FUTURE SPACE

Lesson outline

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Global Warming impact on natural disaster, especially wildfires

Key words:

global warming

natural disaster

wildfires

Topic: **Global warming, natural disaster, wildfires**

Students' age: 15-19

Time: 🕐 **2 lessons**

Subjects:

geography

LESSONS IDEA - Teacher's guide

The lesson 'Global Warming impact on natural disaster, especially wildfires' is a 4th part of a block of 5 lessons devoted to the problem of global warming and its direct and indirect impacts assessment using remote sensing techniques. The lesson length is 90 minutes. Al parts can be realise as separated module. Global warming is one of the main current threat for human life and well-being, as well as, for plant and animal species then ecosystems.

The purpose of this lesson is to evaluate the impact of climate change on natural disaster, especially wildfires in different regions using satellite images. The trend analysis of number of wildfires and fire regime in different region will be searched and discuss. Impact of wildfires will be debated.

✎ Lesson objectives

- ➲ Active participation in the analysis of real data of different sources
- ➲ Extraction of information from satellite image
- ➲ Regime of wildfires analysis and trend analysis
- ➲ Stimulating critical view of results

✎ Results

- ➲ Students will discover how wildfire regimes have changed in various geographic zones in the period 2001-2021
- ➲ Students will know the role of wildfires in ecosystems

ADDITIONAL MATERIALS:

- ⊃ global warming vs natural disasters.pptx – **Appendix 1**
- ⊃ regional sets of data on wildfires extracted from daily MODIS Thermal Anomalies/Fire product (MOD14) and aggregated to months for period 2001-2021 [region]_frequency.xlsx and corresponding sets of xlxs files with solution for teachers
- ⊃ a set of 6 raster layers about forest fire regional density (1 per region) in geo-tiff format

- ⊃ Software: QGIS, Excel
- ⊃ Global Warming vs natural disasters, fires - worksheet.docx – **Appendix 2**

- ✎ *The lesson needs to be done in a computer room.*
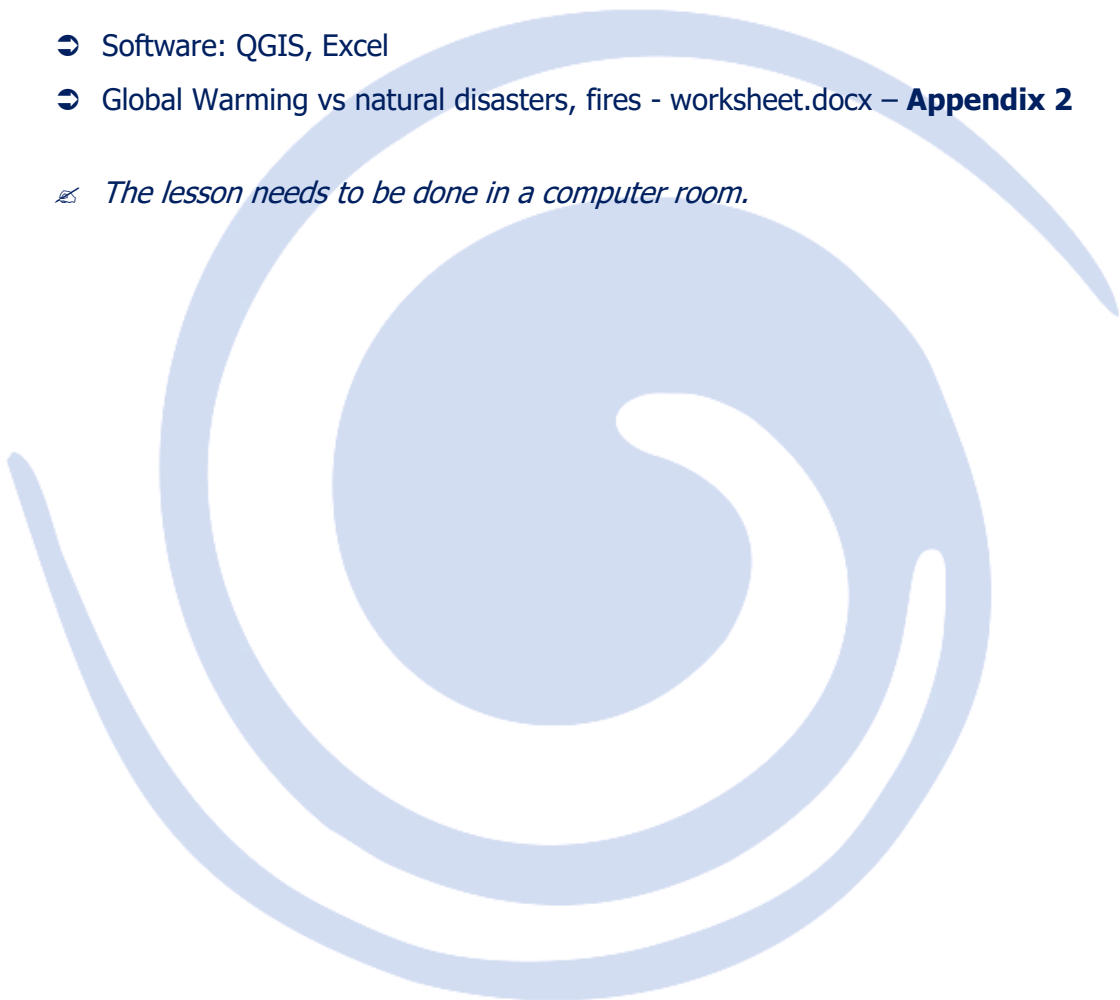
DESCRIPTION OF THE LESSON

✍ Theoretical part

Students will discuss with the teacher about links between global warming and wildland fires. General information about wildfires and their causes.

✍ *Time required to complete this part of lesson: 5 min.*

✍ Practical part 1

The class is divided into groups (6), each group has a designated geographical region:

1. Southeast Asia (e.g. China and India)

2. Central Africa (Tanzania and the Democratic Republic of the Congo)

3. Western and Central Europe (e.g. Germany and Poland)

4. North America (USA and Canada)

5. South America (Brazil and Chile)

6. Oceania (Australia and New Zealand)

Students will analyse changes in wildfire regime in time within regions using data derived from MODIS satellite images.

Time required to complete this part of lesson: 15 min.

✍ Discussion part 1

Students and the teaches discuss about regimes of fires

1. Individual groups present their conclusions regarding the changes in wildfires in the region in the period 2001 – 2021.

2. If there are regional trends of changes? If yes, if they are similar for all regions?

Time required to complete this part of lesson: 15 min.

✍ Practical part 2

Students will analyse spatial distribution of wildfires in their regions and analyse the relation climatic factors.

Time required to complete this part of lesson: 15 min.

✍ Discussion part 2

Students and the teaches discuss about relation of forest fires distribution and climatic variables

1. What is a spatial distribution of wildfires in their regions?

2. They will discuss if there were correlation between weather conditions and wildfires within areas

3. How the climate change will influence on forest fires distribution?

Time required to complete this part of lesson: 15 min

🕒 Wildfires impact

✎ Introduction part

Students will discuss with the teacher about links between global warming and wildland fires. General information about wildfires and their causes.

Time required to complete this part of lesson: 10 min

✎ Practical part 3

Students will search in the internet for fire-dependent species or ecosystems in their regions and collect information in what consists this dependence (as much as possible).

Time required to complete this part of lesson: 10 min

✎ Discussion part 3

Students and the teaches discuss about direct and indirect effects of global warming

1. What fire-dependent species/ecosystems are present in which regions?

2. In what consists this dependency?

Presentation Solutions:

Fire regime

Region name	Country	Monthly statistics (number of fires)			Fire season*			Absolute maximum of fires		Trend line	
		mean	month of maximum	month of minimum	mean length	beginning	end	number of fires	date	direction**	value***
Oceania	Australia	21692	October	January	5	August	December	120348	9/2011	positive	2,22
South America	Brazil	33921	September	January	3	August	October	262967	9/2007	negative	-47,17
North America	Canada	3837	July	February	3	June	August	47897	8/2017	positive	8,38
Asia	China	7013	March	September	2 x 2	March October	April November	33074	3/2008	positive	12,39
Asia	India	5851	March	July	2 x 2	March October	April November	31198	3/2009	positive	14,38
Europe	Poland	90	April	January	2 x 2	March August	April September	1338	3/2003	negative	-0,42
Africa	Tanzania	7096	July	January	5	June	October	34264	7/2003	negative	-5,46

* number of fire higher than the mean
** positive or negative
*** a parameter of lineal function

General conclusions:
- The pick of fires is connected to the end of the dry season in Australia
- The pick of fires is connected to driest and the hottest period in Brazil, the very negative trend is probably related to the international pressure to protect Amazonia
- The pick of fires is connected to the hottest period in Canada
- In Asia it is pretty seen the influence of monsoon
- In Poland the pick of fires is connected to the land management, particularly grass burning, second period is related to the driest period
- The pick of fires is connected to driest and the hottest period in Tanzania
- The longest fire seasons are detected in the driest regions

Fires spatial distribution

Region name	Country	Precipitation	Wet days	Temperature			Wind speed	Vapour pressure	Land cover
				Max	Mean	Min			
Oceania	Australia								
month of maximum	October		weak −	weak +	weak +	weak +		strong −	shrub / forests
South America	Brazil								
month of maximum	September	weak −	strong −	weak +	weak +	strong +		weak −	forests
North America	Canada								
month of maximum	July	weak −	weak −					strong −	forests
Asia	China								
month of maximum	March			weak +	weak +	strong +			forests
Asia	India								
month of maximum	March	weak −	weak −		weak +	strong +			forests / shrubs
Europe	Poland								
month of maximum	April								forests
Africa	Tanzania								
month of maximum	July	strong −	strong −	strong +	strong +	weak +			forests / shrubs

| weak | strong | positive correlation |
| weak | strong | negative correlation |

General conclusions:

- Natural or semi natural vegetation is mostly affected by fires crop land areas normally are not affected
- A temperature and precipitation are the most important drivers
- Lack of any relation with the climatic conditions in Poland indicates that the fires are artificially induced by humans
- Strong dependency on climatic conditions of fire distribution in Tanzania indicates natural origin of fires