "parks" OR woodland* OR "blue space*" OR "blue site*" OR "wild land*" OR "wild space*" OR "wild area*" OR "natural environment*" OR "natural land*" OR "natural area*" OR "natural space*" OR "nature" OR "recreation resource*" OR "urban land*" OR "urban park" OR "vegetation*" OR "grassland*" OR "stream*" OR "land suppl*" OR "water resource*" OR "sea" OR "beach*" OR "brackish water*" OR "ocean*" OR "community park*" OR "bay*" OR "coastal plain*" OR "landscap*" OR "natural spring*" OR "thermal spring*" OR "hot spring*" OR "volcano*" OR "briny water*" OR "estuarine water*" OR "estuary water*" OR "land cover*" OR "hydrosphere*")
- concept 2: 'depression': TS=(Depressi* OR "Mental Health" OR "Dysthymic Disorder*" OR "emotional wellbeing*" OR "emotional well-being*" OR"psychosocial stress*" OR "mental stress*" OR "mood disorder*" OR "psychological wellbeing*" OR "psychological well-being*" OR "mental disorder*" OR "mood disorder*" OR "mental hygiene*" OR "mental wellbeing*" OR "mental well-being*" OR "psychosocial wellbeing*" OR "psychosocial well-being*" OR "dysthymia*" OR "dysphoria*" OR "melanchol*" OR "affective disorder*")
- Concept 3: 'city': TS=(Cities OR "city*" OR "built environment*" OR town* OR urban* OR "municipal*" OR "built-up area*" OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern)

4. **Web of Science: Biosis** *(searched on 8 February 2022)*

- Concept 1: 'green/blue space': TI=("Natural Resource*" OR "Wilderness*" OR "Saline Water*" OR "salt water*" OR "fresh water*" OR "freshwater*" OR Garden* OR Forest* OR lake* OR pond* OR "river*" OR "green*" OR "park" OR "parks" OR woodland* OR "blue space*" OR "blue site*" OR "wild land*" OR "wild space*" OR "wild area*" OR "natural environment*" OR "natural land*" OR "natural area*" OR "natural space*" OR "nature" OR "recreation resource*" OR "urban land*" OR "urban park" OR "vegetation*" OR "grassland*" OR "stream*" OR "land suppl*" OR "water resource*" OR "sea" OR "beach*" OR "brackish water*" OR "ocean*" OR "community park*" OR "bay*" OR "coastal plain*" OR "landscap*" OR "natural spring*" OR "thermal spring*" OR "hot spring*" OR "volcano*" OR "briny water*" OR "estuarine water*" OR "estuary water*" OR "land cover*" OR "hydrosphere*") OR AB=("Natural Resource*" OR "Wilderness*" OR "Saline Water*" OR "salt water*" OR "fresh water*" OR "freshwater*" OR Garden* OR Forest* OR lake* OR pond* OR "river*" OR "green*" OR "park" OR "parks" OR woodland* OR "blue space*" OR "blue site*" OR "wild land*" OR "wild space*" OR "wild area*" OR "natural environment*" OR "natural land*" OR "natural area*" OR "natural space*" OR

"nature" OR "recreation resource*" OR "urban land*" OR "urban park" OR "vegetation*" OR "grassland*" OR "stream*" OR "land suppl*" OR "water resource*" OR "sea" OR "beach*" OR "brackish water*" OR "ocean*" OR "community park*" OR "bay*" OR "coastal plain*" OR "landscap*" OR "natural spring*" OR "thermal spring*" OR "hot spring*" OR "volcano*" OR "briny water*" OR "estuarine water*" OR "estuary water*" OR "land cover*" OR "hydrosphere*")

- Concept 2: 'depression': TI=(Depressi* OR "Mental Health" OR "Dysthymic Disorder*" OR "emotional wellbeing*" OR "emotional well-being*" OR "psychosocial stress*" OR "mental stress*" OR "mood disorder*" OR "psychological wellbeing*" OR "psychological well-being*" OR "mental disorder*" OR "mood disorder*" OR "mental hygiene*" OR "mental wellbeing*" OR "mental well-being*" OR "psychosocial wellbeing*" OR "psychosocial well-being*" OR "dysthymia*" OR "dysphoria*" OR "melanchol*" OR "affective disorder*") OR AB=(Depressi* OR "Mental Health" OR "Dysthymic Disorder*" OR "emotional wellbeing*" OR "emotional well-being*" OR "psychosocial stress*" OR "mental stress*" OR "mood disorder*" OR "psychological wellbeing*" OR "psychological well-being*" OR "mental disorder*" OR "mood disorder*" OR "mental hygiene*" OR "mental wellbeing*" OR "mental well-being*" OR "psychosocial wellbeing*" OR "psychosocial well-being*" OR "dysthymia*" OR "dysphoria*" OR "melanchol*" OR "affective disorder*")
- Concept 3: 'city': TI=(Cities OR "city*" OR "built environment*" OR town* OR urban* OR "municipal*" OR "built-up area*" OR brussels OR paris OR London OR madrid OR berlin OR rome OR Bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern) OR AB=(Cities OR "city*" OR "built environment*" OR town* OR urban* OR "municipal*" OR "built-up area*" OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern)

5. **Scopus** *(searched on 8 February 2022)*

- Concept 1: 'green/blue space': TITLE-ABS("Natural Resource*" OR "Wilderness*" OR "Saline Water*" OR "salt water*" OR "fresh water*" OR "freshwater*" OR Garden* OR Forest* OR lake* OR pond* OR "river*" OR "green*" OR "park" OR "parks" OR woodland* OR "blue space*" OR "blue site*" OR "wild land*" OR "wild space*" OR "wild area*" OR "natural environment*" OR "natural land*" OR "natural area*" OR "natural space*" OR "nature" OR "recreation resource*" OR "urban land*" OR "urban park" OR "vegetation*" OR "grassland*" OR "stream*" OR "land suppl*" OR "water resource*" OR "sea" OR "beach*" OR "brackish water*" OR "ocean*" OR "community park*" OR "bay*" OR "coastal plain*" OR "landscap*" OR "natural spring*" OR "thermal spring*" OR "hot spring*" OR "volcano*" OR "briny water*" OR "estuarine water*" OR "estuary water*" OR "land cover*" OR "hydrosphere*") OR AUTHKEY("Natural Resource*" OR "Wilderness*" OR "Saline Water*" OR "salt water*" OR "fresh water*" OR "freshwater*" OR Garden* OR Forest* OR lake* OR pond* OR "river*" OR "green*" OR "park" OR "parks" OR woodland* OR "blue space*" OR "blue site*" OR "wild land*" OR "wild space*" OR "wild area*" OR "natural environment*" OR "natural land*" OR "natural area*" OR "natural space*" OR "nature" OR "recreation resource*" OR "urban land*" OR "urban park" OR "vegetation*" OR "grassland*" OR "stream*" OR "land suppl*" OR "water resource*" OR "sea" OR "beach*" OR "brackish water*" OR "ocean*" OR "community park*" OR "bay*" OR "coastal plain*" OR "landscap*" OR "natural spring*" OR "thermal spring*" OR "hot spring*" OR "volcano*" OR "briny water*" OR "estuarine water*" OR "estuary water*" OR "land cover*" OR "hydrosphere*")

- Concept 2: 'depression': TITLE-ABS(Depressi* OR "Mental Health" OR "Dysthymic Disorder*" OR "emotional wellbeing*" OR "emotional well-being*" OR "psychosocial stress*" OR "mental stress*" OR "mood disorder*" OR "psychological wellbeing*" OR "psychological well-being*" OR "mental disorder*" OR "mood disorder*" OR "mental hygiene*" OR "mental wellbeing*" OR "mental well-being*" OR "psychosocial wellbeing*" OR "psychosocial well-being*" OR "dysthymia*" OR "dysphoria*" OR "melanchol*" OR "affective disorder*") OR AUTHKEY(Depressi* OR "Mental Health" OR "Dysthymic Disorder*" OR "emotional wellbeing*" OR "emotional well-being*" OR "psychosocial stress*" OR "mental stress*" OR "mood disorder*" OR "psychological wellbeing*" OR "psychological well-being*" OR "mental disorder*" OR "mood disorder*" OR "mental hygiene*" OR "mental wellbeing*" OR "mental well-being*" OR "psychosocial wellbeing*" OR "psychosocial well-being*" OR "dysthymia*" OR "dysphoria*" OR "melanchol" OR "affective disorder*")

- Concept 3: 'city': TITLE-ABS(Cities OR "city*" OR "built environment*" OR town* OR urban* OR "municipal*" OR "built-up area*" OR brussels OR paris OR London OR madrid OR berlin

OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern) OR AUTHKEY(Cities OR "city*" OR "built environment*" OR town* OR urban* OR "municipal*" OR "built-up area*" OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern)

6. **CINAHL through EBSCO** *(searched on 8 February 2022)*

- Concept 1: 'green/blue space': (MH "Natural Environment") OR (MH "Oceans and Seas") OR (MH "Conservation of Natural Resources") OR TI("Natural Resource*" OR "Wilderness*" OR "Saline Water*" OR "salt water*" OR "fresh water*" OR "freshwater*" OR Garden* OR Forest* OR lake* OR pond* OR "river*" OR "green*" OR "park" OR "parks" OR woodland* OR "blue space*" OR "blue site*" OR "wild land*" OR "wild space*" OR "wild area*" OR "natural environment*" OR "natural land*" OR "natural area*" OR "natural space*" OR "nature" OR "recreation resource*" OR "urban land*" OR "urban park" OR "vegetation*" OR "grassland*" OR "stream*" OR "land suppl*" OR "water resource*" OR "sea" OR "beach*" OR "brackish water*" OR "ocean*" OR "community park*" OR "bay*" OR "coastal plain*" OR "landscap*" OR "natural spring*" OR "thermal spring*" OR "hot spring*" OR "volcano*" OR "briny water*" OR "estuarine water*" OR "estuary water*" OR "land cover*" OR "hydrosphere*") OR AB("Natural Resource*" OR "Wilderness*" OR "Saline Water*" OR "salt water*" OR "fresh water*" OR "freshwater*" OR Garden* OR Forest* OR lake* OR pond* OR "river*" OR "green*" OR "park" OR "parks" OR woodland* OR "blue space*" OR "blue site*" OR "wild land*" OR "wild space*" OR "wild area*" OR "natural environment*" OR "natural land*" OR "natural area*" OR "natural space*" OR "nature" OR "recreation resource*" OR "urban land*" OR "urban park" OR "vegetation*" OR "grassland*" OR "stream*" OR "land suppl*" OR "water resource*" OR "sea" OR "beach*" OR "brackish water*" OR "ocean*" OR "community park*" OR "bay*" OR "coastal plain*" OR "landscap*" OR "natural spring*" OR "thermal spring*" OR "hot spring*" OR "volcano*" OR "briny water*" OR "estuarine water*" OR "estuary water*" OR "land cover*" OR "hydrosphere*")

- Concept 2: 'depression': (MH "Depression+") OR (MH "Mental Health") OR (MH "Emotional Lability") OR (MH "Anhedonia") OR (MH "Affective Disorders") OR (MH "Psychological Well-Being") OR TI(Depressi* OR "Mental Health" OR "Dysthymic Disorder*" OR "emotional wellbeing*" OR "emotional well-being*" OR "psychosocial stress*" OR "mental stress*" OR "mood disorder*" OR "psychological wellbeing*" OR "psychological well-being*" OR "mental disorder*" OR "mood disorder*" OR "mental hygiene*" OR "mental wellbeing*" OR "mental well-being*" OR "psychosocial wellbeing*" OR "psychosocial well-being*" OR "dysthymia*" OR "dysphoria*" OR "melanchol*" OR "affective disorder*") OR AB(Depressi* OR "Mental Health" OR "Dysthymic Disorder*" OR "emotional wellbeing*" OR "emotional well-being*" OR "psychosocial stress*" OR "mental stress*" OR "mood disorder*" OR "psychological wellbeing*" OR "psychological well-being*" OR "mental disorder*" OR "mood disorder*" OR "mental hygiene*" OR "mental wellbeing*" OR "mental well-being*" OR "psychosocial wellbeing*" OR "psychosocial well-being*" OR "dysthymia*" OR "dysphoria*" OR "melanchol*" OR "affective disorder*")

- Concept 3: 'city': (MH "Urban Areas") OR (MH "Urban Population") OR (MH "Built Environment") OR (MH "Urbanization") OR TI(Cities OR "city*" OR "built environment*" OR town* OR urban* OR "municipal*" OR "built-up area*" OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern) OR AB(Cities OR "city*" OR "built environment*" OR town* OR urban* OR "municipal*" OR "built-up area*" OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern)

7. **Greenfile through EBSCO** *(searched on 8 February 2022)*

- Concept 1: ‘green/blue space’: DE “LANDSCAPES” OR DE "RECREATIONAL use of forest reserves" OR DE "GRASSLANDS" OR DE "FORESTS & forestry" OR DE "LAND resource" OR DE "WILDERNESS areas" OR DE "NATIONAL parks & reserves" OR DE "NATURE reserves" OR DE "PROTECTED areas" OR DE "WILD & scenic rivers" OR DE "GREENBELTS" OR DE "GARDEN cities" OR DE "GREENWAYS" OR DE "OCEAN" OR TI(“Natural Resource*” OR “Wilderness*” OR “Saline Water*” OR “salt water*” OR “fresh water*” OR “freshwater*” OR Garden* OR Forest* OR lake* OR pond* OR “river*” OR “green*” OR “park” OR “parks” OR woodland* OR “blue space*” OR "blue site*" OR “wild land*” OR “wild space*” OR “wild area*” OR “natural environment*” OR “natural land*” OR “natural area*” OR “natural space*” OR “nature” OR “recreation resource*” OR “urban land*” OR “urban park” OR “vegetation*” OR “grassland*” OR “stream*” OR “land suppl*” OR “water resource*” OR “sea” OR “beach*” OR “brackish water*” OR “ocean*” OR “community park*” OR “bay*” OR “coastal plain*” OR “landscap*” OR “natural spring*” OR “thermal spring*” OR “hot spring*” OR “volcano*” OR “briny water*” OR “estuarine water*” OR “estuary water*” OR “land cover*” OR “hydrosphere*”) OR AB(“Natural Resource*” OR “Wilderness*” OR “Saline Water*” OR “salt water*” OR “fresh water*” OR “freshwater*” OR Garden* OR Forest* OR lake* OR pond* OR “river*” OR “green*” OR “park” OR “parks” OR woodland* OR “blue space*” OR "blue site*" OR “wild land*” OR “wild space*” OR “wild area*” OR “natural environment*” OR “natural land*” OR “natural area*” OR “natural space*” OR “nature” OR “recreation resource*” OR “urban land*” OR “urban park” OR “vegetation*” OR “grassland*” OR “stream*” OR “land suppl*” OR “water resource*” OR “sea” OR “beach*” OR “brackish water*” OR “ocean*” OR “community park*” OR “bay*” OR “coastal plain*” OR “landscap*” OR “natural spring*” OR “thermal spring*” OR “hot spring*” OR “volcano*” OR “briny water*” OR “estuarine water*” OR “estuary water*” OR “land cover*” OR “hydrosphere*”) OR KW(“Natural Resource*” OR “Wilderness*” OR “Saline Water*” OR “salt water*” OR “fresh water*” OR “freshwater*” OR Garden* OR Forest* OR lake* OR pond* OR “river*” OR “green*” OR “park” OR “parks” OR woodland* OR “blue space*” OR "blue site*" OR “wild land*” OR “wild space*” OR “wild area*” OR “natural environment*” OR “natural land*” OR “natural area*” OR “natural space*” OR “nature” OR “recreation resource*” OR “urban land*” OR “urban park” OR “vegetation*” OR “grassland*” OR “stream*” OR “land suppl*” OR “water resource*” OR “sea” OR “beach*” OR “brackish water*” OR “ocean*” OR “community park*” OR “bay*” OR “coastal plain*” OR “landscap*” OR “natural spring*” OR “thermal spring*” OR “hot spring*” OR “volcano*” OR “briny water*” OR “estuarine water*” OR “estuary water*” OR “land cover*” OR “hydrosphere*”)

- Concept 2: ‘depression’: DE "URBAN health" OR DE "ENVIRONMENTAL health" OR DE "PUBLIC health" OR TI(Depressi* OR "Mental Health" OR “Dysthymic Disorder*” OR “emotional wellbeing*” OR “emotional well-being*” OR“psychosocial stress*” OR “mental stress*” OR “mood disorder*” OR “psychological wellbeing*” OR “psychological well-being*” OR “mental disorder*” OR “mood disorder*” OR “mental hygiene*” OR “mental wellbeing*” OR “mental well-being*” OR “psychosocial wellbeing*” OR “psychosocial well-being*” OR “dysthymia*” OR “dysphoria*” OR “melancholˑ” OR “affective disorder*”) OR AB(Depressi* OR "Mental Health" OR “Dysthymic Disorder*” OR “emotional wellbeing*” OR “emotional well-being*” OR“psychosocial stress*” OR “mental stress*” OR “mood disorder*” OR “psychological wellbeing*” OR “psychological well-being*” OR “mental disorder*” OR “mood disorder*” OR “mental hygiene*” OR “mental wellbeing*” OR “mental well-being*” OR “psychosocial wellbeing*” OR “psychosocial well-being*” OR “dysthymia*” OR “dysphoria*” OR “melancholˑ” OR “affective disorder*”) OR KW(Depressi* OR "Mental Health" OR “Dysthymic Disorder*” OR “emotional wellbeing*” OR “emotional well-being*” OR “psychosocial stress*” OR “mental stress*” OR “mood disorder*” OR “psychological wellbeing*” OR “psychological well-being*” OR “mental disorder*” OR “mood disorder*” OR “mental hygiene*” OR “mental wellbeing*” OR “mental well-being*” OR “psychosocial wellbeing*” OR “psychosocial well-being*” OR “dysthymia*” OR “dysphoria*” OR “melancholˑ” OR “affective disorder*”)

- Concept 3: ‘city’: DE "BUILT environment" OR TI(Cities OR “city*” OR “built environment*” OR town* OR urban* OR “municipal*” OR “built-up area*” OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern) OR AB(Cities OR “city*” OR “built environment*” OR town* OR urban* OR “municipal*” OR “built-up area*” OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern) OR KW(Cities OR “city*” OR “built environment*” OR town* OR urban* OR “municipal*” OR “built-up area*” OR brussels OR paris OR London OR madrid OR berlin OR rome OR bucharest OR

Kyiv OR kiev OR vienna OR minsk OR hamburg OR warsaw OR budapest OR barcelona OR munich OR milan OR prague OR sofia OR birmingham OR oslo OR helsinki OR rotterdam OR amsterdam OR stockholm OR copenhagen OR zagreb OR athens OR dublin OR riga OR Luxembourg OR leuven OR lisbon OR ljubljana OR bern)

Supplementary B

The tool for cohort studies consists of 11 questions, which have to be answered with yes, no, unclear or not applicable. The checklist for cross sectional studies consists of 8 questions, which have to be answered the same way as those for cohort studies. After answering the questions, we gave the articles an overall quality rating (good/fair/poor). For cohort studies, we used the following criteria for overall rating (I) poor quality: answer is yes <5 times, (II) fair quality: 5-7 times yes, (III) good quality: >7 times yes. For cross sectional studies, we used the following criteria (I) poor quality: <3 times yes, (II) fair quality: 3-5 times yes, (III) good quality: >5 times yes.

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer_____Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

JBI CRITICAL APPRAISAL CHECKLIST FOR COHORT STUDIES

Reviewer_____Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the two groups similar and recruited from the same population?	☐	☐	☐	☐
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were confounding factors identified?	☐	☐	☐	☐
5. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	☐	☐	☐	☐
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	☐	☐	☐	☐
10. Were strategies to address incomplete follow up utilized?	☐	☐	☐	☐
11. Was appropriate statistical analysis used?	☐	☐	☐	☐

Zelfreflectie

Tijdens de eerste maanden van onze Master-na-Master opleiding voor huisartsgeneeskunde, kregen we de opdracht om een onderwerp te zoeken voor onze masterpaper. Na wat rondhoren en aftoetsen, vormden we uiteindelijk een groepje van acht HAIO's die eenzelfde soort opzet voor masterpaper in gedachten hadden.
We legden een eerste contact met onze promotor Gijs Van Pottelbergh en onze copromotor Simon Beerten. Zij werkten alreeds aan een groter onderzoek naar de link tussen milieublootstelling en gezondheid. Vier groepjes van twee zouden ieders een systematisch literatuuronderzoek uitvoeren over een bepaalde milieublootstelling en een aspect in de gezondheid. Zo kozen Jolien en ik eind januari 2021 om ons onderzoek uit te voeren over de impact van de aan- of afwezigheid van groene omgeving en de link met mentale gezondheid, specifiek depressie.

Eind januari 2021 kwamen Jolien en ik in contact met onze copromotor Simon Beerten, waarbij we een verkennend zoommeeting gesprek hadden over onze onderzoeksvraag. Hij hielp ons onze PICO opstellen en reikte ons verschillende artikels aan om al een verkennend idee te vormen over het onderwerp.

In april 2021 contacteerden we de biomedische bib 2Bergen van KU Leuven en in mei begonnen we onze zoekstrategie op te bouwen. In juni (op 9/6/2021 en 29/6/2021) hadden we tweemaal een gemeenschappelijke zoomsessie met het team van de bib 2Bergen, de andere HAIO's en onze copromotor. We kregen uitleg waar en hoe we in databanken artikels over onze onderwerpen zouden verzamelen. De 7 databanken waar we in zouden zoeken waren de volgende: 1) Pubmed, 2) Embase, 3) Web of Science: core collection, 4) Web of Science: Biosis, 5) Scopus, 6) Cinahl via EBSCO en 7) Greenfile via EBSCO.

Na de zomer van 2021 begonnen Jolien en ik meerdere dinsdagen in oktober en november af te spreken om samen onze zoekstrategie op te bouwen. We vroegen regelmatig feedback aan de bib van KULeuven en finaliseerden onze zoekstrategie in februari 2022. Op 8 februari voegden we onze gevonden artikels allen tezamen in de referentiemanager Endnote. Na even te schrikken, zagen we dat de som van onze gevonden artikels 15.879 bedroeg, wat in overleg met onze copromotor te veel werk voor ons zou betekenen om te screenen. Op advies van de medewerkers van de bib, haalden we de duplicaten uit dit grote aantal en werden we op 8 maart blij verrast dat ons aantal artikels gehalveerd werd naar 8.039. Na groen licht van onze promotor, copromotor en de bib, begonnen Jolien en ik op 9 maart 2022 met het screenen van de overgebleven artikels.

Op lege momenten tijdens of na onze werkdagen, op lege dinsdagvoormiddagen, in het weekend en op verlof aan het zwembad; screenden we allebei onafhankelijk onze 8.039 artikels op basis van titel en abstract. Uiteindelijk kwamen we eind augustus 2022 terug samen om een lijst van 76 artikels overeen te komen die we daarna samen verder zouden opzoeken en nalezen. 48 artikels hiervan bleken niet relevant, 2 artikels bleken geen observationele studie, 1 artikel bleek niet in het Engels of Nederlands geschreven te zijn, 2 artikels waren niet in Europa uitgevoerd en van 5 artikels vonden we de volledige tekst niet terug. Op die manier bleven onze 18 inclusies over en hadden we op 6/09/2022 een verder gesprek met Simon, onze copromotor, over de volgende stappen in ons onderzoek.

In de periode van begin september 2022, schreven we het begin van onze introductie en methoden, en maakten we de flowchart.
Nadien lazen we ieders de 18 geïncludeerde artikels en verdeelden we deze onderling zodat we beide 9 artikels tot in detail invulden in onze *table of findings*.

Eind november 2022 stuurden we onze samengevoegde *table of findings* door naar Simon. Na de jaarwisseling van 2022-2023 schreven we onze gevonden resultaten neer en onderzochten we de kwaliteit van beoordeling (*quality of assessment*). Samen schreven we de discussie en zo ook de conclusie in februari, om in maart en april de feedback van onze copromotor meermaals toe te passen. Midden april was onze thesis inhoudelijk af en spitsten we ons toe op het voorblad, het abstract, de inhoudstafel, de referenties en de bijlagen. Nu, eind april 2023, schrijf ik deze zelfreflectie over het hele afgelegde traject.

Doordat Jolien en ik op dinsdagen vaak afspraken om samen aan onze masterpaper te werken hebben we het werk evenwichtig kunnen verdelen. We ondervonden dat samen op dezelfde locatie en daadwerkelijk afspreken doeltreffend was om werk geleverd te krijgen. In ons laatste jaar zaten we zelfs samen in dezelfde seminariegroep, waardoor het gemakkelijk was om in de voormiddag samen te werken en in de namiddag samen door te rijden naar ons seminarie. Tussendoor gaven we onszelf ook deadlines tegen de volgende afspraak. We beslisten samen over de inhoud en schreven samen tegelijkertijd in een Google Docs.

Gezien we in de wereld, en dus ook in Vlaanderen, een stijgende incidentie van urbanisatie zien, leven steeds meer mensen in een stedelijke omgeving. In zo'n omgeving is het belangrijk om als mens de natuur te blijven opzoeken. Dit hebben we onder andere ondervonden met de recente covid-pandemie, waarbij mensen gedwongen thuis moesten blijven, soms zonder enige buitenruimte en waarbij velen gingen ontspannen in de natuur. Ook zien we wereldwijd een stijgende incidentie van depressieve stoornissen. Met ons onderzoek wilden we nagaan of de stijging van incidentie van depressie mede een gevolg zou kunnen zijn door de stijging van urbanisatie en het verlies van contact met de natuur. Het lijkt mij interessant om als huisarts een notie te hebben van het effect van groen in de nabije omgeving op de mentale gezondheid van patiënten. Dit kadert zich in de preventieve geneeskunde waar we als huisartsen het meeste in kunnen betekenen. We informeren als huisarts over een gezonde levensstijl die onder andere bestaat uit genoeg beweging, gezonde voeding, mentale gezondheid, maar ook uit verbondenheid met de natuur. Zo hebben we respectievelijk de bewegingsdriehoek, de voedingsdriehoek en de geluksdriehoek die we terugvinden op de site van het Vlaamse instituut Gezond leven (www.gezondleven.be). Recent kunnen we hierbij ook de natuurdriehoek toevoegen, waarover ik bijleerde tijdens een bijscholing voor huisartsen *Natuur op verwijzing* van UAntwerpen op 17 februari 2022. (https://www.uantwerpen.be/nl/leerstoelen/zorg-en-natuurlijke-leefomgeving/netwerking/events/update/)