



Quick and Easy Web Maps with Google Fusion Tables

SCO Technical Paper

Version History

Version	Date	Notes	Author/Contact
1.0	July, 2011	Initial document created.	Howard Veregin
1.1	Dec., 2011	Updated to reflect integration into Google Docs. New sections added: additional symbolization methods; using KML and Shapefiles; heat maps; and known problems.	John J Czaplewski
1.2	Feb., 2014	Updated to reflect changes in the graphical interface and software features. New sections added: additional conversion methods for KML and Shapefiles; Google Maps Engine Lite summary.	David J Vogel

Introduction: What are Fusion Tables?

One of the quickest and easiest ways to produce simple maps for your Web site is to use Google's Fusion Tables. Fusion Tables is an online data management application designed for collaboration, visualization and publication of data.

Fusion tables allow you to:

- ✓ Upload and manage map data
- ✓ Map points, lines or areas
- ✓ Create pushpin, intensity, and other types of maps
- ✓ Create other types of visualizations (charts)
- ✓ Embed your visualizations in a Web site
- ✓ Share and collaborate with others

Fusion Tables does not require knowledge of JavaScript or CSS to make online maps. Some knowledge of HTML is useful for styling info boxes and adding more complex features. Fusion Tables maps have limited options and functionality compared to custom mapping applications, but they are far easier to build. Here are some simple use cases for Fusion Tables maps:

- ✓ A biogeographer creates a map of wolf sitings in Wisconsin, publishes the map to a Web site, and then updates the map as new sitings are made.
- ✓ A community maps the locations of available commercial properties and posts the map online to promote business development.
- ✓ A journalist creates a series of election maps for senate districts in the state and embeds the map in an online article.
- ✓ A non-profit organization creates maps of bicycle accident locations to raise awareness of bicycle safety.

For a general background on Fusion Tables see the app's help page:

- ✓ <https://support.google.com/fusiontables>

Google provides several useful tutorials on Fusion Tables to help you import, map and publish your data. For a full listing see:

- ✓ <https://support.google.com/fusiontables/answer/184641>

Some particularly useful tutorials are:

- ✓ Fusion Tables map basics (<https://support.google.com/fusiontables/answer/2527132>)
- ✓ Mapping your own data (<https://support.google.com/fusiontables/answer/181717>)
- ✓ Publishing and sharing maps (<https://support.google.com/fusiontables/answer/2562055>)

Enhancements to Fusion Tables are quite frequent, since Google classifies it as an "experimental app." New features are summarized here:

- ✓ <https://support.google.com/fusiontables/answer/1656859> and
- ✓ <https://support.google.com/fusiontables/answer/184641>

Recent enhancements include:

- ✓ Collaborative data gathering
- ✓ Importing data from mobile devices
- ✓ Importing data from Web forms
- ✓ Making intensity maps and heatmaps
- ✓ Adding charts and street view images to maps
- ✓ Adding your own maps and GPS data
- ✓ Modifying default map symbols

There is also a Fusion Tables API to query, manage and update Fusion Tables data. See <https://developers.google.com/fusiontables/> for more detail.

Objectives of this Technical Paper

This tutorial does not cover all of the enhancements and features of Fusion Tables. Rather it provides an overview of the base functionality of Fusion Tables for making simple Web maps. This tutorial shows you the basic steps for:

- ✓ Making a simple pushpin map from a spreadsheet
- ✓ Customizing icons
- ✓ Publishing this map to a Web site
- ✓ Uploading KML and Shapefiles

Getting Started: Creating a Simple Pushpin Map

To create a simple pushpin map you will need a source of point data, and for this tutorial we will start with a Microsoft Excel spreadsheet of Wisconsin populated places from GNIS (Geographic Names Information System). GNIS is the official repository of place names in the United States. The data was obtained from the *download* link at <http://geonames.usgs.gov/domestic/index.html> and saved to an Excel file. The data was then filtered to include only features with a class equal to "Populated Place." The data includes a place name, county name, latitude and longitude, and several other attributes. Populated places in GNIS include incorporated places (cities and villages) as well as unincorporated places. There are 2583 records in the GNIS dataset for Wisconsin (at time of download, August 2013).

The sample dataset (WI_gnis_ppls_V1.2.xlsx) is available for download at http://www.sco.wisc.edu/images/stories/download/fusion_tables_sample_data

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
1	id	name_place	fclass	name_state	num_state	name_cty	num_cty	lat_dms	long_dms	latitude	longitude	elev	name_map	date_created	date_edited
2	81	Abbotsford	Populated Place	WI	55	Clark	019	445647N	0901837W	44.9463560000	-90.3159690000	429	Abbotsford	8/29/1980	3/20/2008
3	83	Abells Corners	Populated Place	WI	55	Walworth	127	424334N	0883333W	42.7212510000	-88.5436040000	268	Elsikhorn	8/29/1980	
4	86	Abrams	Populated Place	WI	55	Oconto	583	444645N	0880335W	44.7791593000	-88.0598261000	207	Abrams	8/29/1980	
5	92	Ackerlyville	Populated Place	WI	55	Washington	131	431836N	0881529W	43.3100029000	-88.2581502000	320	Hartford East	8/29/1980	
6	97	Ada	Populated Place	WI	55	Sheboygan	117	435237N	0875344W	43.8769382000	-87.8596469000	272	School Hill	8/29/1980	
7	98	Adams	Populated Place	WI	55	Walworth	127	424802N	0883158W	42.8005684000	-88.5328778000	276	Little Prairie	8/29/1980	
8	99	Adams	Populated Place	WI	55	Adams	001	435722N	0894905W	43.9506200000	-89.8181818000	293	Adams	8/29/1980	3/20/2008
9	100	Adams Beach	Populated Place	WI	55	Shawano	115	444110N	0884020W	44.6869300000	-88.6681571000	246	Embarrass	8/29/1980	
10	109	Addison	Populated Place	WI	55	Washington	131	432522N	0882228W	43.4227761000	-88.3745423000	320	Allenton	8/29/1980	
11	113	Adell	Populated Place	WI	55	Sheboygan	117	433709N	0875707W	43.6191633000	-87.9520364000	276	Random Lake	8/29/1980	3/20/2008
12	115	Adella Beach	Populated Place	WI	55	Winnebago	139	440832N	0882742W	44.1422080000	-88.4617767000	229	Neenah	8/29/1980	
13	121	Advance	Populated Place	WI	55	Shawano	115	444716N	0881956W	44.7877705000	-88.3323242000	261	Krakow	8/29/1980	
14	126	Afton	Populated Place	WI	55	Rock	105	423614N	0890416W	42.6039050000	-89.0722230000	232	Beloit	8/29/1980	
15	142	Alaska	Populated Place	WI	55	Kewaunee	561	443226N	0873004W	44.5405547000	-87.5011977000	220	Casco	8/29/1980	
16	143	Alban	Populated Place	WI	55	Portage	097	443740N	0891705W	44.6277513000	-89.2848362000	348	Rosholt	8/29/1980	
17	144	Albany	Populated Place	WI	55	Green	045	424228N	0892613W	42.7077846000	-89.431706290000	247	Albany	8/29/1980	3/20/2008
18	147	Albertville	Populated Place	WI	55	Chippewa	017	445736N	0913602W	44.9599608000	-91.6004413000	307	Albertville	8/29/1980	
19	148	Albion	Populated Place	WI	55	Dane	025	425346N	0896111W	42.8944880000	-89.0698346000	258	Rockdale	8/29/1980	
20	164	Alderley	Populated Place	WI	55	Dodge	027	431303N	0882659W	43.2175040000	-88.4498205000	290	Stonebank	8/29/1980	
21	177	Algoma	Populated Place	WI	55	Kewaunee	561	443632N	0872557W	44.6088840000	-87.4325891000	178	Algoma	8/29/1980	3/20/2008
22	185	Allen	Populated Place	WI	55	Eau Claire	035	443941N	0912201W	44.6613505000	-91.3668244000	297	Brackett	8/29/1980	
23	198	Allens Grove	Populated Place	WI	55	Walworth	127	423449N	0884345W	42.5802926000	-88.7626052000	284	Clinton	8/29/1980	
24	199	Allenton	Populated Place	WI	55	Washington	131	432514N	0882027W	43.4205430000	-88.3409305000	291	Allenton	8/29/1980	
25	200	Allenville	Populated Place	WI	55	Winnebago	139	440759N	0883708W	44.1303900000	-88.6189998000	249	Crinkohr NE	8/29/1980	
26	208	Allouez	Populated Place	WI	55	Brown	009	442839N	0880058W	44.4774923000	-88.0162140000	182	De Pere	8/29/1980	3/20/2008
27	209	Allouez	Populated Place	WI	55	Douglas	031	464119N	0920129W	46.6885509000	-92.0246340000	197	Superior	8/29/1980	
28	213	Alma	Populated Place	WI	55	Buffalo	011	441912N	0915454W	44.3199654000	-91.9148839000	207	Alma	8/29/1980	3/20/2008
29	215	Alma Center	Populated Place	WI	55	Jackson	053	442614N	0905441W	44.4371839000	-90.9112580000	299	Alma Center	8/29/1980	3/20/2008

Excel spreadsheet of GNIS populated places in Wisconsin

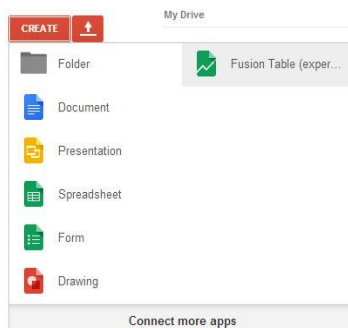
Fusion Tables accepts data in various formats, including Microsoft Excel files, OpenDocument Spreadsheets, delimited text files (such as .csv files), and KML files. For more information on supported file types see <https://support.google.com/fusiontables/bin/answer.py?hl=en&answer=171181>. There are size limits on most files and an overall quota of 250 MB per user.

To produce a map, Fusion Tables requires a field (or fields) that refers to the location of each feature. In the GNIS example, the latitude and longitude fields will be used. These fields are already in decimal degree format. If you have lat-long values that are not in decimal degree format, you will need to convert these to decimal degree format before importing into Fusion Tables.

Fusion Tables can also use an address field to locate data, and addresses will be automatically geocoded as the map is created. Likewise, Fusion Tables will recognize other location fields such as county names.

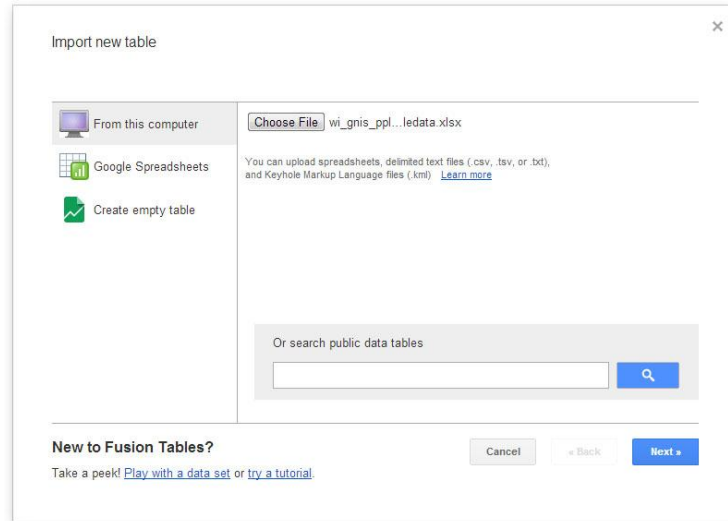
Fusion Tables is integrated into Google Drive (where Google docs are stored). Before importing the Excel file, you will have to use your Google account to login to Google Drive at <https://drive.google.com>. (You will need to create a Google account if you do not have one.)

Once logged in to Google Drive, click the *Create* button in the upper left portion of the window, and choose *Fusion Table (experimental)* from the drop down menu (see figure below). If you haven't used Fusion Tables before, click on "*Connect more apps*" at the bottom of the menu. Once the "*Connect apps to Drive*" window pops up, search for Fusion Tables and select *Connect*.



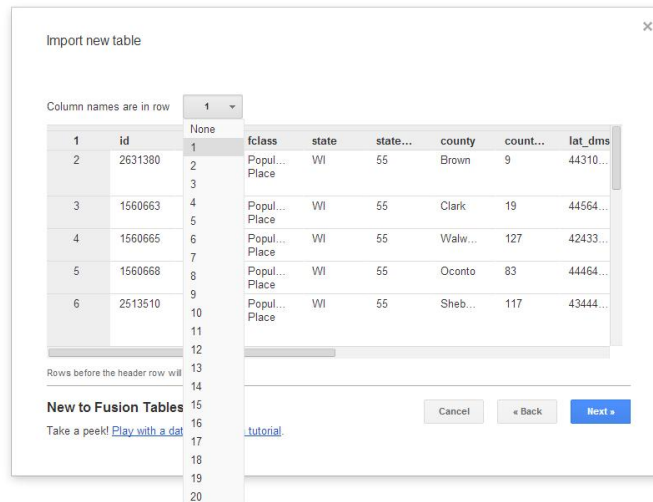
Creating a new Fusion Table

This will open a new tab in your browser, and you will be presented with the following window:



Importing a new table in Fusion Tables

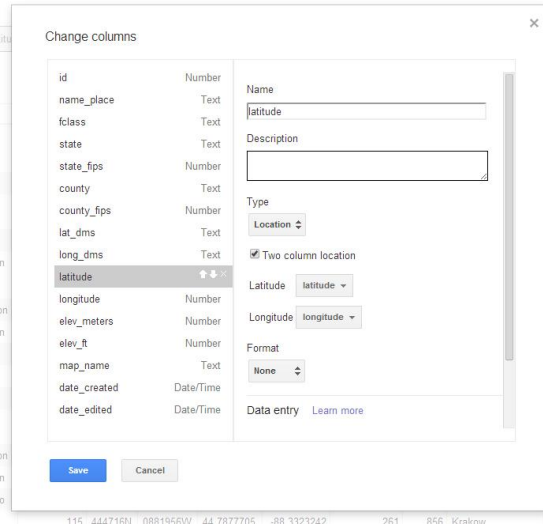
Navigate to your file using the *Choose File* button. Once your file has been selected click the *Next* button. Optionally, you can specify the row in which the column names are located (see figure below).



Configuring the import

Clicking *Next* again takes you to a form that lets you add some simple metadata. Hitting the *Finish* button begins the file import operation.

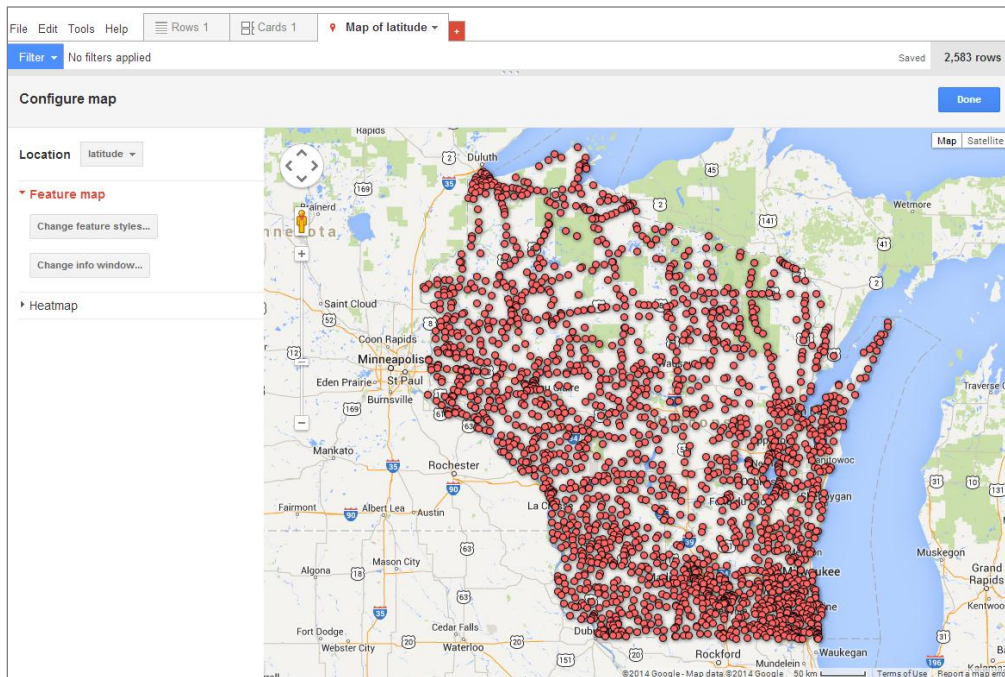
Once the file has been imported, choose *Edit > Change columns*. In the GNIS example, the *latitude* and *longitude* columns have been autodetected by Fusion Tables as a two-column *Location* field. (Note that *longitude* continues to be defined as a *Number*, but that it is paired with latitude which is defined as a *Location* field.)



Viewing and configuring columns in Fusion Tables

Since Fusion Tables autodetected the location fields correctly, there is no need to modify any field definitions. But if needed, you could add or change the location fields. If you do not have latitude or longitude, you could use address data. Fusion Tables will geocode the data when the map is first made. There are other attributes that can be adjusted from this box by using the *Type* and *Format* drop down menu. This will ensure your data is properly visualized once a map is made. You can rename the columns in the *Name* box from this menu as well.

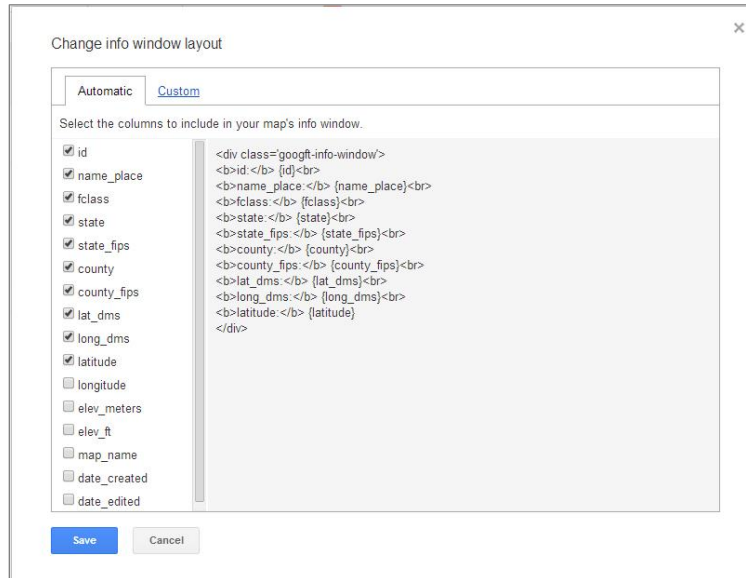
Now you're ready to make a map. To do so, choose the *Map of latitude* tab for your imported dataset. In our example, the resulting map window is shown below.



A simple pushpin map of GNIS populated places in Wisconsin

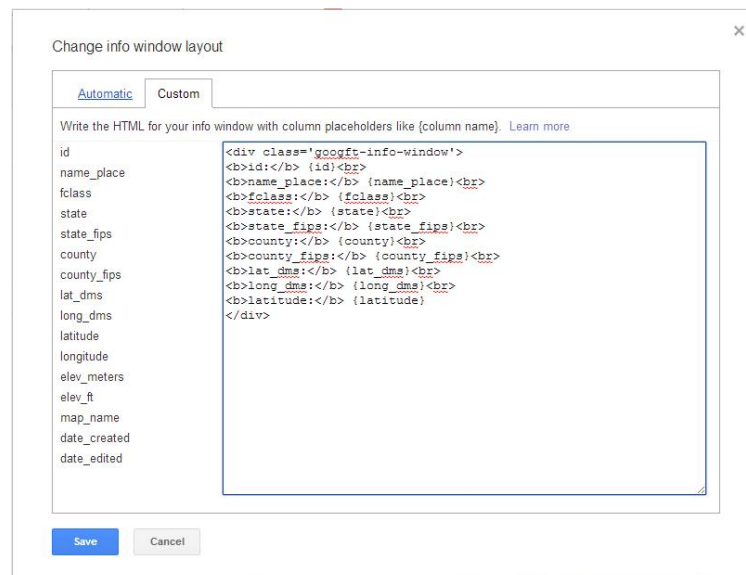
Next Steps: Customizing the Map

Your map can be customized in a few ways. For example, click on the *Map of Latitude > Change info window...* button and click the check boxes to select or deselect attributes for display.



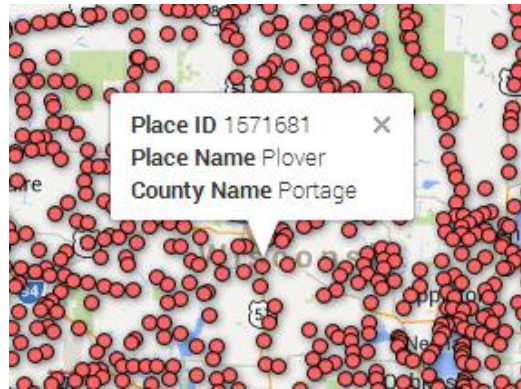
Configuring the information window for the map

Clicking on the *Custom* tab will allow you to modify the HTML code to change labels, text styles, colors, and so on.



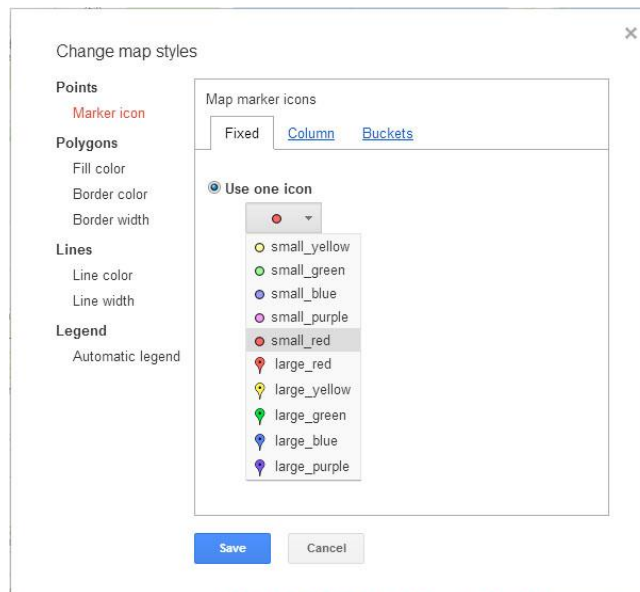
Customizing the information window

The information window below has been customized to show only selected columns of data.



Customized information window

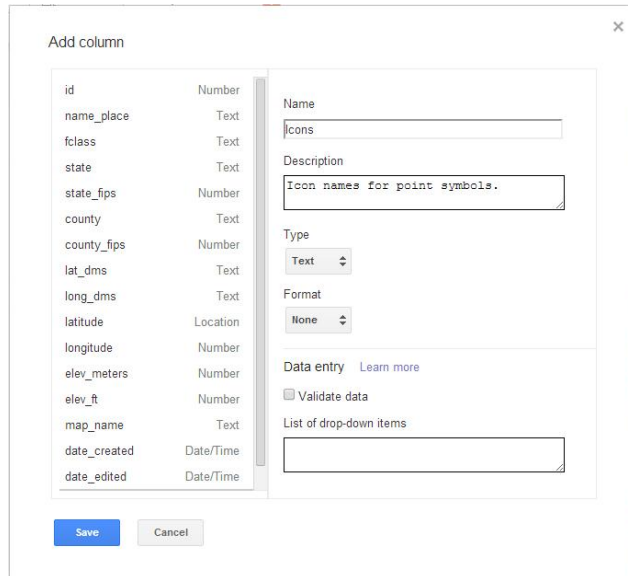
The pushpin symbol can also be changed. To do this click on *Map of Latitude > Change feature styles...*



Customizing the pushpin symbol

In addition to these simple pushpin and dot icons, Fusion Tables supports other basic Google icons that can be found at <https://www.google.com/fusiontables/DataSource?dsrclid=308519>. You can click on the above link and zoom into the icon cluster to see what these icons look like.

To insert these icons into your map you will need to insert a new column into your imported table by selecting *Edit > Add column*. To keep things simple, give this new column a Column Name of *Icons* and accept the defaults for Type and Format (see below).



Adding a new column

Now, switch to the *Rows 1* tab to view the tabular data you imported. Find the row in the table that you want to modify. For example, if you want to use a custom icon for Madison, find that row in the table. Note that to locate a specific row without having to scroll through your entire list, you can select the drop down menu from the *name_place* column heading and click *Find...*

Now double-click the cell you want to modify. This will be the cell corresponding to the *Madison* row and the *Icons* column. Enter *capital_big_highlight* in the *Icons* field in the dialog box. If the *Icons* field is left blank for a row, the symbol will default to the small red dot. Therefore, if a variety of icons are desired the *Icons* field needs to be filled out for every row.

Once an icon scheme is chosen, return to the map view. Click on the *Change feature styles...* button, click on the *Column* tab, click *Use icon specified in a column*, and select *Icons* as the column to use. When you save this, the point symbol for Madison will change.

This method works best when working with small datasets. If you wish to apply custom icons to larger datasets it is best to add a column and specify the names of icons for each row before importing your spreadsheet into Fusion Tables. Fusion Tables has also added the ability to merge tables to apply map symbols. In other words, you can create a look-up table with the map symbols defined for each category on your data, then merge this table with your data using a named icon column as in the above example. More details are provided on the Fusion Tables site at <https://support.google.com/fusiontables/answer/2476954>.

Sharing and Publishing the Map

To share the map, click the *Share* button in the upper right of your map window. You can invite people to view or edit the map, and also specify the visibility. If the map is going to be shared on the Web or embedded in a Web site, it needs to be available with no sign-in required.

Specifying sharing options

Specifying sharing options

Now that the sharing options have been specified, the map can be embedded in a website. To make sure the default view of the map is correct, you should set the map center and zoom level. The easiest way to do this is to zoom and center your maps as desired, then get an embeddable link by selecting *Tools > Publish*. Copy the HTML code from the small window that opens above the map. The code will look similar to the following:

```
<iframe width="500px" height="300px" scrolling="no"
src="http://www.google.com/fusiontables/embedviz?viz=MAP&q=select+col0%2C+col1
%2C+col2%2C+col3%2C+col4%2C+col5%2C+col6%2C+col7%2C+col8%2C+col9%2C+col10
%2C+col11%2C+col12%2C+col13%2C+col14+from+1164973+&h=false&lat=44.71983445
&lng=-89.89321955&z=7&t=1&l=col9"></iframe>
```

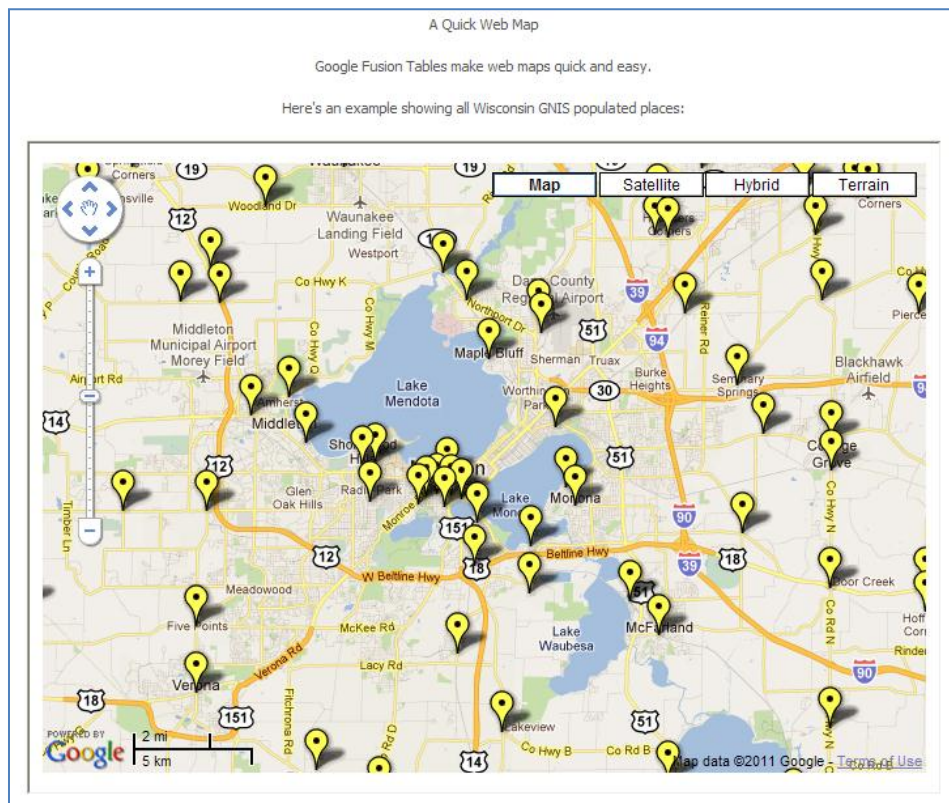
Parameters highlighted in yellow are ones that you may want to modify when embedding the map in a Web site. The *width* and *height* parameters define the size of the map. The *lat* and *lng* parameters

define the center point of the map when it is first displayed, and the z parameter gives the zoom level. For this example, we will simply embed the HTML code into a standard Web page.

```
Source  
A Quick Web Map  
Google Fusion Tables make web maps quick and easy.  
Here's an example showing all Wisconsin GNIS populated places:  
<iframe width="500px" height="300px" scrolling="no"  
src="http://www.google.com/fusiontables/embedviz?viz=MAP&q=select+col0%2C+col1%2C+col2%2C+col3%2C+col4%2C+col5%2C+col6%2C+col7%2C+col8%2C+col9%2C+col10%2C+col11%2C+col12%2C+col13%2C+col14+from+1164973+&h=false&lat=44.71983445&lng=-89.89321955&z=7&t=1&l=col9"></iframe>
```

Embedding the map using an HTML editor

The resulting page might look something like this:



The embedded map

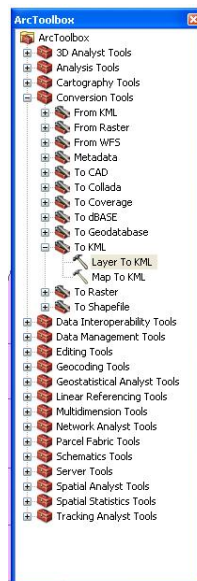
Working with KML and Shapefiles

Fusion Tables also has the ability to work with other types of geodata, such as KML and Shapefiles. With these types of files, users can import line and polygon data. You can upload a KML (.kml) file to Fusion Tables with no conversion required. This is especially useful if you're exporting from Google Earth. However, Fusion Tables cannot natively handle Shapefiles (.shp) so to import this format into Fusion Tables, a series of additional steps is required.

For this example we will work with a Shapefile of Wisconsin counties from the US Census Bureau. This Shapefile can be downloaded from <http://www.census.gov/cgi-bin/geo/shapefiles2010/main>. Under *Select a layer type* select *Counties (and equivalent)* and then chose *Wisconsin*. The shapefile will be downloaded in compressed ZIP format. The sample dataset (tl_2010_55_county10) is also available for download at http://www.sco.wisc.edu/images/stories/download/fusion_tables_sample_data in both compressed and uncompressed formats.

There are a number of different options for converting a Shapefile to KML. The first uses a combination of ArcMap and Google Earth to convert the file manually. The second method uses QGIS, an open source GIS program. If you don't have ArcMap and do not want to download the whole QGIS software package, the third option is a Website that allows you to drag and drop a zipped Shapefile into their converter and will output a KML file for you to download.

ArcGIS and Google Earth Conversion. To convert your Shapefile manually, add it as a layer in ArcMap. Next, open ArcToolbox, and select *Conversion Tools > To KML > Layer to KML*.



Converting to KML

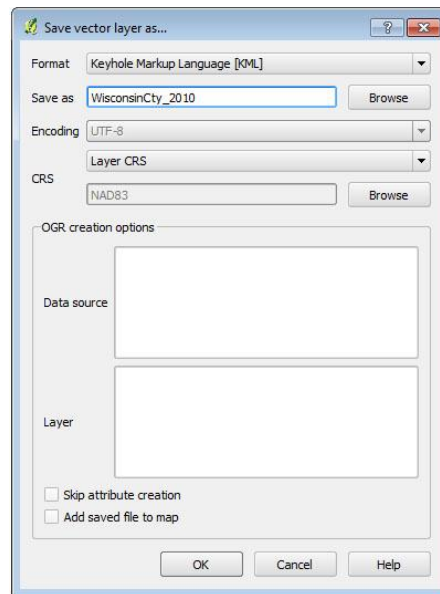
A dialogue box will open. For the *Layer* field select your Shapefile, for the *Output File* select the target directory and a name for the exported file, and for *Layer Output Scale* simply type "1". Let all other fields default and select *OK* to run the script.

A box will pop up telling you the layer has successfully been converted to KML. Now open the target directory specified in the previous step and find your new file. Note that your exported file is actually a KMZ which cannot be read directly by Fusion Tables. To fix this, open the KMZ file in Google Earth. Select *File > Save > Save Place As* which will open a dialog box. Pick a new name for the file and under *Save as type* be sure to change it to KML. Save the file.

QGIS Conversion. This method is much simpler than the method used above and the attribute table of the Shapefile is also preserved. Open QGIS and click the *Add Vector Layer* button and then *Browse* and select your Shapefile and click *Open*. After your layer is added, right click on it in the Layers area on the left side of the screen and select *Save As*. Use the Format drop down menu to select Keyhole Markup Language (KML) and name your file. Once you've done this click *OK*. Once you see the message *Export to vector file has been completed* you are all done. Now you can import the KML file into Fusion Tables.

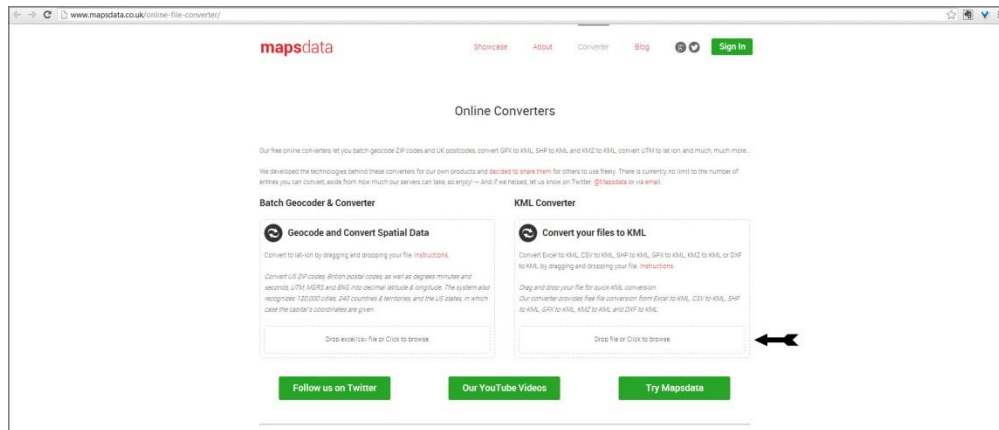


Add Vector Layer button



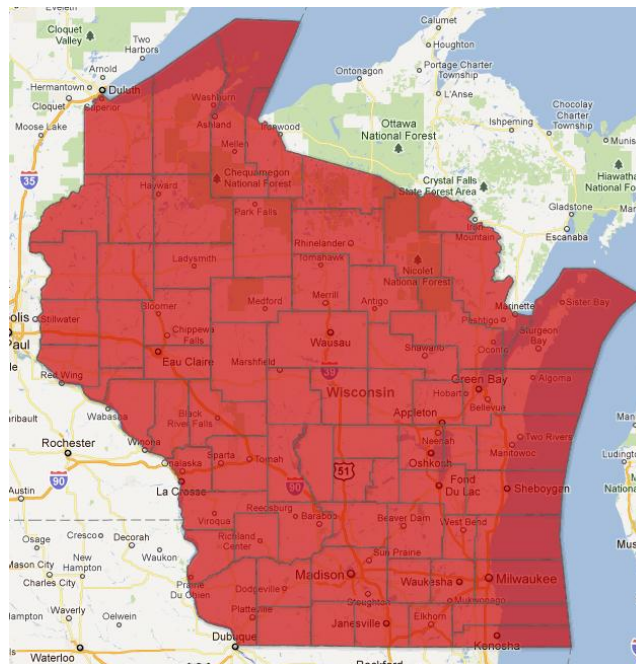
Rename and Select KML in Format dropdown menu

Automated Conversion. This method utilizes the converter on the website <http://www.mapsdata.co.uk/online-file-converter/>. To use this converter your Shapefile must be contained in a zipped folder. Once this is done, you can either drag the zipped folder into the box that says *Drop file or Click to browse* or click that same box to browse to the directory and select the zipped folder. After the conversion is complete you will automatically be prompted to save the new KML file in your downloads folder. After you've saved the KML file you can upload it into Fusion Tables.



Drag and drop zipped file here or click to browse to zipped file

Now you can import the KML file into Fusion Tables. Begin by selecting *Create > FusionTable > Choose File*. After selecting your KML file, click *Next* and ensure that your columns names row is correctly identified, and then click *Next*. In this window you can rename your table if you desire and you can add any additional metadata. Once you satisfied click *Finish*. Now, to view your map, select the *Map of Geometry* tab.

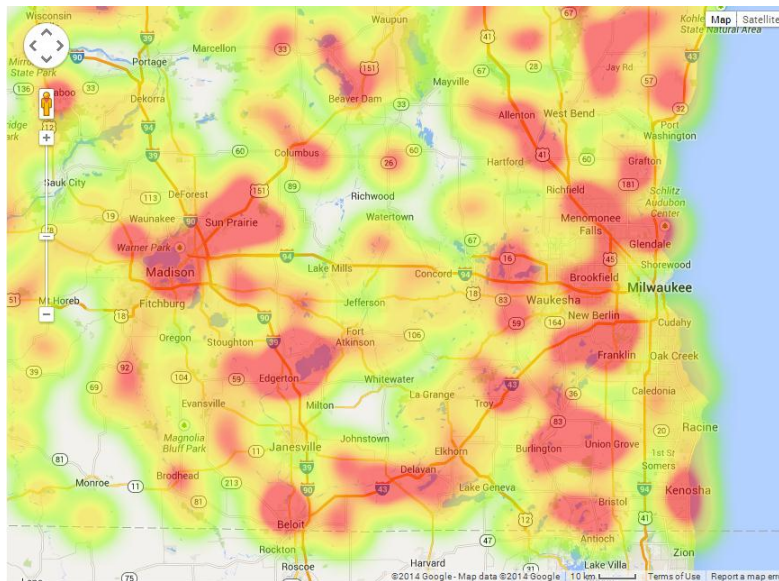


Imported KML file based on Shapefile

As a final alternative, Google suggests using <http://www.shpescape.com> for converting and importing a zipped shapefile directly into Fusion Tables (<https://support.google.com/fusiontables/answer/2592829>).

Creating a Heatmap

Fusion Tables can also be used to create a heatmap. A heatmap shows the density of point observations in different colors, from cool to warm (hence the name “heatmap”). To make a heatmap in Fusion Tables, simply go to the *Map of latitude* tab, and choose *Change Map* from the *Tools* menu. A *Heatmap* entry will now appear in the left-hand panel. By clicking on this entry, you will be able to manipulate several parameters to create a custom heatmap.



Heat map showing the density of populated places in southeast Wisconsin

Known Problems

As Fusion Tables grows in complexity, the number of issues and bugs have also increased. See <https://code.google.com/p/fusion-tables/> for a discussion of software bugs, issues and feature requests.

Google Maps Engine Lite (Beta)

A new, free and stripped-down version of the Google Maps Engine called Google Maps Engine Lite (Beta) was released in March 2013. It allows users more control over the map they are creating than allowed in maps created using Google Fusion Tables.

Google Maps Engine Lite offers the ability to draw directly on top of the basemap (create points, lines and polygons by hand) or import tabular data that has a geographic field of some sort (Latitude/Longitude or Addresses). The user also has the ability to add multiple layers to an individual map, which can be turned on and off at their discretion. Users have much more flexibility when it comes to different labeling and symbolization options as well. Each point, line or polygon can be styled individually or entire layers can be modified and styled at the same time. Google Maps Engine Lite offers

different basemap options including the Google Maps standard basemap, satellite imagery, and a number of different neutral colored and gray scale maps.

While Google Maps Engine Lite offers more than Fusion Tables, there are a number of limitations as well. It can only handle CSV, Excel, My Map or Google Drive Spreadsheet files, so data stored in KML files or a Google Fusion Table are not currently supported. There is also a limit of 100 records for a given layer, which can be a major constraint depending on the size of the dataset you are working with. Maps Engine Lite is only for personal and non-commercial use. To learn more about the acceptable uses read the program policy at

http://www.google.com/enterprise/earthmaps/legal/us/gme_program_policies.html.

Resources

There are many more options available in Fusion Tables for management, display, and sharing of your data. In addition to the resources identified above, there is a help forum at

- ✓ <https://groups.google.com/group/fusion-tables-users-group>

Also be sure to read Google's privacy policy and terms of use at

- ✓ <https://www.google.com/fusiontables>