

IB ESS YEAR 2 - Unit 6

Teacher(s)	IB ESS PLC	Subject Group and Course	Group 4 - ESS		
Course Part and Topic	Topic 8 Human Populations and Urban Systems	SL or HL / Year 1 or 2	SL Year 1	Dates	5 weeks
Unit Description and Texts		DP Assessment(s) for Unit			
<p>In this unit, we will be learning about human populations dynamics, sustainability, resource use, waste, and estimates of global carrying capacity.</p>		<ul style="list-style-type: none"> Formative/Summative assessment quizzes and activities/reports to check for understanding - Based in IB exam questions and format 			

INQUIRY: Establishing the purpose of the unit

<p>Transfer Goals</p> <p><i>List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to “transfer” or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.</i></p>
<p>Statement of Inquiry: Global biodiversity is decreasing rapidly due to human activity. Urbanization, population growth, and consumption patterns drive global environmental change and demand sustainable solutions.</p> <p>Phenomenon: Megacities like Lagos face immense strain on infrastructure and natural resources.</p> <p>3 Unifying Concepts:</p> <ul style="list-style-type: none"> Perspectives: allow students to develop deeper understandings of worldviews and individual perspectives on environmental issues. Systems: allows students to apply holistic analysis and understand the mechanics and purpose of human-constructed systems and the function of natural ones. Sustainability: resource management issues are pivotal to sustainability (central to ESS Course)

Cross-cutting Concepts (CCCs):

- Sustainability and Change
- Cause and Effect

Science and Engineering Practices (SEPs)

- Asking Questions and Defining Problems
- Developing & Using Models
- Analyzing and Interpreting Data
- Constructing Explanations
- Obtaining, Evaluating, and Communicating Information
- Engage in Argument from Evidence

ACTION: teaching and learning through inquiry

Content / Skills / Concepts - Essential Understandings	Learning Process
	<p><i>Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.</i></p>

<p><u>Students will know the following content:</u></p> <p>8.1 Human Populations</p> <p>Guiding questions</p> <ul style="list-style-type: none"> • How can the dynamics of human populations be measured and compared? • To what extent can the future growth of the human population be accurately predicted? <p>8.1.1 Births and immigration are inputs to a human population. Crude birth rate (number of live births per 1,000 people in a population per year) and immigration rate (number of immigrants per 1,000 population per year) are the quantitative measures of population input. The rates can be used at a variety of scales—from small urban areas, like a town, to a country to a region or to the global population.</p> <p>8.1.2 Deaths and emigration are outputs from a human population. Crude death rate (number of deaths per 1,000 people in a population per year) and emigration rate (number of emigrants per 1,000 population per year) are the quantitative measures of population output. The rates can be used at a variety of scales—from small urban areas, like a town, to a country to a region or to the global population.</p> <p>8.1.3 Population dynamics can be quantified and analysed by calculating total fertility rate, life expectancy, doubling time and natural increase. Total fertility rate is the average number of births per woman of childbearing age. Life expectancy is the average number of years that a person can be expected to live, usually from birth, if demographic factors remain unchanged. Doubling time is the number of years it would take a population to double its size at its current growth rate; it can be calculated by using the rule of 70. To do this, divide 70 by the growth rate (as a percentage). Natural increase is birth rate minus death rate, expressed as a number per 1,000 or as a percentage (the birth rate minus the death rate is divided by 10).</p> <p>8.1.4 The global human population has followed a rapid growth curve. Models are used to predict the growth of the future global human population. UN projection models indicate three scenarios linked to future fertility rates. There is uncertainty about how future human fertility rates may change, leading to the three scenarios in the models.</p>	<p>supporting learning:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Socratic seminar <input checked="" type="checkbox"/> Small group/pair work <input checked="" type="checkbox"/> PowerPoint lecture/notes <input checked="" type="checkbox"/> Individual presentations <input checked="" type="checkbox"/> Group presentations <input checked="" type="checkbox"/> Student lecture/leading <input checked="" type="checkbox"/> Interdisciplinary learning <p>Details:</p> <p><i>Students will learn through a combination of presentations, team/small group work, activities surrounding human population dynamics.</i></p> <p>Other(s): Use of social media - Instagram/Twitter for increased awareness - creation of a children's book, game, etc, to inform the younger generation of global population carrying capacity.</p>
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8.1.5 Population and migration policies can be employed to directly manage growth rates of human populations.

These may be anti-natalist or pro-natalist, thereby directly addressing birth rates, or they may address immigration and emigration. These policies may use a variety of cultural, religious, economic, social and political factors to achieve their aims. Include named examples.

8.1.6 Human population growth can also be managed indirectly through economic, social, health, development and other policies that have an impact on births, deaths or migration. Many development policies addressing areas such as, but not limited to, gender equality, education, improvements in public health and welfare will indirectly affect births, deaths and migration. Include two named examples.

8.1.7 The composition of human populations can be modelled and compared using age-sex pyramids.

The pyramid is measured in absolute numbers or as a percentage of the total population. It shows the proportion of the population of either gender in each age group.

8.1.8 The demographic transition model (DTM) describes the changing levels of births and deaths in a human population through different stages of development over time. There are five stages of the DTM, including death and then birth rates declining to produce an exponential increase, stabilization and possible decline in population. Consider the relationship of specific age–sex pyramids to appropriate stages.

Possible engagement opportunities

- Assess and debate issues regarding population change in the local or regional area.
- Investigate traditional migration routes that still exist, the threats to these or solutions involved in maintaining the routes.
- Volunteer in a local refugee centre.
- Engage with local NGOs supporting seasonal or indigenous communities.
- Help with the work of the United Nations High Commissioner for Refugees (UNHCR).

8.2 Urban Systems and Urban Planning

Guiding questions

- To what extent are urban systems similar to natural ecosystems?
- How can reimagining urban systems create a more sustainable future?

Formative assessment(s):

- Quizzes (2)
- Reading Quizzes
- In class activities - Human Population Pyramid Practice, Demographic Transition Model, Case Studies,
- Research assignments - Modeling the Growth of Human Populations

8.2.1 Urban areas contain urban ecosystems.

Urban ecosystems, like all ecosystems, are composed of biotic components (plants, animals and other forms of life) and abiotic components (soil, water, air, climate and topography).

8.2.2 An urban area is a built-up area with a high population density, buildings and infrastructure.

Urban areas have a dense assemblage of buildings and people located close together for residential, cultural, productive, trade and social purposes; rural areas have relatively low population density and dispersed settlements.

Cities, towns and suburbs are classified as urban areas.

8.2.3 An urban area works as a system.

An urban system is the interconnected system of buildings, microclimate, transport, goods and services, power/energy, water/sewage supply, humans, plants and animals.

In urban systems, consider waste/pollution, urban efficiency, sustainability and resilience.

8.2.4 Urbanization is the population shift from rural to urban areas.

Urbanization involves the process of land use becoming more built-up, industrialized and dominated by dense and continuous human settlement and infrastructures.

8.2.5 Due to rural-urban migration, a greater proportion of the human population now live in urban rather than rural systems, and this proportion is increasing.

Include reasons (push–pull factors, forced versus voluntary) for migration from rural to urban areas and the perceived or real advantages of urban settlements. Most rural–urban migration is an internal migration.

Consider the trend within a country for rural–urban migration, along with deurbanization trends.

8.2.6 Suburbanization is due to the movement of people from dense central urban areas to lower-density peripheral areas.

Suburbanization is sometimes referred to as urban sprawl because lower-density settlements require larger areas of land.

8.2.7 The expansion of urban and suburban systems results in changes to the environment.

Include loss of agricultural land, forests or other natural ecosystems, changes to water quality, river flows and air pollution.

<p>8.2.8 Urban planning helps decide on the best way to use land and buildings. Urban planning aims to meet the physical, domestic, environmental, commercial, industrial, financial and health needs of all stakeholders in the community.</p> <p>8.2.9 Modern urban planning may involve considering the sustainability of the urban system. Consider factors including quality and affordable housing, integrated public transport systems, green spaces, security, education and employment, use of renewable resources, reuse and recycling of waste, energy efficiency, involvement of the community, green buildings. Include one example of sustainable urban planning, such as the Cerdà plan in Barcelona (1860), the Hausmann plan for Paris (1850s), Brasilia (1960), the controversial Forest City in Malaysia, reduction or removal of car use (Copenhagen), EV charging stations (San Francisco), water conservation (Dubai green space irrigated with grey water).</p> <p>8.2.10 Ecological urban planning is a more holistic approach that treats the urban system as an ecosystem, understanding the complex relationships between its biotic and abiotic components. Consider one example from the following list.</p> <p>Urban ecology—for example, green spaces, habitats for wildlife, allotments, parks, canals, ponds</p> <p>Urban farming—for example, beekeeping, horticulture, aquaculture and city farms</p> <p>Biophilic design—for example, living green walls and roofs, water features, natural light</p> <p>Resilience planning—for example, vertical farming in cities, building on stilts in flood-prone areas, fail-safe grids</p> <p>Regenerative architecture—for example, building skins that scrub the air clean, capturing rainwater that replenishes aquifers, solar panels/wind turbines/biodigesters that export energy</p> <p>Possible engagement opportunities</p> <ul style="list-style-type: none"> ● Investigate population change in the students’ own country and discuss impacts on society and options for population management. ● Volunteer with an organization that works to support those people who may have suffered from social and environmental inequity locally. 	
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- Students can evaluate the extent to which a local urban environment is sustainable.
- They could engage in additional activities beyond the classroom.
 - Use SDG 11 - for sustainable cities and communities - to evaluate local sustainability.
 - Propose smart city functionality for your school community.

8.3 Urban Air Pollution

Guiding questions

- How can urban air pollution be effectively managed?

8.3.1 Urban air pollution is caused by inputs from human activities to atmospheric systems, including nitrogen oxides (NO_x), sulfur dioxide, carbon monoxide and particulate matter. Particulate matter is categorized according to size of particle, with PM_{2.5} being fine particulate matter with a diameter of 2.5 micrometres or less and PM₁₀ being air pollution that is made of larger particulate matter with a diameter of 10 micrometres.

8.3.2 Sources of primary pollutants are both natural and anthropogenic. Primary pollutants are directly active at the point of emission. Include forest fires, dust and volcanic eruptions as natural sources. Include burning for agricultural and forest clearance, burning of fossil fuels and biomass for energy production, and dust from construction/roads as anthropogenic sources.

8.3.3 Most common air pollutants in the urban environment are either derived directly or indirectly from combustion of fossil fuels. PM_{2.5}, PM₁₀, carbon monoxide and sulfur dioxide are primary pollutants, and tropospheric ozone, nitric acid and sulfuric acid are secondary pollutants.

8.3.4 A range of different management and intervention strategies can be used to reduce urban air pollution. Include strategies such as, but not limited to, improved public transportation, infrastructure for cycling, growing trees, natural screens, green walls, compulsory catalytic converters, limited car use and pedestrianized town centres.

8.3.5 NO_x and sulfur dioxide react with water and oxygen in the air to produce nitric and sulfuric acid, resulting in acid rain. Include the chemistry of acid rain formation.

8.3.6 Acid rain has impacts on ecology, humans and buildings.

<p>Effects are: on terrestrial habitats (leaching, toxification of the soil, direct impact on foliage); on freshwater habitats (toxicity due to aluminium solubilization, impacts on fish gills and invertebrate exoskeletons); the corrosion of marble, limestone, steel, paint and other construction materials; on breathing, from nitrate and sulfate particles (tissue damage and lung inflammation from components of PM2.5 and acid deposition).</p> <p>8.3.7 Management and intervention strategies are used to reduce the impact of sulfur dioxide and NO_x on ecosystems and to minimize their effects.</p> <p>As with other forms of pollution, these pollutants can be managed by altering human activity (for example, using alternative energy sources), controlling at the point of release (for example, scrubbers and catalytic converters) or restoring the damaged systems (for example, healthcare and adding limestone/fertilizer to lakes).</p> <p>Possible engagement opportunities</p> <ul style="list-style-type: none"> ● Investigate and debate the causes and consequences of urban air pollution in the local environment, and strategies that could be used to reduce pollution. ● Participate in citizen science air-quality projects by installing a networked weather station in the school. ● Advocate for improved walking and cycling options for the school <p><u>Students will develop the following skills:</u></p> <p>Application of skills:</p> <ul style="list-style-type: none"> ● Work out natural increase rates and doubling times from given data. ● Create a systems flow diagram representing an urban system. ● Investigate maps that show the urban development of a city over time. ● Plan an experiment to use an indicator species as a correlate for pollution in the local environment. 	
<p>International Mindedness:</p> <p>Local knowledge is valuable for student studies, also in urban areas. Students will be given opportunities to access and gain knowledge may come from various stages of demographic transition.. International mindedness can include developing an understanding of communities with different worldviews.</p>	<p>Summative assessments: MEDCs vs LEDCs presentation Topic Test</p> <hr/> <p>Differentiation:</p> <p><input checked="" type="checkbox"/> Affirm identity - build self-esteem</p>

	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Value prior knowledge <input checked="" type="checkbox"/> Scaffold learning <input checked="" type="checkbox"/> Extend learning <p>Details:</p> <ul style="list-style-type: none"> ● <i>SWD/504 – Accommodations Provided</i> ● <i>ELL – Reading & Vocabulary Support</i> ● <i>Intervention Support</i> ● <i>Extensions – Enrichment Tasks and Project</i>
<p>Approaches to Learning (ATL)</p> <p><i>Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.</i></p>	
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Thinking <ul style="list-style-type: none"> ● Evaluating claims of attaining sustainability and the identification of barriers to attaining sustainability ● Critically examining and evaluating the evidence and theory supporting competing narratives on environmental/sustainability issues ● Evaluating and defending ethical positions on environmental/sustainability issues <input checked="" type="checkbox"/> Social <ul style="list-style-type: none"> ● Assigning and accepting specific roles during group activities ● Generating agreed solutions with respect to the interests of all stakeholders <input checked="" type="checkbox"/> Communication <ul style="list-style-type: none"> ● Practicing active listening skills and appreciating that understanding different perspectives can allow for better communication <input checked="" type="checkbox"/> Self-management <ul style="list-style-type: none"> ● Breaking down major tasks into a sequence of stages ● Logically organizing and ordering a variety of information sources <input checked="" type="checkbox"/> Research <ul style="list-style-type: none"> ● Locating and evaluating secondary information sources for accuracy, bias, credibility and relevance ● Explicitly discussing the importance of academic integrity and full acknowledgement of the ideas of others ● Seeking out interconnections between academic disciplines and real-world experience <p>Details: This topic provides students with a vast amount of information that can be studied in many ways. The ATLs used for this subtopic will vary depending on the individual students and groups approach to showing their understanding of the material.</p>	

Language and Learning <i>Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see the guide.</i>	TOK Connections <i>Check the boxes for any explicit TOK connections made during the unit</i>	CAS Connections <i>Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.</i>
<ul style="list-style-type: none"> <input type="checkbox"/> Activating background knowledge <input checked="" type="checkbox"/> Scaffolding for new learning <input checked="" type="checkbox"/> Acquisition of new learning through practice <input type="checkbox"/> Demonstrating proficiency <p>Details:</p> <p><i>Students will acquire new vocabulary concerning human population dynamics.</i></p>	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Personal and shared knowledge <input checked="" type="checkbox"/> Ways of knowing <input checked="" type="checkbox"/> Areas of knowledge <input checked="" type="checkbox"/> The knowledge framework <p>Details: International mindedness with the various human population dynamics</p>	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Creativity <input checked="" type="checkbox"/> Activity <input type="checkbox"/> Service <p>Details:</p> <p><i>Students may apply creativity in their group and individual projects- species profile and creation of a children's book, song, game, etc, that will teach the younger generation about human population dynamics.</i></p>
Resources <i>List and attach (if applicable) any resources used in this unit</i>		
<ul style="list-style-type: none"> ● Oxford Environmental Systems and Societies ISBN 978-0-19-833256-5 ● Biozone Environmental Science Student Workbook ISBN 978-1-927173-55-8 ● Hodder Education Environmental Systems and Societies Study and Revision Guide ISBN 978-1-471-89973-7 ● IB ESS Schoology Group 		

REFLECTION: considering the planning, process, and impact of the inquiry

<p>What worked well</p> <p><i>List the portions of the unit (content, assessment, planning) that were successful</i></p>	<p>What didn't work well</p> <p><i>List the portions of the unit (content, assessment, planning) that were not as successful as hoped</i></p>	<p>Notes / Changes / Suggestions</p> <p><i>List any notes, suggestions, or considerations for the future teaching of this unit</i></p>
<p>Population case studies for the five stages of demographic transition and presentations.</p>	<p>Students still need more practice with command terms used in IB style assessment questions.</p> <p>Some students are still struggling with graph and chart reading for some types of figures. Students do well with maps or simple line and bar graphs, but struggle with more complex figures.</p>	<p>Increase collection of data. Consider moving this unit to early fall semester or late spring semester to provide more opportunities for field data collection.</p> <p>Include some crossover activities that highlight knowledge and skills used in other topics.</p> <p>Continue including time for IB command term practice and graph/chart/figure analysis.</p>