THE IMPACT OF ARTIFICIAL LIGHT AT NIGHT ON HUMAN AND ECOSYSTEM HEALTH: A *SYSTEMATIC* LITERATURE REVIEW

השפעותיה של תאורה מלאכותית על מערכות אקולוגיות: סקר ספרות סיסטמתי

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מהפכת התאורה והשלכותיה על בריאות האדם והסביבה שימוש נכון בתאורת לד: *חידושים* • יום עיון לזכרו של פרופסור אברהם חיים **9.7.2020**

ONGOING PROJECTS

Project	Funding agency	Lifespan
Modelling the Perceived Quality of Public Space Lighting: An Interactive User-Oriented Approach	Israel Science Foundation (ISF)	2018-2021
Optimizing Public Space Lighting with Residents' Participation: A Step towards Smart and Sustainable Urban Areas in Israel and China	P.R. China Ministry of Science and Technology and Israel Ministry of Science and Technology	2019-2020

PROJECT OBJECTIVE

Instrumentally measured PSL attributes:

- Intensity
- Temperature
- Uniformity
- Glare

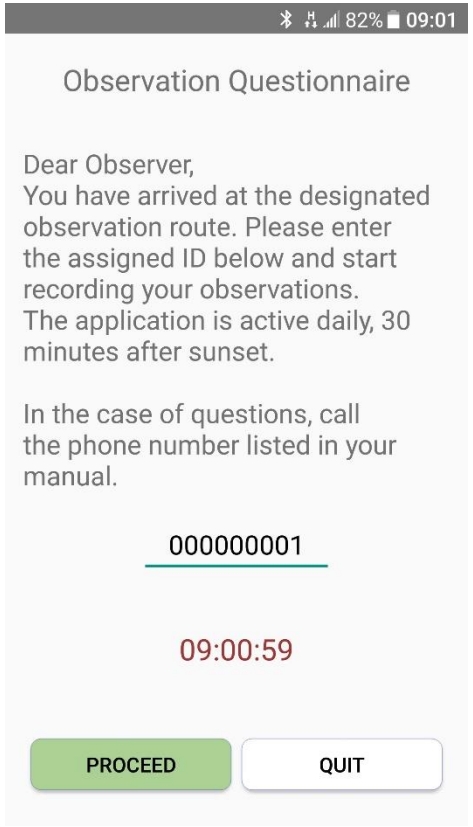
Model tools:

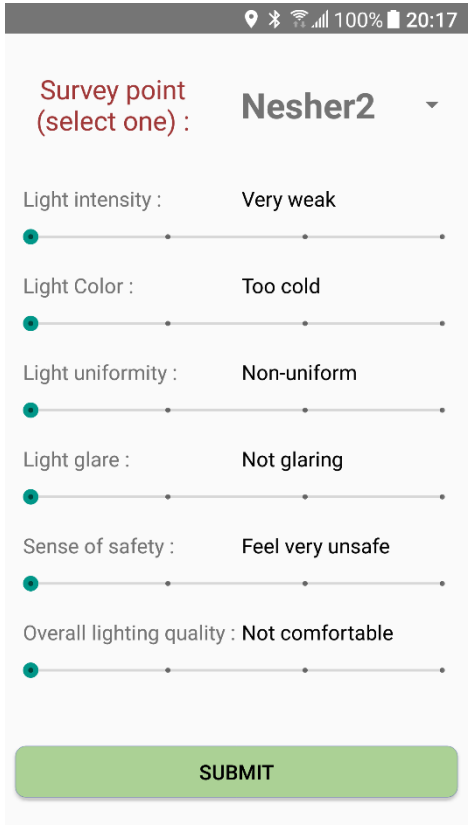
Individual attributes
Temporal attributes
Environmental attributes
…

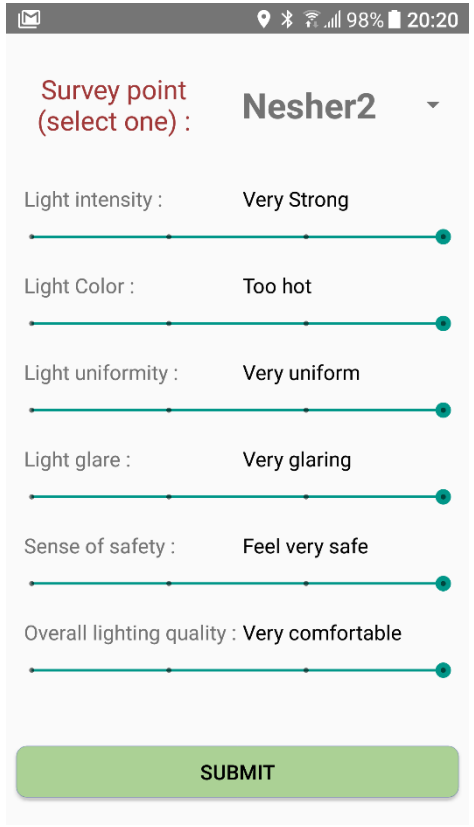
Perceived PSL comfort and quality in terms of:

- Intensity
- Temperature
- Uniformity
- Glare
- Overall comfort
- Sense of security

"CITYLIGHTS™" – APP SCREENS







40,000+ individual reports collected so far

REQUIRED ILLUMINANCE – 1ST PAPER

sustainability

MDPI

Article

How Much Lighting is Required to Feel Safe When Walking Through the Streets at Night?

Alina Svechkina, Tamar Trop and Boris A. Portnov *

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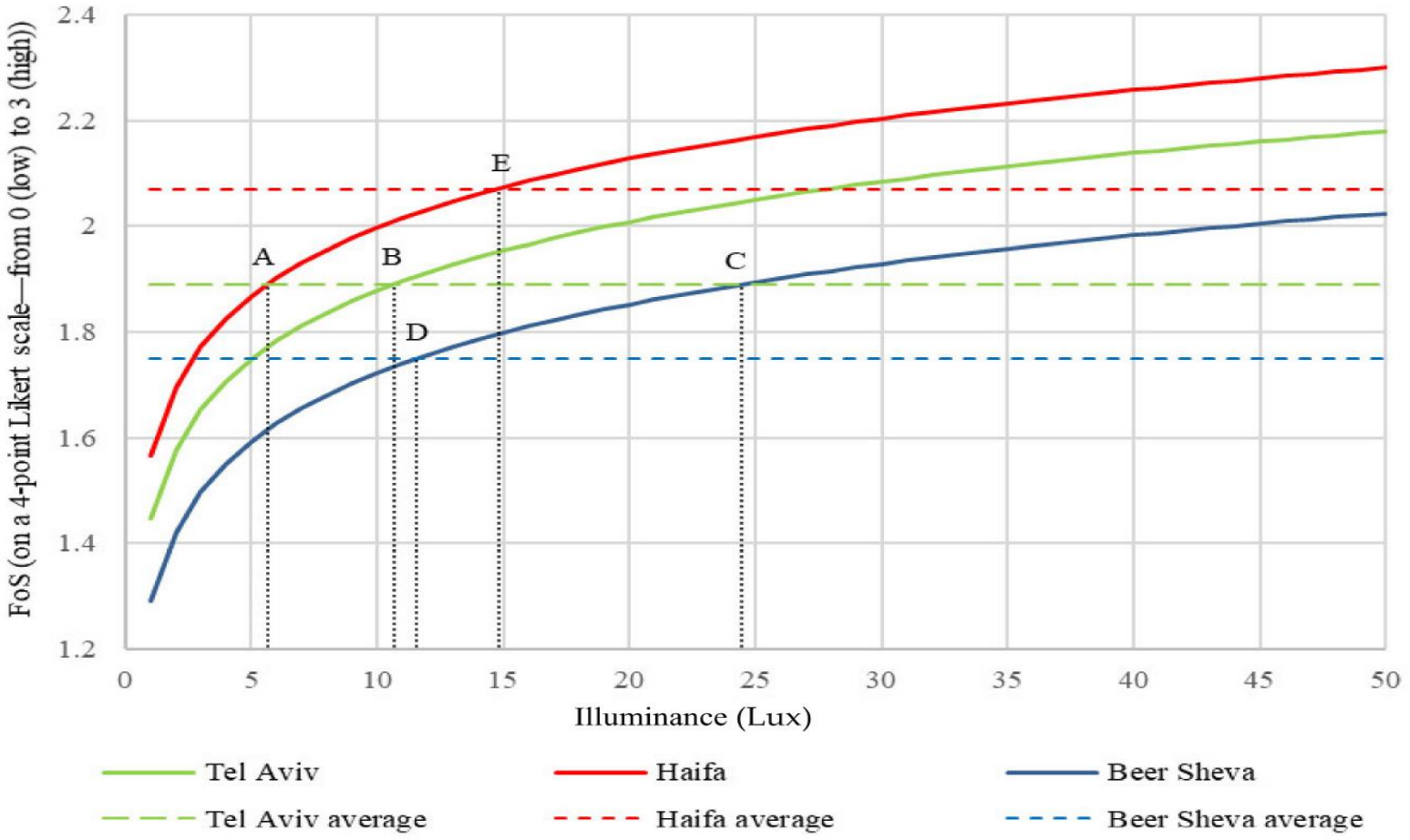
check for updates

MAIN FINDINGS



- Diminishing returns on illumination;
- Different illuminations levels required for people to feel safe in different cities

2ND PAPER – ECO-EFFECTS OF ALAN

Landscape Ecol
https://doi.org/10.1007/s10980-020-01053-1

Check for updates

REVIEW ARTICLE

The impact of artificial light at night on human and ecosystem health: a systematic literature review

Alina Svechkina · Boris A. Portnov · Tamar Trop

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LITERATURE REVIEW TYPES

- Regular (simple expanding, snowballing);
- Systematic (PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

PRISMA – DEFINITION OF SEARCH TERMS

Objects	Modifiers	Effects	Exclusion terms
light*, illumination	night, nocturnal, artificial, street, outdoor	health, human, flora , fauna, ecolo*, biodiversity, ecosystem, environment*	policy, economic*, measur*, model*, laboratory, legislation, technology, sky, stellar, occupation, work, traffic, design, imagery, therapy, optic*, treat*, rehabilit*, UV

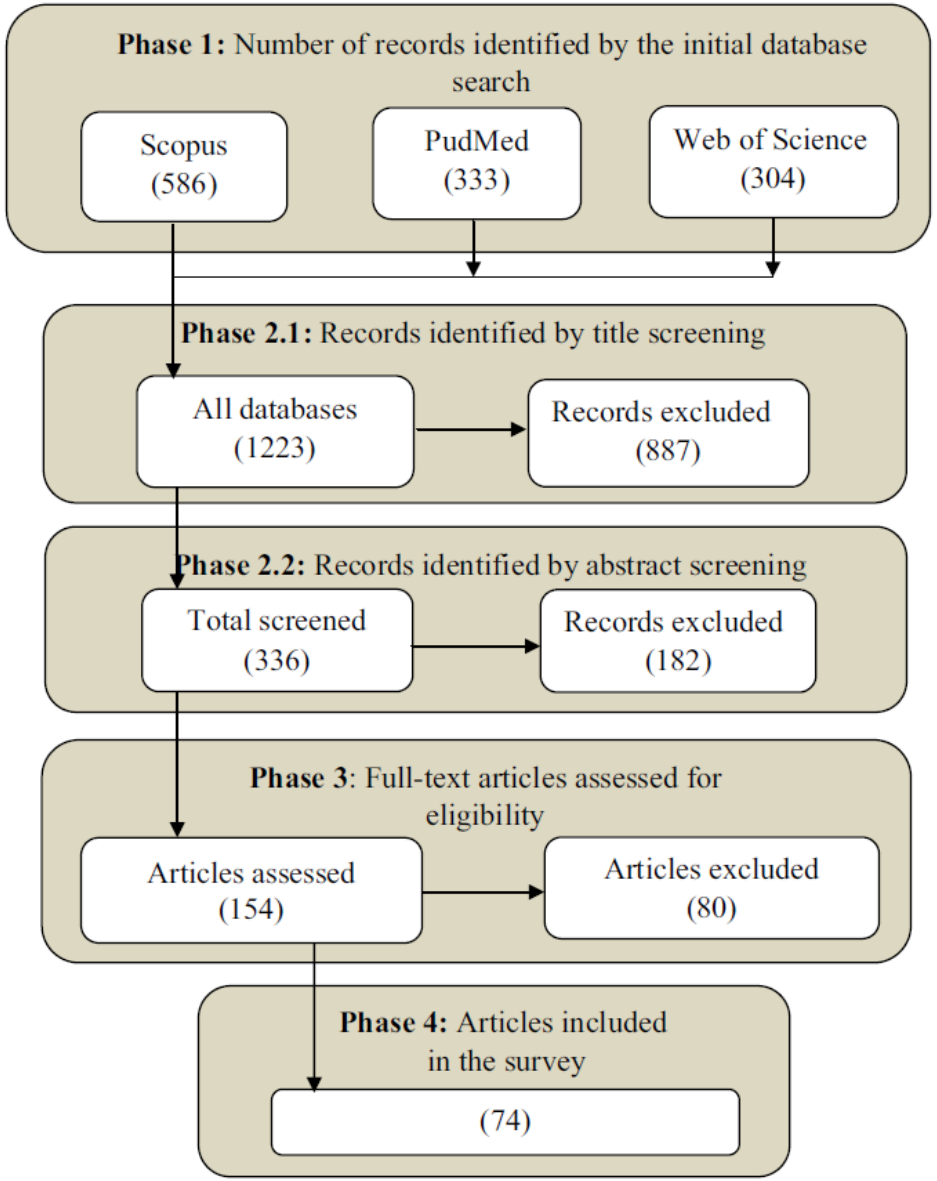
PRISMA – SCOPUS SEARCH SCRIPTS

Scopus	TITLE-ABS-KEY (*light** OR *illumination*) AND (*night* OR *nocturnal* OR *artificial* OR *street*) AND (*health* OR *human* OR *flora* OR *fauna* OR *ecolog** OR *biodiversity* OR *environment*) AND (*pollution* OR *exposure* OR *hazard*) AND NOT (*indoor* OR *daylight* OR *policy* OR *ecomomic** OR *measur** OR *model** OR *laboratory* OR *legislation* OR *technology* OR *sky* OR *stellar* OR *work* OR *occupation* OR *traffic* OR *design* OR *imag** OR *therapy* OR *optic** OR *treat** OR *rehabilit**) AND DOCTYPE (ar OR re) AND (PUBYEAR > 1999 AND PUBYEAR < 2019) AND (LIMIT-TO (LANGUAGE "English"))

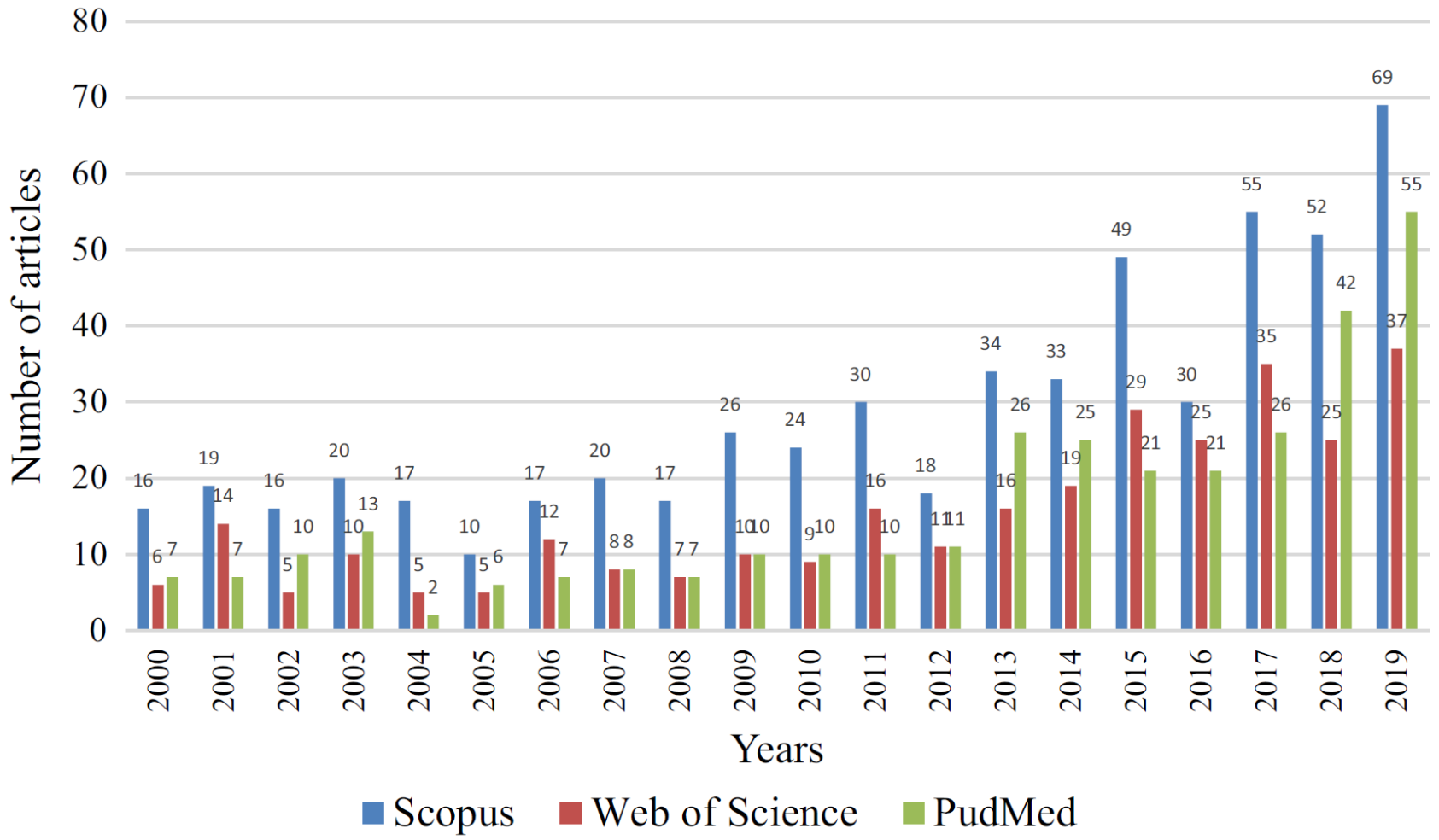
PRISMA – PUBMED SEARCH SCRIPT

PudMed	(light*[Title/Abstract]) OR illumination[Title/Abstract]) AND (nocturnal[Title/Abstract]) OR night[Title/Abstract]) OR artificial[Title/Abstract]) OR street[Title/Abstract])) AND (human[Title/Abstract] OR flora[Title/Abstract] OR fauna[Title/Abstract] OR ecolog*[Title/Abstract] OR biodiversity[Title/Abstract] OR ecosystem[Title/Abstract] OR environment*[Title/Abstract]) AND (pollution[Title/Abstract]) OR exposure[Title/Abstract]) OR hazard[Title/Abstract]) OR health[Title/Abstract])) AND NOT (indoor[Title/Abstract] OR daylight[Title/Abstract] OR policy[Title/Abstract] OR ecomomic*[Title/Abstract] OR measur*[Title/Abstract] OR model*[Title/Abstract] OR laboratory[Title/Abstract] OR legislation[Title/Abstract] OR technology[Title/Abstract] OR sky[Title/Abstract] OR stellar[Title/Abstract] OR work[Title/Abstract] OR occupation[Title/Abstract] OR traffic[Title/Abstract] OR design[Title/Abstract] OR imag*[Title/Abstract] OR therapy[Title/Abstract] OR optic*[Title/Abstract] OR treat*[Title/Abstract] OR rehabilit*[Title/Abstract]) Filters: Publication date from 2000/01/01 to 2018/12/31; English

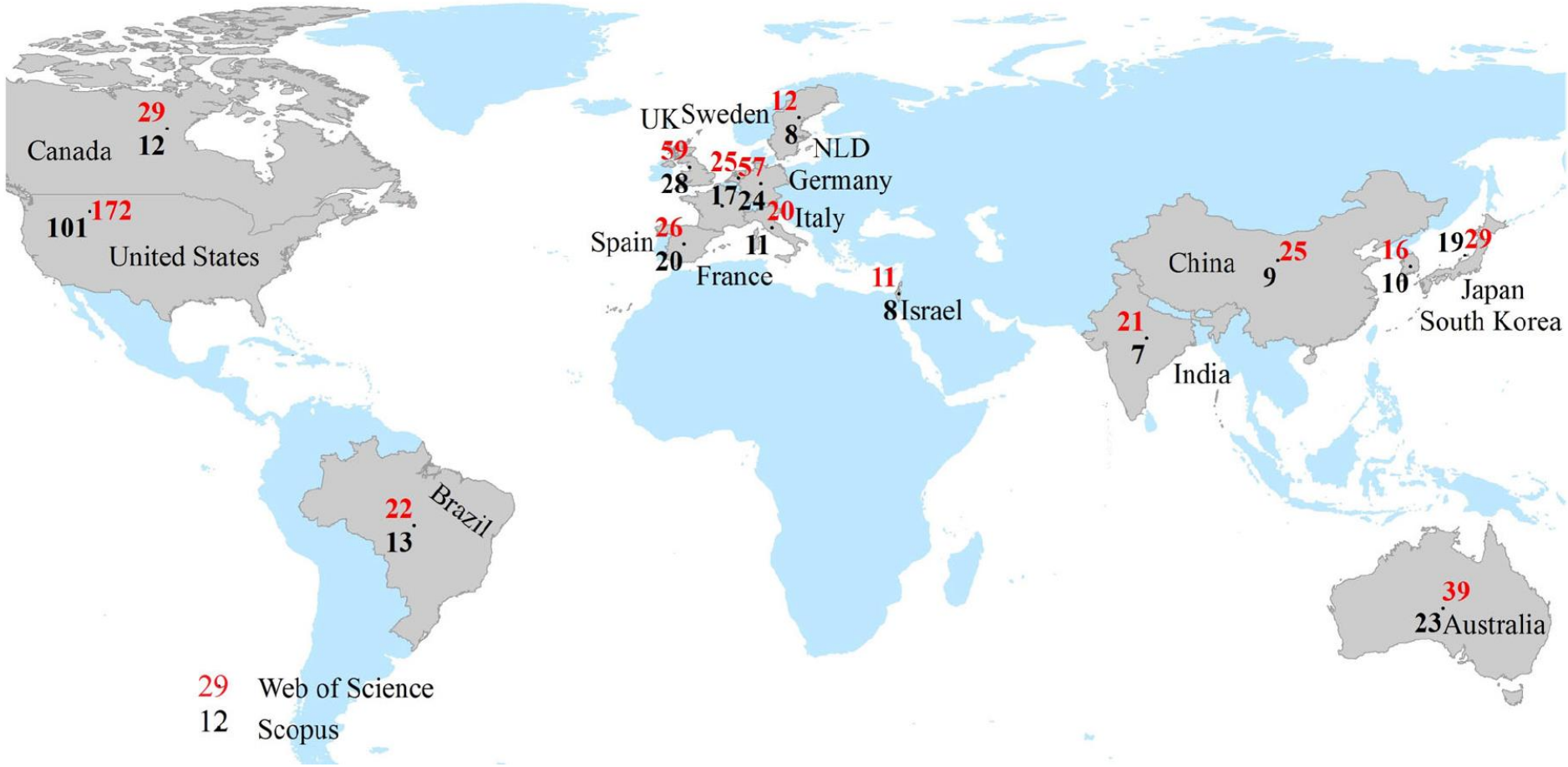
STUDIES RETRIEVED



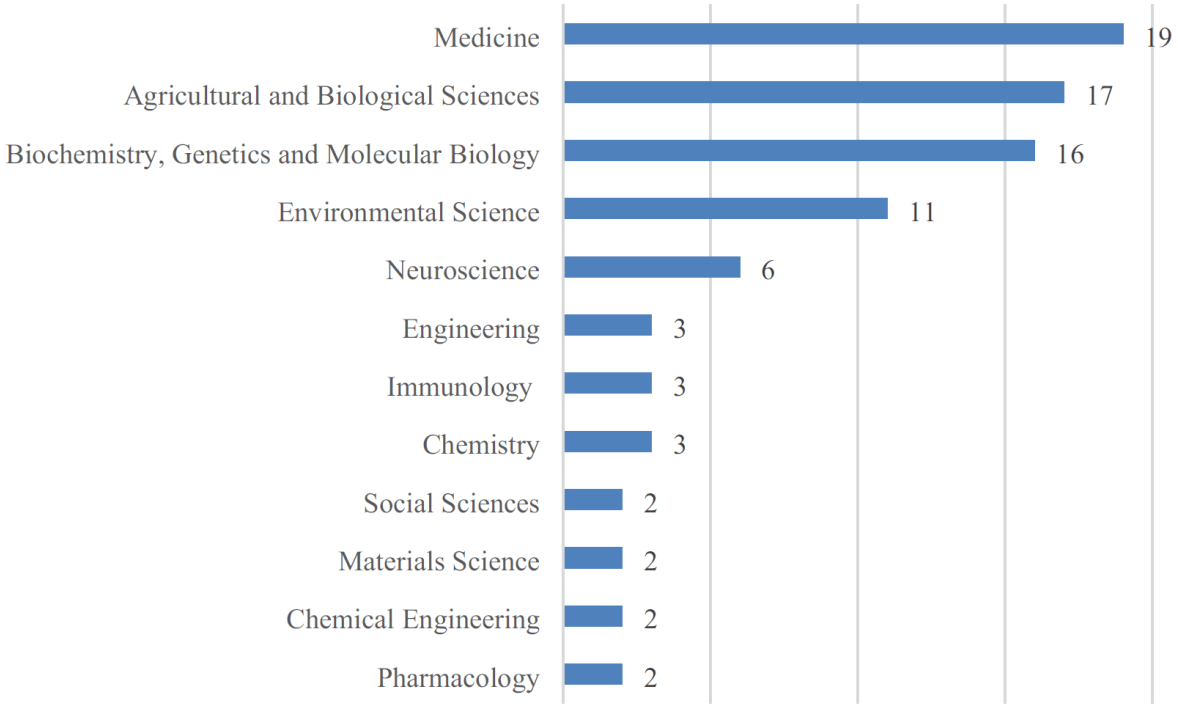
TEMPORAL TRENDS



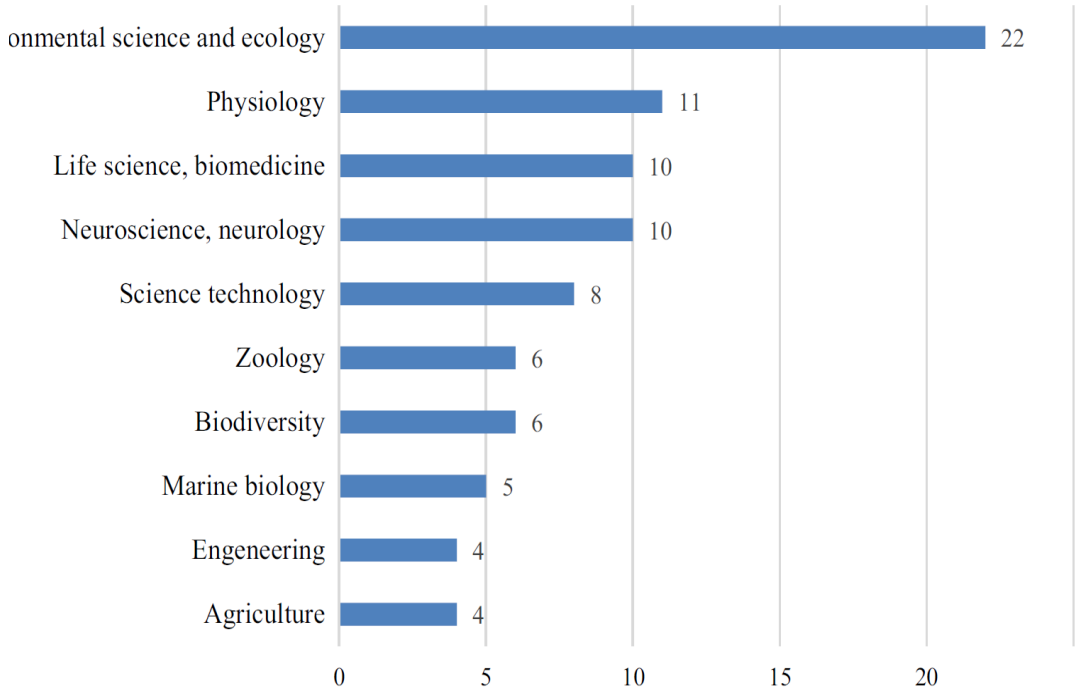
GEOGRAPHIC COVERAGE



RESEARCH FIELD



Scopus



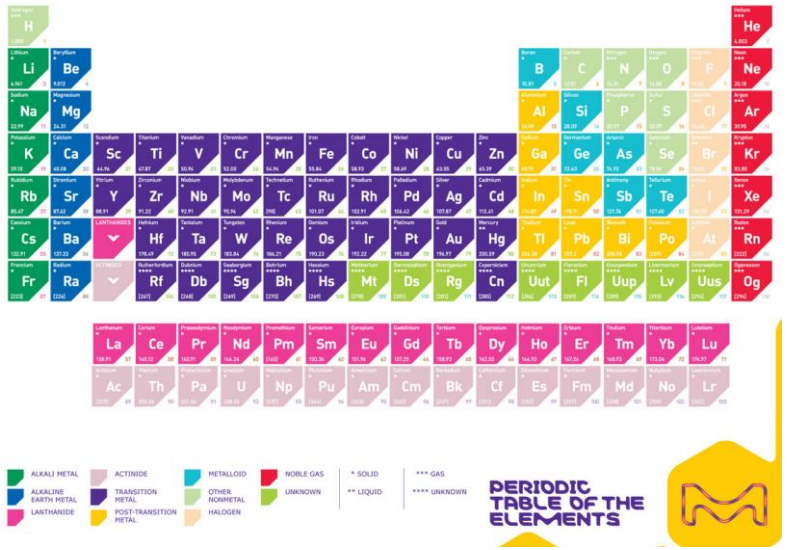
WoS

STUDY OBJECTS

Table 2 Classification of studies by subject and type (number of studies and percent in the parentheses)

Subject	Humans	Vertebrates	Arthropods	Avian species	Aquatic organisms	Vegetation	Total
Study type							
Laboratory	–	11 (85%)	7 (64%)	7 (39%)	6 (46%)	–	31 (42%)
Field	–	2 (15%)	4 (36%)	9 (50%)	7 (54%)	3 (75%)	25 (34%)
Ecological	12(80%)	–	–	2 (11%)	–	1 (25%)	15 (20%)
Case–control	3 (20%)	–	–	–	–	–	3 (4%)
Total	15(100%)	13 (100%)	11 (100%)	18(100%)	13 (100%)	4 (100%)	74(100%)

GLOBAL EFFECTS



Research subject	Tumors	Weight gain/ feeding behavior	Depression / Sleep disorder	Locomotion/ orientation/ trajectory	Reproductive output / pollination
	●	●	●	⊘	⊘
	●	◗	●	●	●
	⊘	◗	●	●	◗
	⊘	◗	●	⊘	●
	⊘	◗	⊘	●	●
	⊘	⊘	⊘	●	●

● - Strong effect found;

● - Probable effect found; found

⊘ - Effect not studied;

◗ - Partial/ inconsistent effect

CONCLUSIONS (I)

Literature suggests three main pathways thorough which ALAN exposure might affect living organisms:

- **Melatonin suppression** attributed primarily to indoor lighting.
- **Circadian disruption**, attributed to night time activities enabled by ALAN, and
- **General stress**, caused by rapidly changing illumination levels, which are both associated with indoor, as well as outdoor, lighting

CONCLUSIONS (II)

- The study highlights that that similar health impacts of ALAN exposure are found is different species.
- This demonstrates that adverse effects of ALAN exposure manifest themselves in a similar manner across different organisms, and therefore have a wider and a more complex impact on the stability and integrity of the ecosystem as a whole.

FUTURE TOPICS

- Several potential health effects of ALAN, such as *heart diseases and diabetes*, have received relatively little research attention.
- The ecosystem effects of ALAN with *different spectral properties* also warrant more research.

THANK YOU FOR YOUR ATTENTION