USING SPATIAL INFORMATION TO SUPPORT DECISIONS ON SAFEGUARDS AND MULTIPLE BENEFITS FOR REDD+



PROCESSING AND VISUALISING FIRE DATA TO IDENTIFY POTENTIAL PRESSURES FROM FIRES ON FOREST USING QGIS V 2.18



The UN-REDD Programme is the United Nations Collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries. The Programme was launched in September 2008 to assist developing countries prepare and implement national REDD+ strategies, and builds on the convening power and expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP).

The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is the specialist biodiversity assessment centre of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organisation. The Centre has been in operation for over 30 years, combining scientific research with practical policy advice.

Prepared by Corinna Ravilious, Barbara Pollini and Xavier de Lamo

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1. Introduction

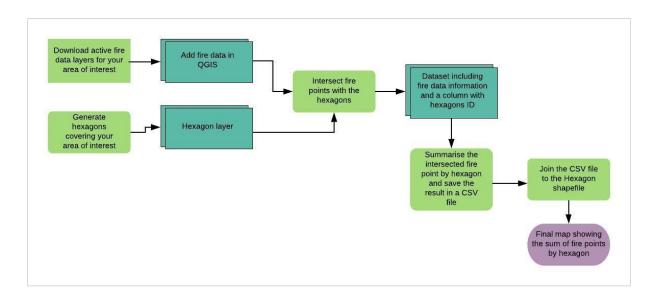
REDD+ has the potential to deliver multiple benefits beyond carbon. For example, it can promote biodiversity conservation and secure ecosystem services from forests such as water regulation and non-timber forest products. Some of the potential benefits from REDD+, such as biodiversity conservation, can be enhanced through identifying areas where REDD+ actions might have the greatest impact using spatial analysis.

Open Source software can be used to undertake spatial analysis of datasets of relevance to multiple benefits and environmental safeguards for REDD+. Open-source software is released under a license that allow software to be freely used, modified, and shared (http://opensource.org/licenses). Therefore, using open source software has great potential in building sustainable capacity and critical mass of experts with limited financial resources.

The purpose of this tutorial series is to help participants in technical working sessions, who are already skilled in open source QGIS, to undertake analyses that are relevant to REDD+. The tutorials have been used to build capacity in a number of countries to produce datasets and maps relevant to their spatial planning for REDD+, and to develop such map products. Maps developed using these approaches appear in a number of publications whose aim is to support planning of strategy options that enhance biodiversity and ecosystem services as well as delivering climate change mitigation (see http://bit.ly/mbs-redd for country materials). There is of course no requirement for countries to use the approaches described in these tutorials.

Fire can be a direct driver of deforestation and forest degradation. It can be natural, for example the result of an extended period of drought, or result from human activity where fire is used for activities such as pasture management, land preparation or clearing for cultivation. Whatever the initial cause, fires may also create further opportunity for activities such as agricultural expansion when fire spreads outside of target areas opening up new areas of land (Maukonen et al., 2010). This tutorial demonstrates how to map areas under pressure from fire using the fire hotspots data from the Fire Information for Resource Management System (FIRMS). Whilst this tutorial shows how to map areas affected by fire, further analysis would be required to understand and identify the causes of the fire and to define effective actions to address the driver. There are many other databases to get fire data (e.g. all MODIS fire products, USA), which are equally valid. This manual uses the FIRMS data as example.

The analysis runs entirely in the QGIS version 2.18 (<u>www.qgis.org</u>). Below an image showing the key steps to carry out this analysis



2. Request and download active fire data layers

a. Go to the website <u>https://firms.modaps.eosdis.nasa.gov/download/</u> to download data from the FIRMS Archive download.

	FIRMS A				
Ge Map	Archive Download				
Active Fire Data	Download active fire/hotspot information older than the last 7 days as:				
Fire Alerts	 shapefiles (.shp), comma-separated text files (.csv) or JSON files (.json) 				
Web Services	Note: Near Real-Time (NRT) data are replaced with standard science quality data as they become available (usually with a 2-3 month lag). For information on the difference between NRT and standard data see our FAQs 🗗.				
	Once the request has been processed, you will receive an email with instructions on how to download your data.				
	MODIS Collection 6: Temporal Coverage: 11 November 2000 - present				
	VIIRS 375m: Temporal Coverage: 20 January 2012 - present				
	Create New Request				
	Enter email address				
	Check Request Status				
	~				

Note: there are two different active fire/hotspot datasets available. For historical data prior to January 2016, you will need Modis C6. VIIRS data are a newer product at a higher spatial resolution (375m compared to 1km) which therefore potentially provides a more accurate fire detection. At present, being a relatively new product, it is currently considered an experimental product.

Further information on both MODIS (C6) and VIIRS are available at the links below:

https://viirsland.gsfc.nasa.gov/PDF/VIIRS_activefire_User_Guide_v1_3.pdf https://cdn.earthdata.nasa.gov/conduit/upload/3865/MODIS_C6_Fire_User_Guide_A.pdf

b. Click on the green button Create New Request.You will be presented with a Download Request form.

🥳 EA	ARTH DATA Find a DAAC -	
M	FIRMS Fire Information for Resource Management System	
😵 Fire Map		
Active Fire Data		Download Request
Fire Alerts		Country Papua New Guinea
Archive Download		Buffer 0 km
Web Services		MODIS C6 & VIIRS
		2012-01-01 - 2017-12-31
		Shapefile (.shp)
		Barbara.Pollini@unep-wcmc.org
		Send email confirmation for this data request
		Please note: The MODIS data is available from November 2000 (for Terra) and from July 2002 (for Aqua) to the present. VIIR5 375 m data is available from January 2012 to the present. All requests are monitored and approved by the FIRMS team. Please provide us with accurate and valid information in order to prevent delays in processing your request.
		Cancel Submit

In this example we request to download country information:

- c. Change the selection from World to Country
- d. Choose your country of interest e.g. in this example, Papua New Guinea
- **e.** Choose the **Buffer** around each fire point. For this example leave 0, but you have the option to select 0km, 5km, 10km and 15km buffer.
- f. Choose the Fire Data source, in this example we will download both **MODIS C6 & VIIRS**
- g. Select the date ranges. E.g. in this example we have picked a 5 year time period from 1st
 January 2012 to 31st December 2017.
- h. Leave the output format as Shapefile
- i. Enter your email address
- j. Leave the tick to receive a confirmation email about your request
- k. Click the green submit button to submit your request

You now need to wait for an email to say that your request has been processed.

- I. If you want to check the status of your requests you can go to the url https://firms.modaps.eosdis.nasa.gov/download/
- m. Enter your email address and click on Check Request Status

Ì	FIRMS Fire Inform	5 Nation for Resource M	anagement System			ñ	
Map e Fire	Download Requests for corinna.ravilious@unep-wcmc.org						
Alerts			Create	e New Request			
the niced	Id	Source	Area of interest	Request Date	Status	Delete	
	9085	VIIRS	Papua New Guinea	2018-05-02 16:22:13	Submitted on 2018-05-02 16:22:13	Û	
	9084	MODIS C6	Papua New Guinea	2018-05-02 16:22:13	Submitted	Đ	

- 🞯 E/	ARTH DATA Find a DAAC -		
(and the second	FIRMS Fire Information for Resource Management System	m	
Fire Map		Archive Download	
Active Fire Data		shapefiles (shp), comma-separated text files (csv) or jSON files (json) Note: Near Real-Time (NRT) data are replaced with standard science quality data as they become available (usually with a 2-3 month lag). For information on the difference between NRT and standard data see our FAQs //.	
Archive Download		Once the request has been processed, you will receive an email with instructions on how to download your data. MODIS Collection 6: Temporal Coverage: 11 November 2000 - present VIIRS 375m: Temporal Coverage: 20 January 2012 - present	
		Create New Request	Enter email address
			Check Request Status
		CLANCE-MODIS mailing list	

- n. You should receive an email from FIRMS confirming your download request is complete. The email will contain a download link to a zip file containing the active fire point data. If you have requested more than one dataset, each dataset will be sent in a separate email.
- **o.** Download and unzip the file(s).

Include in library 👻 Share with 👻	New folder		
Name	Date modified	Туре	Size
DL_FIRE_M6_9084.zip	02/05/2018 17:30	Compressed (zipp	1,617 KB
DL_FIRE_V1_9085.zip	02/05/2018 17:30	Compressed (zipp	9,432 KB
fire_archive_M6_9084.cpg	02/05/2018 17:28	CPG File	1 KB
fire_archive_M6_9084.dbf	02/05/2018 17:28	DBF File	12,110 KB
fire_archive_M6_9084.prj	02/05/2018 17:28	PRJ File	1 KB
fire_archive_M6_9084.shp	02/05/2018 17:28	SHP File	1,325 KB
fire_archive_M6_9084.shx	02/05/2018 17:28	SHX File	379 KB
fire_archive_V1_9085.cpg	02/05/2018 17:29	CPG File	1 KB
fire_archive_V1_9085.dbf	02/05/2018 17:29	DBF File	59,969 KB
fire_archive_V1_9085.prj	02/05/2018 17:29	PRJ File	1 KB
fire_archive_V1_9085.shp	02/05/2018 17:29	SHP File	6,854 KB
fire_archive_V1_9085.shx	02/05/2018 17:29	SHX File	1,959 KB
🗋 Readme.txt	05/03/2018 16:26	Text Document	7 KB

2.1. Add active fire points to QGIS project

The fire data points represent the centre longitude/latitude of 1km pixels flagged as containing one or more fires. Each point contains an attribute FRP (Fire radiative power) showing the amount of heat output from the fires within the 1km pixel. This is measured in MW (megawatts).

a. Click on the Add Vector layer button and click on browse to navigate to the active fire point layer(s)

🥑 🖪 👁 🝸	ε ₁₁ - 10, 11 □
	🔏 Add vector layer
-	Source type
-	File O Directory O Database O Protocol
	Encoding System
-	Source
	Dataset _archive_M6_9084.shb;D:\Fire\PNG\fire_archive_V1_9085.shp Browse
Value Tool	
- Enable	Open Cancel Help

b. Click Open to add the data to your QGIS project

2.2. Style the fire points based on intensity of fire

- **a.** In the layer panel right click on the fire points layer and click on **Properties**. This will bring up the **Layer Properties** window.
- b. Click on the Style tab and change from Single symbol to Graduated

🕺 Layer Properties - fi	re_archive_M6_9084 Style	8 ×
General	Single symbol	•
	No symbols	
Style	E Single symbol	
	Categorizad	
abc Labels	Graduated	
	Rule based Point displacement	
Fields	Point displacement Heatmap	
No. of Concession, Name		
Kendering		

- c. Next to **Column**, choose the field **FRP** to shade the data based on Fire Radiative Power.
- **d.** Next to symbol click on **Change...** and change the marker outline style to no pen so that the data are presented as a solid filled circle without an outline.

🕺 Layer Properties - fire	e_archive_M6_9084 Style	<u> </u>
🔀 General	a Graduated	•
😻 Style	Column 1.2 FRP	3 •
(abc) Labels	Symbol	ange
Fields	Legend Format %1 - %2	Precision 0 🛬 🛄 Trim
	Method Color	
Kendering	Color ramp OrRd	Edit 🔲 Invert
🤛 Display	Classes Histogram	
Actions	Symbol Values Legend	
Joins	Image: Constraint of the state of	
Diagrams	♥ 83.00 - 200.00 83.0 - 200.0 ♥ 200.00 - 532.50 200.0 - 532.5	
👔 Metadata	1342.80 - 2169 1342.8 - 2169.5	marker
Variables	Fil Outine	
E Legend	Size 1.800000	
· · · · · · · ·	Mode Natural Breaks (Jenks)	Classes 6 🕀
	Classify (Delete all Join style Revel	
	✓ Link dass boundaries	Symbol levels
	▼ Layer rendering	
	Layer transparency	0 🔹
	Layer blending mode Normal	
	Feature blending mode Normal	(m)
	Control feature rendering order	
	Style 🔻	OK Cancel Apply Help

e. Next to Color ramp change the symbology to a yellow-orange-red ramp

Change the classification **Mode** choose the method for categorizing the data for display e.g. in this example **Natural Breaks (jenks)** has been chosen.

- f. Change the no of Classes to 6 (or the number of classes you want)
- g. Click **Classify** to apply the chosen classification to the data.
- h. Click OK

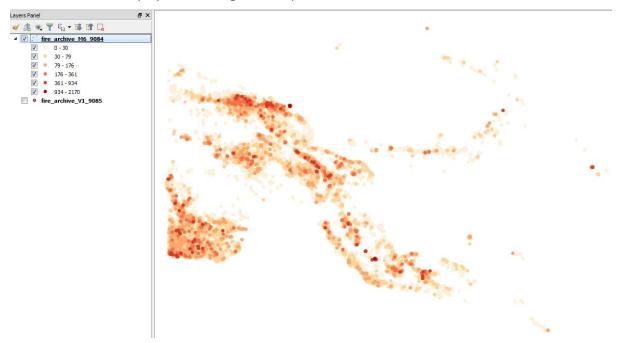
When the fire points are drawn you will notice that there are many points which fall on top of each other and that the points with the lower FRP value are drawn last. This does not give a good visualisation of the data if you want to see where the most intense fires occurred.

🔏 Layer Properties - fire_a	archive_M6_9084	Style				? ×	
🔀 General	😑 Graduated					•	
X Style	Column	1.2 FRP				3	
abc Labels	Symbol			Change			
	Legend Format	%1 - %2				Precision 0 🚔 🔲 Trim	
Fields	Method	Color				•	
Kendering	Color ramp	[source]			• E	dit 📃 Invert	
🧭 Display	Classes H	listogram					
Actions	Symbol	Values	Legend				
• ┥ Joins	✓✓✓	0.00 - 29.50 29.50 - 79.10	0 - 30 30 - 79				
Diagrams		79.10 - 175.50 175.50 - 360.60	79 - 176) 176 - 361				
🥡 Metadata	•	360.60 - 934.50 934.50 - 2169					
8 Variables	Mode Natural I	Breaks (Jenks)	•			Classes 6	
Legend	Classify	f =	Delete all			Advanced 🔻	
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	Feature blending	mode	Normal 🔹				
	Draw effects					*	
	Control featur	re rendering orde	r			A.	
	Style 🔻			ОК	Cancel	Apply Help	

i. Right click on the fire data layer in the Layers Panel and click on Advanced>>Symbol levels

j. In the symbol levels window, the number in on the right shows the order in which to draw the symbols. They are all initial set to 0. Change the numbers sequentially i.e. so the class that draws first remains at 0 and the class that draws last has a value of 5.

	inable symbol levels		
efir II b	ne the order in which e drawn.	ne symbol layers are rendered. The numbers in the cells define in which rendering pass	the layer
		Layer 0	
	0.0 - 30.6	• 0	
•	30.6 - 83.0	• 1	
•	83.0 - 200.0	• 2	
•	200.0 - 532.5	• 3	
•	532.5 - 1342.8	• 4	
•	1342.8 - 2169.5	• 5	



The Fire data now display with the highest FRP points drawn last:

This classification method shows the maximum intensity of fire at a particular location but does not show the number of fires at each location.

2.3. Generate hexagon grid and summarise fire data based on intensity and density

To assess fire impact over the 1-year period that gives a measure of both intensity and density of fire points over the period, a vector grid of hexagons can be generated and used to tabulate the intersection of the fire points within each hexagonal polygon.

2.3.1. Project fire data to an equal area projection

The hexagons need to be generated in an equal area projection. The fire data points are currently in Geographic coordinate system (EPSG 4326). Therefore, the first step is to change the projection (CRS) of the fire data.

For country level analysis if your country crosses only one UTM zone then you can use a UTM (Universal Transverse Mercator) as UTM is an equal area projection. However, if your country crosses more than one UTM zone then Lambert Azimuthal Equal Area projection is a good option. You will need to define a **custom CRS** as this projection requires you to set a central latitude and longitude.

Papua New Guinea crosses 3 UTM zones therefore in this example we will use a custom Lambert Azimuthal Equal Area projection with a latitude of -6 and a longitude of 148.

If your data needs a custom CRS follow steps a – c below; otherwise, go straight to step d.

a. from the main menu click on Settings>>Custom CRS

💋 QGIS 2.18.26 - fire						
Project Edit View Layer	Settings Plugins Vector	Raster Database Web CLUZ MMQGIS Processing Help				
	Custom CRS	0 A 🖸 11 A A Q 🖬 🖉 🔍				
	Nonfigure Shortcuts					
	🗞 Customization	🚺 🗿 Ab 🕐 🔸 🐂 👯 🎡 🤣 🏥				
	Noptions					
Layers Panel B X	Snapping Options					

- b. Click "+" and then under the Name tab give your CRS a name e.g. in this example png_la_lon148_lat_minus6
- **c.** Under Parameters use the following syntax for Lambert Azimuthal Equal Area projection (changing the lat_0=-6 and the Lon_0=148 to the centre latitude and longitude of your area of interest):

+proj=laea +lat_0=-6 +lon_0=148 +x_0=0 +y_0=0 +ellps=WGS84 +units=m +no_defs

Name	Parameters		4
* Generated	. +proj=laea +lat_0=5 +lon_0=19 +x_0=0 +y_0=0 +datum=WGS84 +units=m +no_defs		
* Generated	. +proj=laea +lat_0=5 +lon_0=19 +x_0=0 +y_0=0 +ellps=WGS84 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs		
* Generated	. +proj=laea +lat_0=5 +lon_0=19 +x_0=0 +y_0=0 +ellps=WGS84 +units=m +no_defs	-	
* Generated	. +proj=laea +lat_0=-6 +lon_0=34.5 +x_0=0 +y_0=0 +ellps=WGS84 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs	=	
* Generated	. +proj=laea +lat_0=-6 +lon_0=34.5 +x_0=0 +y_0=0 +ellps=WGS84 +units=m +no_defs		
* Generated	. +proj=laea +lat_0=-9 +lon_0=36 +x_0=0 +y_0=0 +ellps=WGS84 +units=m +no_defs		
* Generated	. +proj=merc +lon_0=0 +k=1 +x_0=0 +y_0=0 +a=6378137 +b=6378137 +units=m +no_defs		
* Generated	. +proj=merc +lon_0=0 +lat_ts=5 +x_0=0 +y_0=0 +ellps=WGS84 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs		
* Generated	. +proj=sinu +lon_0=0 +x_0=0 +y_0=0 +a=6371007.181 +b=6371007.181 +units=m +no_defs		
* Generated	. +proj=tmerc +lat_0=0 +lon_0=104.75 +k=0.9999 +x_0=500000 +y_0=0 +datum=WGS84 +units=m +no_defs		
* Generated	. +proj=tmerc +lat_0=0 +lon_0=104.75 +k=0.9999 +x_0=500000 +y_0=0 +ellps=WGS84 +towgs84=0,0,0,0,0,0,0 +unit		
		•	
	- +proj=tmerc +lat_0=0 +lon_0=104.75 +k=0.9999 +x_0=500000 +y_0=0 +elips=WGS84 +towgs84=0,0,0,0,0,0 +unit a_lon148_lat_minus6	v	
ame png_la		-	
		×	

- In the processing toolbox search for project tools
- e. Double click on the **Reproject layer** tool under the vector general tools in the **QGIS geoalgorithms**
- f. Select the fire points as the input layer
- g. Select the target CRS i.e. the Equal Area projection, in this example the Lambert Azimuthal Equal Area projection defines in steps a-c.
- h. Navigate to an output folder and give the projected dataset a new name. In this example it is the same as the input dataset name but with an ending _la.

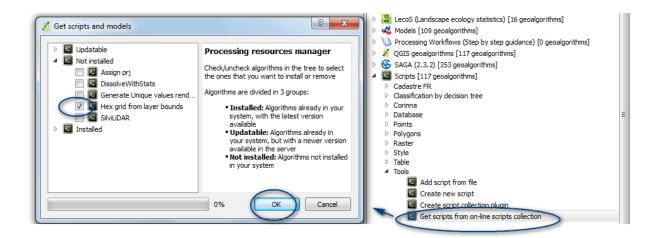
Proc	cessi	ing Toolbox	ð	×
pro	ject			
4	6040	GDAL/OGR [48 geoalgorithms]		
	⊿	[GDAL] Projections		
		Assign projection	-	
		Extract projection		
		Warp (reproject)		
⊿	Ŷ	GRASS GIS 7 commands [314 geoalgorithms]		
	⊿	Raster (r.*)		
		😵 r.tileset - Produces tilings of the source	proj	
⊿	X	QGIS geoalgorithms [117 geoalgorithms]		
	4	Vector general tools		
		Ø Define current projection		
		2 Reproject layer		

🕺 Reproject layer	8 23
Parameters Log Run as batch process Input layer [fire_archive_M6_9084 [EPSG:4326]] • <td< th=""><th>Reproject layer This algorithm reprojects a vector layer. It creates a new layer with the same features as the input one, but with geometries reprojected to a new CRS. Attributes are not modified by this algorithm.</th></td<>	Reproject layer This algorithm reprojects a vector layer. It creates a new layer with the same features as the input one, but with geometries reprojected to a new CRS. Attributes are not modified by this algorithm.
K:/Laptop/fire/fire_archive_M6_9084_la.shp Open output file after running algorithm	0% Run Close

2.3.2. Generate 10 km² hexagons

There is no tool for generating hexagons in the processing toolbox but there is a script available in the on-line scripts collection.

- a. In the processing toolbox expand Scripts
- b. Expand Tools and double click on Get scripts from on-line scripts collection



- c. In the Get scripts and models window expand Not Installed and tick Hex grid from layer bounds
- d. Click OK

The script will have been added under the **Polygons** section of the Scripts. If you cannot see it, close your project and open QGIS again.

- e. Double click on the Hex grid from layer bounds script.
- **f.** Set the input dataset as the fire points in the equal area projection
- **g.** Set the cellsize e.g. in this example **10000** (i.e. 10km²)
- h. Navigate to an output folder and give the new dataset a name e.g. hexagons_10km.shp

4	 Scripts [118 geoalgorithms] ▷ Cadastre FR
	Classification by decision tree
	Corinna
	Database
	Points
	Polygons
	Assing predominant category
	Create tiling from vector layer
	Hex grid from layer bounds
	Raster
	Style
	Table
	> Tools

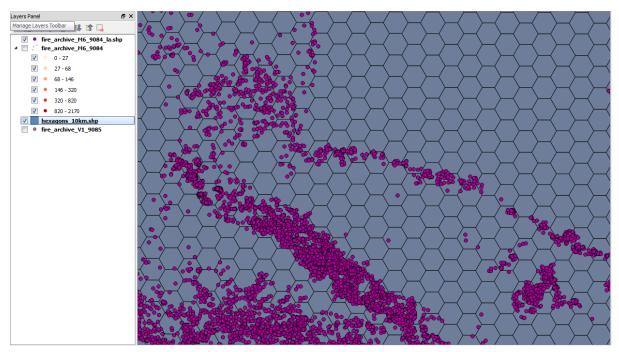
🕺 Hex grid from layer bounds	8 23
Parameters Log Help	Run as batch process
input fire_archive_M6_9084_la.shp [USER: 100006]	▼ ⊘
cellsize 10000.000000	< ₹
grid K:/Laptop/fire/hexagons_10km.shp Open output file after running algorithm	
	0%
	Run Close

- i. Click **Run** to run the tool.
- j. Check that the hexagons draw. They should over the extent of the fire points.

k. If the hexagons do not draw, right click on the hexagons layer and click **properties**. The Coordinate reference system should be the equal area projection of the fire points. If it is not change it to the correct projection.

🕺 Layer Properties - he	exagons_10km.shp General	? ×
General	▲ ▼ Layer info	^
	Layer name hexagons_10km.shp displayed as hexagons_10km.shp Layer source K:/Laptop/fire/hexagons_10km.shp	
(abc) Labels	Data source encoding System	
Fields	Coordinate reference system	=
🞸 Rendering	USER:100006 - png_la_lon148_lat_minus6	▼ 🛞
🧭 Display	E Create spatial index Update extents	
Actions	Cale dependent visibility Minimum (exclusive) Maximum (inclusive)	
• Joins		-
Diagrams	▼ Provider feature filter	
🥡 Metadata		
Variables		- Help

I. Click Ok and the fire points should now draw



- m. Right click on the hexagons dataset and click Open Attribute Table
- n. Click on the Toggle Edit button and then on the Open Field Calculator button
- o. In the Field calculator window tick Create a new field called HEX_ID and calculate the expression to be \$ID +1
- **p.** Click **OK** to add and calculate the field

🥖 he	🗶 hexagons_10km.shp :: Features total: 21660, filtered: 21660, selected: 0					
		& 🗮 💟 🖕	7 🖀 🐥 🔎	8 8 1.		
1.2 lef	t ▼ = E				Update All Update Selected	
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1	-794031.933449	504024.2896259	-782484.928065	494024.2896259	Only update 0 selected features	
2	-794031.933449	494024.2896259	-782484.928065	484024.2896259	The ate a new field - Update existing field -	
3	-794031,933449	484024.2896259	-782484.928065	474024.2896259	Create virtual field	
4	-794031.933449	474024.2896259	-782484.928065	464024.2896259	Output field name (HEX_ID)	
5	-794031.933449	464024.2896259	-782484.928065	454024.2896259	Output field type Whole number (integer) Output field length 10 The precision 3	
6	-794031.933449	454024.2896259	-782484.928065	444024.2896259	Expression Function Editor	
7	-794031.933449	444024.2896259	-782484.928065	434024.2896259	= + - / * ^ () r Search function \$id	
8	-794031.933449	434024.2896259	-782484.928065	424024.2896259	\$id +1 Fuzzy Matching A General A Returns the feature id of the surged same	
9	-794031.933449	424024.2896259	-782484.928065	414024.2896259	▷ Geometry	
10	-794031.933449	414024.2896259	-782484.928065	404024.2896259	> Operators	
11	-794031.933449	404024.2896259	-782484.928065	394024.2896259	attribute _ Examples	
12	-794031.933449	394024.2896259	-782484.928065	384024.2896259	$\begin{array}{c} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	
13	-794031.933449	384024.2896259	-782484.928065	374024.2896259	sid scale uid +	
14	-794031.933449	374024.2896259	-782484.928065	364024.2896259	Output preview: 1	
T Sh	ow All Features				OK Cancel Help	
86.8			6936938	28 28 K		

q. Click on the Toggle edit button again and Save the changes

2.3.3. Intersect fire point and with 10km² hexagons

- a. In the processing toolbox search for Intersect
- b. Double click on the Intersection tool under the vector overlay tools in the QGIS Geoalgorithms
- c. Set the input dataset to be the fire points in equal area projection
- d. Set the intersect layer to be the hexagons file
- e. Navigate to an output folder and save the output intersection layer with a new name

Pro	essing Toolbox	8	×
inte	rsect		Ø
4	Recently used algorithms		_
	Intersection		
⊿	LecoS (Landscape ecology statistics) [16 geoalgo	rithm	s]
	A Landscape preparation		
	🚏 Intersect Landscapes		
⊿	💋 QGIS geoalgorithms [117 geoalgorithms]		
	 Vector overlay tools 		
	(Intersection)		
	Eine intersections		
	-		

🚀 Intersection		? ×
Parameters Log	Run as batch process	Intersection
Input layer fire_archive_M6_9084_la.shp [USER: 100006] Intersect layer	▼ ⊘	This algorithm extracts the overlapping portions of features in the Input and Intersect layers. Features in the Intersection layer are assigned the attributes of the overlapping features from both the Input and Intersect layers.
hexagons_10km.shp [USER: 100006]	• 🥥	Attributes are not modified.
Intersection K:/Laptop/fire/fire_archive_M6_9084_la_hex.shp Open output file after running algorithm		
		0%
		Run Close

f. The output dataset is a copy of the fire points in equal area projection with the HEX_ID added. Open the attribute table to view the data.

/ 1	🖉 📑 🔁 📑 i	🗄 🗧 ڬ 🍡	7 🔳 🍫 🞾					
	VERSION	BRIGHT_T31	FRP	left	top	right	bottom	(HEX_ID)
	j.1	300.300000000	11.5000000000	-534224.312313	-315975.710374	-522677.306929	-325975.710374	3503
2	5.1	294.100000000	12.5000000000	-534224.312313	-305975.710374	-522677.306929	-315975.710374	3502
3	5.1	296.300000000	12.100000000	-534224.312313	-325975.710374	-522677.306929	-335975.710374	3504
4	5.1	300.100000000	16.2000000000	-525564.058275	-330975.710374	-514017.052892	-340975.710374	3618
5	5.1	299.400000000	12.2000000000	-525564.058275	-310975.710374	-514017.052892	-320975.710374	3616
6	5.1	291.900000000	5.800000000	-516903.804237	-305975.710374	-505356.798854	-315975.710374	3730
7	5.1	286.200000000	6.0000000000	-516903.804237	-315975.710374	-505356.798854	-325975.710374	3731
8	5.1	291.100000000	7.100000000	-516903.804237	-305975.710374	-505356.798854	-315975.710374	3730
9	5.1	298.800000000	16.6000000000	-516903.804237	-315975.710374	-505356.798854	-325975.710374	3731
10	5.1	292.600000000	28.7000000000	-516903.804237	-315975.710374	-505356.798854	-325975.710374	3731
11	5.1	293.300000000	12.5000000000	-516903.804237	-305975.710374	-505356.798854	-315975.710374	3730
12	5.1	306.000000000	52.300000000	-516903.804237	-305975.710374	-505356.798854	-315975.710374	3730
13	5.1	294.300000000	8.300000000	-516903.804237	-315975.710374	-505356.798854	-325975.710374	3731
14 1	5.1	295.300000000	27.8000000000	-534224.312313	-325975.710374	-522677.306929	-335975.710374	3504

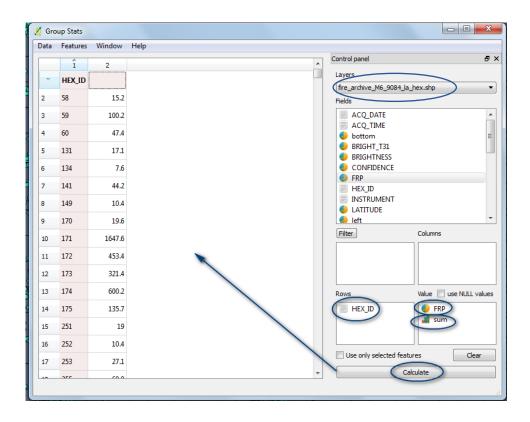
2.3.4. Summarise the Intersected fire point by HEX_ID

- a. From the main menu click on Plugins>>Manage and Install Plugins
- **b.** Search for and install the plugin **GroupStats**

	? ×
Search Group	(B)
ClusterPoints Clusterpy - Spatially constrained dustering Coov layers and groups to dipboard	Group Stats
 Dissolve with stats Floodrisk 	Stats and analysis for vector layers data
Forop Stats ImportLayersFromProject Invisible layers and groups Layer manger Layer Metadata Dock Loop Visible Layers NEV2 Datum Transformations PointsToPaths prepair Sicer VetEpiGISgroup	Migrated to QGIS 3 version by Faunalia. Sponsored by Arpa Piemonte for ERIKUS program in collaboration with Regione Piemonte e Dipartimento della Protezione Civile - Funzione Censimento Danni Migrato alla versione QGIS3 da Faunalia per Arpa Piemonte per il programma ERIKUS in collaborazione con Regione Piemonte e Dipartimento della Protezione Civile - Funzione Censimento Danni
	ClusterPoints CusterPoints Custerpy - Spatially constrained dustering Copy layers and groups to clipboard Dissolve with stats Floodrisk Group Stats Corput State Layer Arranger Layer Arranger Layer Metadata Dock Layer Metadata Dock NTV2 Datum Transformations PointsToPaths ProvintsToPaths Sicer Slicer

- 💋 QGIS 2.18.26 fire Project Edit View Layer Settings Plugins Vector Raster Database Web CLUZ MMQGIS Processing H 🗅 🗁 🖶 🖶 🖓 🕅 🖑 Chuyển đối mã font chữ tiếng Việt 2 Coordinate Capture //. / ₿ •°: Га • •°: јӽ 面 Dxf2Shp ۲ GPS 7 Group Stats ۲ GroupStats Layers Panel V OpenStreetMap 🚽 🟥 🐙 - 🖓 🍞 🧶 🏨 ≽ Point to Polygon • 🔽 🍳 fire archive M6 9084 la h Road Graph ۲ fire_archive_M6_9084_la.sl Po Spatial Query ۲ 4 🔲 🕺 fire_archive_M6_9084 **@**. -Table Manager ۲ 🔽 🔍 0 - 27 Topology Checker 27 - 68 - 💮 Vertices Counter . **V** 68 - 146 Research Tools . 146 - 320 Geoprocessing Tools ۲ - 💱 1 9 320 - 820 Geometry Tools 820 - 2170 ?.. hexagons_10km.shp Analysis Tools . \mathbb{V} fire_archive_V1_9085 Data Management Tools ۲
- c. From the Vector menu click on Group Stats>>GroupStats

- d. Select in the Layers box the shapefile resulting from the intersection(section 2.3.3)
- e. Drag HEX_ID into the row box
- f. Drag FRP and sum into the Value box
- g. Click Calculate to generate a table showing HEX_ID and sum of FRP values



h. From the GroupStats menu click on Data>>Save all to CSV file

🕺 Group Stats		
Data Features Window Help		
Copy all to clipboard	Control panel	₽×
Copy selected to clipboard	Layers	
Save all to CSV file	fire_archive_M6_9084_la_hex.shp	•
Save selected to CSV file	Fields	

i. Navigate to an output folder and save the CSV file as Hex_sumFRP.csv

🚀 Save As		? ×
Look in: 🛛 🖟 K: \Laptop\fire	- 0 0 0	📑 📰 🔳
My Comp corinnar		
File name: Hex_sumFRP.csv Files of type: CSV files (*.csv)	▼	Save Cancel

- j. Close GroupStats
- k. Click on the Add delimited text button to add Hex_sumFRP.csv to your QGIS project

₩	🌠 Create a Layer from a	Delimited Text File		? ×				
	File Name (::/Laptop/fire/Hex_sumFRP.csv Browse							
	Layer name Hex_sumFR	2		Encoding UTF-8				
	File format 💿 🔿	SV (comma separated values)	om delimiters 🔘 Re	Regular expression delimiter				
?₀		Comma Tab er delimiters Quote	Space Colon Escape	emicolon				
V	Record options Num	er of header lines to discard 0 🗧 🖓 First r	ecord has field names					
¥ 🖸 T	Field options 📃 T	im fields 🔲 Discard empty fields 🔲 Decimal s	eparator is comma					
.	Geometry definition 💿 Point coordinates 💿 Well known text (WKT)							
	Layer settings	se spatial index 🔲 Use s	subset index	atch file				
	HEX_ID None			<u>^</u>				
Å,	1 58 15.2							
	2 59 100.2							
	3 60 47.4							
\ ķ	4 131 17.1							
X								
2			Ск	Cancel Help				

- I. Change to Custom delimiter and Semicolon
- m. Tick First record has field names and select geometry (attribute only table)
- n. Click OK

o. When you open the CSV file you will note that the sum of the FRP values have a fieldname of None. To change this search for **Refactor fields** in the processing toolbox

<u> </u> Refactor field	s					? ×
Parameters	Log			R	un as batch process	Refactor fields
Input layer Hex_sumFRP Fields mapping					•	This algorithm allows editing the structure of the attributes table of a vector layer. Fields can be modified in their type and name, using a fields mapping.
Name	Туре	Length	Precision	Expression		The original layer is not modified. A new layer is generated, which contains a modified attributes
0 HEX_ID	Integer	0	0	"HEX_ID"		table, according to the provided fields mapping.
1 SumFRP	Double	0	0	"None"		ggis-ltr-bin
Load fields from	m layer [Hex_	sumFRP	Yes No			
Refactored K:/Laptop/fire/HEX_sumFRP.dbf Open output file after running algorithm						
						0% Run Close

- p. Change the input layer to the Hex_sumFRP csv file. Click Yes to the popup Do you want to reset the field mappings?
- q. Change the Name None to sumFRP
- r. Navigate to an output folder and save the CSV file as Hex_sumFRP.dbf
- s. Click Run

2.3.5. Join the summarized fire data to the hexagon polygons

- a. Right-click on the hexagons polygon i.e. in this example, hexagons_10km2.shp and click properties
- b. In the Layer Properties window click on Joins
- c. Click on the + button to add a join
- d. Select the Hex_sumFRP.dbf as the Join Layer
- e. Pick HEX_ID for both the Join field and Target Field
- f. Tick Chose which fields are joined and tick SumFRP
- g. Click OK and then Apply

🕺 Layer Properties - hexag	gons_10km.shp Joins	2 23
K General	Join layer Join field Target field Memory cache Prefix Joined fields	
Style	HEX_sumFRP.dbf HEX_ID V 1	
abc Labels	Add vector join	
_	Join layer	
Fields	Join field	
≼ Rendering	Target field	
🧭 Display	Cache join layer in virtual memory	
Actions	Create attribute index on join field	
Joins	HEX ID	
	V SumFRP	
Diagrams		
🥡 Metadata		
2 Variables		
Egend	Custom field name prefix	
-	HEX_sumFRP.dbf_	
	OK Cancel	
	Style OK Cancel Apply	Help

- **h.** Right click the layer "Hexagon _10km2" and select Properties
- i. In the left hand column of the Layer Properties window click on Style
- j. Change the from Single symbol to Graduated
- k. Select the Column (to use to shade the hexagons) HEX_sumFRP.dfb_SumFRP
- I. Change the symbol by clicking on Change

🕺 Layer Properties - hexago	ons_10km.shp Style	? ×
🔀 General	Graduated	•
🐳 Style	Column 1.2 HEX_sumFRP.dbf_SumFRP	₹ 8
(abc) Labels	Symbol Change	
Fields	Legend Format %1 - %2 Method Color	Precision 0 💿 🔲 Trim

- m. Change the outline style to No Pen and click on OK to close the symbol selector. This removes the black outlines from all the hexagons
- **n.** Select an orange colour ramp to shade the hexagons
- **o.** Change the number of classes to **6**
- p. Change the classification method to Natural Breaks (Jenks)
- q. Click Classify
- r. Click OK



	Fields	Method	Color			•
Ý	Rendering	Color ramp	[source]			Edit Invert
9	Display	Classes	Histogram			
٩	Actions	Symbol	Values	Legend		
•	Joins	V	0.00 - 372.40 372.40 - 1051.10	0 - 372 372 - 1051		
1	Diagrams		1051.10 - 2219.50 2219.50 - 4558.50	1051 - 2220 2220 - 4558		
i	Metadata		4558.50 - 18535.60 18535.60 - 29861.10	4558 - 18536 18536 - 29861		
3	Variables	Mode Natural	Breaks (Jenks) 🔻	>		Classes
÷	Legend	Classify		ete all		Advanced V
		✓ Link class b	oundaries			
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		Feature blending	mode No	ormal 🔹		
		Draw effects				(h)
		Control featu	re rendering order			A.J.
		Style 🔻			ОК Сап	cel Apply Help

The final map show the sum of FRP values in each 10km2 hexagon representing both intensity and density of fires. The resultant data have been displayed using natural breaks (jenks) classification method.

