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**Environmental systems and societies**  
**Standard level**  
**Paper 1 – resource booklet**

Thursday 5 May 2022 (afternoon)

1 hour

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**Instructions to candidates**

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

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**Figure 1: Map showing the location of Costa Rica**



**Figure 2: Fact file on Costa Rica**

- Costa Rica covers a total area of 51 100 km<sup>2</sup>.
- The country lies on a tectonic plate margin and has a number of volcanoes, some of which are still active.
- The country covers 0.03 % of the world's surface and contains 5% of the world's biodiversity.
- Its high biodiversity makes Costa Rica an attractive location for tourism.
- Major exports include medical equipment, electronic components, beef and cash crops such as pineapples, bananas, coffee and sugar. ("Cash crops" are produced by intensive commercial agriculture).
- Costa Rica was ranked first in the *Happy Planet Index* (2009, 2012, 2016) based on life expectancy, wellbeing, ecological footprint and level of inequalities within the population.

Figure 3(a): Main vegetation zones in Costa Rica

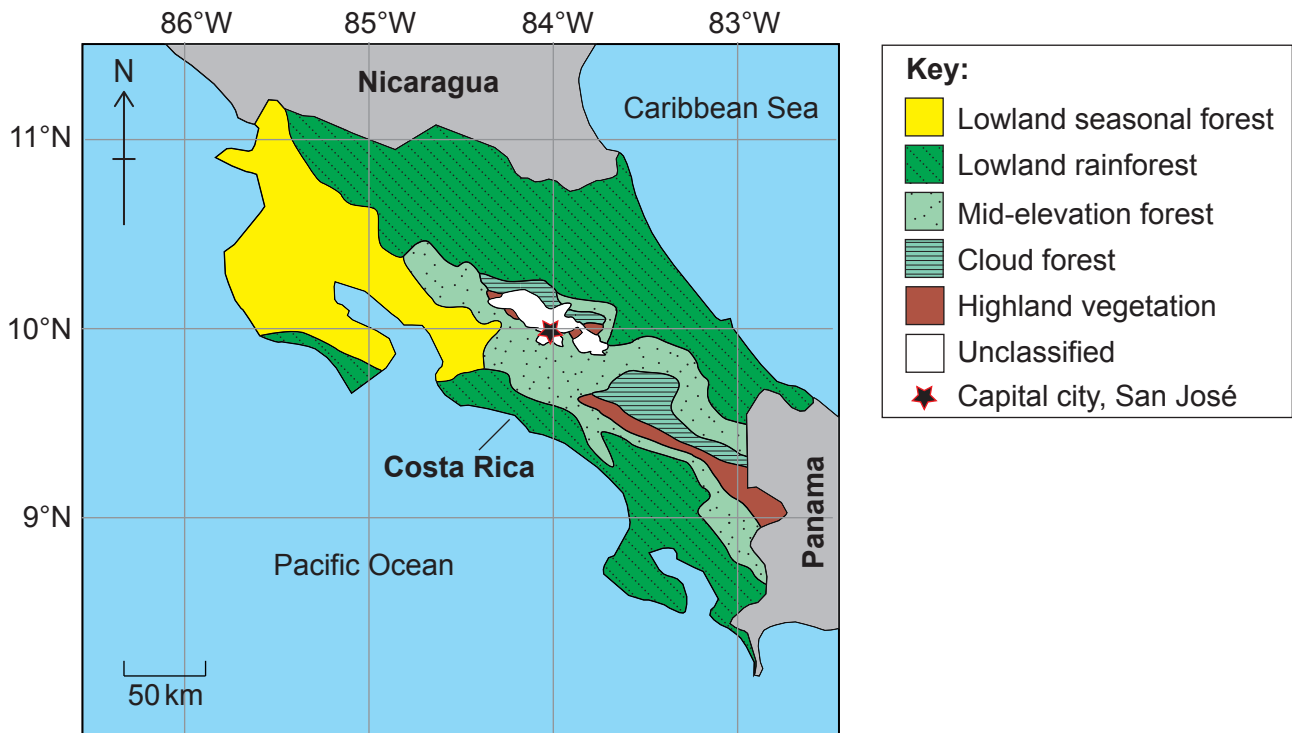
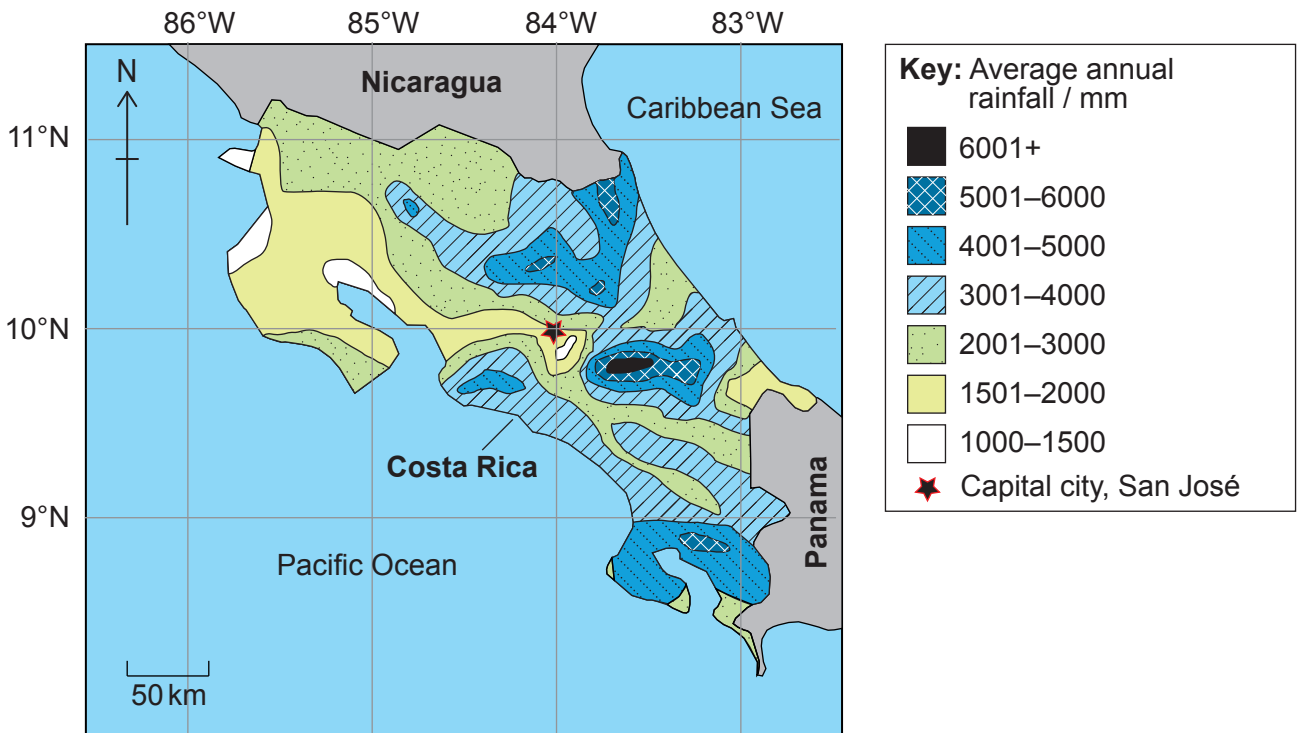


Figure 3(b): Average annual temperature in Costa Rica

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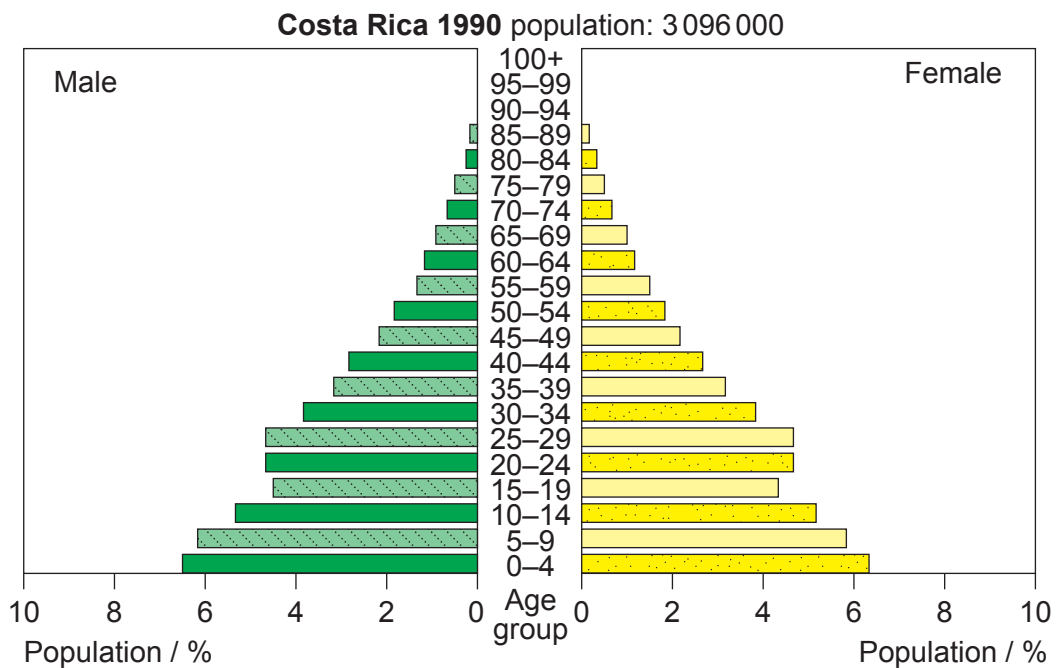
Figure 3(c): Average annual rainfall in Costa Rica



**Figure 4(a): Demographic data for 2018**

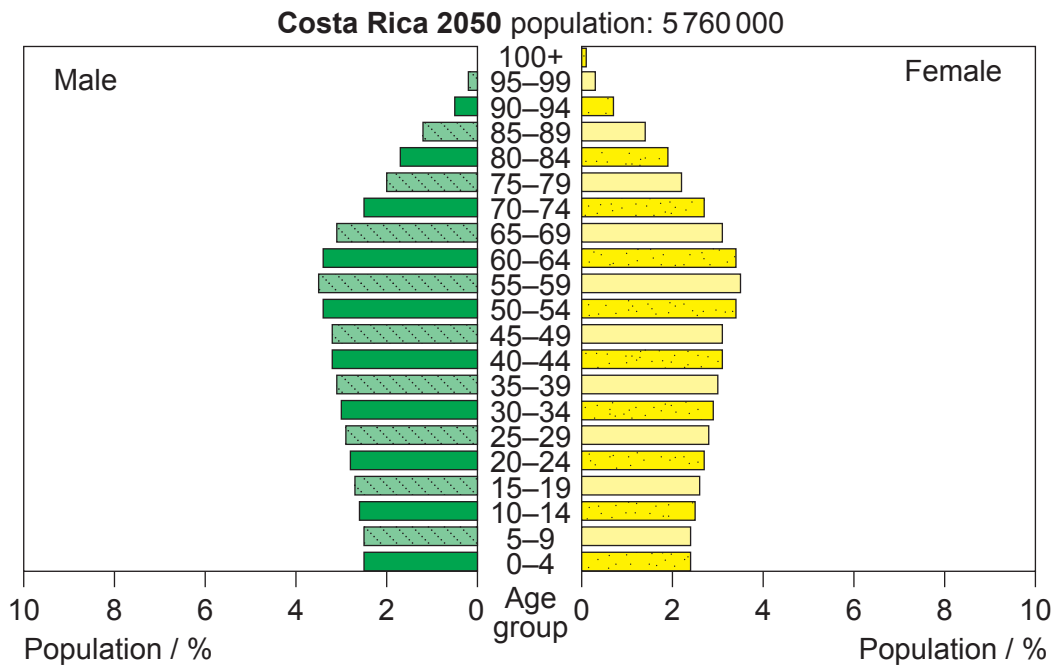
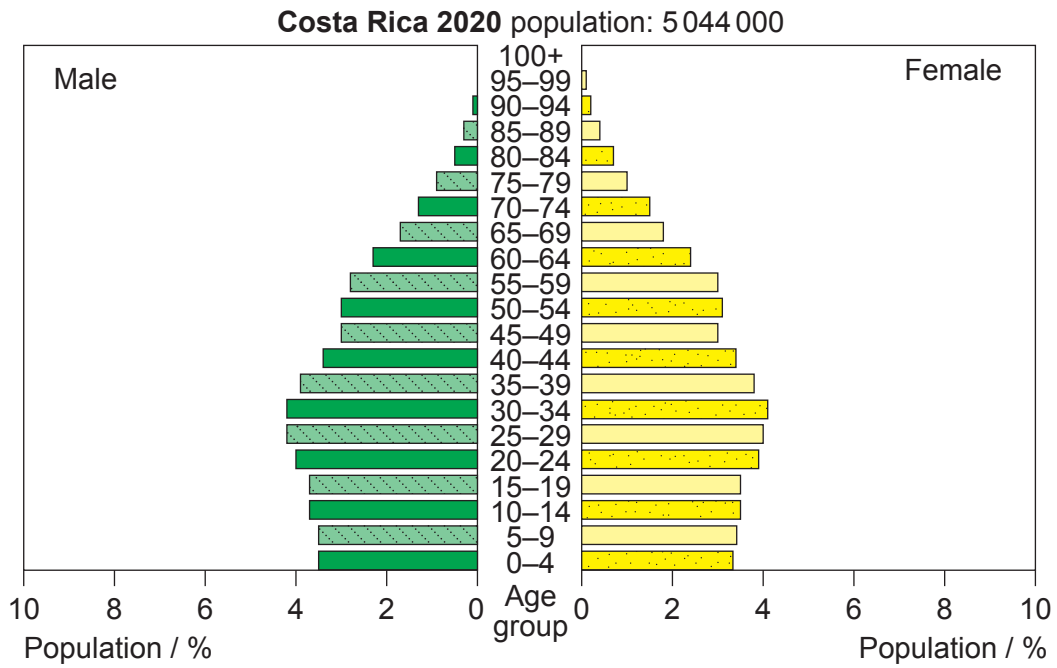
Population (estimated)	5 million (including 104 000 indigenous people)
Natural increase rate	1.05 %
Crude birth rate	15.3/1000
Crude death rate	4.8/1000
Life expectancy / years	78.9
Total fertility rate	1.89 (Note: In 1973, total fertility rate was 5.6)

**Figure 4(b): Age-gender pyramid for Costa Rica in 1990 and projected pyramids for 2020 and 2050**



(Figure 4(b) continues on the following page)

(Figure 4(b) continued)





**Figure 5(a): Biodiversity in Costa Rica**

Over 25% of land is protected forest and reserves with over 190 protected sites. Ecosystems range from coral reefs and mangroves to tropical rainforests and provide a range of goods and environmental services.

**Figure 5(b): Estimated number of species in Costa Rica**

Total number of species	more than 500 000
Flowering plants	9000
Ferns	800
Mammals	250
Birds	850
Reptiles	220
Amphibians	200
Insects	more than 300 000 (including more than 1200 butterflies and 8000 moths)

Figure 5(c): Development of protected areas in Costa Rica

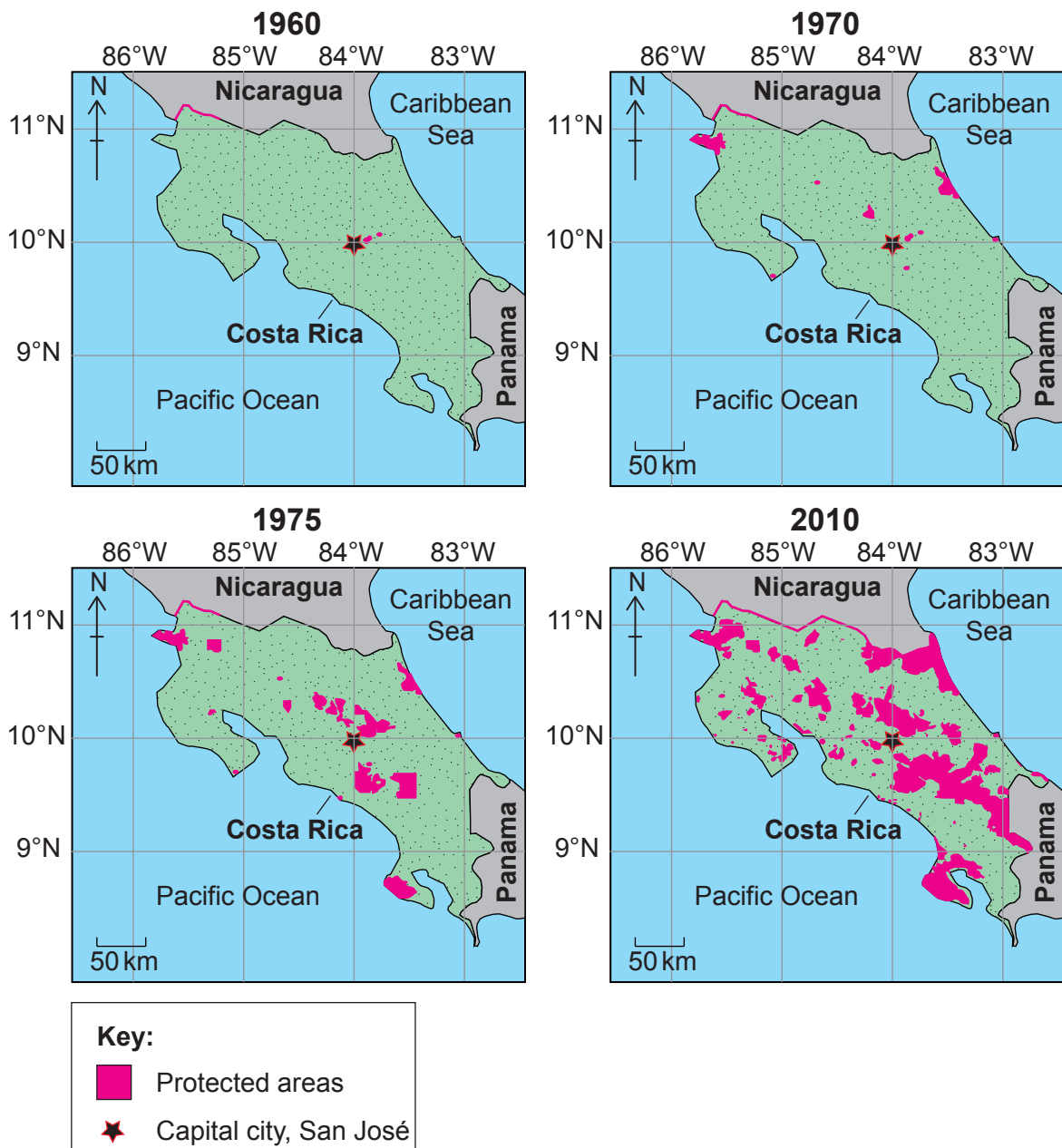
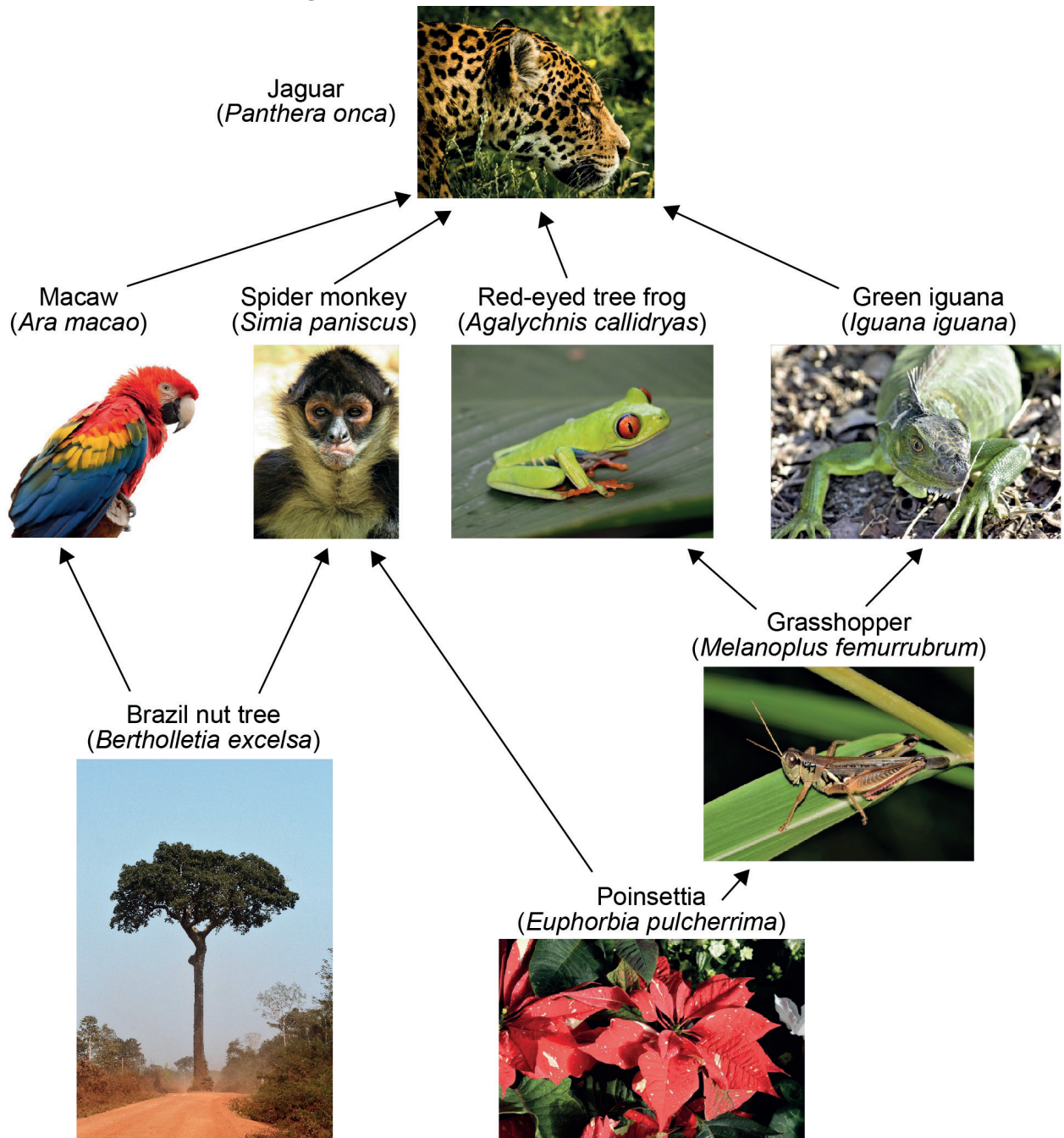


Figure 6(a): Jaguar (*Panthera onca*)



Classified as “near threatened” on the IUCN Red List of Threatened Species

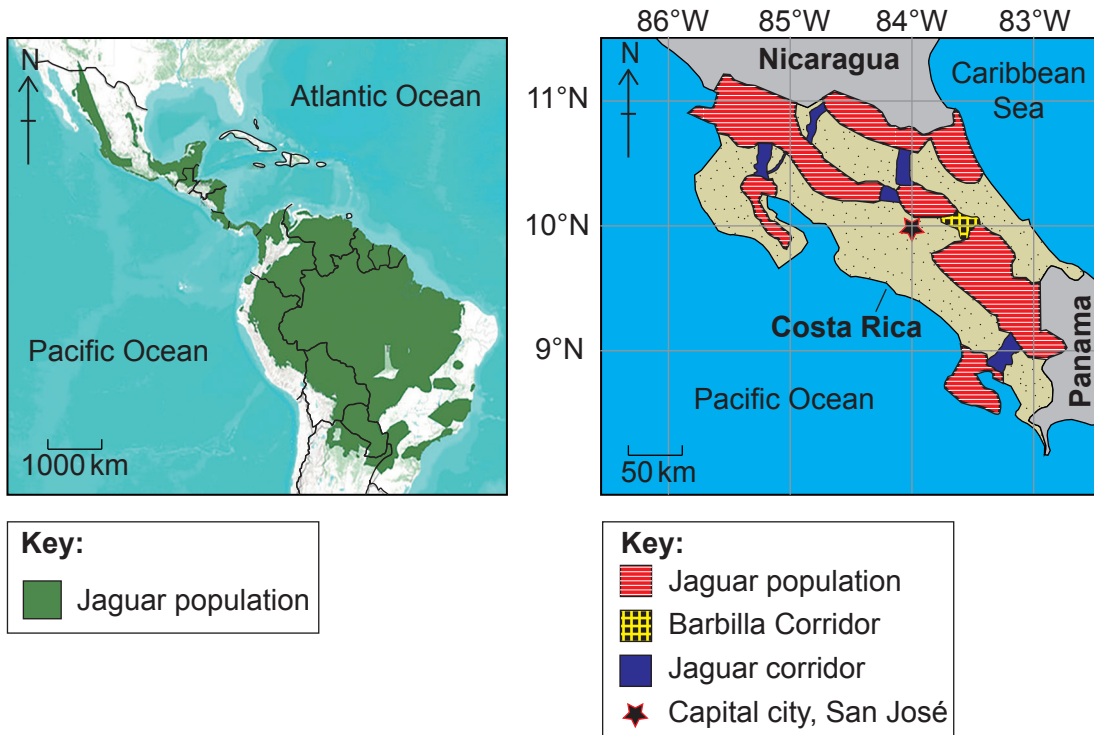
Figure 6(b): Example of a Costa Rican web



**Figure 6(c): Wildlife corridors**

Costa Rica has created 128 wildlife corridors to link many of its conservation areas, eg the Barbilla Corridor. The Barbilla Corridor is part of a larger network across 18 countries (from Mexico to Argentina) that aims to link the traditional migratory route of the jaguar and other animals.

**Figure 6(d): The Barbilla Corridor within the larger international network connecting jaguar populations**



**Figure 7(a): Variation in forest cover in Costa Rica between 1940 and 2010**

<b>Year</b>	<b>Percentage of forest cover</b>
1940	76%
1962	54%
1987	22%
1998	43%
2010	53%

**Figure 7(b): Forest initiatives in Costa Rica**

- Through programmes such as the Payment for Environmental Services Programme (PES) the government pays landowners to plant trees in deforested areas and to manage their land sustainably.
- In 1996, deforestation of mature forest was banned.
- The goal is to achieve 60 % forest coverage of the country.

Figure 8(a): Economic activity (GDP) in Costa Rica by sector

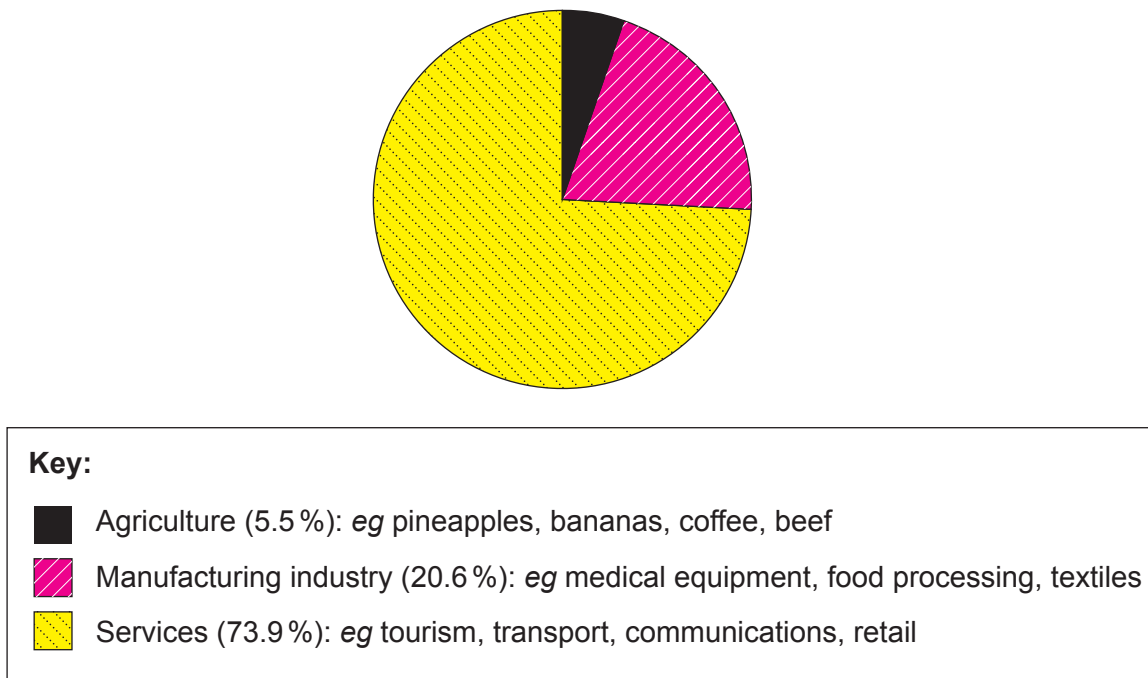
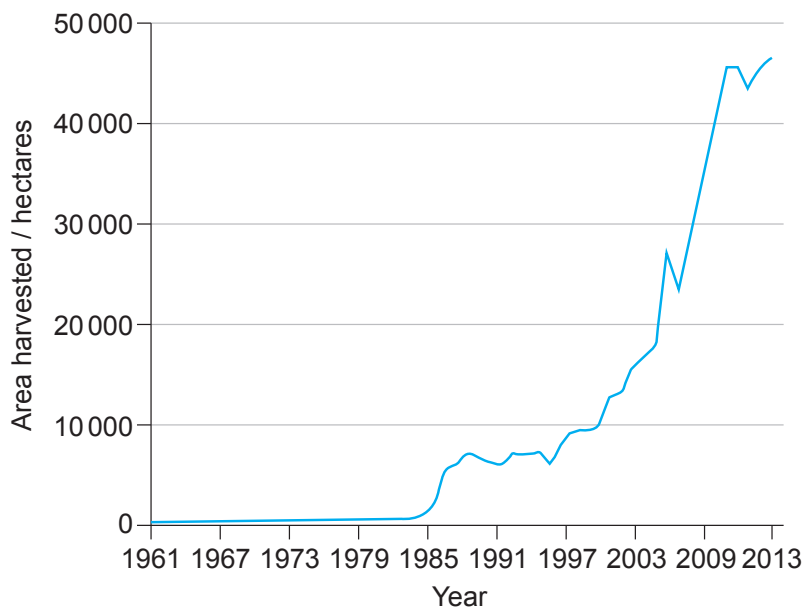
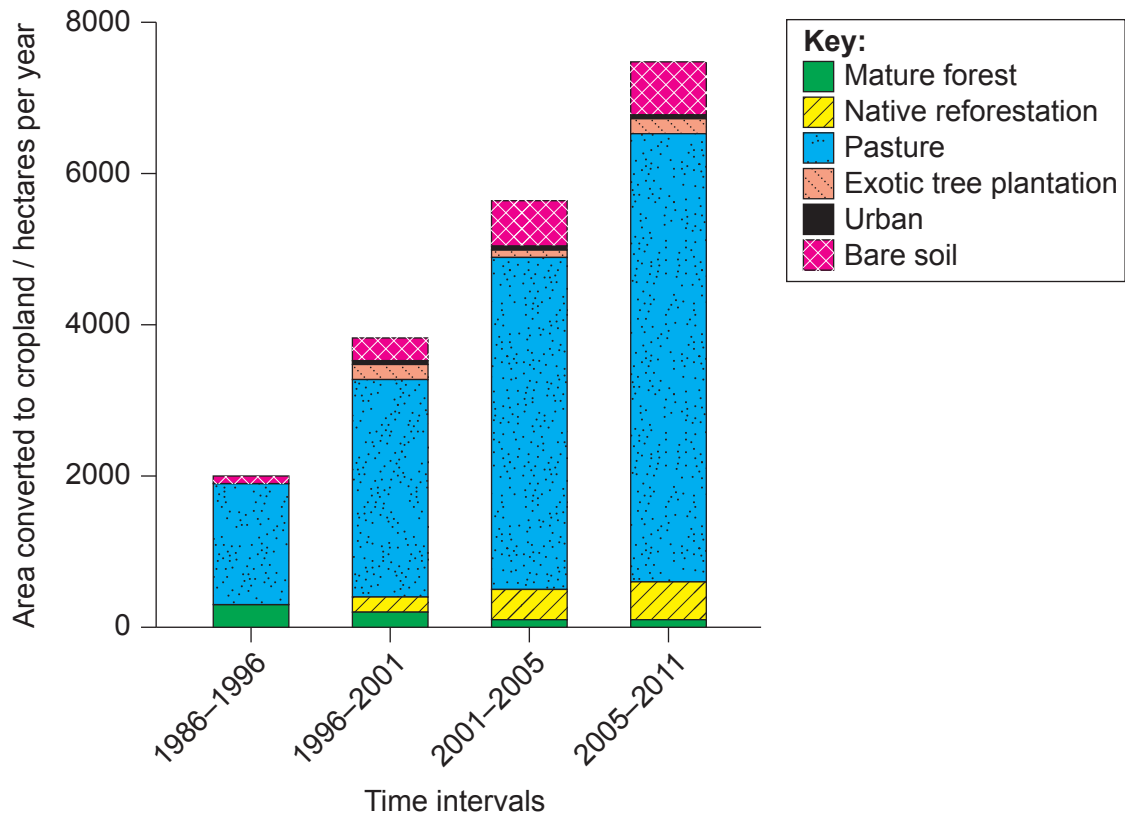


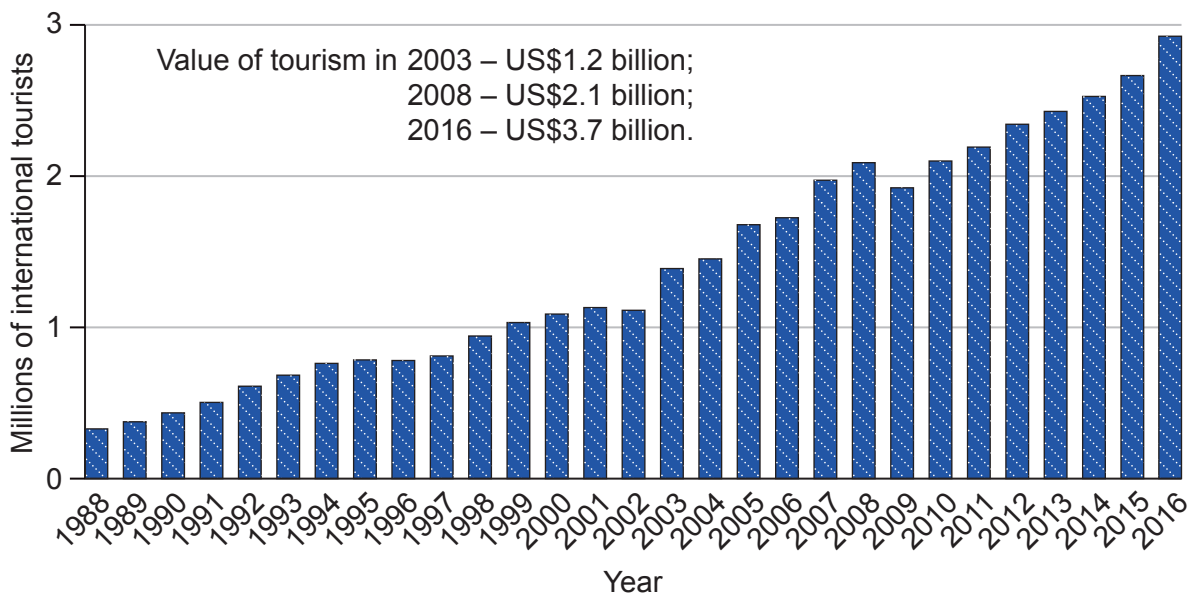
Figure 8(b): Land used in Costa Rica for pineapple production between 1961 and 2013



**Figure 8(c): Conversion to cropland from other land uses in north-eastern Costa Rica (1986–2011)**

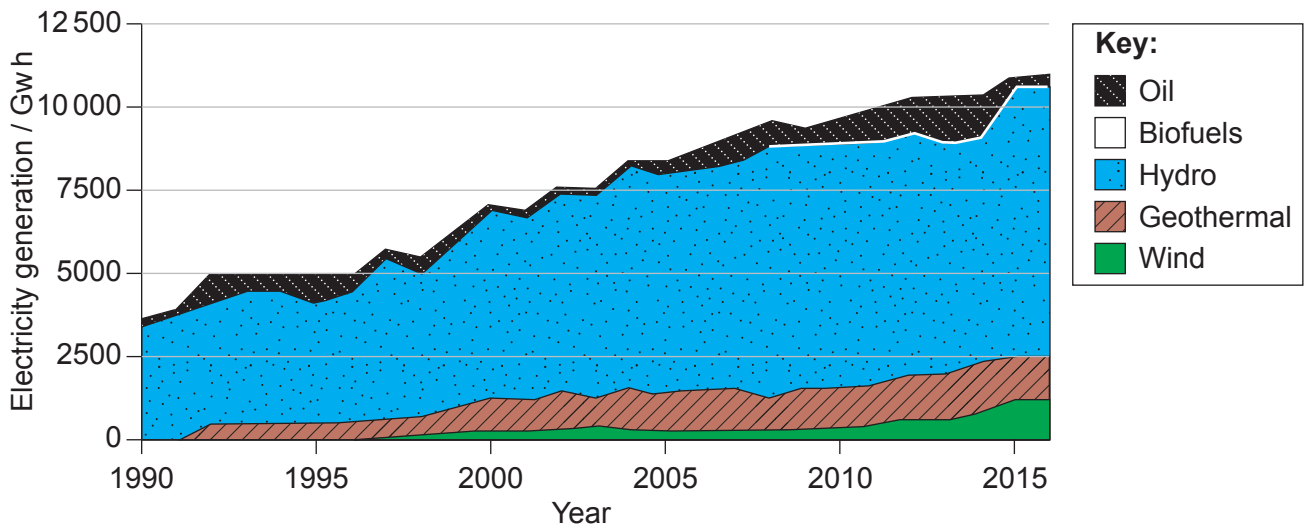


**Figure 8(d): Growth in international tourism in Costa Rica (1988–2016)**

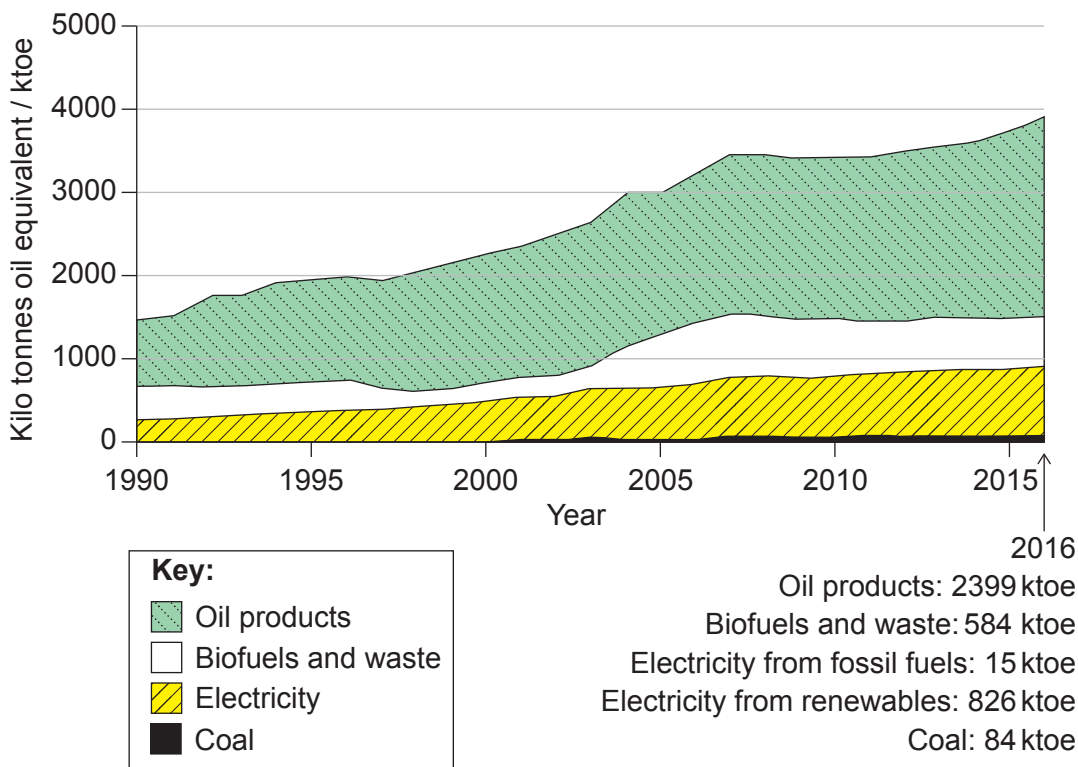


**Figure 9(a): Electricity generation in Costa Rica by energy source (1990–2016)**

Most of the electricity generated in Costa Rica comes from renewable sources (98.2% in 2016 and 98.56% in 2018).

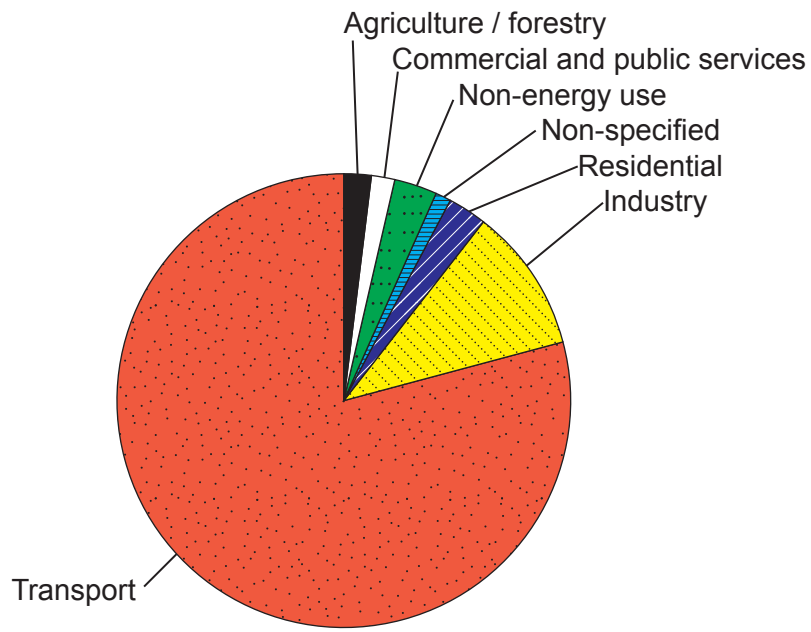


**Figure 9(b): Total energy consumption in Costa Rica (including electricity) between 1990 and 2016**





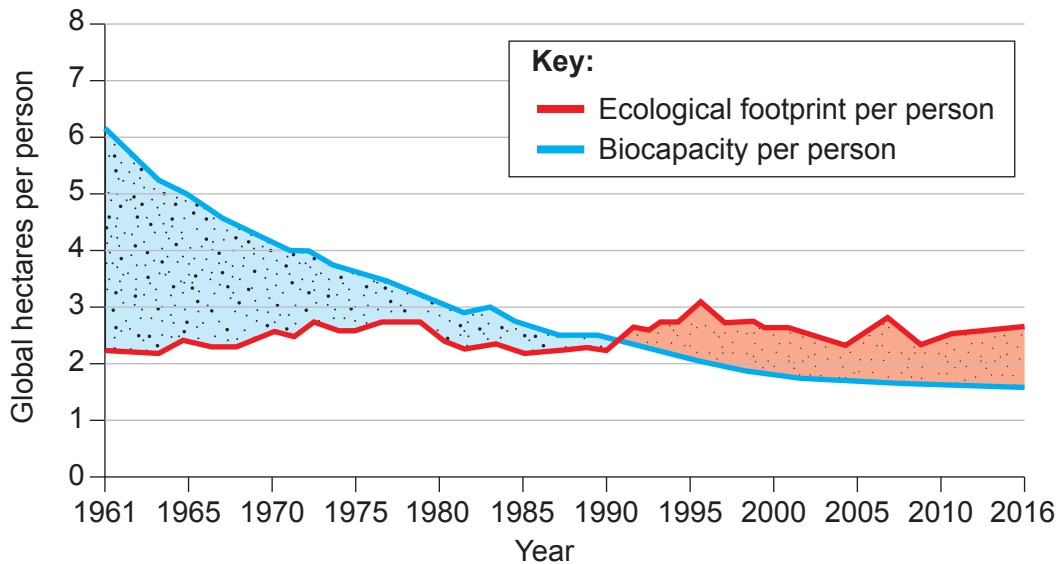
**Figure 9(c): Consumption of crude oil in Costa Rica by sector (2016)**



**Figure 10(a): Fact file on carbon neutrality**

- Costa Rica has pledged to become carbon neutral by balancing carbon dioxide output with carbon dioxide input to give zero net carbon emissions in the future.
- Since the mid-1980s, national methane emissions have decreased and, following pressure from the public, a twenty-year ban was placed on oil exploration in Costa Rica in 2002.
- For the year 2017, carbon dioxide emissions per person (1.45 tonnes) were above the regional average for Central America (1.18 tonnes). The government is now encouraging:
  - greater use of public transport and adopting vehicles with lower emissions of carbon dioxide, nitrogen oxides or particulates
  - use of electric, biofuel, hybrid and hydrogen vehicles
  - generation of electricity through renewable resources
  - carbon off-set schemes that plant trees and improve land management to compensate for carbon emissions.
- The world’s first certified carbon-neutral coffee producer was established in Costa Rica.

**Figure 10(b): Ecological footprint and biocapacity per person in Costa Rica (1961–2016)**



Biocapacity is the amount of biologically productive land, measured in hectares per person.

## References:

- Figure 1** Pixabay.
- Figure 3a** Monge-Nájera, J., Z. Barrientos & M. Zúñiga. 2013. A satellite and ground evaluation of urban vegetation and infrastructure in the landscape of a tropical city: Heredia, Costa Rica. *Cities and the Environment* 6 (1): 12. [online] Available at: <http://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1124&context=cate>. Source adapted.
- Figure 3c** With permission from Costa Rica Guide. Source adapted.
- Figure 4a** Data from: CIA, 2019. *The World Factbook: Costa Rica*. Available at: <https://www.cia.gov/library/publications/the-world-factbook/geos/cs.html/> [Accessed 06 November 2019].
- Figure 4b** Population Pyramid. Costa Rica 1990, 2020 and 2050. [online] Available at: <https://www.populationpyramid.net/costa-rica/1990/>, <https://www.populationpyramid.net/costa-rica/2020/>, <https://www.populationpyramid.net/costa-rica/2050/> Made available under a Creative Commons license CC BY 3.0 IGO: <http://creativecommons.org/licenses/by/3.0/igo/> [Accessed 06 November 2019].
- Figure 5a** Data from: González-Maya, J.F., Víquez-R, L.R., Belant, J.L. and Ceballos, G, 2015. Effectiveness of Protected Areas for Representing Species and Populations of Terrestrial Mammals in Costa Rica. *PLoS ONE* 10(5): e0124480. doi:10.1371/journal.pone.0124480 [online]. Available at: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0124480> This file is licensed under the Creative Commons Attribution 4.0 International (CC BY 4.0) <https://creativecommons.org/licenses/by/4.0/> [Accessed 06 November 2019].
- Figure 5c** González-Maya, J.F., Víquez-R, L.R., Belant, J.L. and Ceballos, G, 2015. Effectiveness of Protected Areas for Representing Species and Populations of Terrestrial Mammals in Costa Rica. *PLoS ONE* 10(5): e0124480. doi:10.1371/journal.pone.0124480 [online]. Available at: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0124480> This file is licensed under the Creative Commons Attribution 4.0 International (CC BY 4.0) <https://creativecommons.org/licenses/by/4.0/> [Accessed 06 November 2019].
- Figure 6a** [Jaguar] Pixabay.
- Figure 6b** [Jaguar] Pixabay.  
[Iguana] Pixabay.  
[Red-eye frog] Pixabay.

[Macao] Pixabay.

[Spider monkey] Pixabay.

[Grasshopper] Pixabay.

[Brazil nut tree] Pixabay.

[Poinsettia] Pixabay.

- Figure 6d** The Jaguar Project. *Costa Rica Wildlife Corridors*. [online] Available at: [http://www.thejaguarproject.com/jaguar\\_corridor\\_conservation.html](http://www.thejaguarproject.com/jaguar_corridor_conservation.html) [Accessed 06 November 2019]. Source adapted.
- Figure 8a** Data from: CIA, 2017. *The World Factbook: Costa Rica*. [online] Available at: <https://www.cia.gov/the-world-factbook/countries/costa-rica/#economy> [Accessed 06 November 2019].
- Figure 8b** FAO. FAOSTAT Crops and livestock products. License: CC BY-NC-SA 3.0 IGO. Extracted from: <https://www.fao.org/faostat/en/#data/QCL>. Date of Access: 06-11-2019. This file is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported (CC BY-NC-SA 3.0) <https://creativecommons.org/licenses/by-nc-sa/3.0/>.
- Figure 8c** Data from: Fagan, M.E., DeFries, R.S., Sesnie, S.E., Arroyo, J.P., Walker, W. Soto, C., Chazdon, R.L., and Sanchun, A., 2013. Land cover dynamics following a deforestation ban in northern Costa Rica. *Environ. Res. Lett.* [e-journal] (8)034017 <http://doi:10.1088/1748-9326/8/3/034017>. This file is licensed under the Creative Commons Attribution 3.0 Unported (CC BY 3.0) <https://creativecommons.org/licenses/by/3.0/>.
- Figure 9a** Based on IEA data from IEA (2019) *Costa Rica Energy Policy*, <https://www.iea.org/countries/costa-rica>, IEA (2022), [www.iea.org/statistics](http://www.iea.org/statistics), All rights reserved; as modified by International Baccalaureate Organization.
- Figure 9b** Based on IEA data from IEA (2019) *Costa Rica Energy Policy*, <https://www.iea.org/countries/costa-rica>, IEA (2022), [www.iea.org/statistics](http://www.iea.org/statistics), All rights reserved; as modified by International Baccalaureate Organization.
- Figure 9c** Based on IEA data from IEA (2019) *Costa Rica Energy Policy*, <https://www.iea.org/countries/costa-rica>, IEA (2022), [www.iea.org/statistics](http://www.iea.org/statistics), All rights reserved; as modified by International Baccalaureate Organization.
- Figure 10b** Global Footprint Network. Costa Rica (2022) [online] Available at: <http://data.footprintnetwork.org/#/>. Source adapted.