



20th International Geography Olympiad

Maynooth, Ireland

19–24 August 2024

WRITTEN RESPONSE TEST

Resource Booklet

Do NOT open the Booklet before instructed to do so by a supervisor.

Do NOT write any of your answers in this Booklet.

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Written Response Test

Contributions from: Denmark, Indonesia, Latvia, Poland, Slovenia and Switzerland
Committee Convenor: Ivan Sulc (Croatia)
Director of Tests: Susan Lomas (UK)

Section A: Plastic pollution in oceans



Figure A1: Ocean gyres in the world: 1 – North Pacific Gyre, 2 – Indian Ocean Gyre, 3 – South Pacific Gyre, 4 – South Atlantic Gyre, 5 – North Atlantic Gyre
(<https://theoceancleanup.com/great-pacific-garbage-patch/>)

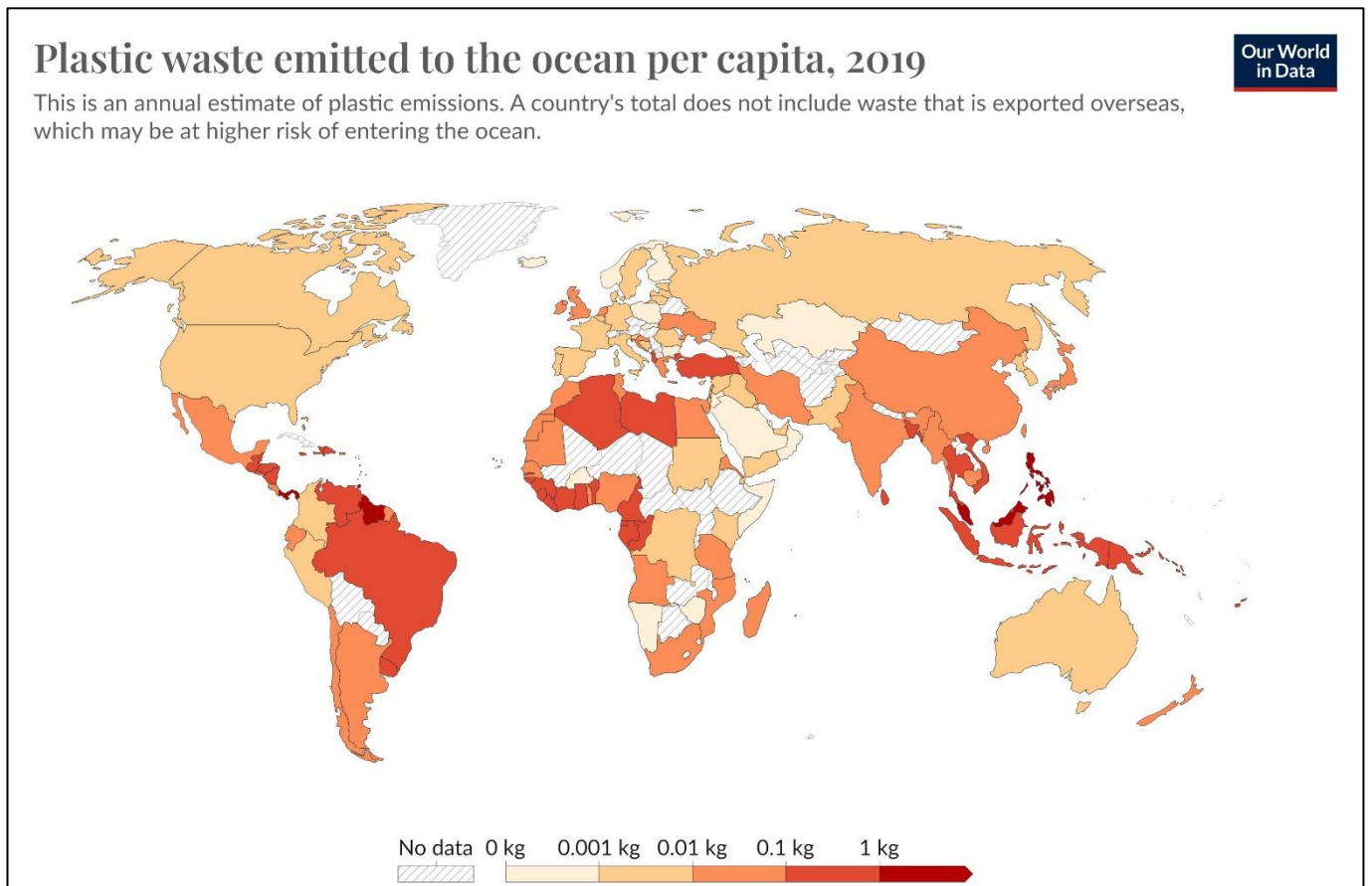
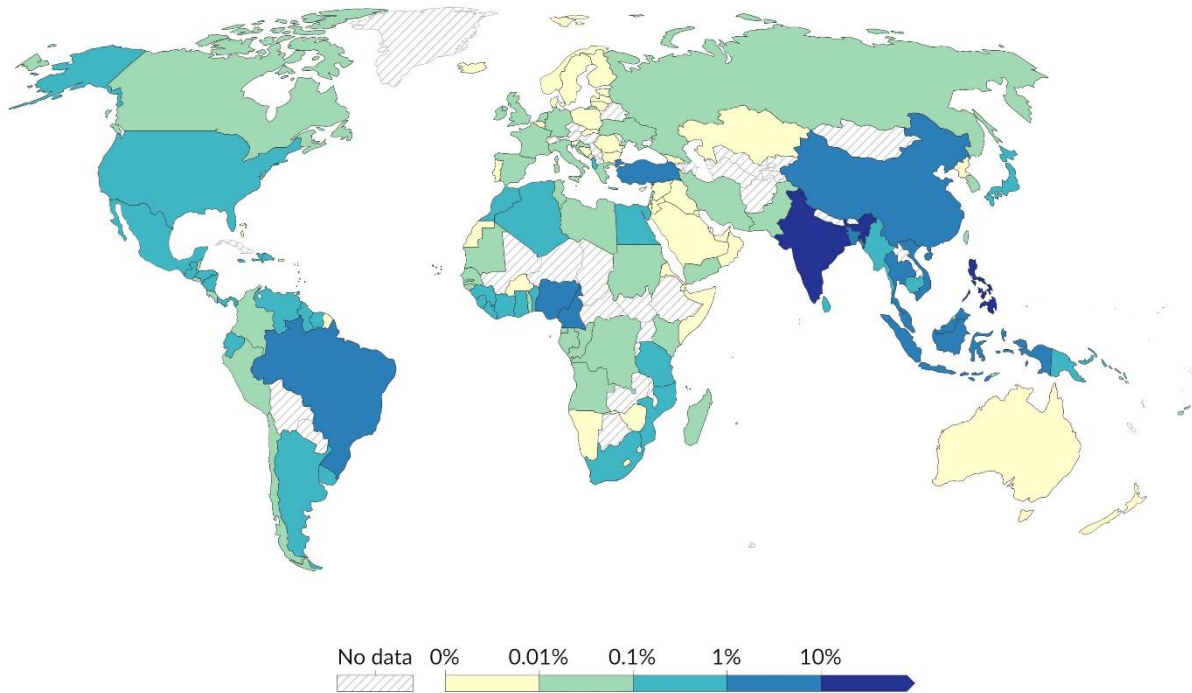


Figure A2: Plastic waste emitted to the ocean per capita by country in 2019
(Meijer et al., 2021)

Share of global plastic waste emitted to the ocean, 2019

Annual estimate of plastic emissions. A country's total does not include waste that is exported overseas, which may be at higher risk of entering the ocean.



Data source: Meijer et al. (2021)

OurWorldInData.org/plastic-pollution | CC BY

Figure A3: Share of global plastic waste emitted to the ocean by country in 2019
(Meijer et al., 2021)

Section B: Amazon forest ecosystem

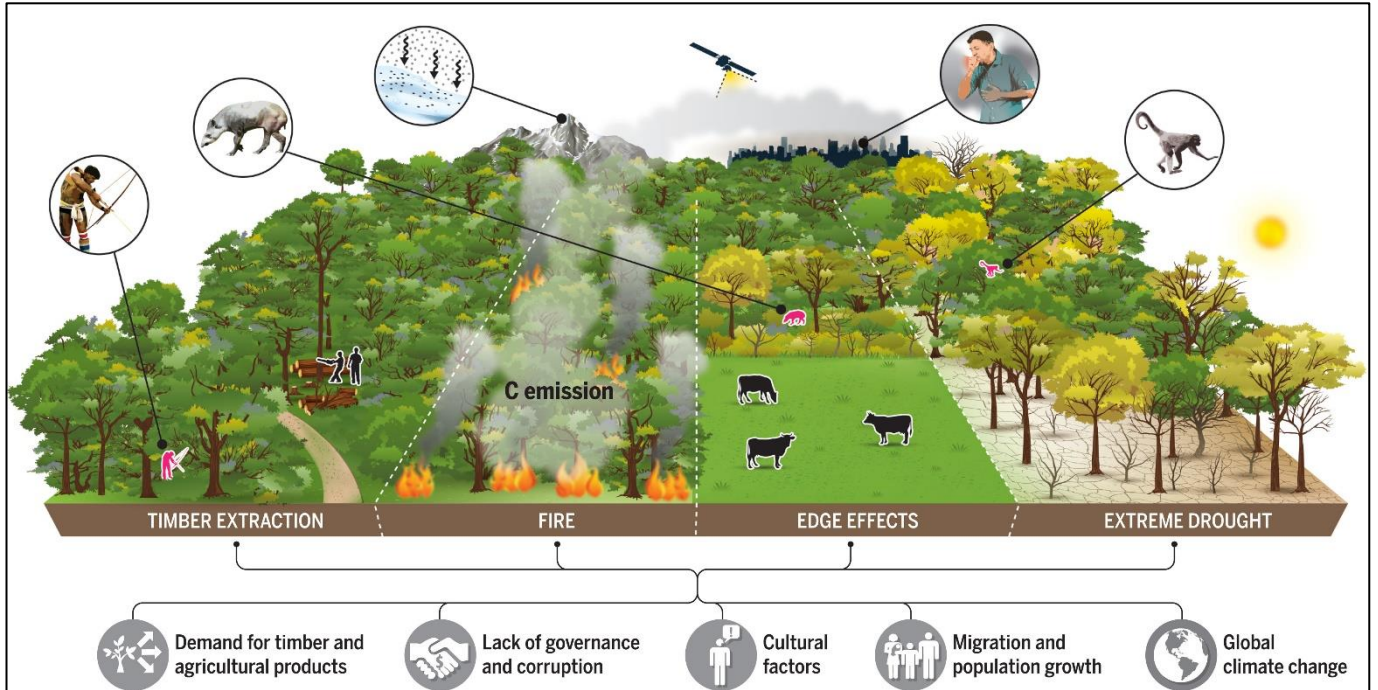


Figure B1: An overview of tropical forest degradation processes in the Amazon

(<https://www.science.org/doi/10.1126/science.abp8622>)

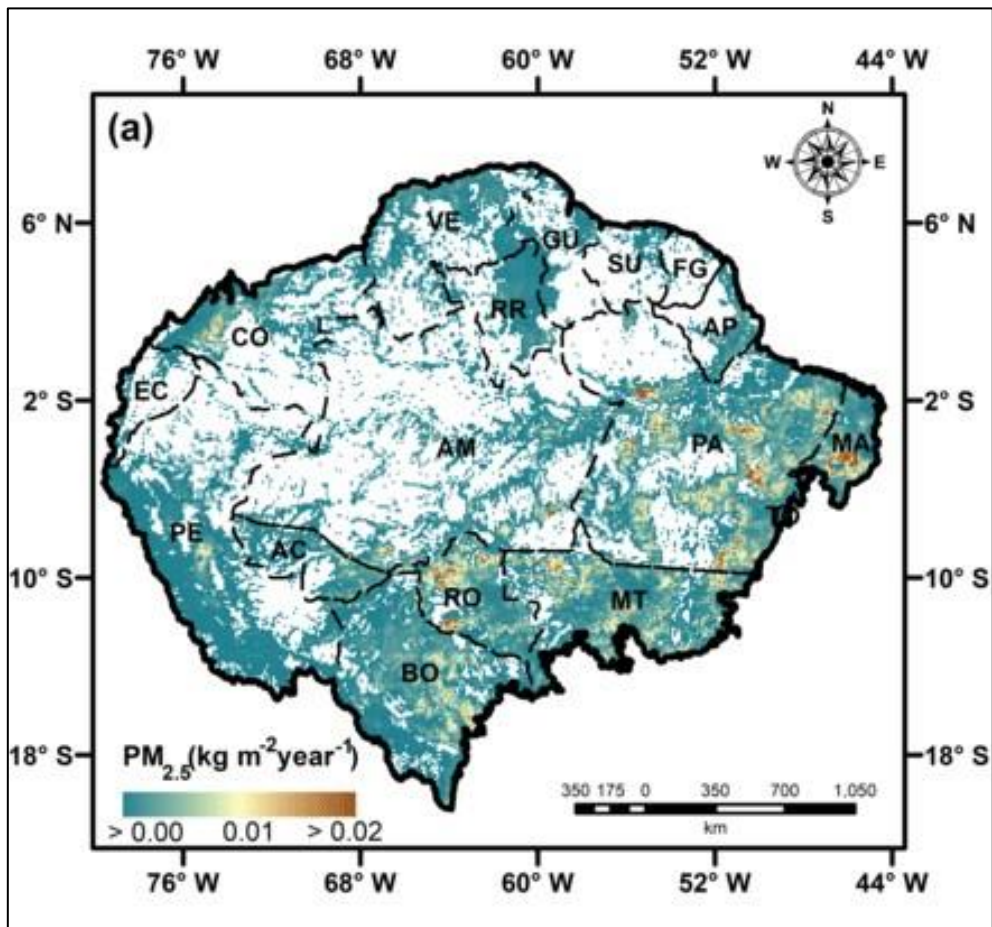


Figure B2. The distribution of PM_{2.5} persistent organic pollutants in the atmosphere
NOTE: PM_{2.5} – fine particles in the air that are 2.5 microns or less in diameter

(https://www.researchgate.net/publication/354428933_Relationship_between_Biomass_Burning_Emissions_and_Deforestation_in_Amazonia_over_the_Last_Two_Decades)

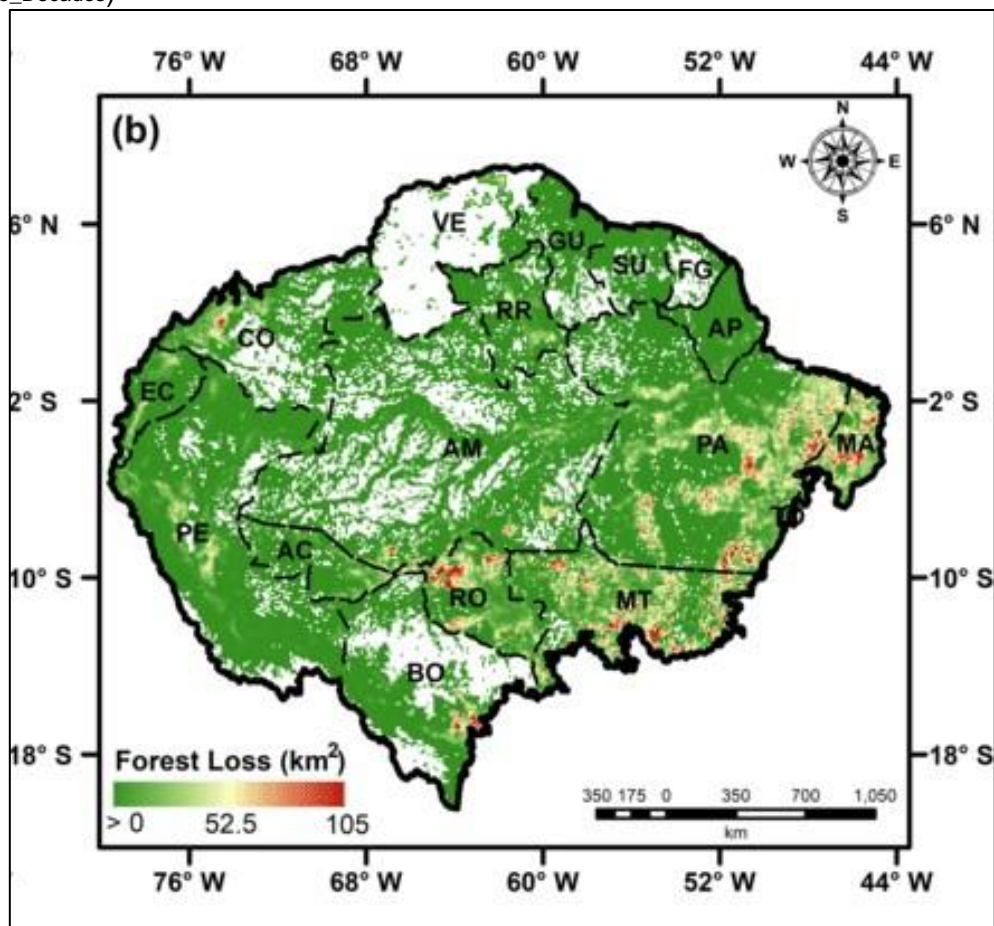


Figure B3. The extent of deforestation in the Amazon Forest.

(https://www.researchgate.net/publication/354428933_Relationship_between_Biomass_Burning_Emissions_and_Deforestation_in_Amazonia_over_the_Last_Two_Decades)

Section C: Monsoon and weather phenomena in Dubai

Table C1. Climate data of Kathmandu and Dubai

(<https://en.climate-data.org/>)

Month	Average Temperature (°C)		Precipitation (mm)		Humidity (%)		Rainy Days	
	Kathmandu	Dubai	Kathmandu	Dubai	Kathmandu	Dubai	Kathmandu	Dubai
January	9.2	19.4	44	17	73%	61%	5	2
February	11.3	20.7	56	15	69%	57%	7	2
March	14.6	23.3	59	16	57%	52%	8	2
April	17.9	27.7	79	4	54%	45%	10	0
May	19.1	31.8	205	0	72%	42%	16	0
June	20.5	33.8	460	0	85%	47%	19	0
July	20.3	35.6	778	2	92%	47%	22	0
August	20.3	35.7	643	0	91%	46%	22	0
September	19.5	33.2	334	0	88%	52%	20	0
October	16.8	30.0	98	1	80%	54%	12	0
November	13.6	25.5	30	3	75%	57%	6	1
December	10.7	21.3	26	10	76%	61%	4	1

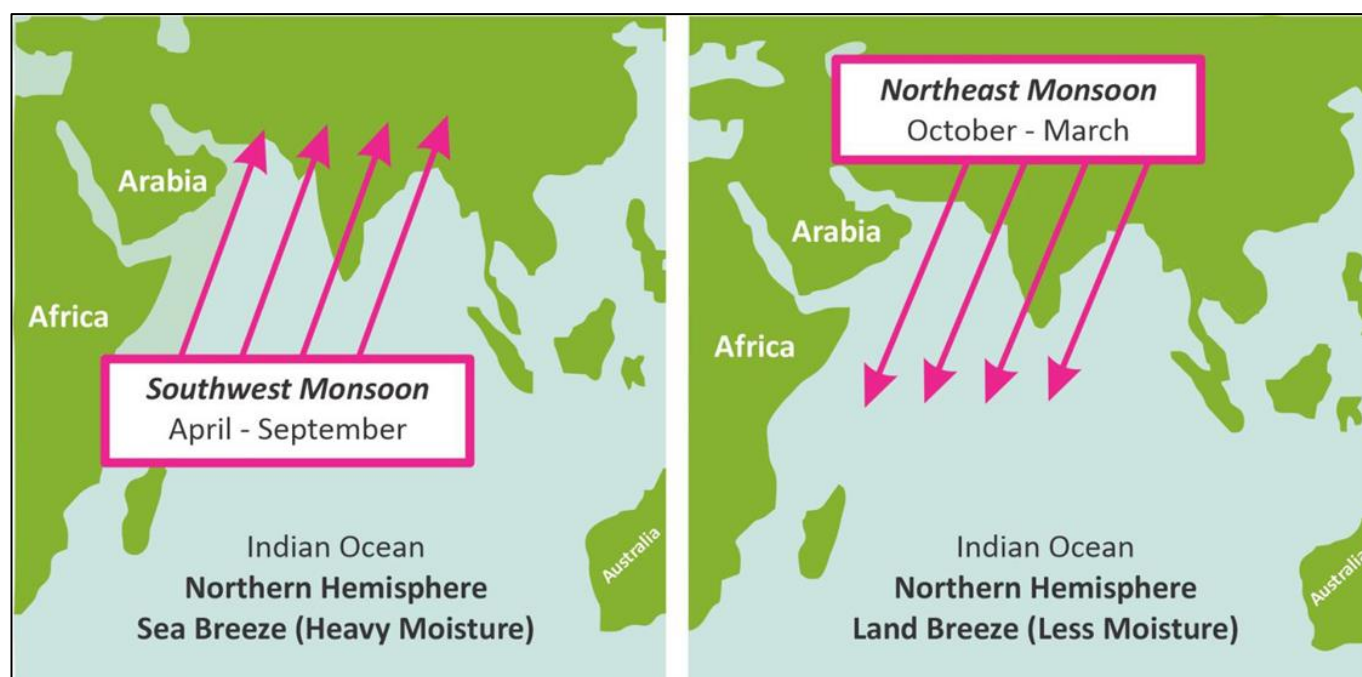


Figure C1. Monsoon system mechanism in Indian ocean and surrounding continents

(<https://plutusias.com/monsoon-shocks/>)

Text box C1. Flood after a rainstorm in Dubai on 19 April 2024

On 19 April 2024, Dubai experienced an unprecedented weather event with record-breaking rainfall of 259.5 mm, causing widespread flooding and the heaviest rainfall since records began in 1949. The impact of this historic storm had a profound effect on traffic and daily life in Dubai, particularly at Dubai International Airport. There were hundreds of flight cancellations and delays, and commuters were stranded for more than 12 hours in some cases. The heavy rainfall overwhelmed the infrastructure and raised the question of how prepared the city is for such extreme weather events.

Satellite image of Dubai,
April 3, 2024. NASA



Satellite image of Dubai,
April 19, 2024. NASA

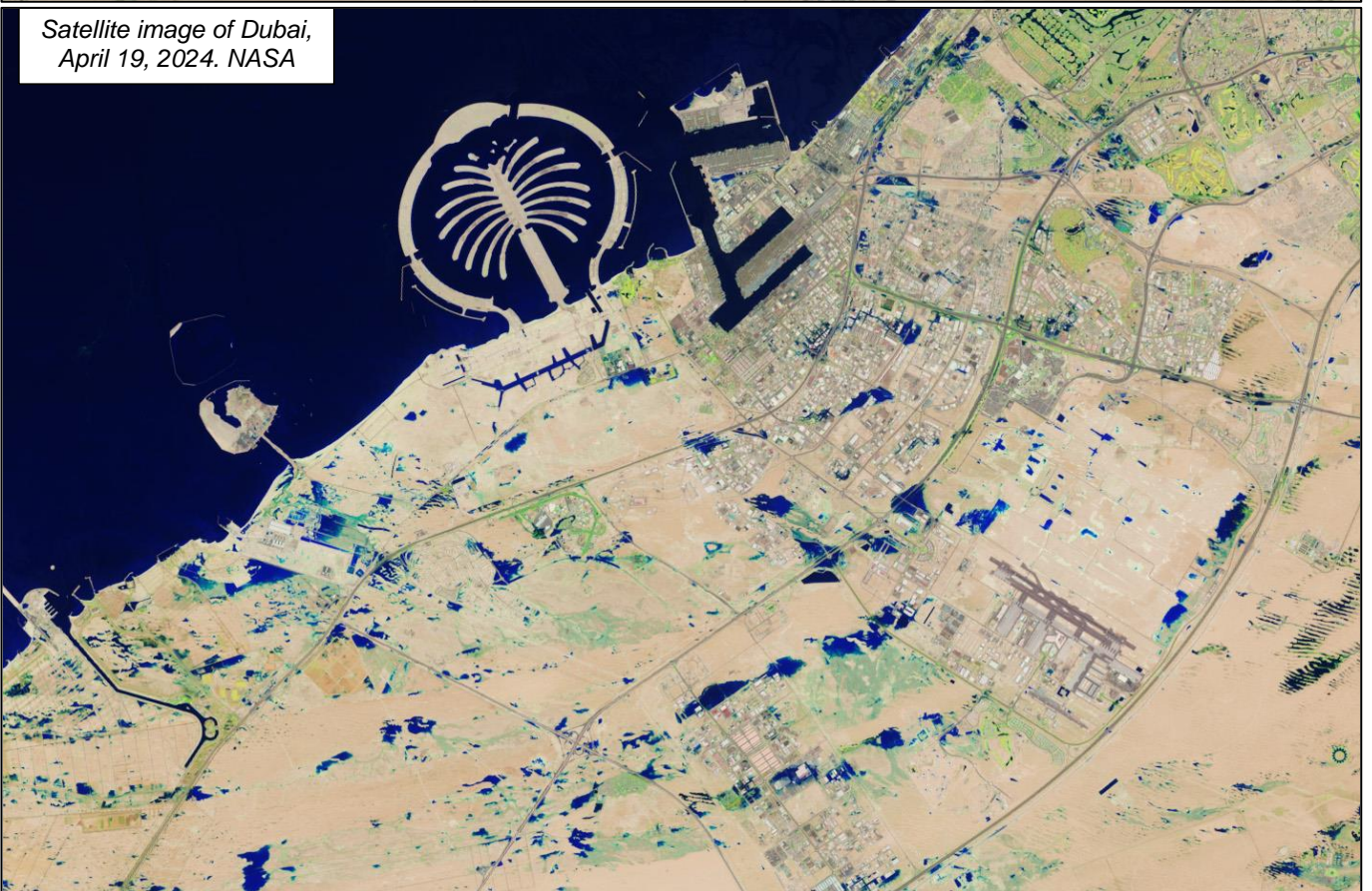


Figure C2. Deluge in the United Arab Emirates in April 2024
(<https://earthobservatory.nasa.gov/images/152703/deluge-in-the-united-arab-emirates>)



Figure C3. Flooded road and airport after a rainstorm in Dubai on 19 April 2024
(<https://www.reuters.com/>, <https://moodiedavittreport.com>)

Section D: Periglacial landscape and climate change

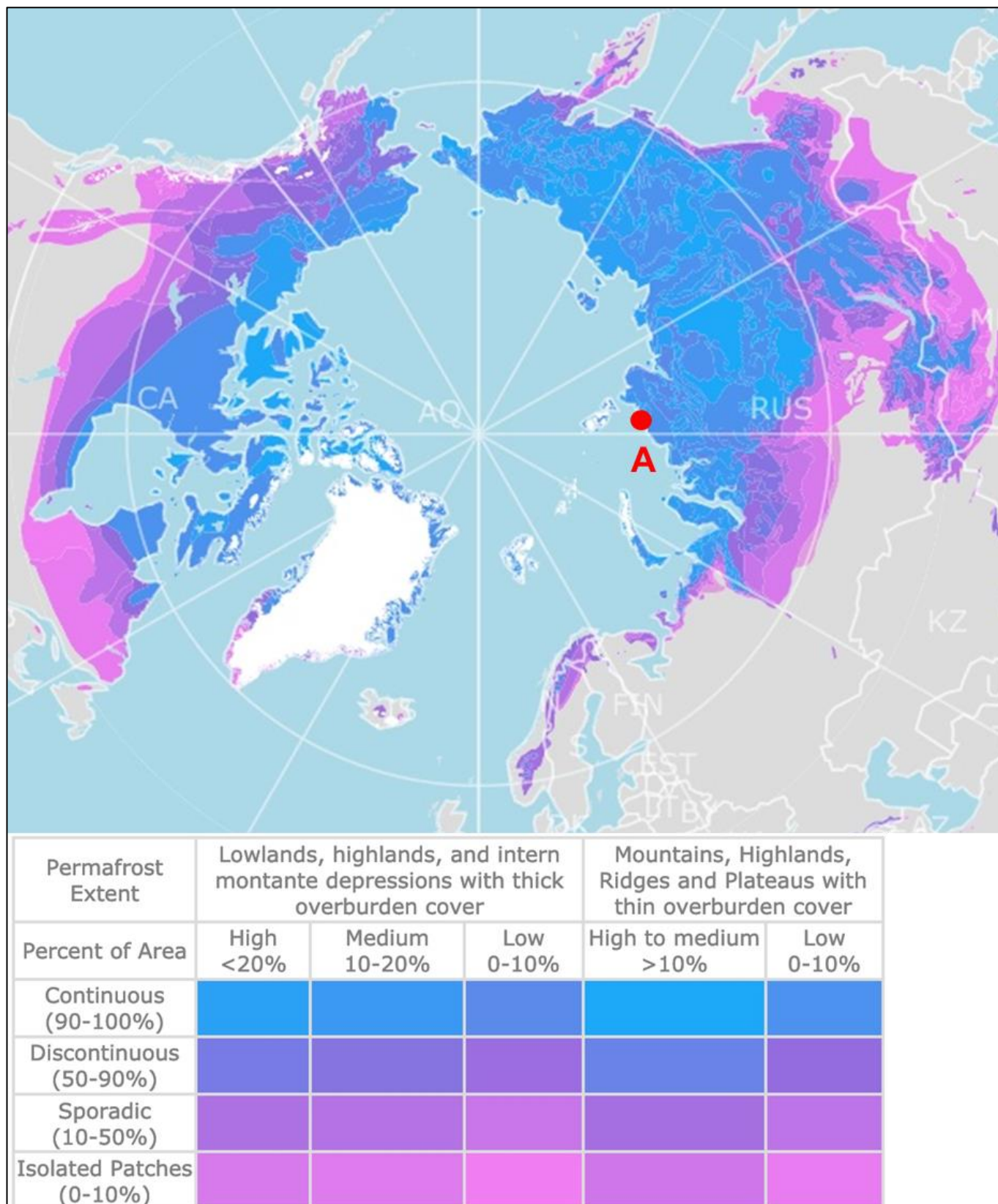


Figure D1. Permafrost zones in the Arctic area (point A represents the site in Figure D2)
 (<https://databayou.com/arctic/permafrost.html>)

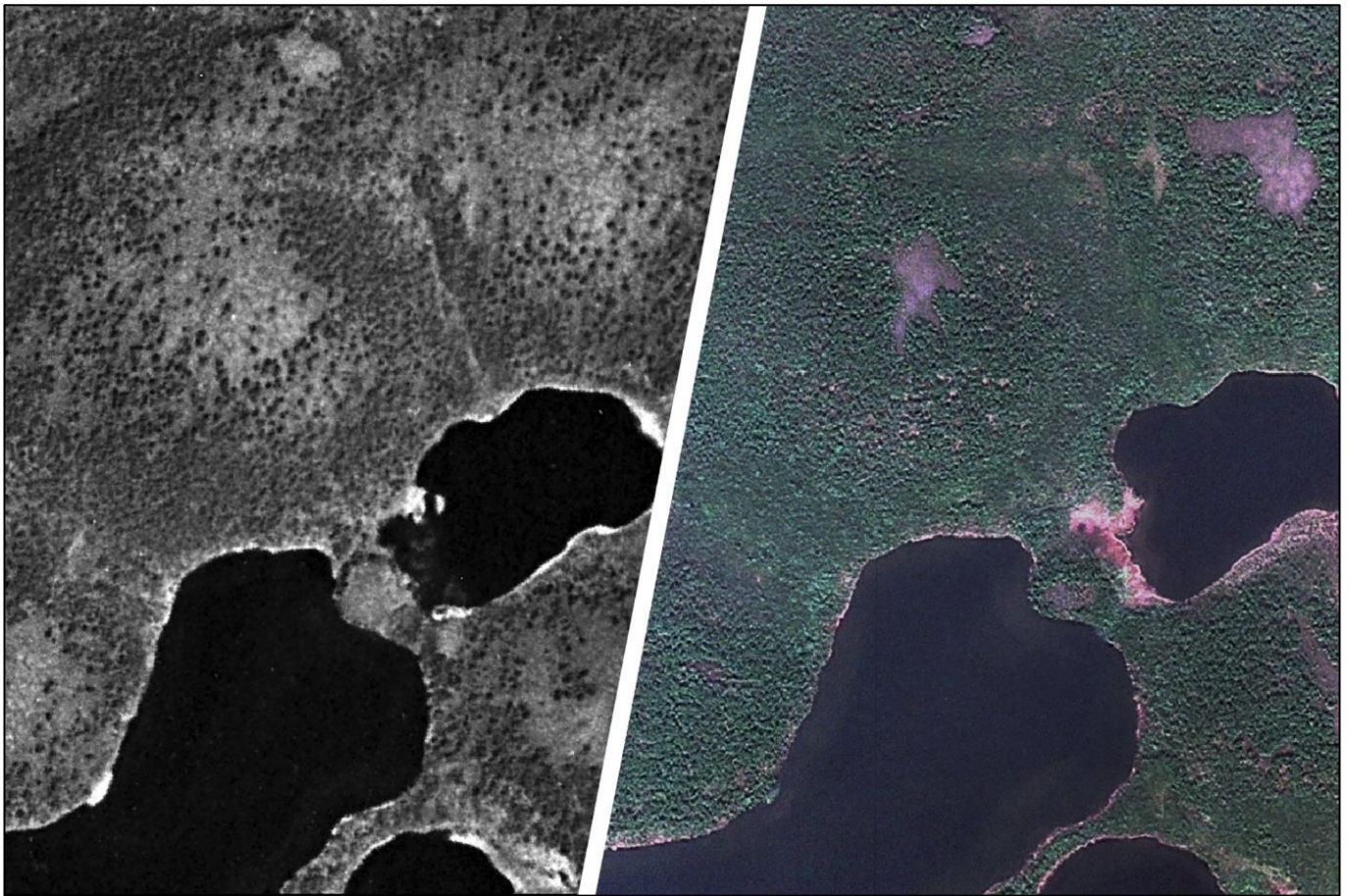


Figure D2. Satellite image of the site on Taymyr Island in Russian Siberia in July 1966 (left) and July 2009 (right), marked with point A in Figure D1

(<https://news.virginia.edu/content/cold-war-era-spy-satellite-images-reveal-possible-effects-climate-change>)

Table D1. Data on main greenhouse gases in the atmosphere

(<https://css.umich.edu/publications/factsheets/climate-change/greenhouse-gases-factsheet>)

Compound	Pre-industry Concentration	Concentration in 2019	Atmospheric Lifetime (years)	Main Human Activity Source	GWP**
Carbon dioxide (CO ₂)	278 ppm	416 ppm*	Variable	Fossil fuels, cement production, land use change	1
Methane (CH ₄)	729 ppb	1908 ppb*	12	Fossil fuels, Rice paddies, waste dumps, livestock	30 (fossil fuel), 27 (non fossil fuel)
Nitrous Oxide (N ₂ O)	270 ppb	335 ppb*	109	Fertilizers, combustion industrial processes	273
HFC-134a (CF ₃ CH ₂ F)	0 ppt	108 ppt	14	Refrigerant	1,526
HFC-32 (CH ₂ F ₂)	0 ppt	20 ppt	5	Refrigerant	771
CFC-11 (CCl ₃ F)	0 ppt	226 ppt	52	Refrigerant	6,226
PFC-14 (CF ₄)	34 ppt	86 ppt	50,000	Aluminum production	7,380

*Concentration in 2021; ** GWP – 100-year global warming potential; PPM – parts per million; PPB – parts per billion

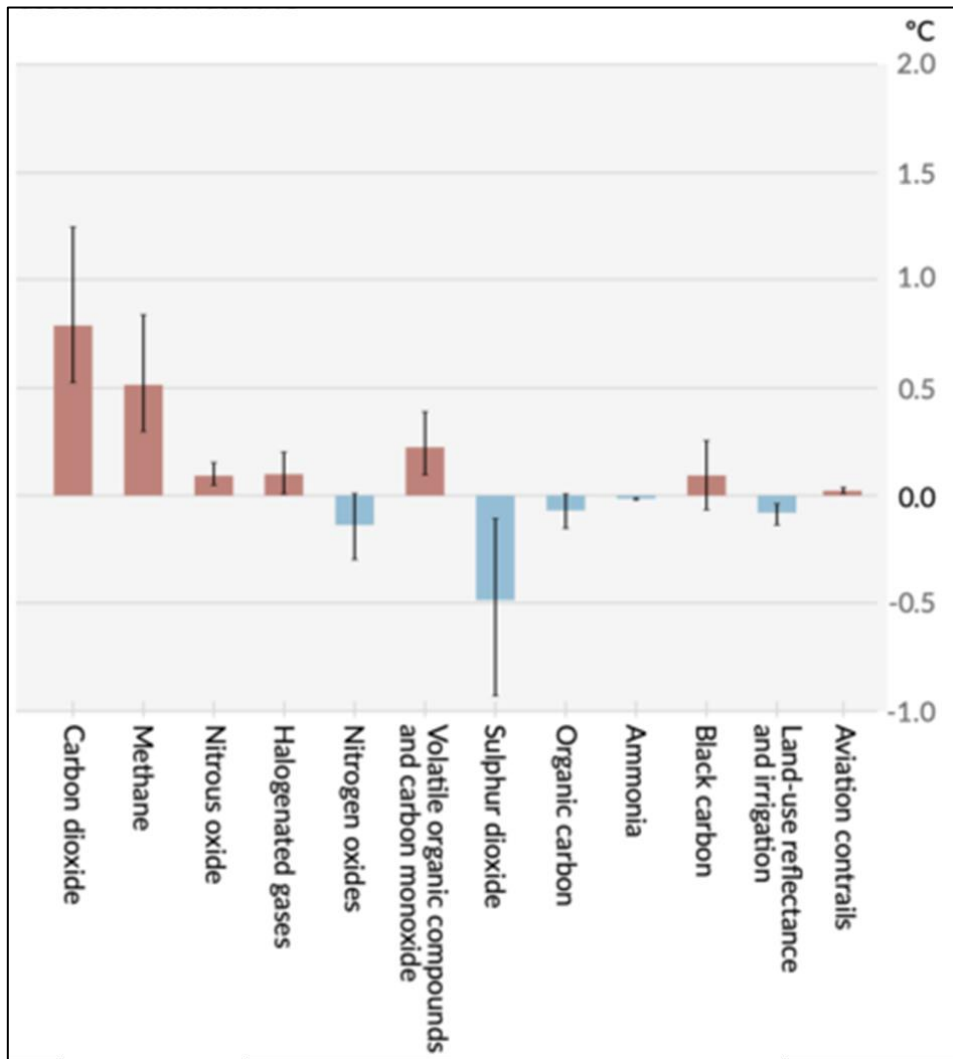


Figure D3. Contribution of greenhouse gases to global temperature rise (2010-2019 compared to 1850-1900)

(<https://www.realclimate.org/index.php/archives/2021/09/the-definitive-co2-ch4-comparison-post/>)

Section E: Olympic games

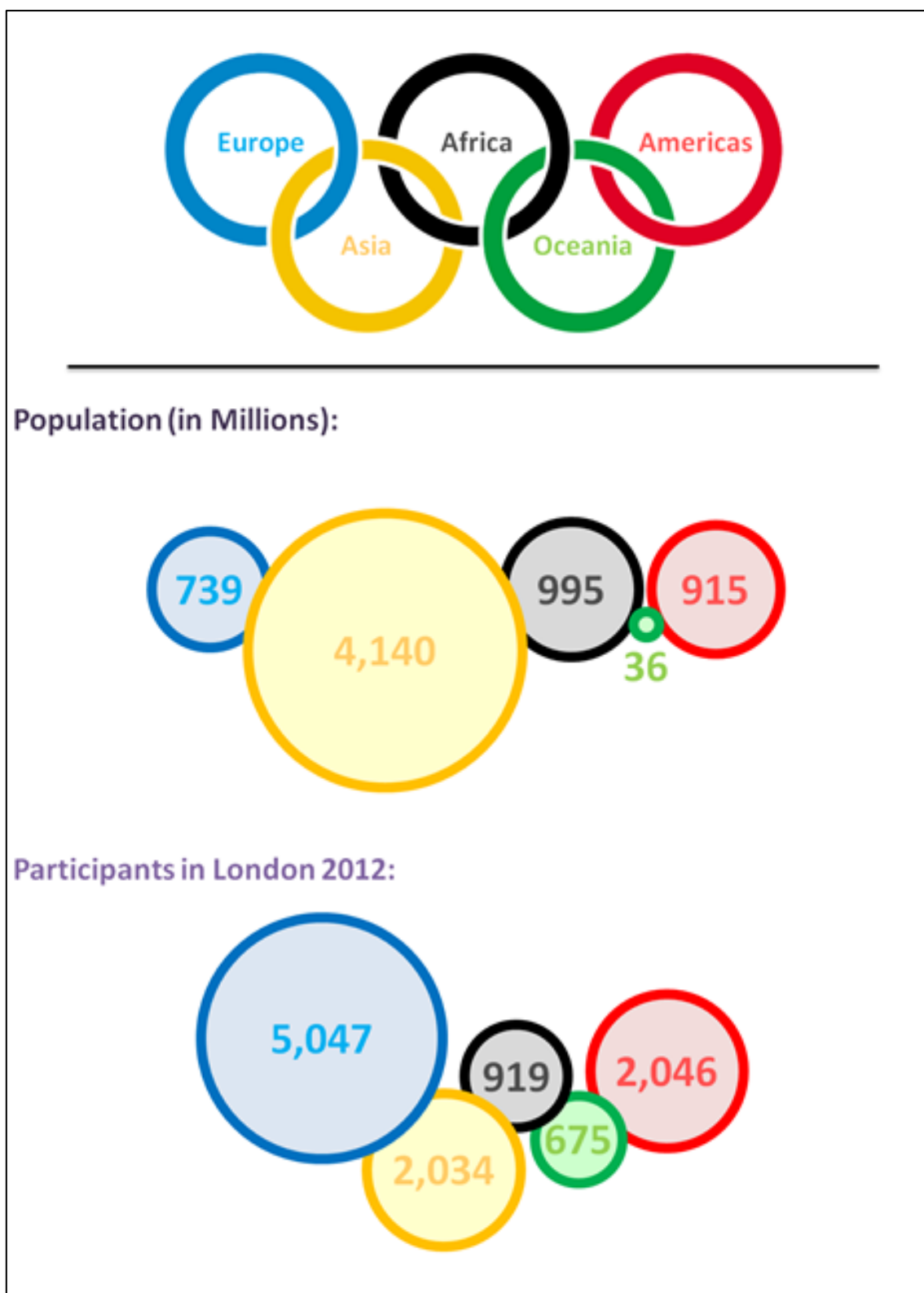


Figure E1. Population and number of participants in London Summer Olympic Games in 2012 per continent

(<http://www.ativaesporte.com/curiosities/olympic-geography/attachment/olympics/>)

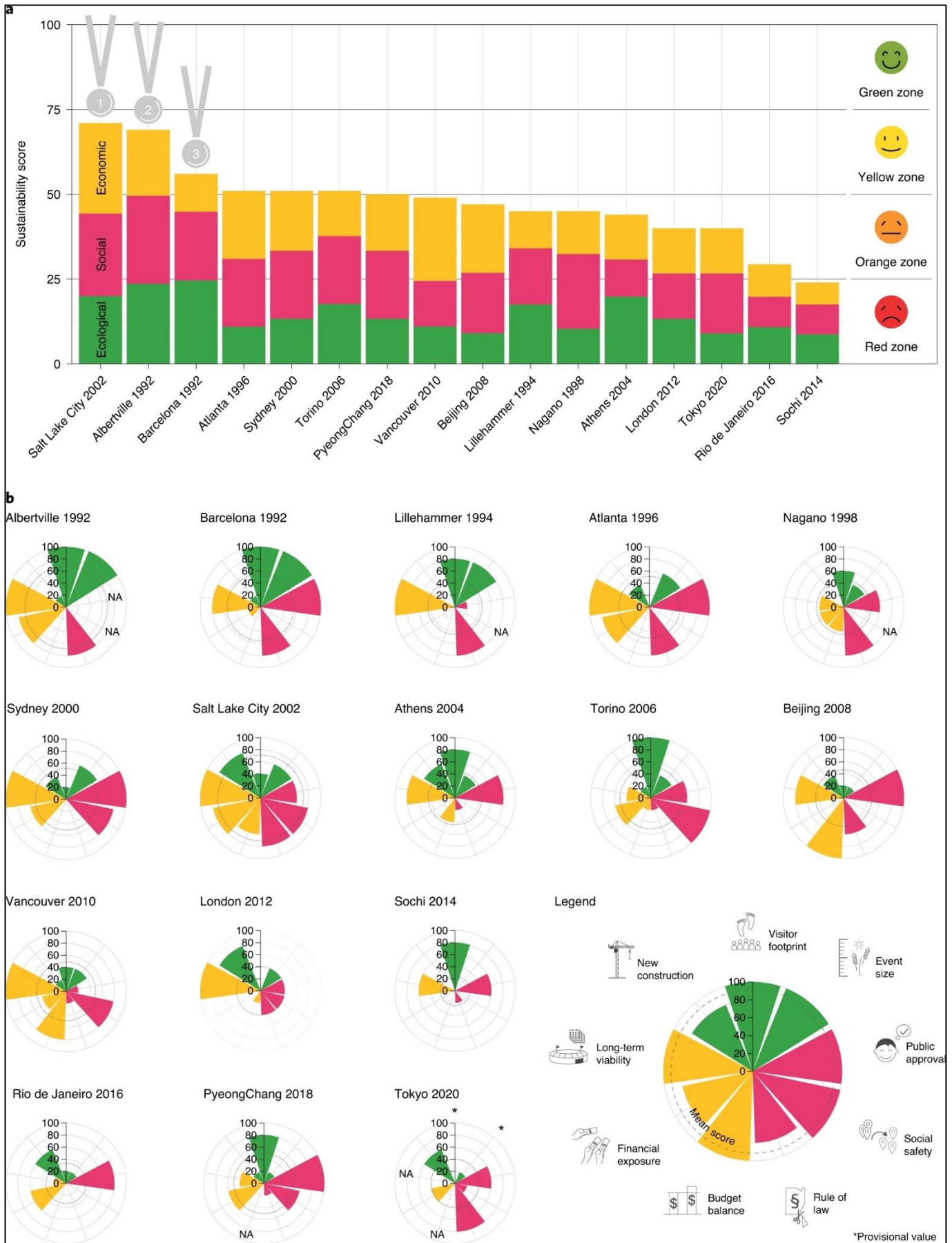


Figure E2. Ranking of Olympic cities according to ecological, social and economic sustainability
<https://www.nature.com/articles/s41893-021-00696-5#additional-information>



Figure E3. Aerial imagery of the site of the Olympic Village of Poblenou in Barcelona in 1977 (top image) and in 2022 (bottom image)

(<https://soar.earth/maps?pos=41.3896825636242%2C2.1963317950353645%2C16.54>)

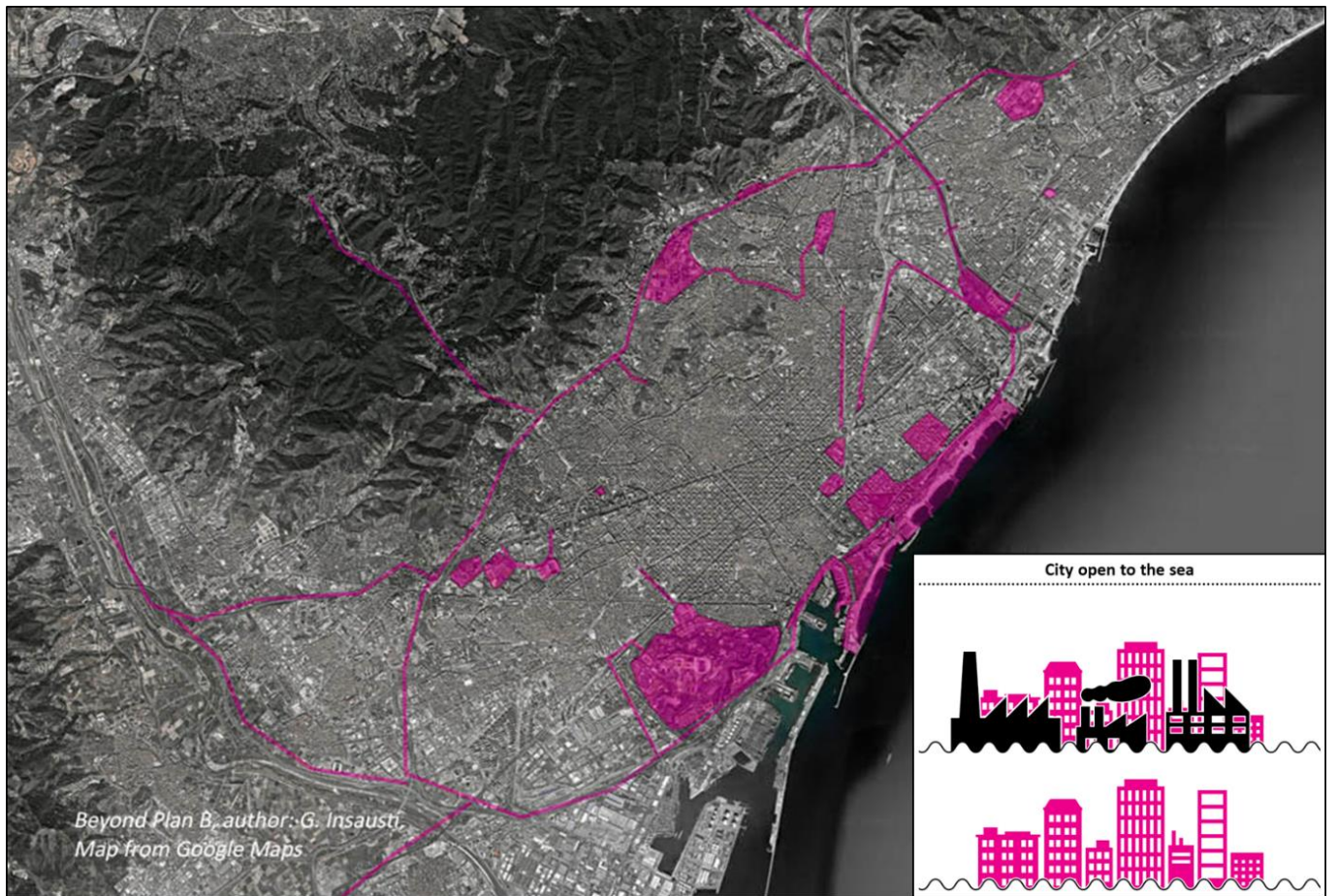


Figure E4. Barcelona urban regeneration project 1986-1992 (remodelled areas are marked in pink)
(https://beyondplanb.eu/projects/project_barcelona_a_92_olympic.html#3)

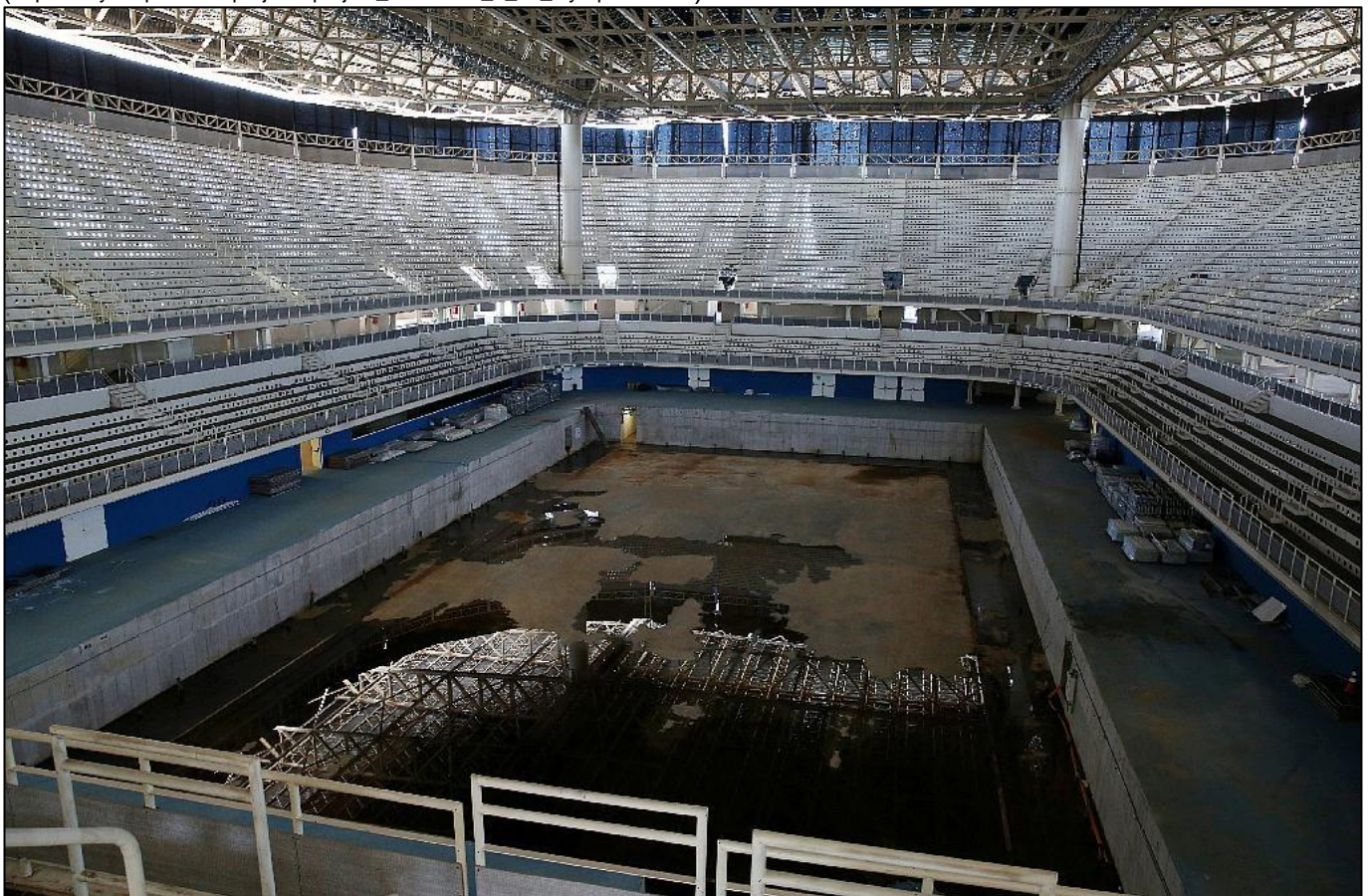


Figure E5. The condition of one of the venues after the Olympic Games in Rio de Janeiro
(<https://www.rtvsllo.si/zabava-in-slog/ture-avanture/novice/foto-olimpijski-objekti-v-riu-ze-po-enem-letu-v-zalostnem-stanju/429544>)

Section F: Commuting mobility in the cities

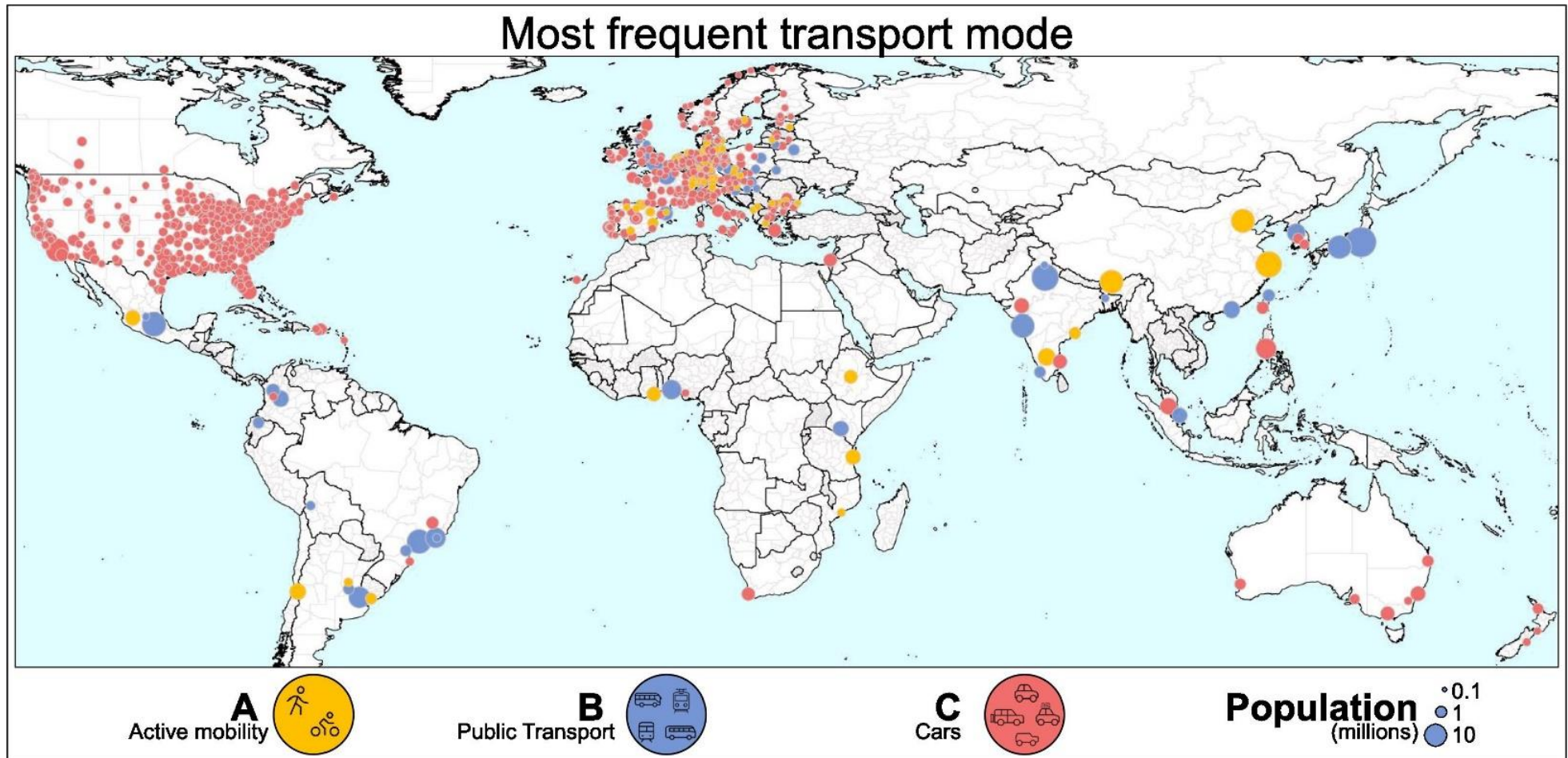


Figure F1: The most frequent mode of transport for selected World cities

NOTE: Each dot represents a city. The size of each dot is proportional to the population of the city.

(Source: <https://www.sciencedirect.com/science/article/pii/S0160412024001272>)

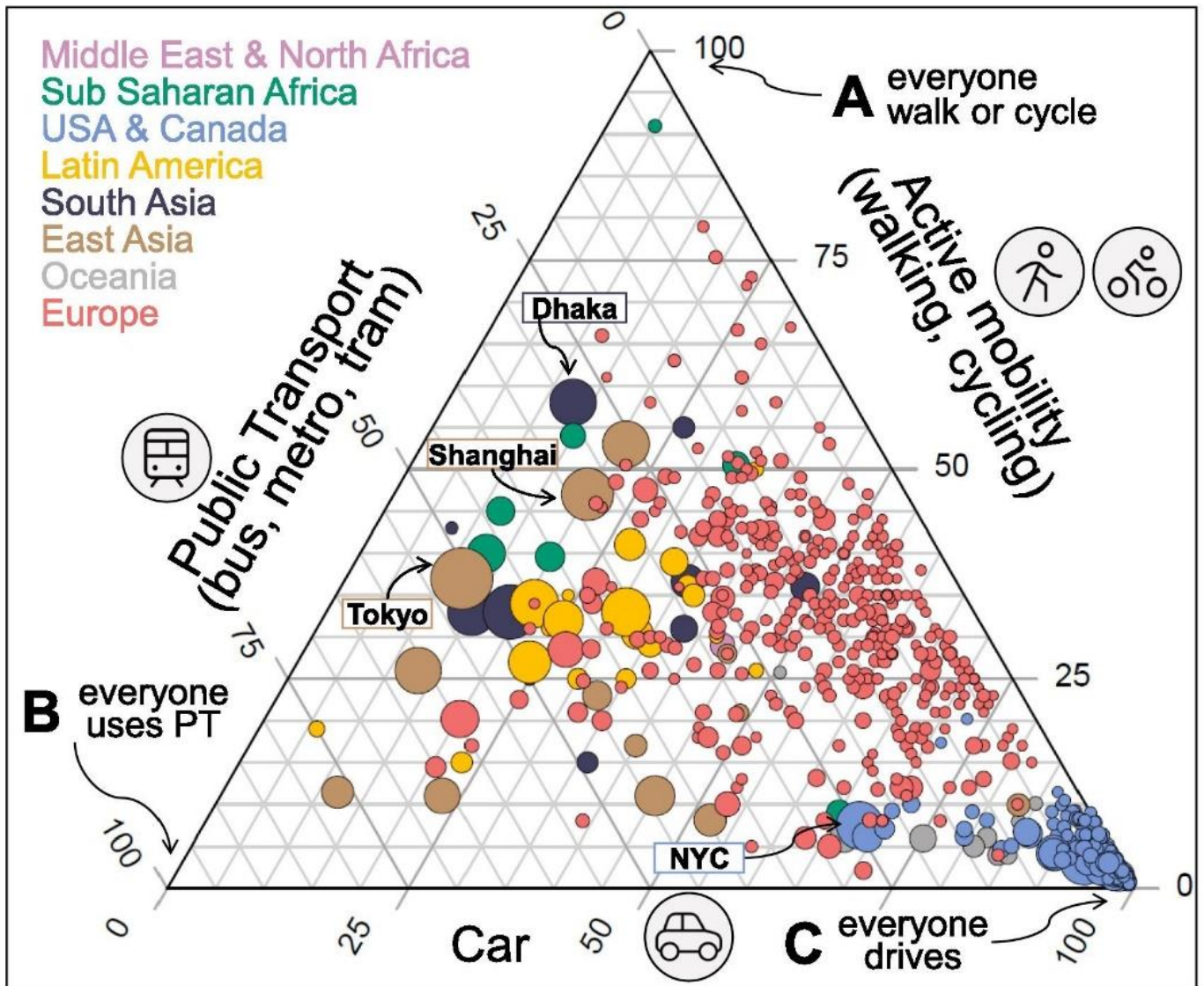


Figure F2: ABC modal share for selected 794 World cities

The size of the disc is proportional to the city's population, and the colour corresponds to the region.
 (Source: <https://www.sciencedirect.com/science/article/pii/S0160412024001272>)

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WRITTEN RESPONSE TEST

Question and Answer Booklet

Name: Team:

Student number

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Do NOT open the Booklet before instructed to do so by a supervisor.

Instructions for Students

1. Fill in your name, team and iGeo student number on the front page of this Question and Answer Booklet.
2. Fill in your iGeo student number in the boxes on top of the pages in this Booklet.
3. This test consists of 6 sections.
4. The maximum total mark is 90.
The mark for each question is given in the margin at the beginning of the question.
There is a maximum of 15 marks for each section.
5. Answer all questions in the spaces provided in this Booklet in English.
Keep the left margin free for markers.
Please write clearly.
Please use blue (or black) pen, not pencil.
6. Check the backs of pages as questions are printed on both sides of a page.
7. There are blank pages which you can use as additional space for your notes.
Please cross through any notes so that we know they are not part of your answers.
If you use these pages for answers, please label them clearly with the Section and question number (e.g. A1).
8. Where appropriate, please write sentences or phrases not single words.
9. Give only the required number of answers (reasons, examples, etc.).
For instance, if the question asks for 2 reasons and you give more than 2, only the first 2 reasons will be marked.
10. The Resource Booklet contains Figures referred to in this Booklet.
Do not write any of your answers in Resource Booklet.
11. You may use a calculator during the test.
12. Students not educated in English are allowed to use bilingual dictionaries during the test.
Students must ensure that their bilingual dictionaries do not contain unauthorized material such as study notes and named examples of places etc
13. Time:
180 minutes for students not educated in English (+10 minutes reading time),
150 minutes for students educated in English (+10 minutes reading time).

Good luck!

Written Response Test
Contributions from: Denmark, Indonesia, Latvia, Poland, Slovenia and Switzerland
Committee Convenor: Ivan Sulc (Croatia)
Director of Tests: Susan Lomas (UK)

Section A: Plastic pollution in oceans

Resource Booklet Figure A1 provides information on ocean gyres in the world.
Resource Booklet Figure A2 shows the plastic waste emitted to the ocean per capita by country in 2019.
Resource Booklet Figure A3 shows the share of global plastic waste emitted to the ocean by country in 2019.

1 m 1. Name the natural resource from which most plastics are produced.

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2 m 2. Identify two sources used to produce bioplastics.

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3. Study Resource Booklet Figure A1. Ocean gyres are locations where large amounts of plastic and other waste accumulate.

5 m a) Choose **one** of the ocean gyres. Draw and label a diagram to show the wind patterns **and** ocean currents that contribute to the formation of your chosen gyre in the space below.



2 m

b) Explain the **reasons** for the accumulation of plastic pollution in the location you have chosen.

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2 m

4. Study Resource Booklet Figures A2 and A3.

Describe two **spatial patterns** regarding the origin of plastic waste emissions into the oceans. Provide specific data from the sources. Your answer should refer to regions and/or multiple countries, not individual countries.

Pattern 1:

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Pattern 2:

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3 m

5. Study Resource Booklet Figures A1-A3.

Using the sources provided and your geographical knowledge discuss why it is difficult to eliminate plastic pollution from **entering** the oceans. Give at least three arguments.

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Section B: Amazon rainforest ecosystem

Resource Booklet Figure B1 shows an overview of tropical forest degradation processes in the Amazon.

Resource Booklet Figure B2 shows the distribution of PM_{2.5} persistent organic pollutants in the atmosphere in the Amazon Forest.

Resource Booklet Figure B3 shows the extent of deforestation in the Amazon Forest.

3 m

1. Study Resource Booklet Figure B1.

Identify and explain **three main reasons** for the deforestation of the Amazon rainforest.

Reason 1:

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Reason 2:

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Reason 3:

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3 m

2. Study the Resource Booklet Figures B2 and B3.

Analyse the **spatial relationship** between the intensity of PM_{2.5} emissions and the extent of deforestation.

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3. Study Resource Booklet Figures B1-B3. Using the information provided and your geographical understanding answer the following questions.

a) What is meant by the term **ecosystem services**?

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b) Identify and explain the importance of three ecosystem services provided by the Amazon rainforest.

Ecosystem service 1:

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Ecosystem service 2:

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Ecosystem service 3:

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4 m

4. Study Resource Booklet Figures B1-B3. Specify two impacts of deforestation of the Amazon rainforest on its **ecosystem services** and two impacts on **human well-being**.

Impact on ecosystem service 1:

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Impact on ecosystem service 2:

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Impact on human well-being 1:

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Impact on human well-being 2:

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Section C: Monsoon and weather phenomena in Dubai

Resource Booklet Table C1 provides climate data of Kathmandu and Dubai.

Resource Booklet Figure C1 shows Monsoon system mechanism in Indian ocean and surrounding continents.

Resource Booklet Text Box C1 gives information on the flood after a rainstorm in Dubai on 19 April 2024.

Resource Booklet Figure C2 shows satellite images before and during the deluge in the United Arab Emirates in April 2024.

Resource Booklet Figure C3 shows flooded road and airport after a rainstorm in Dubai on 19 April 2024.

5 m

1. Study Resource Booklet Table C1.

Create a combined climate diagram that compares the precipitation and temperature data for both Dubai and Kathmandu **in one diagram**. Label your diagram appropriately.



1 m

2. Study Resource Booklet Table C1 and the climate diagram you made.

Calculate the average annual temperature **amplitude/range** in Dubai and Kathmandu (round the value to one decimal place).

Dubai:.....

Kathmandu:

4 m

3. Study Resource Booklet Figure C1 and your climate diagram of Dubai and Kathmandu. Both cities are influenced by the Asian monsoon, but Dubai has completely different rainfall patterns from Kathmandu, which has more typical characteristics of the Asian monsoon climate. Explain the differences between the **rainfall patterns** in Dubai and Kathmandu, although both climates are influenced by the same wind patterns.

Dubai:.....

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1 m

4. Study Resource Booklet Figures C2 and C3 and Text Box C1. Since climate change has most likely increased the presence of warm, moist air in a region, atmospheric triggers are necessary to initiate large-scale cloud formation and significant precipitation events. Name one such primary atmospheric **mechanism** that can cause such conditions that lead to severe flooding.

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2 m

5. Explain two reasons why, even after significant rain events, the landscape in Dubai **remains arid** and the surrounding desert does not transform into a green environment.

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6. Discuss how the urban environment of Dubai contributed to the flooding in April 2024.

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for answers, which are clearly labelled with the Section and question number).

Section D: Periglacial landscape and climate change

Resource Booklet Figure D1 shows the map of permafrost zones in the Arctic area.
Resource Booklet Figure D2 shows satellite images of the site on Taymyr Island in Russian Siberia in July 1966 and July 2009.
Resource Booklet Table D1 gives data on main greenhouse gasses in the atmosphere.
Resource Booklet Figure D3 shows the contribution of greenhouse gases to global temperature rise (2010-2019 compared to 1850-1900).

2 m

1. Study Resource Booklet Figure D1.

a) Identify the area near the North Pole where there are no or only a few isolated permafrost areas.

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b) Suggest the **reason** why this area is free of permafrost.

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2 m

2. Study Resource Booklet Figure D1.

With the help of information provided and your geographical understanding outline **two reasons** why the extent of permafrost areas in North America differs significantly from that in Europe.

Reason 1:

.....

Reason 2:

.....

1 m

3. Study Resource Booklet Figure D2 that shows a site on Taymyr Island in the north of Siberia. Describe the **change in the vegetation** from 1966 to 2009.

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3 m

4. Study Resource Booklet Figure D2.

a) Explain how **climate change** has affected the described change in vegetation.

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b) Outline the **mechanism** by which this change in vegetation can affect the climate.

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2 m

5. Study Resource Booklet Figure D3 and Table D1.

Analyse the **change in the concentrations** of carbon dioxide and methane in the atmosphere from pre-industrial times to the present day and their contribution to the **rise in temperature**. Use statistical data to justify your answers.

Concentration:

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Temperature:

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5 m

6. Study Resource Booklet Figure D3 and Table D1.

Evaluate the role of carbon dioxide and methane in **global warming**. Justify your answer with specific data.

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Section E: Olympic Games

The Olympic Games are a global event that attracts attention worldwide. They bring athletes, tourists, politicians and others together to create a global spectacle and leave a certain legacy.

Resource Booklet Figure E1 shows the population and number of participants in London Summer Olympic Games in 2012 per continent.

Resource Booklet Figure E2 represents the ranking of Olympic cities according to ecological, social and economic sustainability.

Resource Booklet Figure E3 shows the aerial imagery of the site of the Olympic Village of Poblenou in Barcelona in 1977 and in 2022.

Resource Booklet Figure E4 gives an insight into the Barcelona urban regeneration project 1986-1992.

Resource Booklet Figure E5 shows the condition of one of the venues after the Olympic Games in Rio de Janeiro.

1 m

1. Study Resource Booklet Figure E1.

Name the continent that was most underrepresented at the London Olympics when comparing the ratio of Olympic participants to the world's population. Justify your answer with specific data.

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4 m

2. Study Resource Figure E2.

a) Describe the general trend of the overall **sustainability** of the Olympic Games 1992-2020. Your answer should not include only one aspect (pillar) of sustainability.

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b) Suggest two main **reasons** for the described trend.

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3. Study Resource Booklet Figures E3 and E4.

Analyse the process of urban transformation of Barcelona between 1977 and the time of the 1992 Summer Olympics (in terms of general character, services, size/locations).

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4. Study Resource Booklet Figures E3 and E4.

Explain two ways in which the urban remodelling of Barcelona has improved the quality of life of its citizens.

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5 m

5. Study Resource Booklet Figures E2-E5 and use your geographical understanding.

Evaluate whether major sporting events such as the Olympic Games have a positive or negative **socio-economic impact** on the target cities during and after these events. Use at least two positive and two negative socio-economic impacts as examples to support your ideas.

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Section F: Commuting mobility in the cities

Resource Booklet Figure F1 shows the map of the most frequent mode of transport for selected World cities. Each dot represents a city. The size of each dot is proportional to the population of the city.
Resource Booklet Figure F2 shows ABC modal share for selected 794 World cities. The size of the disc is proportional to the city's population, and the colour corresponds to the region.

2 m

- 1. Study Resource Booklet Figure F1.
Identify the **most frequently** used transport modes for commuters in cities in North America and Europe.

North America:

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Europe:

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5 m

- 2. Study Resource Booklet Figure F2.
Give two **differences** between the way commuters travel in Tokyo and Dhaka. Explain **three** reasons for these differences.

Differences:

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Reason 1:

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Reason 2:

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Reason 3:

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4 m

3. Explain the negative aspects of **the increase in commuting on** people and the economy.

People:

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Economy:

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4 m

4. To ensure **efficient and sustainable commuting**, public policymakers face many challenges. Suggest **4** possible solutions that policymakers may adopt to achieve this goal.

Solution 1:

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Solution 2:

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Solution 3:

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Solution 4:

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end ■