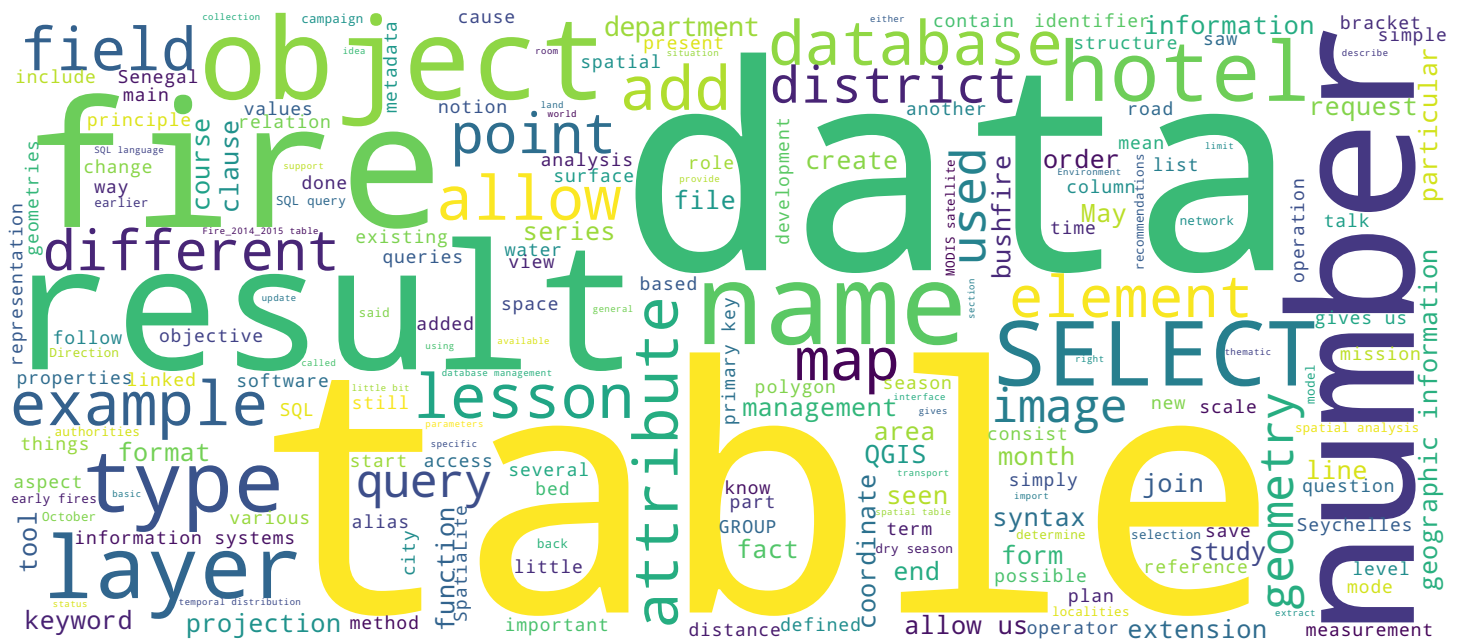


An Introduction to Geographic Information Systems

Case study – Bush fires in the Sahelian area

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Video



Bush fires in the Sahelian area

Objectives of the lecture

- To understand the role of information systems in the management of bush fires
- To be able to use GIS in monitoring bush fires

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Welcome to this course which is about a case study in which we will present the bushfires in Senegal. The purpose of the lesson is to get you to understand the role of information systems in the management of bushfires but also to be able to use them in the monitoring of bushfires.

Notes

Summary



0m 25s

Bush fires in the Sahelian area

Causes

- Burn farming and land-clearing
- Carelessness and early fires

Extension

- Sudan-Sahel region
- During the dry season (October to May)



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Concerning the plan of this lesson, here is how it is declined. First we will characterize the bushfires, then decline the mission of the CSE and the public authorities in Senegal and in the management of bushfires. Thirdly, we will talk about the role of the geographic information system and the methodology that was used and finally, we will finish with the results and make some recommendations. In this section, we will talk about the causes and the extension of the phenomenon. First of all, we must know that Senegal suffers every year from enormous damages from bushfires estimated at hundreds of millions of CFA francs. As for the causes, there are 2 we can remember. First, what is called slash-and-burn cultivation and clearing. We have to say though that it is an ancestral part of the itinerant slash-and-burn cultivation. Farmers have a tendency to expand their field or to seek new land to increase their production using fire as a means of clearing. That is one cause. A second cause is all this negligence around early fires because these early fires, if they are done according to the rules, constitute a way of preventing late fires and unfortunately, the respect by the populations of the best conditions for their implementation is sometimes left to be desired.

Notes

Summary



0m 48s

Bush fires in the Sahelian area

Causes

- Burn farming and land-clearing
- Carelessness and early fires

Extension

- Sudan-Sahel region
- During the dry season (October to May)



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As a result these fires which were perceived as means of limiting damages often become real fires. As far as the extension is concerned, this phenomenon covers the entire Sudano-Sahelian zone, especially in the dry season, that is to say between October and May, the period that precedes the cultivation.

Notes

Summary



2m 29s

Bush fires in the Sahelian area

Consequences

- Forest destruction
- Loss of bio-diversity
- Threat on population and goods
- Global warming
 - Production of greenhouse gases
 - Loss of atmospheric carbon sequestration capacities due to vegetation destruction

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As for the consequences, we can list a certain number of them, 4 or 5 consequences.

Notes

Summary



2m 58s

Bush fires in the Sahelian area

Consequences

- Forest destruction
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- Threat on population and goods
- Global warming
 - Production of greenhouse gases
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The first is the destruction of the forest heritage. Forest resources of Senegal play an important role in improving food security. It is a very important source of energy for Senegalese households. Another consequence is the loss of biological diversity. The threat to people and human establishments is another, global warming since there is a production of greenhouse gas, a reduction also in sequestration capacities of the atmospheric carbon by destruction of the vegetation.

Notes

Summary



3m 11s

Bush fires in the Sahelian area

Consequences

- Forest destruction
- Loss of bio-diversity
- Threat on population and goods
- Global warming
 - Production of greenhouse gases
 - Loss of atmospheric carbon sequestration capacities due to vegetation destruction



A final and no less important consequence, is the damages that are linked in particular to the forage resources which are the basis of livestock feed.

Notes

Summary



4m 02s

The mission

Authorities – Ministry of environment

- To define a bush fire management strategy
- To setup a surveillance



Let's stop a little on the mission of the public authorities in Senegal regarding the management of fires.

Notes

Summary



The mission

Authorities – Ministry of environment

- To define a bush fire management strategy
- To setup a surveillance



Mission granted to CSE –
the Centre de Suivi Ecologique

- Data collection and storage
- Spatial analysis and mapping



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It should be noted that the State of Senegal has initiated for years programs of monitoring and management of bushfires, particularly with the Direction of Water and Forests, Hunting and Soil Conservation by establishing a monitoring strategy. It is in this context also that the Ecological Monitoring Center CSE, since 1990, uses spatial techniques presently by using the data of the MODIS satellite - so they use spatial techniques for the monitoring and cartography of the burned areas.

Notes

Summary



4m 42s

The mission

- Data collection and storage
- Spatial analysis and mapping



To provide synthetic information to support decision making at the level of the ministry of environment

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Regarding the collection, processing and and distribution of information on bushfires, an integrated system involving the various structures of the Ministry of the Environment and the National Meteorological Agency is implemented with a roadmap and well-defined roles in order to convey an information on fires, an information that is unique and reliable. We also proceed, always in the case of the mission, to a spatial analysis and a cartographic representation of the products in order to provide synthetic information as a support for decision at the level of the Ministry of the Environment.

Notes

Summary



5m 21s

Methodology and role of GIS

Bush fire follow up campaign from end of October to end of May (dry season)

- Fire tracking
MODIS satellite imagery
- Inspection and characterisation of the identified sites – through GPS surveys and Landsat imagery among others



With regards to the methodology and role of geographic information systems, we must distinguish two things: the follow-up campaign itself and the development of seasonal reports. With regards to the follow-up campaign of bushfires, there is obviously the detection of fires by the MODIS satellite image and also the characterization of the sites identified in situ. And what you need to know is that this follow-up campaign of fires is conducted from October to May during the dry season and is based on the use of MODIS imagery. The use of these satellite data offer bushfires monitoring opportunities and the study of thermal anomalies by the MODIS satellite has become a common tool of characterization of spatial and temporal distribution of bushfires based on the energy emitted by fires. These satellites allow to have data on active fires twice a day. The method used to study the fire regime consists of counting the number of burned pixels on a monthly basis.

Notes

Summary



6m 23s

Methodology and role of GIS

Seasonal report

- Analysis of the spatial and temporal distribution of fires
- Map production
- Impact assessments
- Recommendations



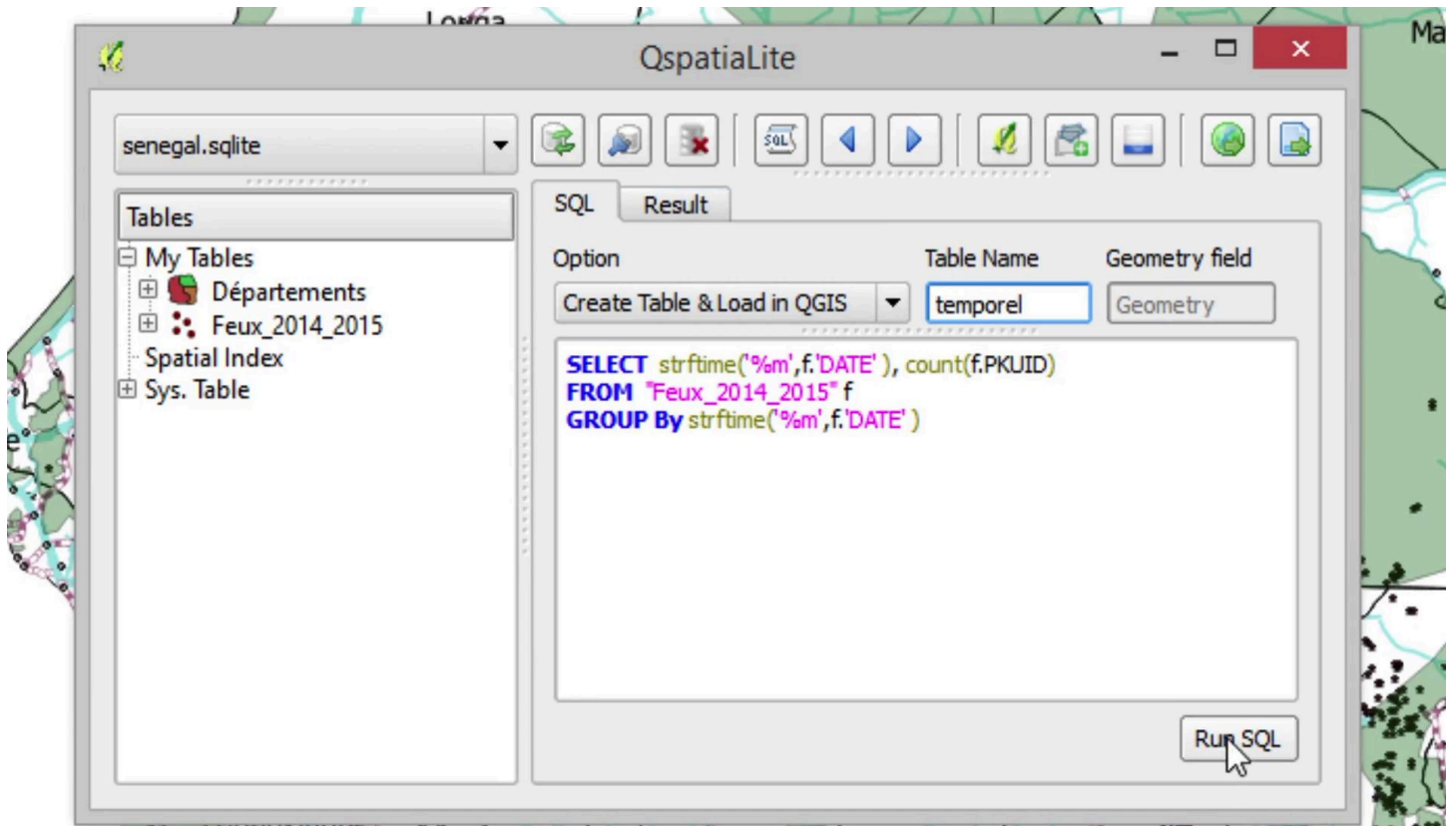
The data collected are used to construct evolution curves of the fires during the dry season. In the seasonal report that we transmit to decision-makers, to the authorities, we proceed to the analysis of the spatial and temporal distribution of fires, and the production of maps. And it is to formulate, to make an impact assessment in terms of economic loss and, finally, to make recommendations. But it must be said that there is a space-time mask which is defined with the Direction of Water and Forests and the local communities. There is a mask that is applied to the burned areas in order to exclude fires in the fields or what we call clearing fires and the fires triggered as a precautionary measure or early fires to keep only what may be considered as a bushfire.

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Summary



7m 59s



The analysis of the temporal distribution will allow us to determine the number of fires by month. We will do it with the QGIS software. With QGIS, we will go in the database menu and take the QspatialLite extension. And the extension will allow us to make the SQL query on the Fire_2014_2015 table. Here, we will... The first thing to do is to take SELECT, so it is the SELECT FROM WHERE. In SELECT, we have to type the formula that you see on the screen. So SELECT is what you have to type, STRFTIME in brackets etc. In the FROM now, you will select the Fire_2014_2015 table. We can even add an alias F. The alias will allow us not to repeat this table since it is going to be too long Fire table 2014-2015 but just the F. So this F-is going to be in SELCT. Now we have F. So SELECT is done. FROM is OK. And we are going to put GROUP BY. In GROUP By, we will do the same thing as what we did in the SELECT. So we will go back to SELECT to add the COUNT. This is important since it will allow us for each month, as you can see here, for each month to give the number of fires we observed. Now we have to save everything in a table and load it into QGIS. We can give a name to the table, it is temporal table.

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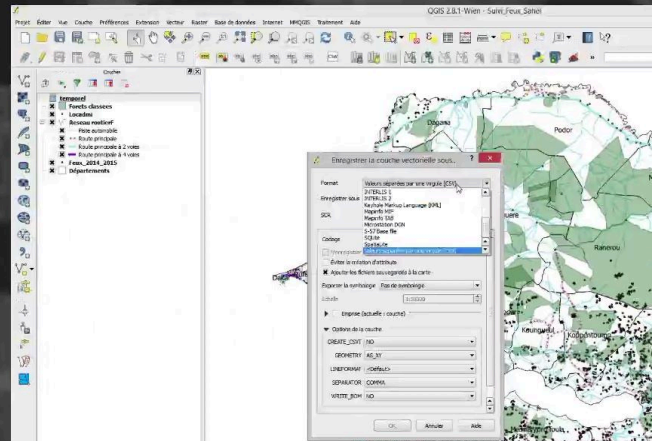


9m 10s

Analysis of the temporal distribution

Objective

- To ascertain the number of fires per month

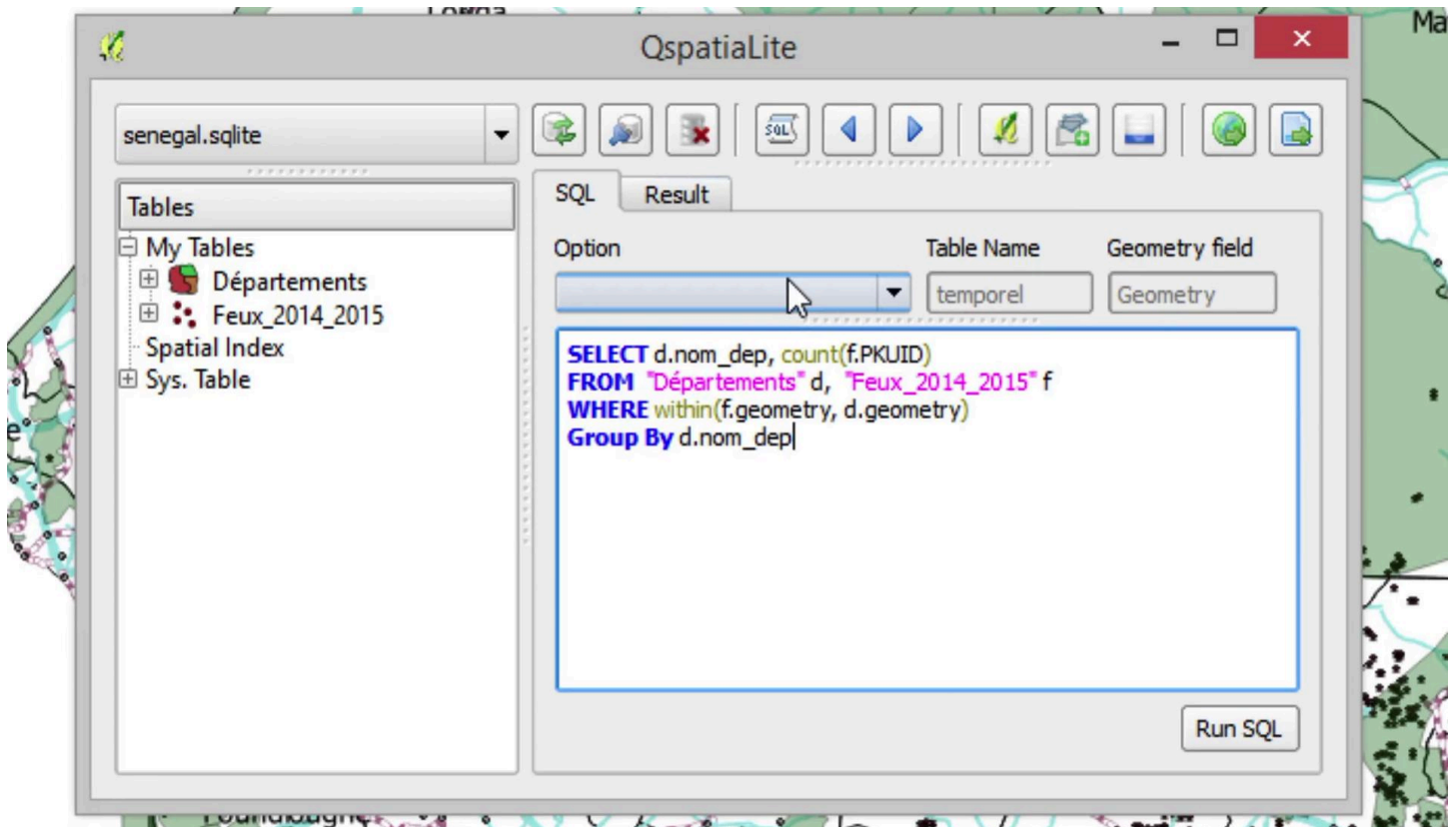


Since we do a temporal analysis, we will use temporal. And there you see, here we have this table that is displayed. We can even open this table and you will see, we have the months and next to it, we have the number of fires observed. We will save it, if we want, in CSV format to make analyzes with Excel if we want.

Notes

Summary





The objective is to determine the number of fires by department. So here we will do the same thing. We will load QSpatialLite. And so we will do the same operation, except that here, it is not a question of having the number of fires per month but the number of fires per administrative department of Senegal. So still in the SQL query, we have the SELECT, FROM and WHERE. And in FROM, it is the departments that will interest us and also the fires, the Fire table. So we have both tables in the FROM, departments table, with the alias D which we will prepare and Fire_2014_2015 that we will call F. So in the SELECT, we will take the field called name_department of the department table and we will add the COUNT function, in brackets the "primary" which is the primary key of the Fire_2014_2015 table and in the WHERE, we will take all the fires that are in the departments. So the formula is WITHIN, in brackets F.GEOMETRY, that is to say, the fire that is in a given department so which are in the departments, and we will add GROUP BY as we had earlier with the department name. Here is the result that it gives us. We will click on RUN SQL, which gives this table that you see with for each department of Senegal, the number of fires we observed.

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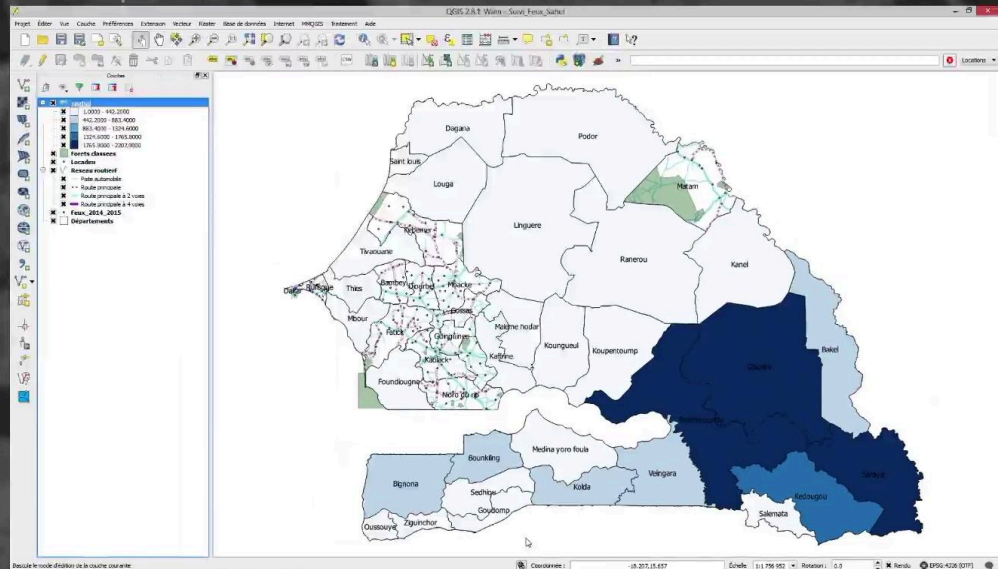


11m 48s

Analyse de la distribution spatiale

Objectif

- Déterminer le nombre de feux par départements



We will also create a... We will save this query as a spatial table so we go in option, choose Create Spatial Table and in Table Name, we will put spatial. And something very important since it is a spatial table, we will add in SELECT the aspect...the geometric attribute. So we add the D.GEOMETRY. And here in "geometry field", we will also add the geometry aspect, that is to ie D.GEOMETRY. And here you see the result it gives us. This result that you see. For all the departments where there was at least one fire, there is this table. Now we can make several links, we can carry out to the spatial analysis by going into the styles of the layers, by right-clicking on "properties" and that gives us that window. So here is the result that we have concerning spatial analysis. As you can see, there is a spatial distribution of bushfires throughout Senegal with a concentration of fires in the South-East part, precisely in the departments of Goudiry, Tambacounda and Saraya.

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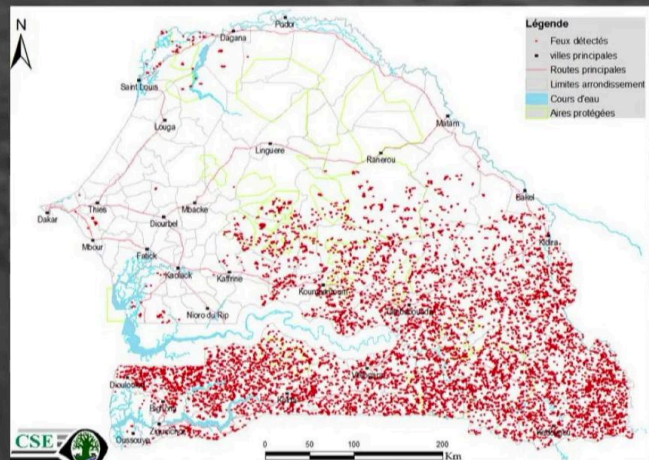
Results

During the season

- Weekly newsletters

At the end of the season

- Summary maps
- Analyses, namely economic impact
- Recommendations



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With regard to the results, we need to know two things: the results during the season and the results that we give at the end of the season, that is to say after the end of May, that is to say in June. In terms of the results during the season, it is generally the weekly bulletins where we assess the situation, the fire monitoring. Now at the end of the season, we provide the authorities with maps of the synthesis which list all the fires observed in October until May by also doing analyzes, particularly in terms of economic impact and make recommendations. I would like to pause a little bit on the analysis of economic impacts. The aim here is to identify and give a monetary value to damages related to fires, as well as to interventions to combat this scourge. What can also be said is that a good exploitation of these data can contribute enormously to the fight and better, to the management of bushfires.

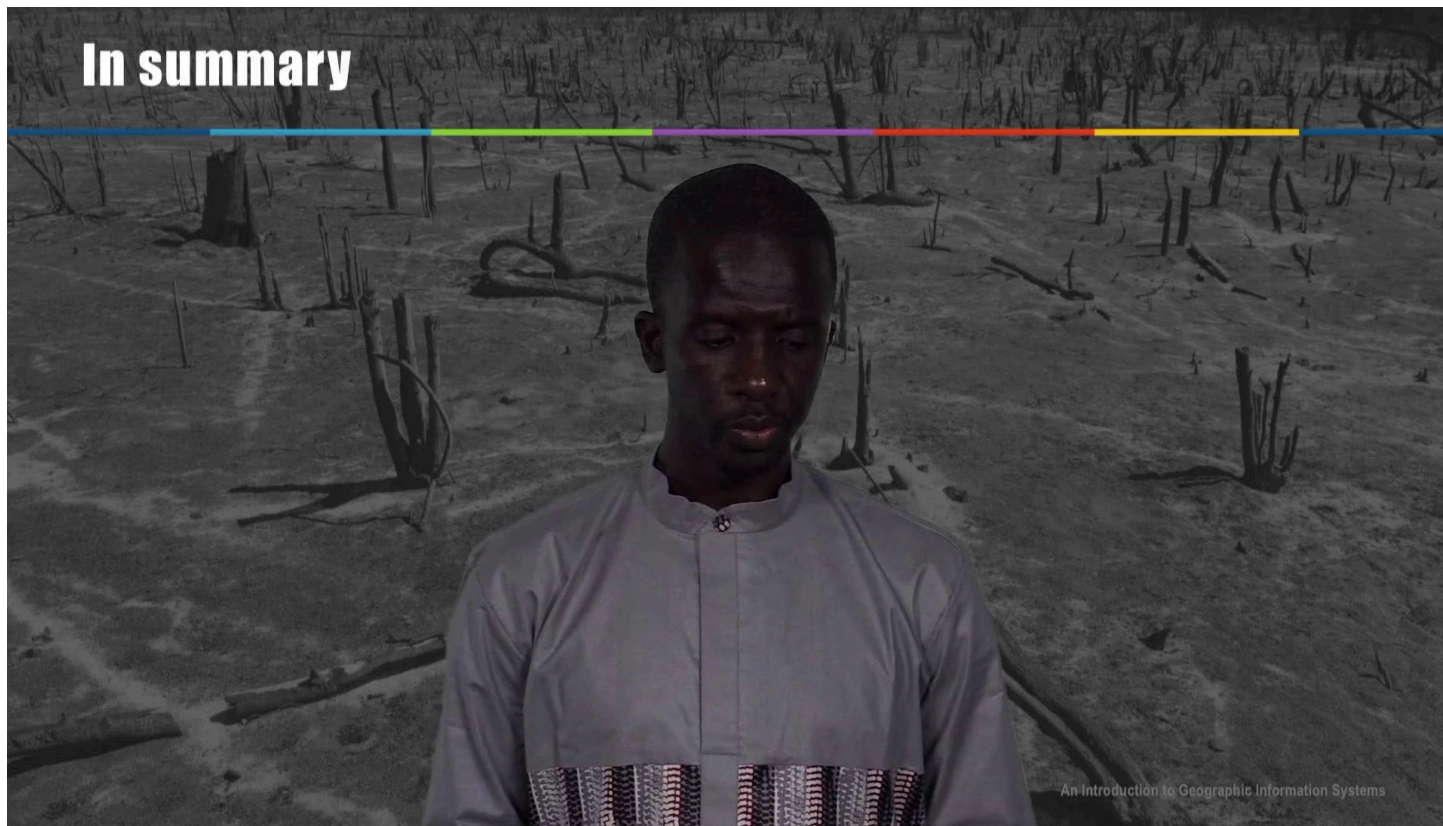
Notes

Summary



15m 58s

In summary



To sum up, we can say that geographic information systems are a tool that allow us to better manage bushfires in the sense that they allow us to know the months in which we register the greatest number of fires, so the months to watch, it is important. Secondly, information systems with spatial reference allow us to determine the most vulnerable departments. And this allows the authorities to take the necessary measures in order to have a better management of bushfires.

Notes

Summary



17m 53s