18th International Geography Olympiad

Paris, France

12 July – 18 July 2022

Written Response Test

Question and Resource Booklet

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

Name: _____

Team: _____

iGeo student number: _____

Instructions for Students

1. This booklet contains both the questions (Pages 3 to 7) and resources (Pages 9 to 27) required for each question.

2. This test consists of 5 sections.

3. The maximum total mark is 75.
   The mark for each question is given in the margin at the end of the question.
   There is a maximum of 15 marks for each section.

4. At the beginning of each Section, there will be a description of all resources used for the Section. You will refer to the Resource Booklet (Page 9 to 27) for these resources.

5. Do not write any of your answers in this booklet.
   Only answers written in the Answer booklet will be marked.

6. You may use a calculator during the test.

7. 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.
   Test supervisors will conduct checks on these bilingual dictionaries.

8. Time:
   150 minutes for students not educated in English.
   120 minutes for students educated in English.

Good luck!

Witten Response Test

Contributions from: Estonia, France, India, Poland, Romania,
Singapore, China-Macau and Taiwan (China-Taipei)
Committee Convenors: Dubravka Spevec (Croatia) and Tan Li Ling (Singapore)
Director of Tests: Shen Su-min (Taiwan, China-Taipei)

Section A: Air transport and greenhouse gases

Resource A1 shows the primary greenhouse gases (dynamics, longevity and potential impact). Resource A2 shows the carbon dioxide emissions from air travel in the world by country in 2018. Resource A3 shows the number of air passengers in Europe in 2019 by country.

(a) Study Resource A1. Define the term *greenhouse effect*. [2 marks]

(b) Study Resource A1. Outline **three** impacts of selected greenhouse gases on climate change. [3 marks]

(c) **(i)** Study Resource A2. Name the countries that have the highest carbon footprints in international and domestic air travel. [1 mark]

(ii) Study Resource A2. Outline **two** reasons why some countries have very high carbon dioxide emissions per capita from domestic air travel. [2 marks]

(d) In addition to carbon dioxide, other greenhouse gases and aerosols are emitted from air transport. Explain the effect of condensation trails on climate. [2 marks]

(e) Study Resource A3. Use an appropriate data representation method to display the total number of passengers in air travel and their profile (national and international passengers) in European countries with more than 50 million total passengers. [5 marks]

Section B: South Pacific Ocean

A 2016 animated movie "*Moana*", produced by Walt Disney, tells the story of a strong-willed girl, Moana, who lives in a Polynesian village. Since the location of this story is set in the South Pacific Ocean, many unique geographic features can be found in this movie. Resource B1 shows a rock type 'A' and a water body 'B'. Resource B2 shows the climate data for an island in the South Pacific Ocean. Resource B3 shows the global distribution of natural hazards. Resource B4 shows the international arrivals of overnight and same day visitors to various places in the world in 2008 and 2018.

(a) **(i)** Study Resource B1. Identify the type of rock represented by 'A'. [1 mark]

(ii) Study Resource B1. Identify the type of water body represented by 'B'. [1 mark]

(b) An atoll is a unique feature in the South Pacific Ocean. With the use of an annotated diagram, explain clearly how an atoll is formed. [4 marks]

(c) Study Resource B2. Identify the climate type of the island in the South Pacific Ocean using the Köppen climate classification. [1 mark]

(d) Study Resource B3. Explain **two** natural hazards occurring in the South Pacific Ocean which might affect the local economies of the South Pacific Ocean islands. [4 marks]

(e) Study Resource B4. To what extent do you agree that tourism is beneficial for the Pacific Least Developed Countries (LDCs)? [4 marks]

Section C: Lower Mekong Basin

Resource C1 shows the map of the Mekong Basin. Resource C2 shows the average wet season precipitation in the Mekong Basin in 2019, as compared to 2000-2018. Resource C3 shows the satellite image of part of the Mekong River in Thailand in 2015 and 2020. Resource C4 shows future scenarios (i.e. B1, M1 and M3) for land subsidence in the Vietnamese Mekong Delta between 2030 and 2100. Resource C5 shows the Vietnamese government's future vision for the sustainable development of the Mekong Delta. This plan was developed in consultation with the Dutch government.

(a) Study Resources C1 and C2. Describe the average wet season precipitation in the Mekong Basin in 2019, as compared to 2000-2018. [3 marks]

(b) **(i)** Study Resource C3. Describe the change(s) observed in this part of the Mekong River in Thailand between 2015 and 2020. [1 mark]

(ii) Study Resource C3. Explain **two** reasons to account for the change(s) observed in this part of the Mekong River in Thailand between 2015 and 2020. [2 marks]

(c) **(i)** Study Resource C4. Explain the relationship between groundwater extraction and land-subsidence. [1 mark]

(ii) Study Resource C4. Explain which scenario is likely to be the **most sustainable** scenario for the Vietnamese Mekong Delta. [2 marks]

(iii) Study Resource C4. Explain which scenario is likely to be the **most realistic** scenario for the Vietnamese Mekong Delta. [2 marks]

(d) Study Resource C5. Choose **two** solutions shown in Resource C5 and explain how **each of them** could help the Vietnamese Mekong Delta be sustainable. [4 marks]

Section D: Wildfires, sinking cities and sustainable development

Resource D1 shows the top 20 largest wildfires in California, USA. Resource D2 shows the distribution of population density growth projections and fire hazards in California. Resource D3 shows the risk to selected Asian cities due to rising sea levels and flooding by 2030. Resource D4 shows the Sustainable Development Goals as part of the 2030 Agenda for Sustainable Development.

(a) Study Resource D1. Explain how wildfires can be caused by both human and natural factors. [4 marks]

(b) Study Resource D2. Compare the distributions of population density growth projections and fire hazards in California. [2 marks]

(c) **(i)** Study Resource D3. Describe the severity of risks to the selected Asian cities due to rising sea levels and flooding. [2 marks]

(ii) Study Resource D3. Choose a city in Resource D3 and explain **two** strategies it can adopt to increase overcome the risk of flooding. [2 marks]

(d) Study Resource D4. In your opinion, are wildfires or floods more damaging towards a city's pursuit of sustainable development? Explain your choice. [5 marks]

Section E: Green Revolution and Population Development

Resource E1 shows the global change in population development, cereal production, cereal yield and land use from 1961 to 2021. Resource E2 shows contemporary farming occurring in Bangladesh.

(a) Define the 'Green Revolution'. [2 marks]

(b) Study Resource E1. Describe the trends observed. [2 marks]

(c) **(i)** Using your own knowledge, outline Thomas Malthus' theory on the concept of "population-resources" relationship. [2 marks]

(ii) Using your own knowledge, outline Ester Boserup's theory on the concept of "population-resources" relationship. [2 marks]

(d) Study Resource E2. Suggest **three** ways in which farmers in Bangladesh have benefitted differently from the Green Revolution. [3 marks]

(e) Using your own knowledge, explain **two** ways in which agricultural practices can be improved to allow countries to benefit more. [4 marks]

Resources for each Section are found from Page 9 to Page 27

Resource A1 for Section A

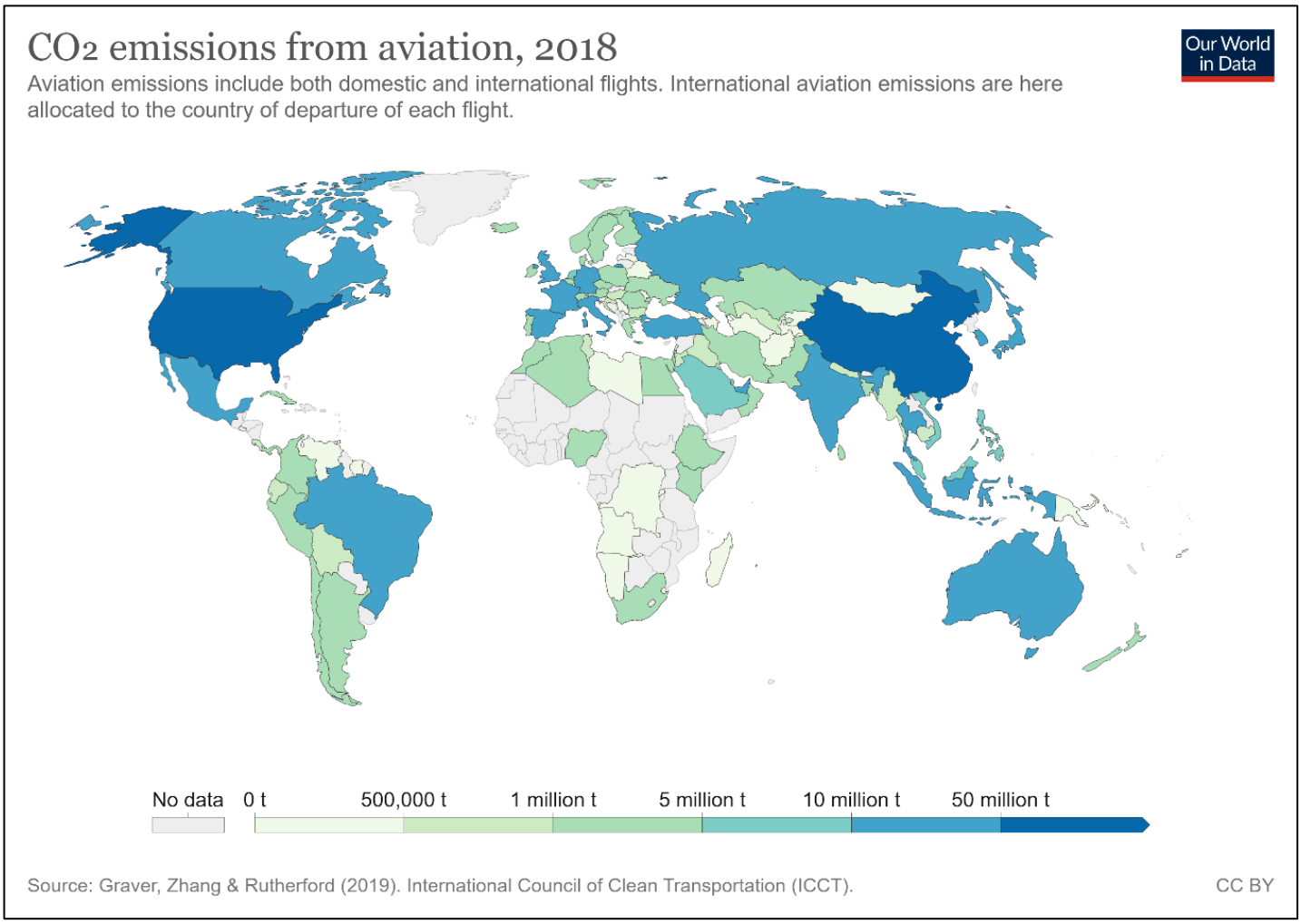
Primary greenhouse gases: dynamics, longevity and potential impact

	CO_2	CH_4	N_2O
Atmospheric concentrations in 2021 (ppmv)[a]	41	1.896	0.335
Increase in concentrations since 1750 (%)	49	164	24
Atmospheric lifetime (years)	<10	8.4	120
Percentage of the greenhouse effect (%)	65	25	5
Relative effect on the Earth's radiation balance (GWP)[b] over a 100-year cycle	1	23	320

[a] ppmv – parts per million volume
[b] GWP – Global Warming Potential

Resource A2 for Section A

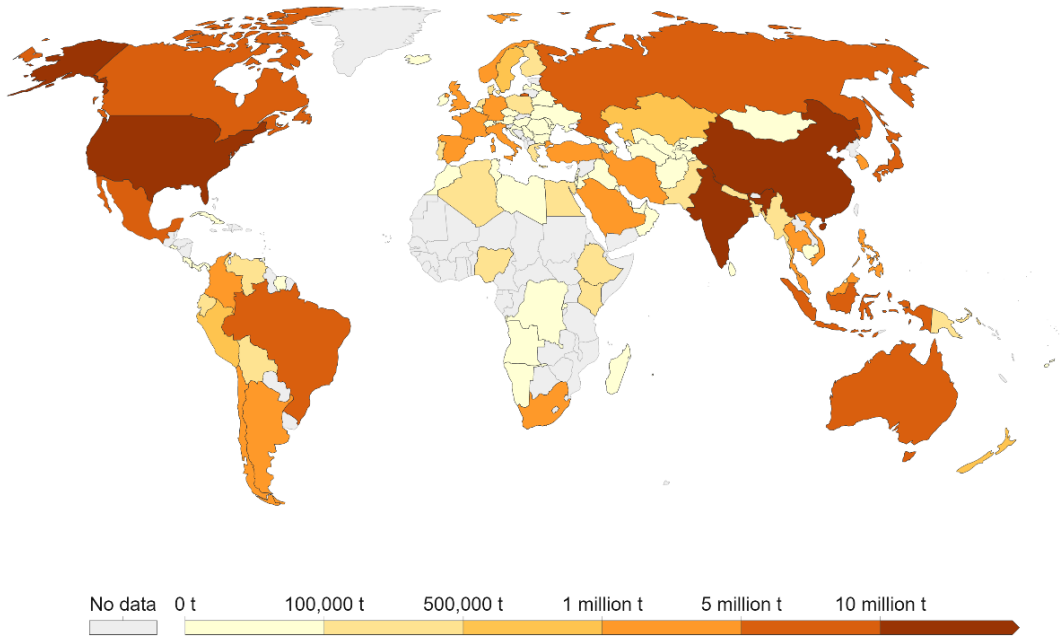
Carbon dioxide emissions from air travel in the world by country in 2018



CO_2 emissions from domestic air travel, 2018

Domestic aviation represents flights which depart and arrive within the same country.

Our World in Data



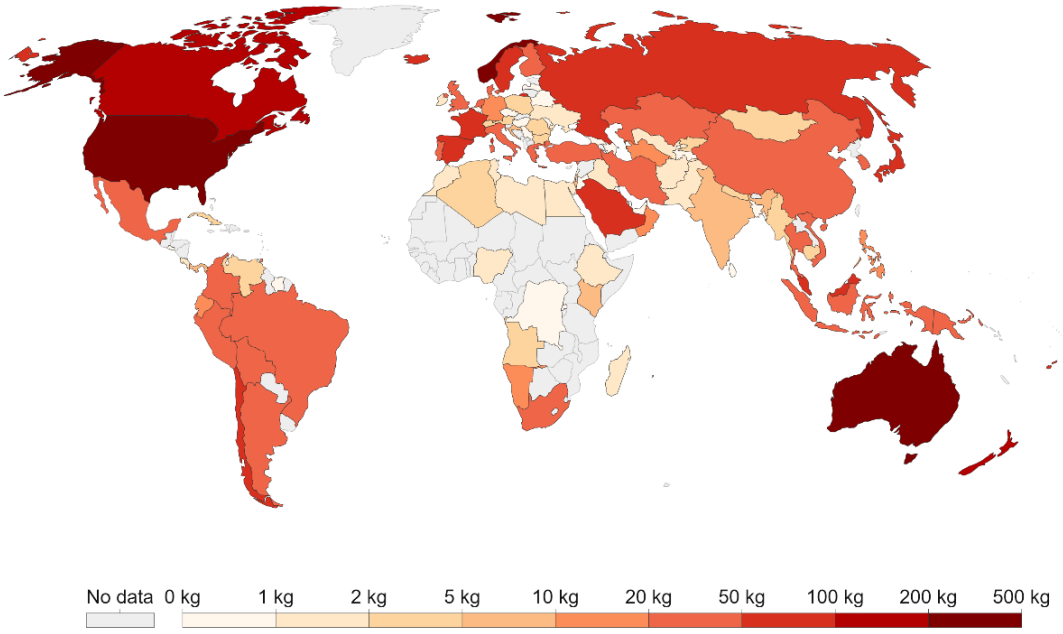
Source: Graver, Zhang & Rutherford (2019). International Council of Clean Transportation (ICCT).

CC BY

Per capita CO_2 emissions from domestic aviation, 2018

Domestic aviation represents flights which depart and arrive within the same country.

Our World in Data



Source: Graver, Zhang & Rutherford (2019). International Council of Clean Transportation (ICCT).

Note: Per capita emissions are calculated as the mean, and do not account for within-country differences in air travel.

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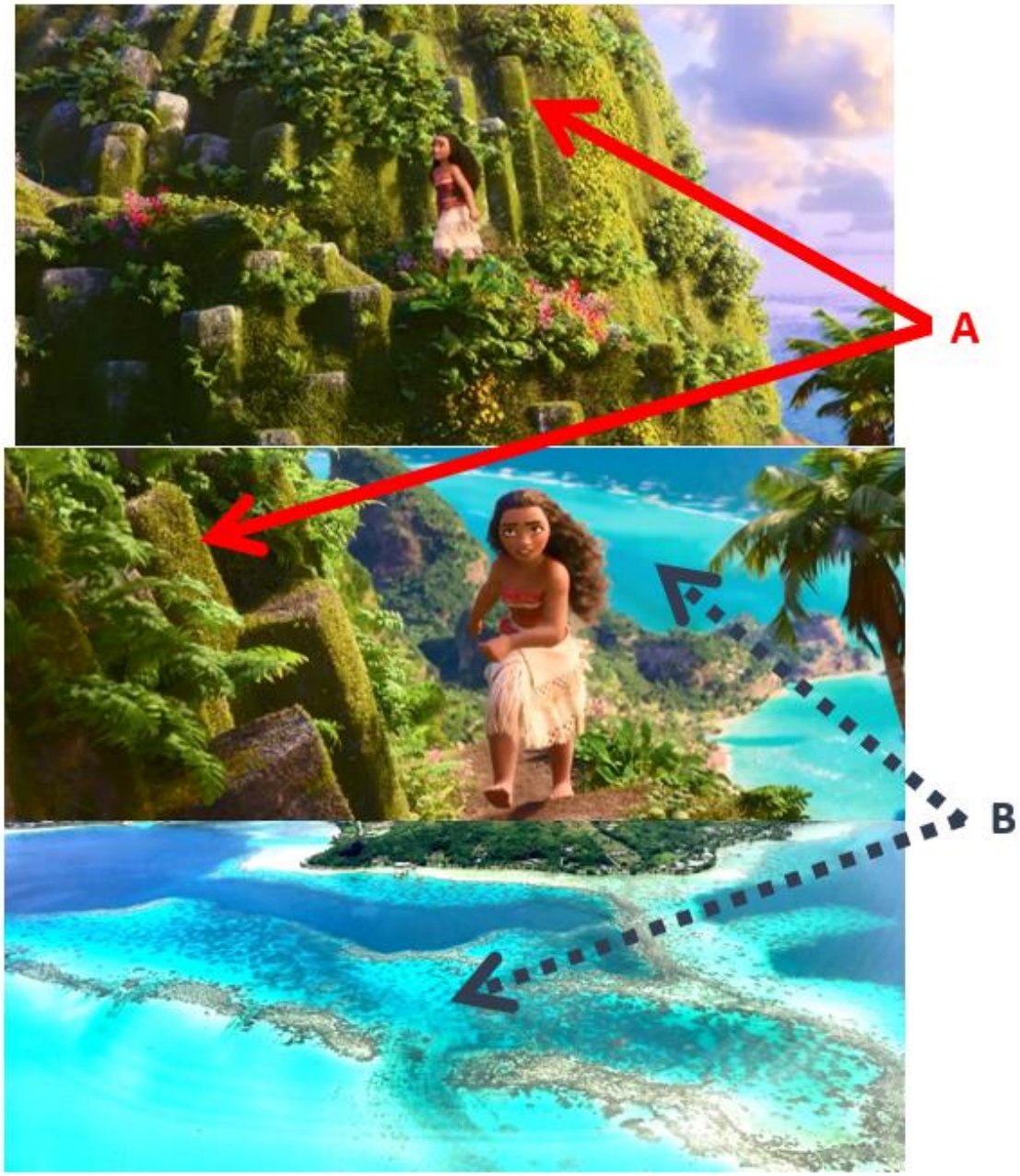
Resource A3 for Section A

Number of air passengers in Europe in 2019 by country

Country	Total	National	International
Austria	35.811.789	563.959	35.247.830
Belgium	35.495.479	10.630	35.484.849
Bulgaria	11.742.520	301.075	11.441.445
Croatia	10.687.231	554.137	10.133.094
Cyprus	11.412.130	22	11.412.108
Czechia	18.853.186	42.556	18.810.630
Denmark	34.894.908	1.890.330	33.004.578
Estonia	3.258.323	31.064	3.227.259
Finland	23.338.254	3.064.954	20.273.300
France	169.419.180	32.116.174	137.303.006
Germany	227.413.603	23.323.490	204.090.113
Greece	56.085.668	8.572.291	47.513.377
Hungary	16.730.494	272	16.730.222
Iceland	7.584.420	327.014	7.257.406
Ireland	37.993.913	102.730	37.891.183
Italy	161.390.853	32.548.396	128.842.457
Latvia	7.786.569	15.634	7.770.935
Lithuania	6.509.879	15	6.509.864
Luxembourg	4.365.569	1.587	4.363.982
Malta	7.318.357	170	7.318.187
Montenegro	2.652.801	31	2.652.770
Netherlands	81.274.281	2.220	81.272.061
North Macedonia	2.353.327	0	2.353.327
Norway	40.848.699	16.341.949	24.506.750
Poland	46.960.641	1.978.736	44.981.905
Portugal	54.692.738	5.016.956	49.675.782
Romania	21.586.079	1.339.371	20.246.708
Serbia	6.707.217	103	6.707.114
Slovakia	2.847.115	2.495	2.844.620
Slovenia	1.720.491	0	1.720.491
Spain	228.634.398	42.627.071	186.007.327
Sweden	37.840.909	7.003.695	30.837.214
Switzerland	57.267.916	691.623	56.576.293
Turkey	159.156.950	50.245.672	108.911.278
United Kingdom	277.548.891	23.039.313	254.509.578

Resource B1 for Section B

Image from the 2016 animated movie “Moana”



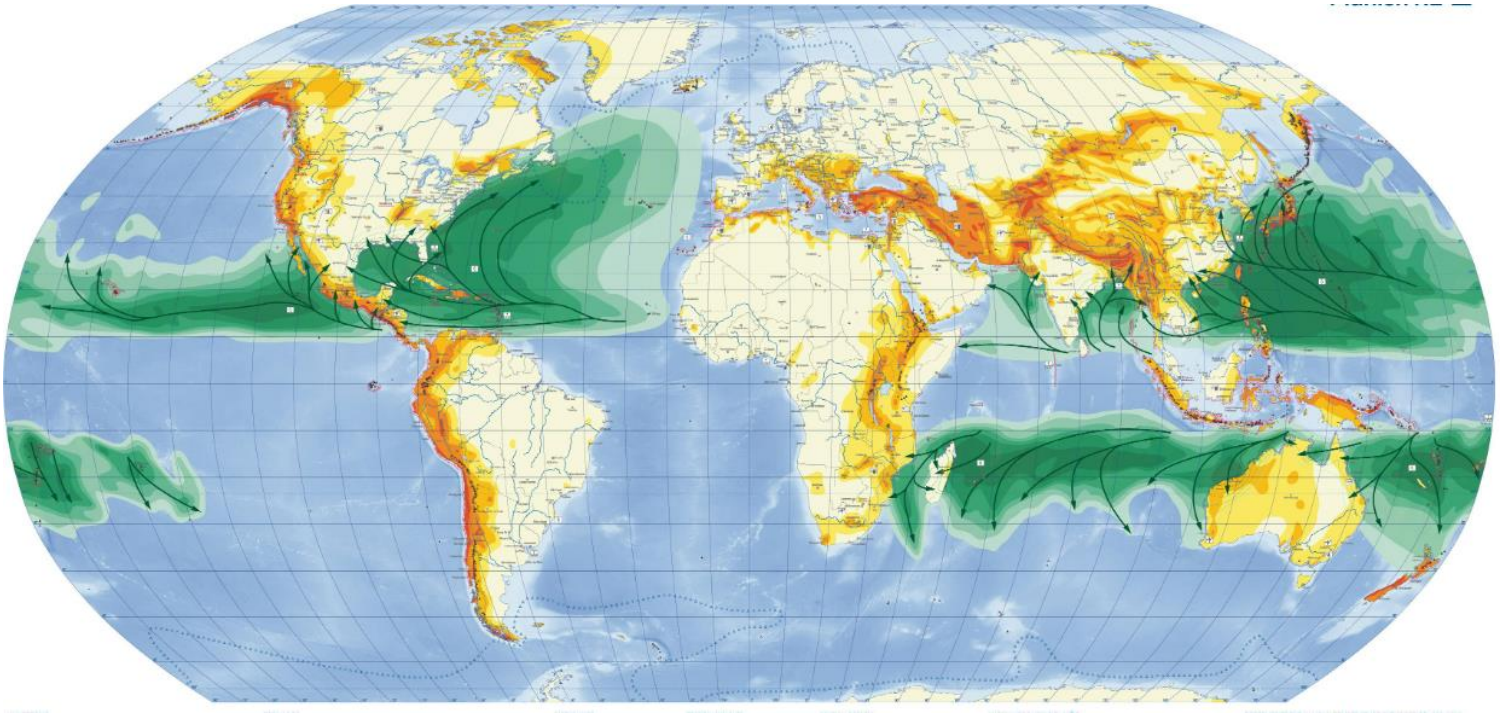
Resource B2 for Section B

Climate data for an island in the South Pacific Ocean

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A	26.9	27	27.2	27	26.1	25.1	24.6	24.6	24.8	25.5	26	26.5
B	314	226	186	126	101	63	59	50	52	91	152	295

Resource B3 for Section B

Global distribution of natural hazards



Resource B4 for Section B

International arrivals of overnight and same-day visitors, 2008 and 2018

International arrivals of overnight and same-day visitors, 2008 and 2018

	Overnight visitors			Same-day visitors			Total visitors		
	Arrivals (Thousands)		Percentage change	Arrivals (Thousands)		Percentage change	Arrivals (Thousands)		Percentage change
	2008	2018	2008-2018	2008	2018	2008-2018	2008	2018	2008-2018
Kiribati	4	6	49	..	2	..	4	8	92
Solomon Islands	16	28	71	..	5	..	16	33	102
Tuvalu	2	3	47	..	..	..	2	3	47
Vanuatu	91	116	28	106	234	121	197	350	78
Pacific LDCs	**112**	**152**	**35**	**106**	**241**	**127**	**219**	**393**	**80**
Small island developing States in:									
Asia-Pacific	1 811	3 131	73	173	482	179	1 984	3 614	82
Latin America and the Caribbean	17 806	24 792	39	14 030	19 621	40	31 836	44 413	40
Africa	1 407	2 551	81	54	75	39	1 461	2 626	80
World	847 185	1 180 243	39	607 278	642 874	6	1 454 463	1 823 117	25

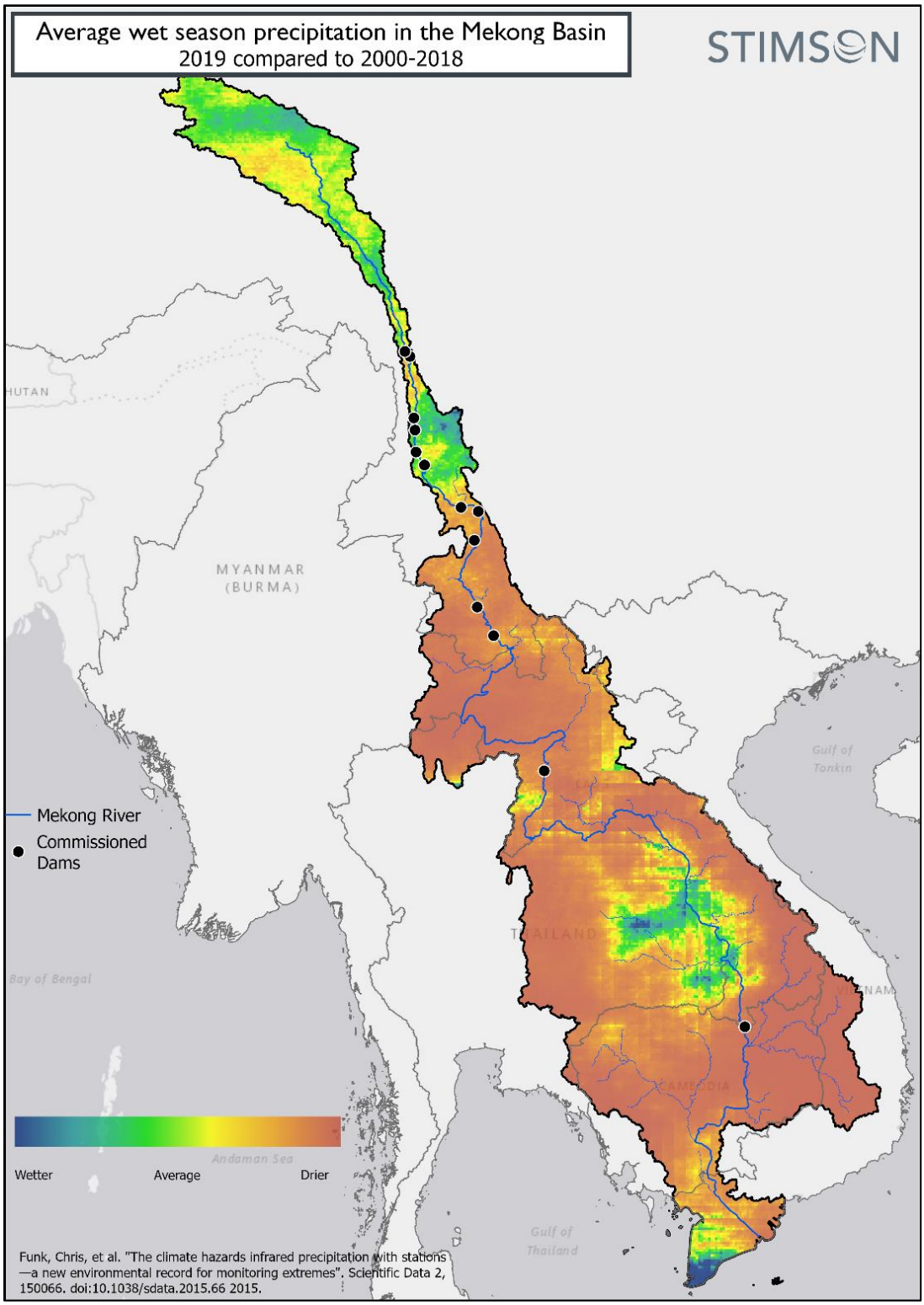
Sources: ESCAP, based on tourism arrival data from UNWTO Compendium of Tourism and SPTO (2019).
Notes: (..) indicates data not available. Data reported are for 2008 and 2018 or latest year available.

Resource C1 for Section C

Map of the Mekong Basin

Resource C2 for Section C

Map showing average wet season precipitation in the Mekong Basin in 2019



Resource C3 for Section C

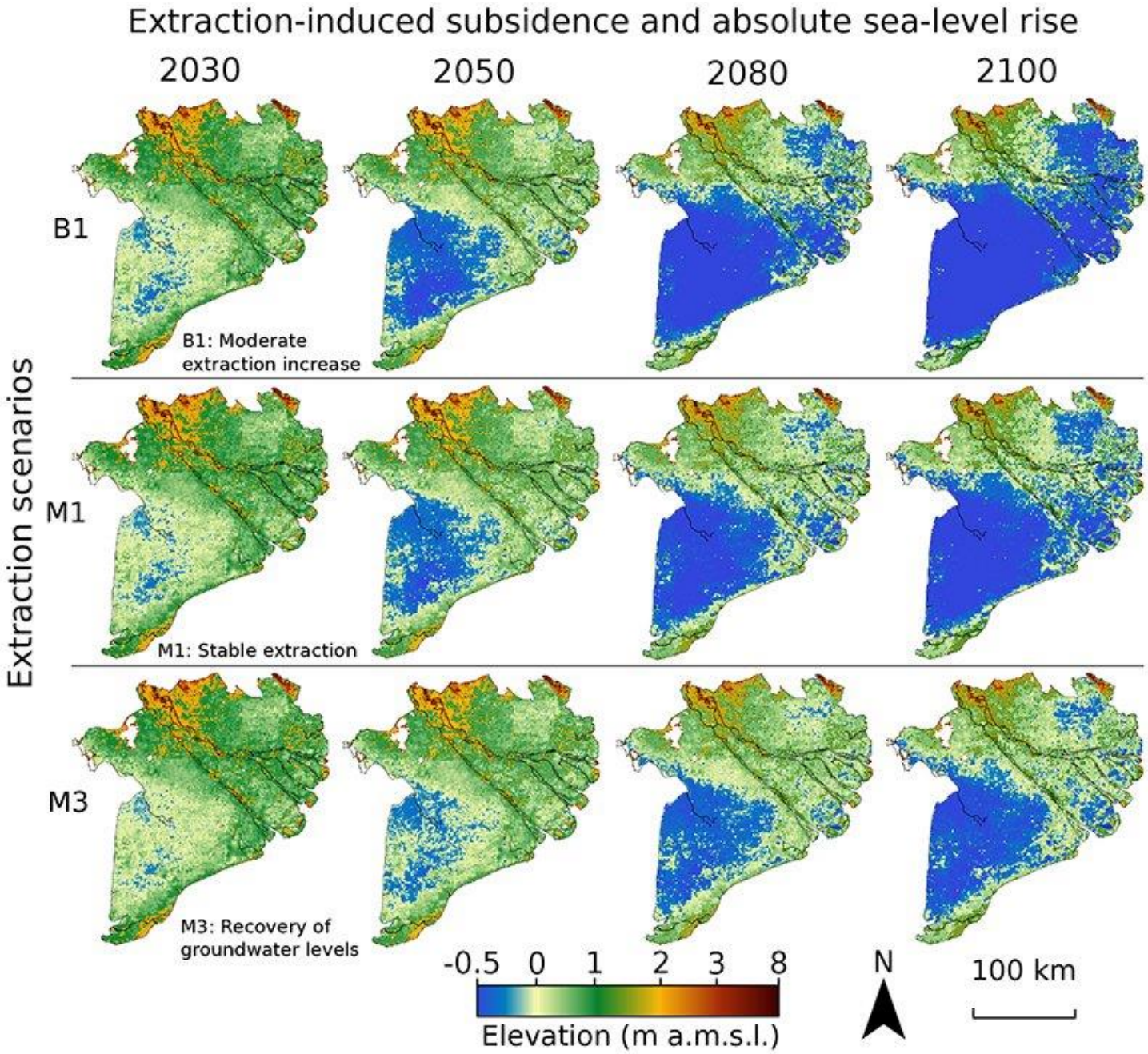
Satellite image of part of the Mekong River in Thailand in 2015 and 2020

January 27, 2015

January 25, 2020

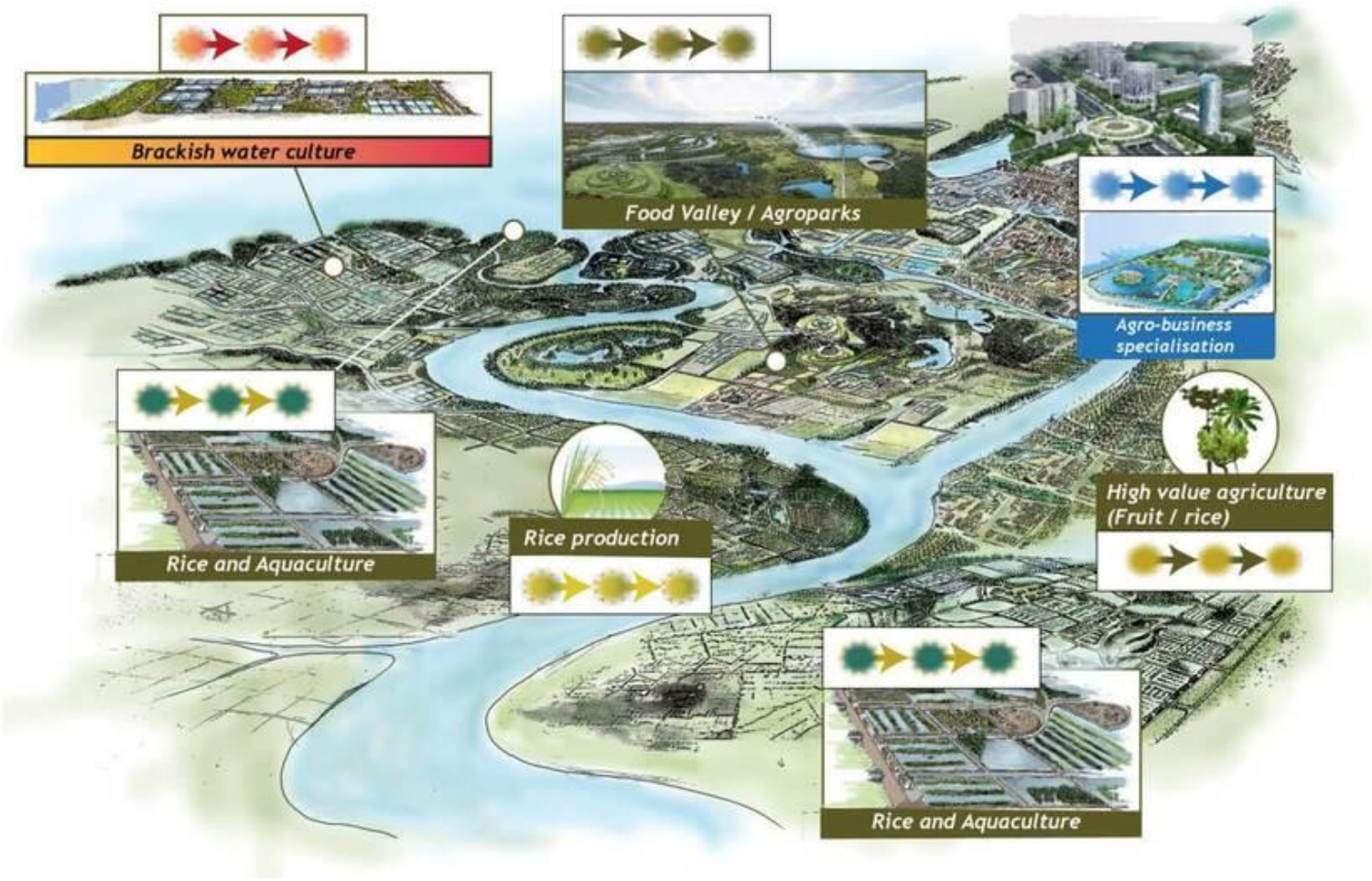
Resource C4 for Section C

Future scenarios (i.e. B1, M1 and M3) for land subsidence in the Vietnamese Mekong Delta between 2030 and 2100



Resource C5 for Section C

Vietnamese government's future vision for the sustainable development of the Mekong Delta



Resource D1 for Section D

Top 20 largest California Wildfires

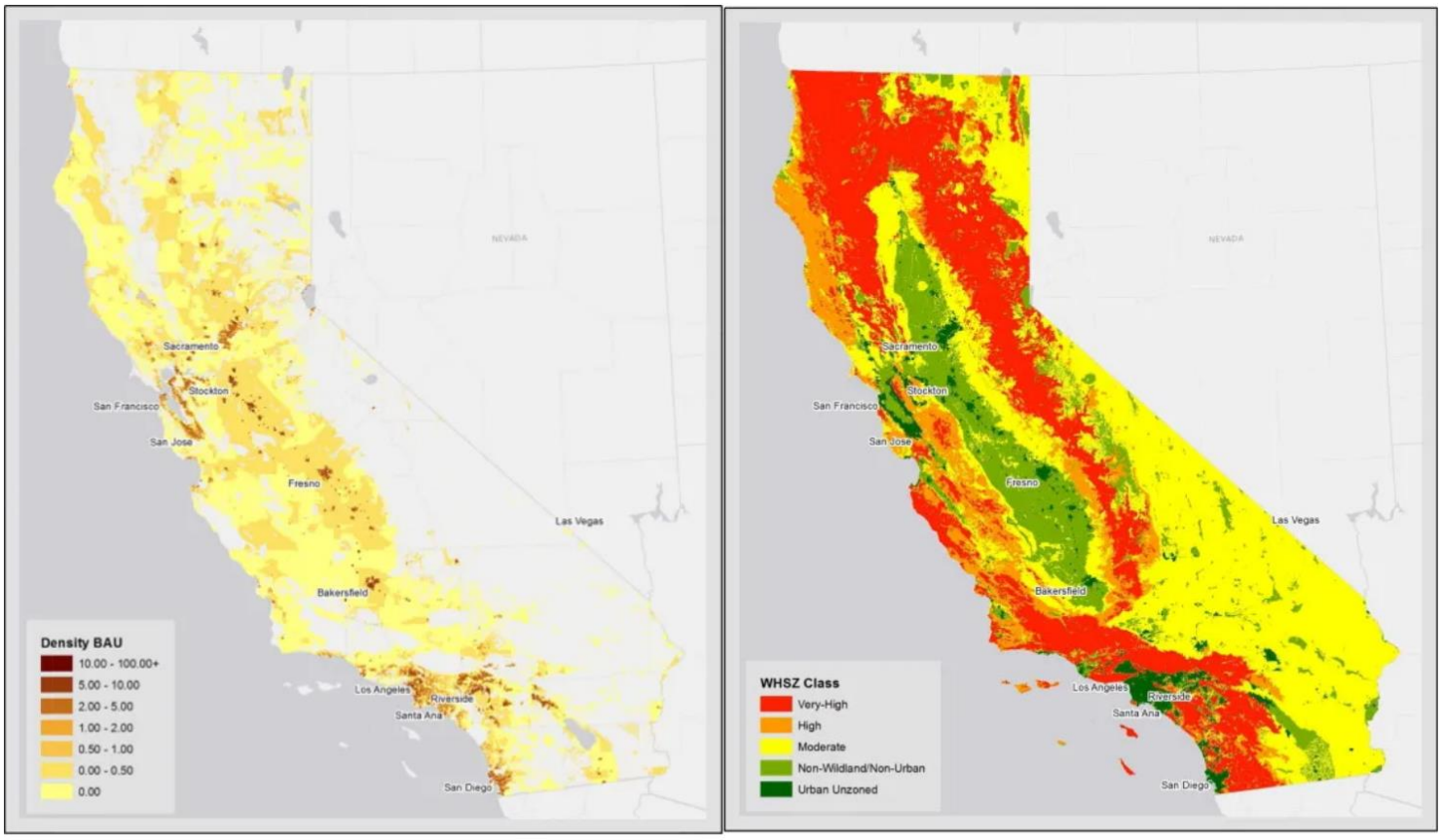
	FIRE NAME (CAUSE)	DATE	COUNTY	ACRES	STRUCTURES	DEATHS
1	**AUGUST COMPLEX** *(Lightning)*	August 2020	Mendocino, Humboldt, Trinity, Tehama, Glenn, Lake, & Colusa	**1,032,648**	935	1
2	**DIXIE** *(Powerlines)*	July 2021	Butte, Plumas, Lassen, Shasta & Tehama	**963,309**	1,329	1
3	**MENDOCINO COMPLEX** *(Human Related)*	July 2018	Colusa, Lake, Mendocino & Glenn	**459,123**	280	1
4	**SCU LIGHTNING COMPLEX** *(Lightning)*	August 2020	Stanislaus, Santa Clara, Alameda, Contra Costa, & San Joaquin	**396,624**	222	0
5	**CREEK** *(Undetermined)*	September 2020	Fresno & Madera	**379,895**	853	0
6	**LNU LIGHTNING COMPLEX** *(Lightning/Arson)*	August 2020	Napa, Solano, Sonoma, Yolo, Lake, & Colusa	**363,220**	1,491	6
7	**NORTH COMPLEX** *(Lightning)*	August 2020	Butte, Plumas & Yuba	**318,935**	2,352	15
8	**THOMAS** *(Powerlines)*	December 2017	Ventura & Santa Barbara	**281,893**	1,063	2
9	**CEDAR** *(Human Related)*	October 2003	San Diego	**273,246**	2,820	15
10	**RUSH** *(Lightning)*	August 2012	Lassen	**271,911 CA / 43,666 NV**	0	0
11	**RIM** *(Human Related)*	August 2013	Tuolumne	**257,314**	112	0
12	**ZACA** *(Human Related)*	July 2007	Santa Barbara	**240,207**	1	0
13	**CARR** *(Human Related)*	July 2018	Shasta County & Trinity	**229,651**	1,614	8
14	**MONUMENT** *(Lightning)*	July 2021	Trinity	**223,124**	50	0
15	**CALDOR** *(Human Releated)*	August 2021	Alpine, Amador, & El Dorado	**221,835**	1,003	1
16	**MATILIJA** *(Undetermined)*	September 1932	Ventura	**220,000**	0	0
17	**RIVER COMPLEX** *(Lightning)*	July 2021	Siskiyou & Trinity	**199,343**	122	0
18	**WITCH** *(Powerlines)*	October 2007	San Diego	**197,990**	1,650	2
19	**KLAMATH THEATER COMPLEX** *(Lightning)*	June 2008	Siskiyou	**192,038**	0	2
20	**MARBLE CONE** *(Lightning)*	July 1977	Monterey	**177,866**	0	0

There is no doubt that there were fires with significant acreage burned in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large fires in more recent times.
This list does not include fire jurisdiction. These are the Top 20 regardless of whether they were state, federal, or local responsibility.
*Numbers not final.

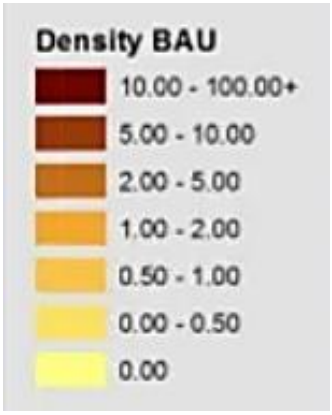
1/13/2022

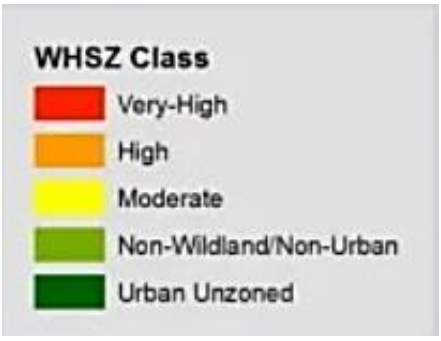
Resource D2 for Section D

Distribution of population density growth projections and fire hazards in California



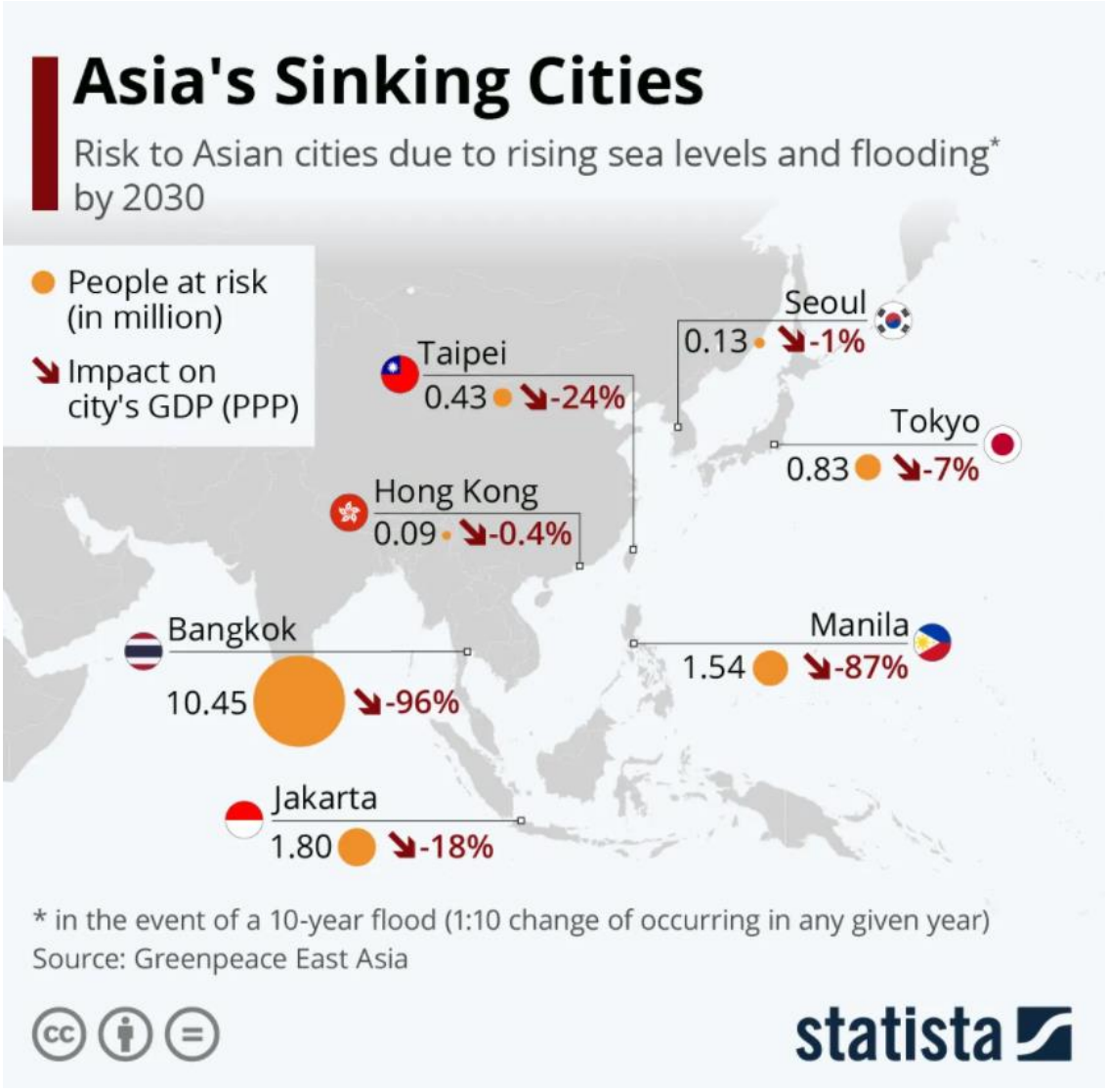
A map showing population density growth projections (left) and a map showing fire hazards. | Mann et al./Land Use Policy





Resource D3 for Section D

Risk to selected Asian cities due to rising sea levels and flooding by 2030

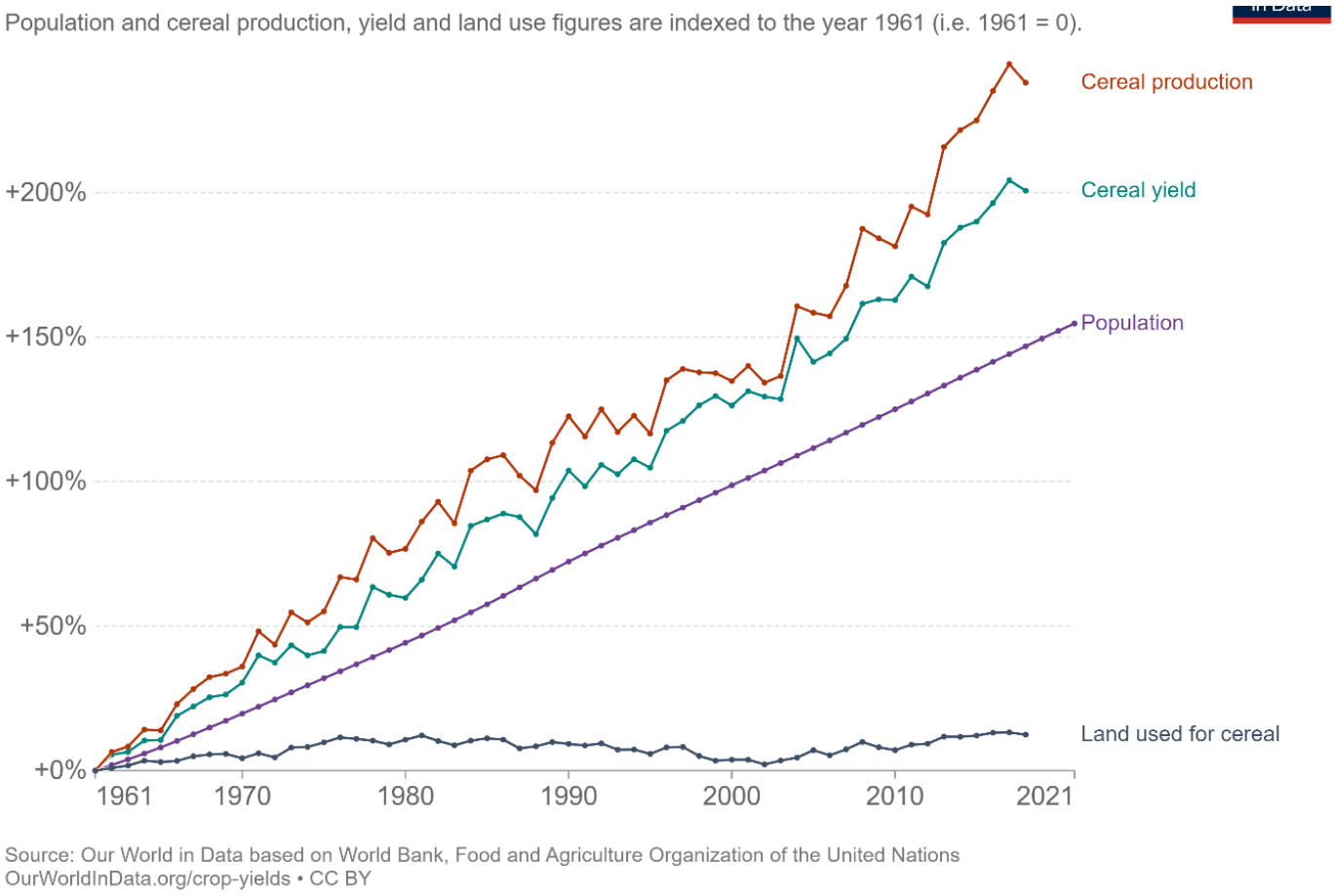


Resource D4 for Section D

Sustainable Development Goals as part of the 2030 Agenda for Sustainable Development

Resource E1 for Section E

Global change in population development, cereal production, yield and land use from 1961-2021



Resource E2 for Section E

Contemporary farming in Bangladesh

END OF PAPER