



International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

Managing Sciences* and Geography Extended Essays without lab work or fieldwork

[* Biology, Chemistry, Physics, Environmental Systems and Societies, Sports Exercise and Health Science]

Further advice to schools: this advice complements the following guidance documents:
<https://resources.ibo.org/dp/topic/Supporting-guidance-2021/resource/11162-413519/?>
<https://resources.ibo.org/dp/topic/Supporting-guidance-2020/resource/11162-413518/?>



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IB mission statement

The International Baccalaureate aims to develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect.

To this end the organization works with schools, governments and international organizations to develop challenging programmes of international education and rigorous assessment.

These programmes encourage students across the world to become active, compassionate and lifelong learners who understand that other people, with their differences, can also be right.



IB learner profile

The aim of all IB programmes is to develop internationally minded people who, recognizing their common humanity and shared guardianship of the planet, help to create a better and more peaceful world.

As IB learners we strive to be:

INQUIRERS

We nurture our curiosity, developing skills for inquiry and research. We know how to learn independently and with others. We learn with enthusiasm and sustain our love of learning throughout life.

KNOWLEDGEABLE

We develop and use conceptual understanding, exploring knowledge across a range of disciplines. We engage with issues and ideas that have local and global significance.

THINKERS

We use critical and creative thinking skills to analyse and take responsible action on complex problems. We exercise initiative in making reasoned, ethical decisions.

COMMUNICATORS

We express ourselves confidently and creatively in more than one language and in many ways. We collaborate effectively, listening carefully to the perspectives of other individuals and groups.

PRINCIPLED

We act with integrity and honesty, with a strong sense of fairness and justice, and with respect for the dignity and rights of people everywhere. We take responsibility for our actions and their consequences.

OPEN-MINDED

We critically appreciate our own cultures and personal histories, as well as the values and traditions of others. We seek and evaluate a range of points of view, and we are willing to grow from the experience.

CARING

We show empathy, compassion and respect. We have a commitment to service, and we act to make a positive difference in the lives of others and in the world around us.

RISK-TAKERS

We approach uncertainty with forethought and determination; we work independently and cooperatively to explore new ideas and innovative strategies. We are resourceful and resilient in the face of challenges and change.

BALANCED

We understand the importance of balancing different aspects of our lives—intellectual, physical, and emotional—to achieve well-being for ourselves and others. We recognize our interdependence with other people and with the world in which we live.

REFLECTIVE

We thoughtfully consider the world and our own ideas and experience. We work to understand our strengths and weaknesses in order to support our learning and personal development.

The IB learner profile represents 10 attributes valued by IB World Schools. We believe these attributes, and others like them, can help individuals and groups become responsible members of local, national and global communities.

Managing Sciences* and Geography Extended Essays without lab work or fieldwork: further advice to schools

[* Biology, Chemistry, Physics, Environmental Systems and Societies, Sports Exercise and Health Science]

At the outset it is important to note that Extended Essays researched and written in Sciences and Geography that use methods other than experimentation or fieldwork have the potential to perform very well. All Extended Essays are assessed by applying the same criteria. Following is advice to help students use these methods fully and effectively.

<p>General advice that could apply to any sciences EE</p>	<p>As in the case of an experimentally or field-based investigation, an extended essay based on secondary data requires a research question that can be explored and addressed using material obtained from the sources used. Data and information can be found in peer-reviewed journal articles and reliable websites with sound scientific information.</p> <p>A quick, effective way to determine how focused the author of an article is, is to refer to their tables, diagrams, graphs, and equations. How clearly are these organized and presented? Is the style used by the author easy to follow?</p> <p>The research question should have clear variables. This usually helps to establish a viable approach that includes analyzing and/or comparing data on a well-defined topic from different authors/sources, different times, different geographical locations etc.</p> <p>For library-based essays the process used to identify and select relevant sources needs to be particularly thorough, and selection criteria for the material to be included should be made explicit in the essay. With a broad-based approach to background research in the early stages of the research, it is possible that not all of the sources accessed will turn out to be relevant. In this case the bibliography should be selective and should only include material that was actually used in the writing process.</p> <p>When choosing sources, students must consider the setting of the scientific context for the research and the method's design if applicable. With this in mind, attention should be paid to the methods to be used for data analysis, the interpretation of data, the conclusion (that should respond to the research question) and evaluation of the method and data used. It is also important that students explain the type of sampling used to extract the data.</p> <p>Research questions that link properties to brands (students may use label information of different foods to determine vitamin or other nutrients content) should be avoided as it is usually difficult to support the conclusion from a scientific point of view.</p>
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	<p>As always, students should consult with their supervisor about the topic and the research question and keep them regularly informed about progress.</p>
<p>Advice specific to various subjects</p>	<p>Biology: There are numerous online sources of biological publications including NCBI, PubMed, DOAJ and Science Direct to name a few. Other sources of data include university and government websites and databases as well as data released by companies and other organizations involved in biological research and or biological products.</p> <p>Chemistry: Students should always explain ideas carefully to show understanding of the relevant chemical principles underlying any investigation. When databases or other people's results are used, students should be sure they understand the method used, that they will be able to use it to support their argument, and that they can evaluate it effectively.</p> <p>There are some experiments that could be carefully done at home, using everyday chemicals such as vinegar, sodium hydrogen carbonate, cooking oil, hydrogen peroxide, etc. and electronic scales, together with glassware. However, students should take care to develop a challenging research question. If this option is being considered, health and safety procedures must be taken into account and discussed with the student.</p> <p>It is also possible to produce a good essay using virtual labs.</p> <p>Physics: With imagination, experimentation is possible, for example the water can collapsing experiment, making reference to Torricelli's law. However, it is important to note that if the student is carrying out an experiment at home, they must perform a risk analysis and check with the supervisor prior to starting any data collection.</p> <p>Simulation is a method that can be useful, but it is important to list all the input statements you need to enter before the simulation comes into play. Which dependent variable(s) are to be explored? What are the corresponding independent variables? What uncertainties does the simulation present?</p> <p>When using secondary sources, it is important to explain the origin of the available data, which experimental method was followed, what equipment was used, and what uncertainties and limitations are evident.</p>



Survey essays in physics can be successful, but there are pitfalls to avoid. The purpose of the essay is not principally to inform the reader, nor to deliver a summary of collected information. The student should be personally involved, not simply act as an informant. Arguments, counter arguments, and critical thinking should be evident.

Environmental Systems and Societies:

Due to the multidisciplinary nature of ESS, there are many online sources of publications. However, the data needs to be manipulated in order to investigate the association between the well-being of a society and the quality of the environment in which a society lives.

Students can use online sources of biological publications, for example, epidemiological data from WHO or PubMed. Other sources of data include university and government websites and databases as well as data released by other organizations involved in environmentally related research.

Sports Exercise and Health Science:

Review-based essays

The challenge here is for the student to engage with critical thinking and avoid being too descriptive. Taking a systematic approach is important, following a process similar to that illustrated in PRISMA flow diagrams (<http://www.prisma-statement.org/>).

Online data collection

Students can conduct effective studies online using surveys or longitudinal data – psychometric tests, physical activity diaries etc. These can also be supplemented with self-reported objective data if students have activity trackers on their smart phones.

Examples of face to face data collection with social distancing

If schools are open but with social distancing measures in place, it is still possible to collect data. Most fitness tests can be done safely this way and activities can be demonstrated and imitated.



	<p>Geography:</p> <p>Geography Extended Essays can be based entirely on secondary data. This can be data from a census, the World Bank, the United Nations, etc. It is important that there is a strong component of data in the secondary sources used so that patterns can be mapped, and statistical tests applied. Literature review is another important dimension of geographical research.</p>	
<p>Potential issues and suggested solutions</p>	<p>Issue:</p>	<p>Solution:</p>
	<p>The methods used to search for relevant sources/data is not described [Criterion A]</p>	<p>In the early part of the essay make sure there is information about the strategy used to search for publications and data. What search engine / key terms / websites were used.</p>
	<p>The criteria used to select sources/data for inclusion are not described. [Criterion A]</p>	<p>In the early part of the essay make sure there is information about the criteria that were applied are described and justified.</p>
<p>The essay is descriptive [Criteria B and C]</p>	<p>This can happen when there is not a well-defined research question and when the essay is simply a review of literature or a presentation of ideas on a topic. This problem can be avoided by ensuring that there is a clearly defined research question, that variables are clearly identified, and that the selection of literature and data is designed to address this question. There can then be a clear line of argument linking the data and the findings to the original question. It may be necessary to amend the research question. It is also helpful to define a theoretical background and refer to it.</p> <p>Ensure that the essay is based on data derived from the sources and that the variables defined in the research question can be addressed. The essay should go beyond simply re-presenting the data and should involve processing steps that the candidate has applied. The data can then be subject to processing steps that address the research question (calculations, comparisons, graphical analysis, statistical analysis).</p>	



	<p>There is no data analysis. [Criterion C]</p>	<p>If statistical analysis is used, students should ensure that a clear explanation of its application is included.</p>
	<p>The sources accessed are too complex to understand or to critically evaluate. [Criteria A, B and C]</p>	<p>Only sources that are easily understood should be used. This applies to both the findings and the methods used. Sources that require extensive descriptive accounts and precise technical language in order for the data to be understood should be avoided.</p>
	<p>The sources accessed require extensive use of complex and topic-specific terminology. [Criterion B]</p>	<p>Avoid topics and research that require extensive use of complex terminology; this can result in a “cut and pasted” type of essay, which includes little input from the student. When precise subject specific or topic specific terminology is needed make sure it is well explained and used judiciously.</p>
	<p>There is no critical evaluation of the methods used to obtain and select data [Criterion C]</p>	<p>An essay based on secondary data should provide two levels of critical evaluation. On the one hand the methods used by the researchers to collect the data reported in the sources can be critically evaluated. However, this is often difficult to do, especially if the candidate is unfamiliar with those methods or if they are very complex. In addition, there should be a critical evaluation of the methods used to find and select sources to be included in the essay. Has the search been extensive enough? Is it possible that important perspectives were overlooked? Are the sources all reliable and up to date? Have any of the sources been criticized by other researchers? Is there any potential for bias in the selection process?</p>



Suggestions for useful subject-specific websites and other resources (to source data etc.) (English)

Biology:

NCBI: www.ncbi.nlm.nih.gov

PubMed: pubmed.ncbi.nlm.nih.gov

Directory of Open Access Journals (DOAJ): doaj.org

ScienceDirect: www.sciencedirect.com

The Red List: iucnredlist.org

NASA Climate Change: <http://climate.jpl.nasa.gov/>

National Wildlife Health Center: <https://www.usgs.gov/centers/nwhc/publications>

USDA nutrient database:
<https://fdc.nal.usda.gov/> (contains a complete nutrition profile for various food and drink items)

Satellite Data: <https://www.nasa.gov/content/goes>

Ocean Tracks: oceantracks.org

The Paleobiology Database: <http://paleobio.org/education/education.html>

eBird: ebird.org

RCSB Protein Data Bank: <http://pdb101.rcsb.org/>

BioServers: <http://www.bioservers.org/bioserver/> (Easy to use interface for DNA database searches)

ALFRED: <https://alfred.med.yale.edu/> (allele frequency)



Gorongosa Wild Cam: <https://www.wildcamgorongosa.org>

Chemistry:

The Royal Society of Chemistry: www.rsc.org

PubChem: pubchem.ncbi.nlm.nih.gov

ChemSpider: www.Chemspider.com

Chemistry Views: www.chemistryviews.org

ACS: <https://www.acs.org/content/acs/en/education/students/highschool/chemistryclubs/activities/simulations.html>

Praxilabs: <https://praxilabs.com/en/>

Virtual Chemistry Laboratory: <http://www.chem.ox.ac.uk/vrchemistry/>

Virtual lab: <http://vlab.co.in/broad-area-chemical-sciences>

Physics:

Ehrlich, Robert, 1990. Turning the World Inside Out and 174 Other Simple Physics Demonstrations. Princeton, Princeton University Press

<https://press.princeton.edu/books/paperback/9780691023953/turning-the-world-inside-out-and-174-other-simple-physics>

Ehrlich, Robert, 1997. Why toast lands jelly-side down: Zen and the Art of Physics Demonstrations. Princeton, Princeton University Press

<https://press.princeton.edu/books/paperback/9780691028873/why-toast-lands-jelly-side-down>

<http://www.flyingcircusofphysics.com/> (Jearl Walker)



<http://www.aapt.org/>

<http://scitation.aip.org/content/aapt/journal/tpt>

<http://iopscience.iop.org/>

<http://iopscience.iop.org/0031-9120>

(Example of an article: The speed of sound in singing tubes: http://iopscience.iop.org/0031-9120/49/3/268/pdf/0031-9120_49_3_268.pdf)

Helpful articles about understanding how to write an essay in physics in the journals The Physics Teacher (AAPT Physics Education) or Physics Education (IOP Science). Example of article from The Physics Teacher: *The Physics Teacher*, Vol. 5, Issue 4 pages 160-163, 1967 “A student exercise for determining the average density of a celestial body by a limiting process” by T. E. Pomeroy.

Online video analysis: Vernier’s LoggerPro <https://www.vernier.com/product/logger-pro-3/> This programme allows the student to insert a video for analysis. The video can be one made by the student or one found online. The LoggerPro software comes with hundreds of videos. The student calibrates the scale, tracks the motion, and then can analyze the result.

Iteration: http://www.feynmanlectures.caltech.edu/l_09.html

Simulations: <https://phet.colorado.edu/en/simulations/filter?subjects=physics&sort=alpha&view=grid>

Interactive Physics Simulations:

<https://ophysics.com/>

<https://sites.google.com/site/studentdcpsimulations/>

SERC, The Science Education Resource Center at Carleton College. <http://serc.carleton.edu/> and https://serc.carleton.edu/serc/search.html?search_text=physics+videos&search=Go



The PIVOT Interactives from Vernier provide online supplement to hands on experiments, videos that allow students to vary experimental parameters, and allows students to use embedded analysis tools to make measurements and develop their own conclusion www.vernier.com/pivot-interactives

Interactive Video Vignettes: <https://www.compadre.org/ivv/>

Statistical and Thermal Physics: <https://www.compadre.org/stp/>

Cosmic Ray-eLab: <http://www.i2u2.org/elab/cosmic/home/project.jsp>

KCVS: King's University in Edmonton, Canada, web site of King's Center for Visualization in Science: <https://kcv.ca/cards.html?type=applets>

NASA (National Aeronautics and Space Administration), undergraduate computer programs to download: <https://www.grc.nasa.gov/WWW/k-12/UndergradProgs/index.htm>

Particle Physics: OnScreen Science—accurate subatomic particle decay events simulation with analysis tools. <http://www.onscreen-sci.com>

oPhysics: Interactive Physics Simulations listed by topic: <https://ophysics.com/index.html>

PhET: The University of Colorado, Boulder, USA, web site for Physics Education Technology. <https://phet.colorado.edu/en/simulations/category/physics>

Physlets and HTML5 Simulations for physics from Andrew Duffy. <http://physics.bu.edu/~duffy/sims.html>

The Physics Aviary: From Boston University, includes topics for AP physics courses. <https://www.thephysicsaviary.com/Physics/Programs/Labs/find.php>

Virtual Physics Labs from Kentucky Educational Television: <https://virtuallabs.ket.org/physics/>

yTEACH Web Site: <http://www.yteach.com/> There are hundreds of simulations that are categorized by IB physics syllabus topics.



<https://www.edumedia-sciences.com/en/node/402-forces>

Environmental Systems and Societies:

EPA: (demographic, climate change, environmental justice, etc.) - <https://edg.epa.gov/metadata/catalog/main/home.page>

EWG : (toxic, consumer products, energy, farming, etc.) (<https://www.ewg.org/>)

PANGAEA: (atmosphere, ecology, biosphere, fisheries, etc.)
(<https://www.pangaea.de/>)

OECD: (pollution, policies, natural resources) - (<https://www.oecd.org/env/indicators-modelling-outlooks/data-and-indicators.htm>)

USDA nutrient database: (contains a complete nutrition profile for various food and drink items)
<http://ndb.nal.usda.gov/ndb/search/list>

Statistics Canada: (Human activity and the environment)
(<https://www150.statcan.gc.ca/n1/en/catalogue/16-201-X>)

NASA (timely news and information about Earth's changing climate)
(<https://climate.nasa.gov/>)

UNEP (Statistical data published by United Nations Environmental Programme)
(<https://www.unenvironment.org/>)

Center for International Environmental Law: (reports published every year on important environmental issues)
(<https://www.ciel.org/>)

IUCN : (Red list of endangered species)
(<https://www.iucnredlist.org/>)

WWF (Conservation science data and tools)
(<https://www.worldwildlife.org/pages/conservation-science-data-and-tools>)



Environmental Performance Index (Ranks 180 countries on 32 performance indicators across 11 issue categories)
(<https://epi.yale.edu/>)

NOAA: (world's largest provider of weather and climate data)
(<https://www.ncdc.noaa.gov/climate-information>)

Old Maps: (over 400,000 historical maps digitized)
(<https://www.oldmapsonline.org/about/>)

IISD: (An independent think tank championing solutions to the world's sustainability challenges.)
(<https://www.iisd.org/>)

Plants of the World online: (By the Royal Botanic Gardens, Kew)
(<http://www.plantsoftheworldonline.org/>)

World Health Organization (<https://www.who.int/features/factfiles/environmental-disease-burden/en/>)

Geography:

Websites and data sources will depend on the nature of the research and on the specific location. It is important to focus on local studies and, even more than ever, in contexts that are familiar to the candidates (such as the local city or neighbourhood).

Local census data and available databases are highly recommended.

Below are possible research questions for geography EEs potentially based on secondary data:

- To what extent are income, ethnicity and education levels causes of crime in the London boroughs of Hackney, Lewisham, Tower Hamlets and Kensington & Chelsea?
- Does a relation exist between rural decline and the increasing magnitude of wildfires in Asturias, Spain?
- How and why do total fertility rates vary spatially in the urban town of Cascais, Portugal?
- To what extent does socioeconomic development affect gender equality in the neighbourhoods of Rio de Janeiro?
- To what extent does socioeconomic status of each neighbourhood reflect access to ATMs in Amsterdam?



	<ul style="list-style-type: none">• To what extent does Rio de Janeiro's transport infrastructure meet the needs of its residents across the city's neighbourhoods?• To what extent are primary education and income inequality likely to be improved in Buenos Aires as a response to UN SDGs 4 and 10 by 2030 if current changes are maintained?
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Suggestions for useful subject-specific websites and other resources (to source data etc.) [Spanish]	<p>Physics:</p> <p>a) Virtual lab or simulation experiences. These sites contain virtual experiences. They allow collection of data for later use.</p> <p>http://labovirtual.blogspot.com/p/fisica.html</p> <p>https://www.uv.es/casherma/presenta.htm</p> <p>https://www.educaplus.org/games/fisica</p> <p>http://www.exactas.unlp.edu.ar/articulo/2019/5/1/wolfram_demonstrations</p> <p>https://phet.colorado.edu/es/simulations/filter?subjects=physics&sort=alpha&view=grid</p> <p>https://www.walter-fendt.de/html5/phes/</p> <p>http://www.sc.ehu.es/sbweb/fisica/</p> <p>http://www2.montes.upm.es/dptos/digfa/cfisica/animaciones.html</p> <p>https://coleccion.siaeducacion.org/taxonomy/term/3103</p> <p>https://www.geogebra.org/m/TRa7qwhx</p> <p>b) Lessons and ideas: Sites with lessons for gathering ideas or problems that can become research.</p> <p>http://revistadefisica.es/index.php/ref</p>
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<http://revistas.unam.mx/index.php/rmf>

<https://www.muyinteresante.es/tag/fisica>

<https://www.investigacionyciencia.es/materias/fisica>

http://vinculacion.dgire.unam.mx/vinculacion-1/sitio_LCDC/PDF-LCDC/REVISTA%20DE%20CIENCIAS-TEMAS-DE-INTERES/doc96.pdf

<https://rsef.es/problemas-de-la-oef>

<https://oaf.famaf.unc.edu.ar/cuadernillos/pruebas-nacionales/>

<https://www.edumedia-sciences.com/es/node/402-fuerzas>

Chemistry:

<https://clickmica.fundaciondescubre.es/>

<https://ptable.com/?lang=es>

<https://avogadro.cc/>

https://multimedia.uned.ac.cr/pem/laboratorio_quimica/pag/inicio.html

<https://phet.colorado.edu/es/simulations/filter?subjects=chemistry&sort=alpha&view=grid>

<https://www.quimitube.com/>

Environmental Systems and Societies:

World Meteorological Organization. <https://public.wmo.int/es>

United Nations. <https://www.un.org/es/>



World Health Organization. https://www.who.int/features/factfiles/environmental_health/es/

International Union for Conservation of Nature. <https://www.iucn.org/es>

World Wide Fund for Nature. <https://www.wwf.es/>

Intergovernmental Panel on Climate Change. https://archive.ipcc.ch/home_languages_main_spanish.shtml

World Bank environmental and social policies. <https://www.bancomundial.org/es/projects-operations/environmental-and-social-policies>

Earth in real time. <http://www.meteovigo.es/multimedia/la-tierra-en-tiempo-real-nasa.html>

Real time world statistics. <https://www.worldometers.info/es/>

World Data Atlas. <https://knoema.es/atlas/topics/Datos-demogr%C3%A1ficos>

Waste statistics from Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics/es

Food and Agriculture Organization of the United Nations. <http://www.fao.org/animal-genetics/es/>

The most comprehensive botanical database in the world. <https://www.guiaverde.com/noticias/la-base-de-datos-botanica-mas-completa-del-mundo-417/>

Fundación Aquae: Oceans of the World. <https://www.fundacionaquae.org/oceanos-del-mundo/>

Climate change data and graphics. <https://www.epdata.es/datos/cambio-climatico-datos-graficos/447>

Biodiversity database. <https://www.miteco.gob.es/es/ceneam/recursos/pag-web/conservacion/biodiversidad.aspx>

World Bank databank. <https://databank.bancomundial.org/home.aspx>

Statistical data published by the UN Environment Programme (UNEP). <https://www.unenvironment.org/>



	Biology: eBird. https://ebird.org/home
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Suggestions for useful subject-specific websites and other resources (to source data etc.) [French]	General https://phet.colorado.edu/fr/ [Simulations] https://www.pedagogie.ac-nantes.fr [Simulations and videos] http://itarride.chez-alice.fr/anim-simul.htm [Animations] http://www.cea.fr [Simulations and videos] https://www.pccl.fr/ [Animations, simulations and videos] http://www.physagreg.fr/animations.php [Software, applications and animations] https://www.elementschimiques.fr/ [Information and properties] Chemistry http://uel.unisciel.fr/ [Online chemistry course] https://webbook.nist.gov/chemistry/fluid/index.html.fr [Thermochemical database] https://fr.khanacademy.org/science [General and organic chemistry] https://www.faidherbe.org/site/cours/dupuis/accueil.htm [Organic chemistry] https://biochim-agro.univ-lille.fr/ [For option B - biochemistry]
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Physics

<https://phet.colorado.edu/fr/simulations/filter?subjects=physics&sort=alpha&view=grid>

<https://www.walter-fendt.de/html5/phfr/>

<https://www.edumedia-sciences.com/fr/>

Biology

http://membres-timc.imag.fr/Francoise.Giroud/Bio24a/pdf/TD1_Bio24a_BasesDonnees.pdf [Biology database and knowledge base for better understanding of the use of bioinformatics]

https://climat.meteo.gc.ca/historical_data/search_historic_data_f.html [Database on the meteorological and climate conditions in Canada]

https://donneespubliques.meteofrance.fr/?fond=produit&id_produit=110&id_rubrique=37 [Climate data from all French stations]

La Biobase d'ABioDoc. https://abiodoc.docressources.fr/index.php?lvl=cmspage&pageid=4&id_etagere=33

Open Food. <https://fr.openfoodfacts.org/>

Food and Agriculture Organization of the United Nations. <http://www.fao.org/statistics/fr/>

eBird. <https://ebird.org/home>

Environmental Systems and Societies

OECD (pollution, policies, natural resources). <https://www.oecd.org/fr/env/indicateurs-modelisation-perspectives/donnees-et-indicateurs.htm>

Statistics Canada (Human activity and the environment). <https://www150.statcan.gc.ca/n1/fr/catalogue/16-201-X>

UN Environment Programme. <https://www.unenvironment.org/fr>



World Health Organization. https://www.who.int/features/factfiles/environmental_health/fr/

Intergovernmental Panel on Climate Change. https://archive.ipcc.ch/home_languages_main_french.shtml

World Bank environmental and social policies. <https://projects.banquemondiale.org/fr/projects-operations/environmental-and-social-policies>

Real time world statistics. <https://www.worldometers.info/fr/>

Waste statistics from Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics/fr

Food and Agriculture Organization of the United Nations. <http://www.fao.org/animal-genetics/fr>