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Environmental systems and societies

Standard level

Paper 1 – resource booklet

28 October 2024

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

1 hour

Instructions to candidates

- Do not open this booklet until instructed to do so.
- This booklet contains all the resources to answer paper 1.

Figure 1(a): Map showing the location of Switzerland

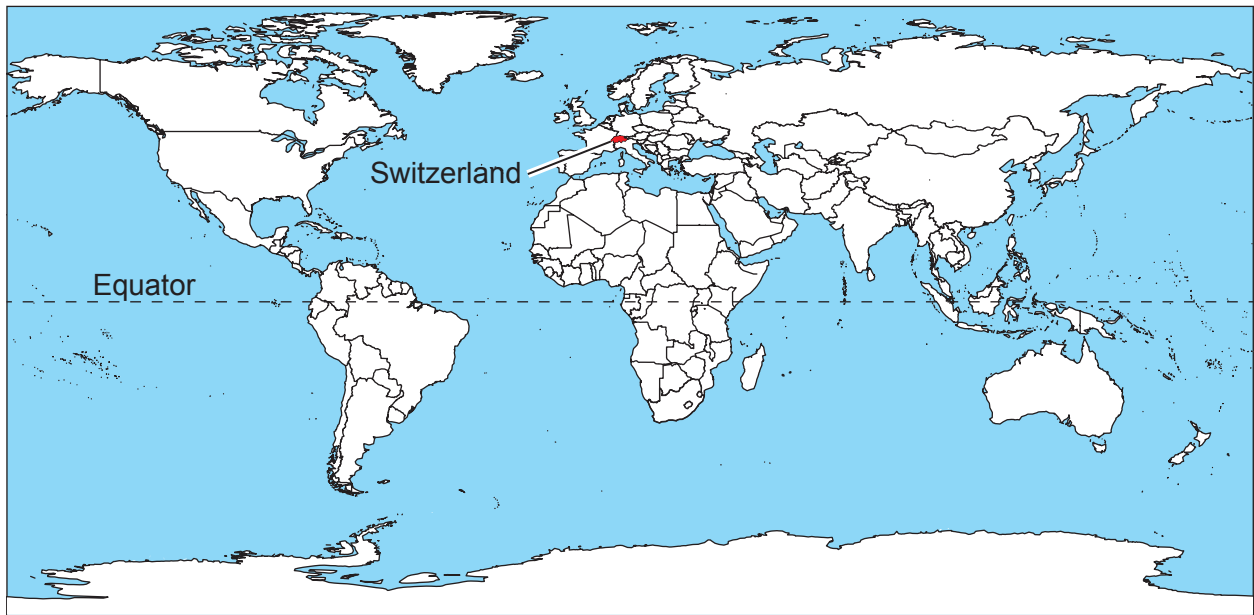


Figure 1(b): Topographic map of Switzerland

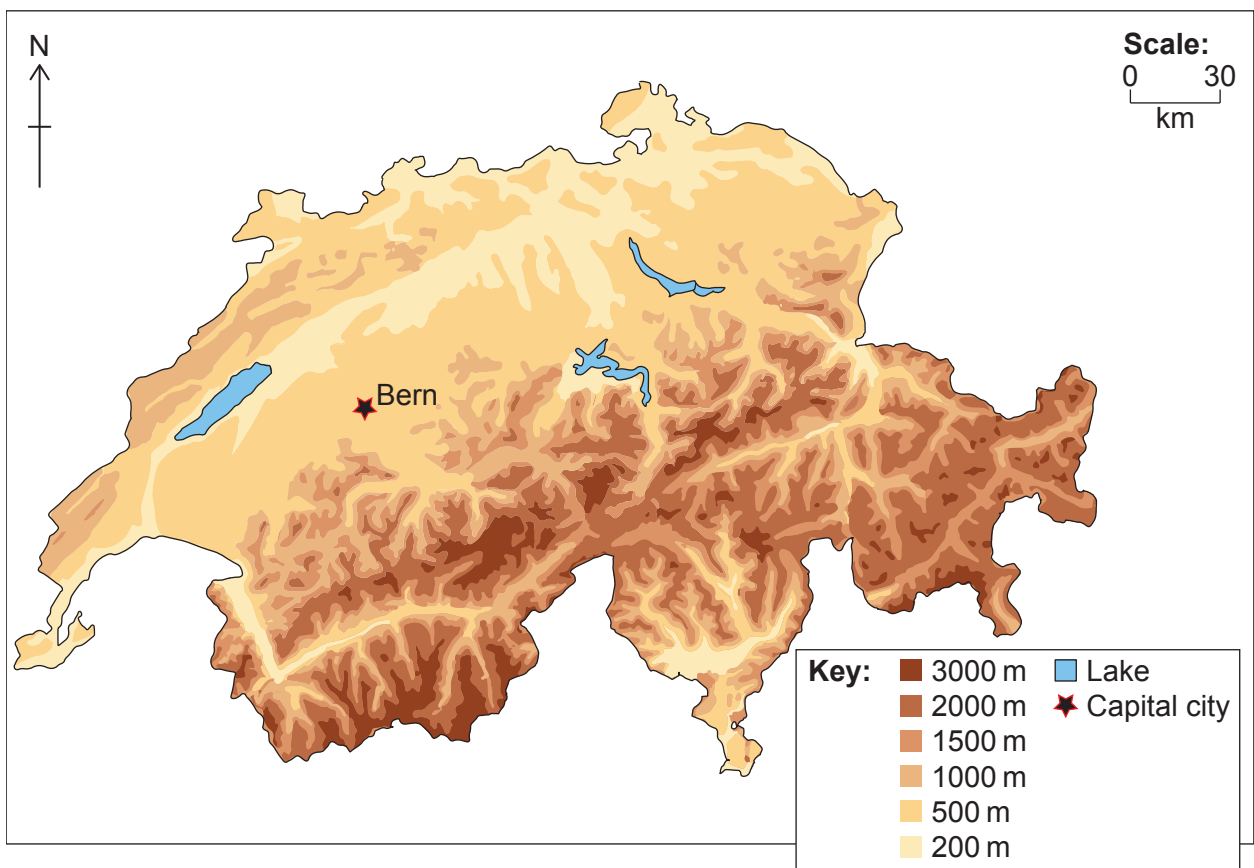


Figure 1(c): Fact file on Switzerland

- Switzerland has a population of 8.7 million (2021), with 85 % living in urban areas.
- It has the second-highest GDP in the world (\$86 850 per capita in 2020).
- The country is divided into regions called cantons.
- The Alps mountain range runs through the southern part of the country.
- Populations in over 50 % of alpine villages have decreased by 35 % since the 1950s.
- However, villages that have developed winter ski tourism have grown rapidly since the 1980s.
- While winter tourism accounts for only 1 % of Switzerland’s GDP (2020), in alpine regions it rises to over 10 %.
- A requirement to protect the alpine regions is part of the Federal Constitution.

Figure 1(d): Winter ski tourism in the Swiss Alps



Figure 2(a): Mountain zones and climate in the Swiss Alps

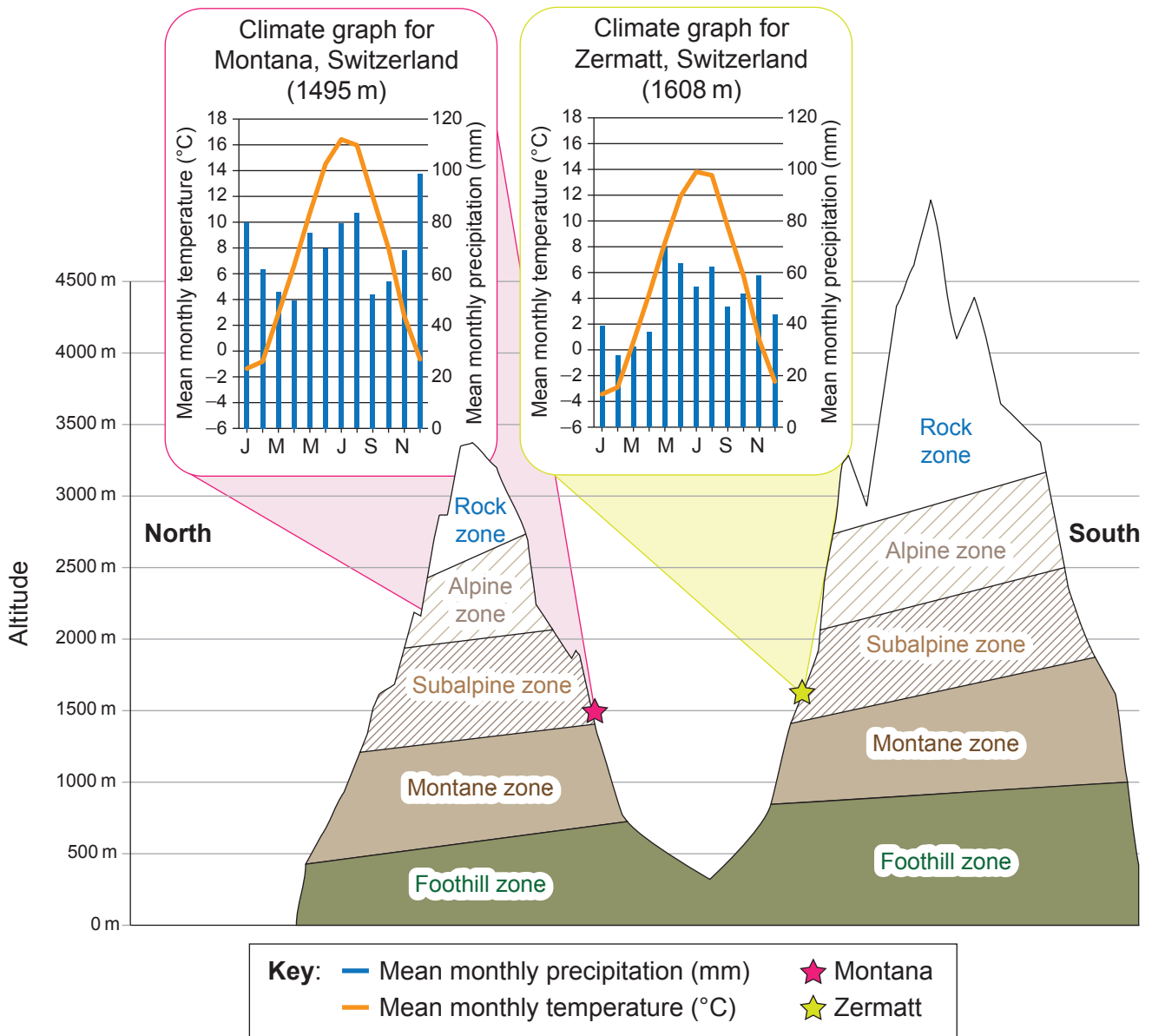


Figure 2(b): Types of vegetation found in each mountain zone

Foothill zone	Deciduous forest
Montane zone	Coniferous forest
Subalpine zone	Transition zone of coniferous forest and grassland
Alpine zone	Grassland
Rock zone	Lichens

Figure 3: A bar chart showing total snowfall in a ski resort in the Swiss Alps (1200 m), 1957–2021

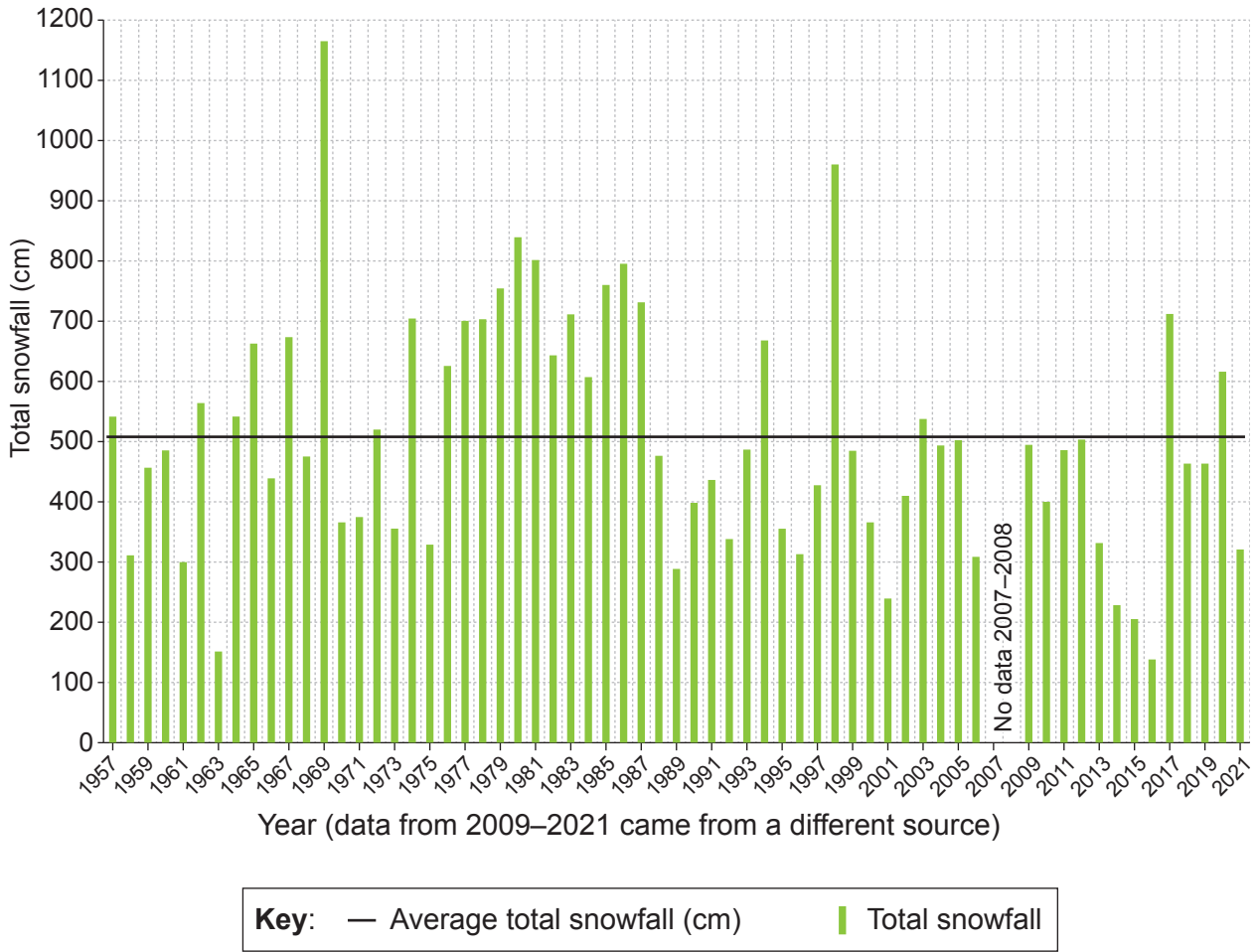


Figure 4(a): Fact file on glaciers in Switzerland

- The average annual temperature in Switzerland has risen by 2°C since 1864.
- All Swiss glaciers are retreating as summer melting outputs are greater than winter snowfall inputs.
- 500 glaciers have disappeared since 1850.
- The minimum elevation for accumulation of snow in winter is predicted to rise from 850 m in 2019 to 1750 m by 2100.
- Glacial regions are important for both summer hiking and winter ski tourism.
- Glaciers in the Swiss Alps are the source of two major rivers in Europe: the Rhine and the Rhône.

Figure 4(b): Ice volume in Swiss glaciers, 1850–2100

Year	1850	2010	2019	2100
Ice volume (km ³)	130	60	53	7

Figure 4(c): An example of a retreating glacier in the Swiss Alps, 1891 (left) and 2019 (right)



[Source: The Trient Glacier is seen in the Swiss Alps in Trient, Switzerland August 26, 2019. Picture taken August 26, 2019. REUTERS/Denis Balibouse.]

Figure 4(d): Average percent cover vegetation (%) near a glacier (2500 m elevation)

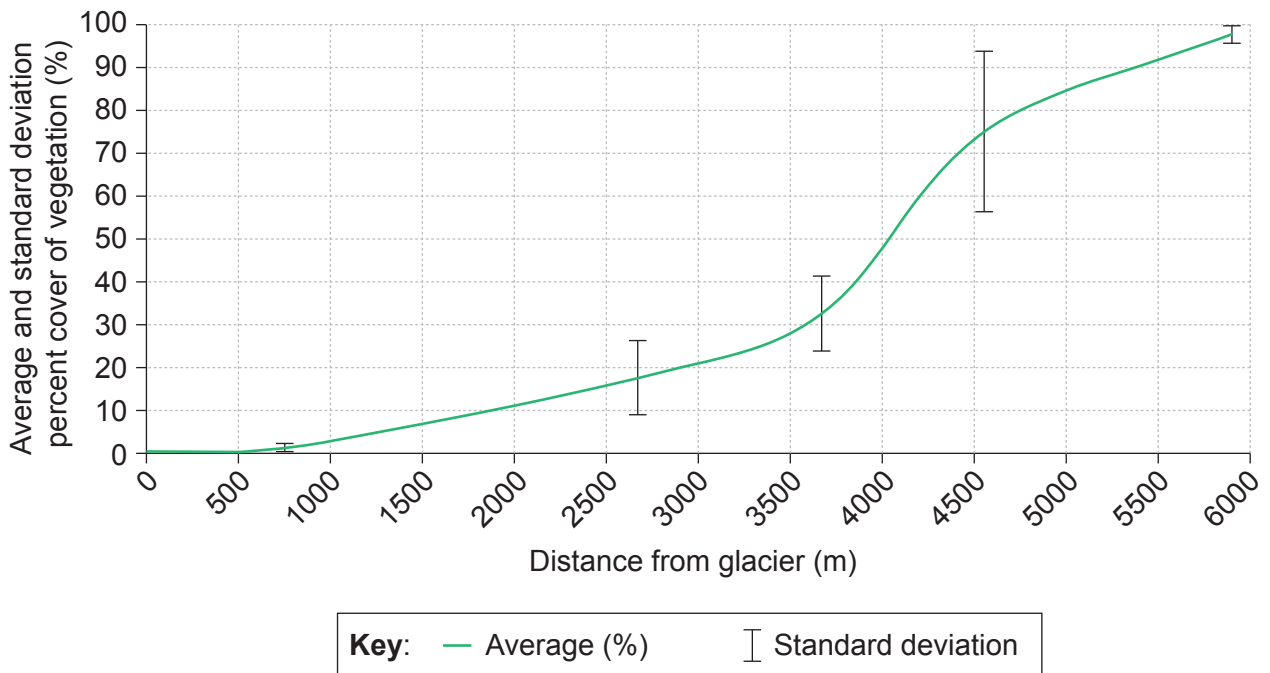


Figure 5: Sources of electricity generation in Switzerland (2020)

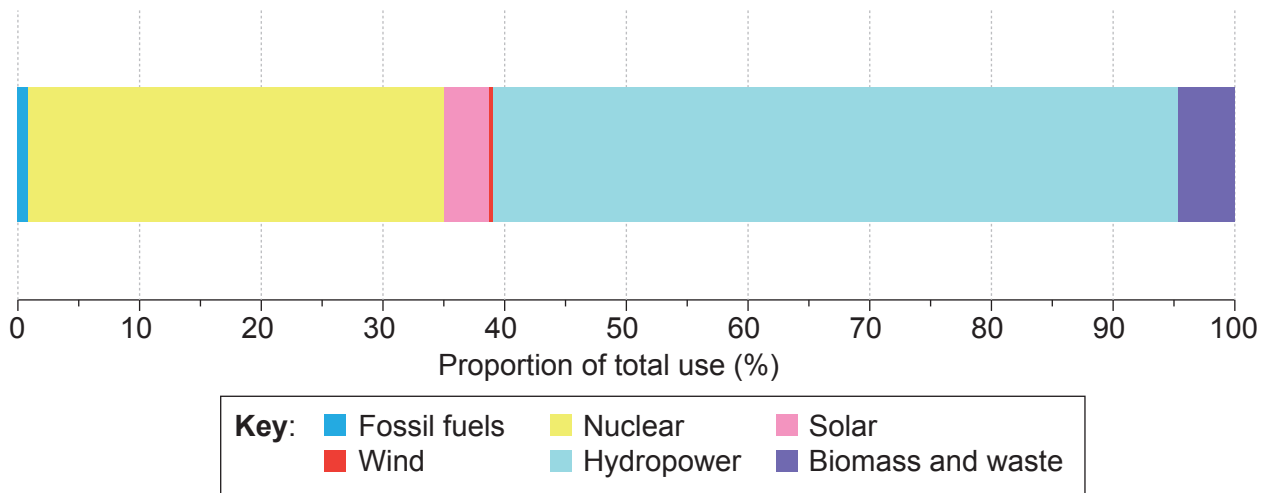


Figure 6(a): Image of a Eurasian wolf (*Canis lupus lupus*)



Figure 6(b): Simplified food web of the Eurasian wolf (*Canis lupus lupus*)

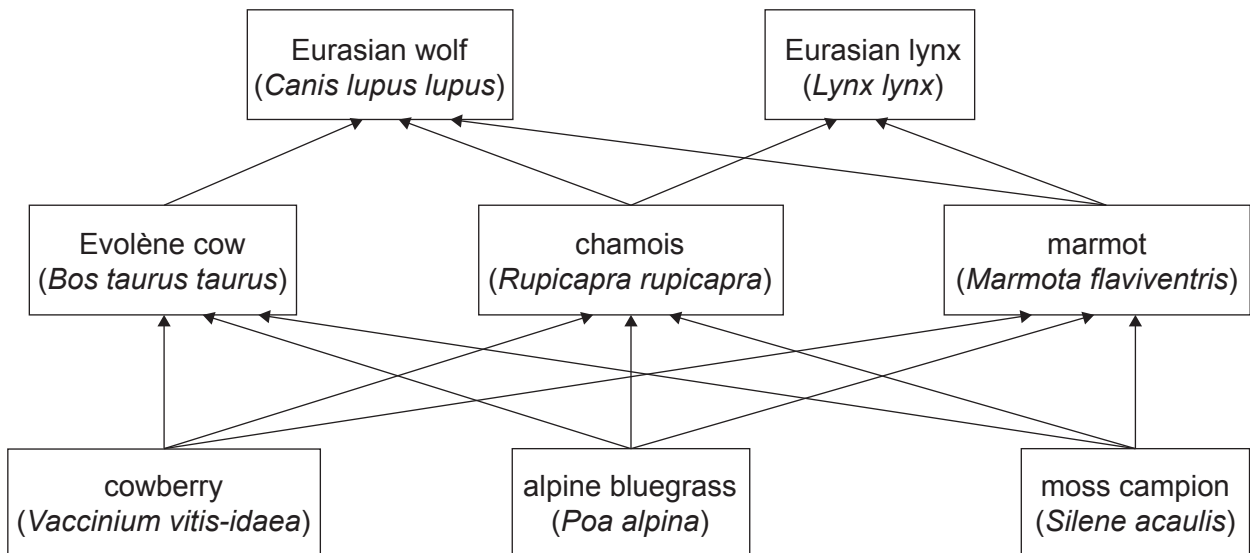


Figure 6(c): Timeline of the Eurasian wolf (*Canis lupus lupus*) in Switzerland

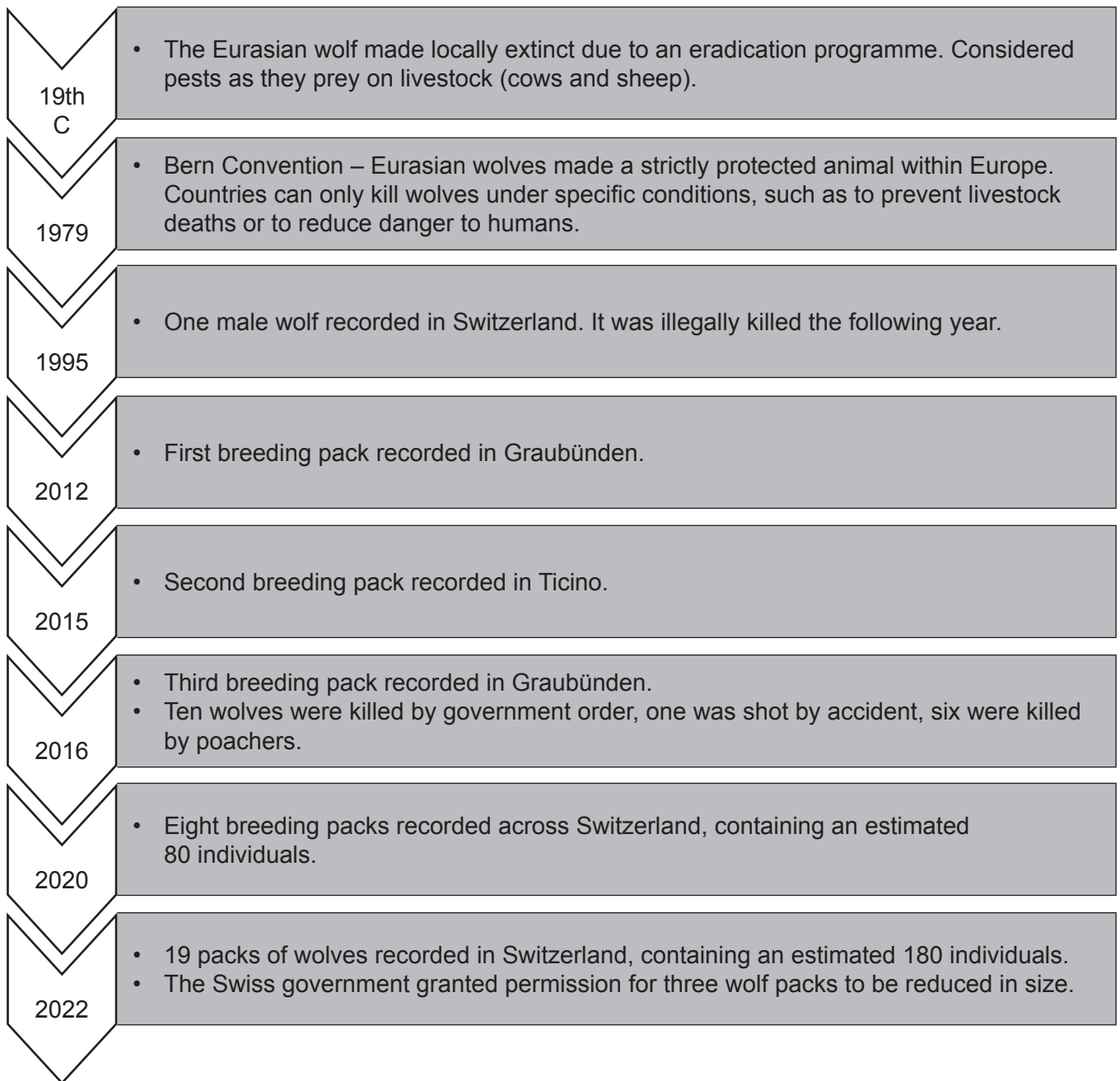


Figure 6(d): Number and locations of breeding Eurasian wolf packs in Switzerland, 2020

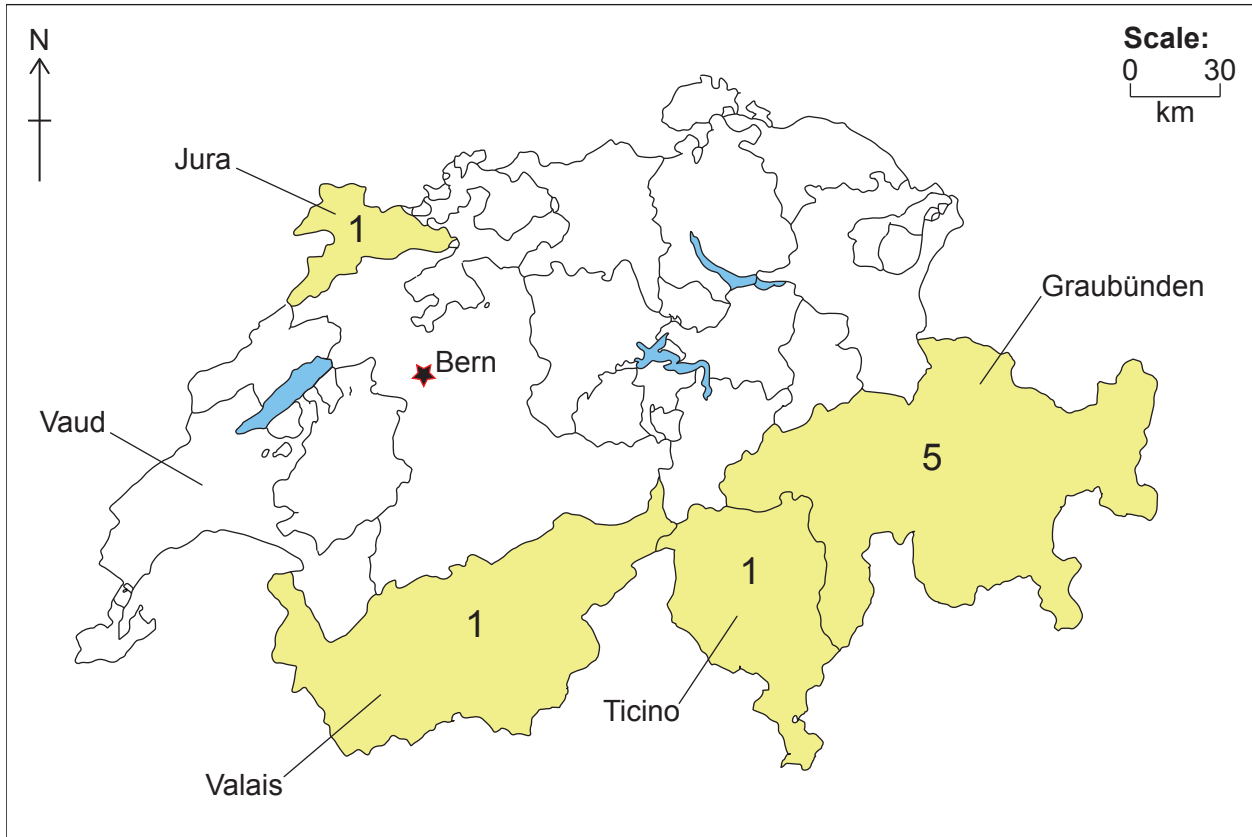


Figure 7: Fact file on Switzerland's dairy farms

- There were over 27 000 dairy farms in Switzerland in 2022, which produced 4 billion kg of milk per year.
 - The average farm has 26 cows and is often family owned and operated.
 - Cows have both cultural and tourism value in the Alps.
 - Cows are taken to the alpine meadows for grazing in the summer, and down to the valleys for shelter during the winter.
 - Methane gas from cow digestion contributes 6.2 % of Switzerland's total greenhouse gas emissions.
 - When cows eat fresh grass from alpine meadows, methane emissions are reduced when compared to eating hay (dried plants).
 - Alpine meadows are carbon sinks.
 - The Swiss dairy industry involves local production, processing and consumption.
 - In 2021, wolves killed six calves in Vaud and two adult cows in Graubünden.
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References:

- Figure 1(d)** Taylor-Cevey, H., n.d. *Winter ski tourism in the Swiss Alps*. [photograph] (Helen Taylor-Cevey's own private collection). Source adapted.
- Figure 2(a)** Delphi234. https://commons.wikimedia.org/wiki/File:Altitudinal_zones_of_Alps_mountains-extended_diagram.svg. Licensed under CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0/deed.en>. Source adapted.
- Figure 3** Data by R Perrin.
- Figure 4(c)** Anon, 1891. Le glacier du Trient en 1891, vu du chemin de la Lys. https://eth.swisscovery.slsp.ch/discovery/fulldisplay?docid=alma99117373671905503&context=L&vid=41SLSP_ETH:ETH&lang=en&search_scope=DiscoveryNetwork&adaptor=Local%20Search%20Engine&tab=discovery_network&query=any,contains,trient%20glacier%201891&offset=0. Public domain image. Source adapted.
- The Trient Glacier is seen in the Swiss Alps in Trient, Switzerland August 26, 2019. Picture taken August 26, 2019. REUTERS/Denis Balibouse.
- Figure 5** Energy in Switzerland. https://en.wikipedia.org/wiki/Energy_in_Switzerland. Licenced under Creative Commons CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0/deed.en>. Source adapted.
- Figure 6(a)** Honig, Y., n.d. *Image of a Eurasian wolf (Canis lupus lupus)*. [photograph] (Yenka Honig's own private collection). Source adapted.