

Main Aim:

AIMS

To obtain a tool that allows visual impact assessment, and to apply it to renewable energy systems such as wind turbines, photovoltaic power plants, biomass plants... achieving the lowest possible visual impact.

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Questions to answer:

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Questions to answer:

1.- Where do we place it?



AIMS

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Questions to answer:

1.- Where do we place it? 2.- What kind of system?



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Questions to answer:

1.- Where do we place it?
 2.- What kind of system?
 3.- Which system specifically?



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Questions to answer:

- 1.- Where do we place it?
 2.- What kind of system?
 3.- Which system specifically?
- 4.- HOW do we place it?



What do we know about an area?

METHODOLOGY

1.- The height (as a surface)

What do we know about an area?

1.- The height (as a surface)

2.- Tracks, roads and railroads features (as a layer)



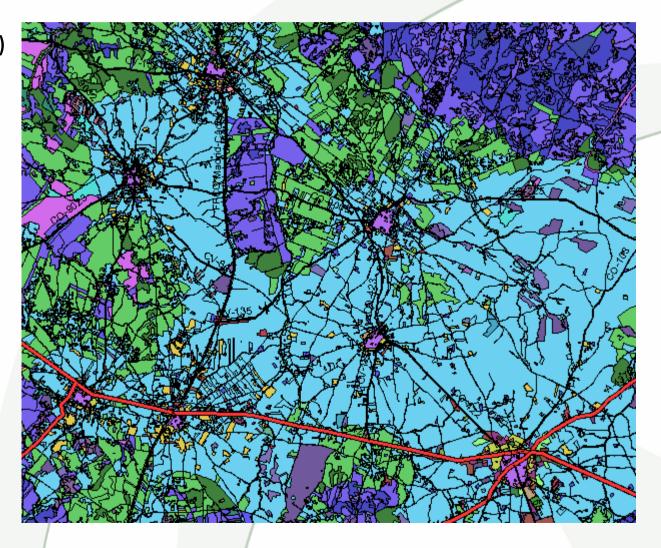
What do we know about an area?

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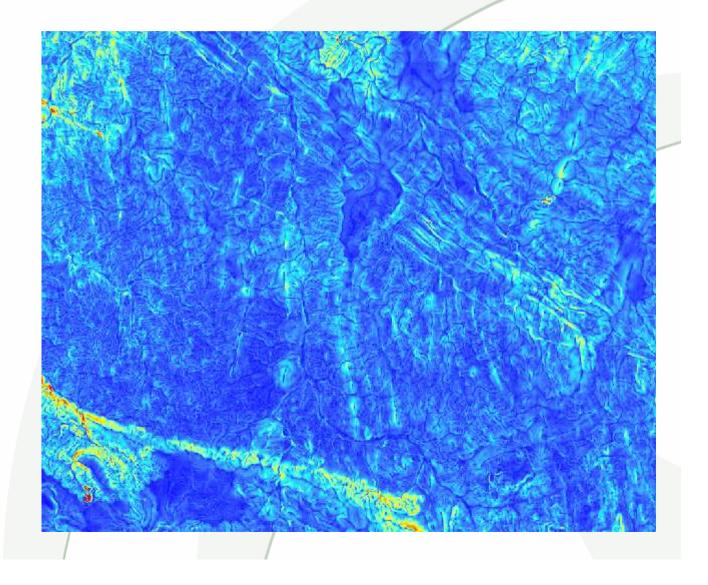
3.- Land USES & land

coverages



What can we derive from the height?

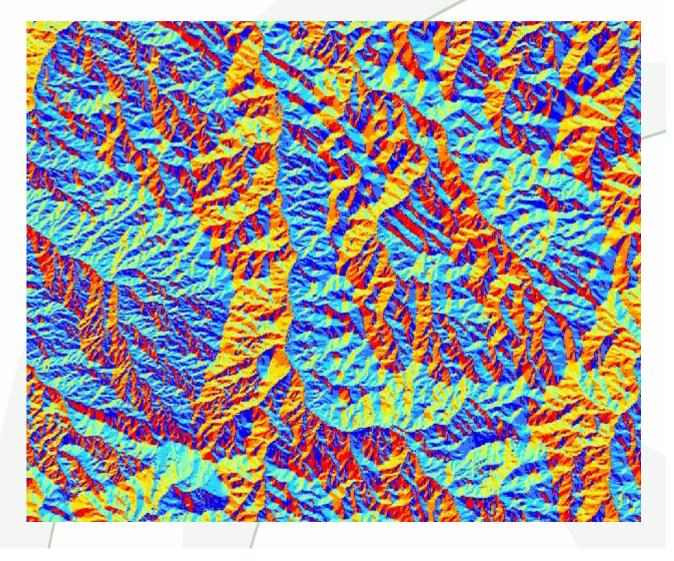
1.1- The Slope



What can we derive from the height?

1.1- The **Slope** 1.2- The **aspect**

And related to a point (source):

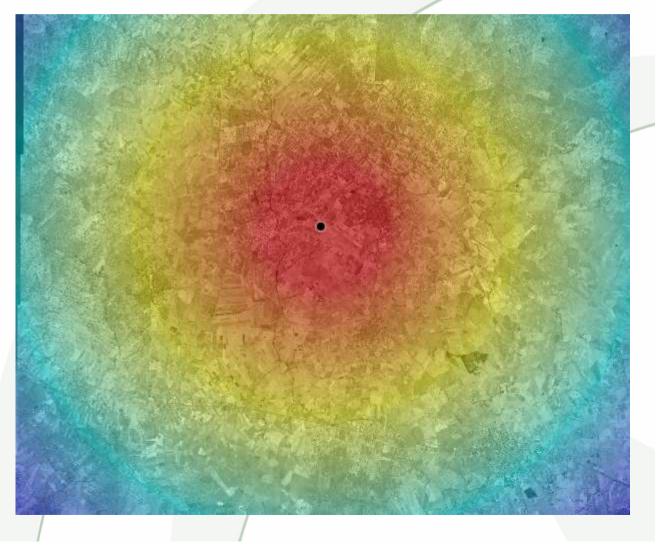


What can we derive from the height?

1.1- The Slope 1.2- The aspect

And related to a point (source):

1.3- The **distance** between any point and the source.

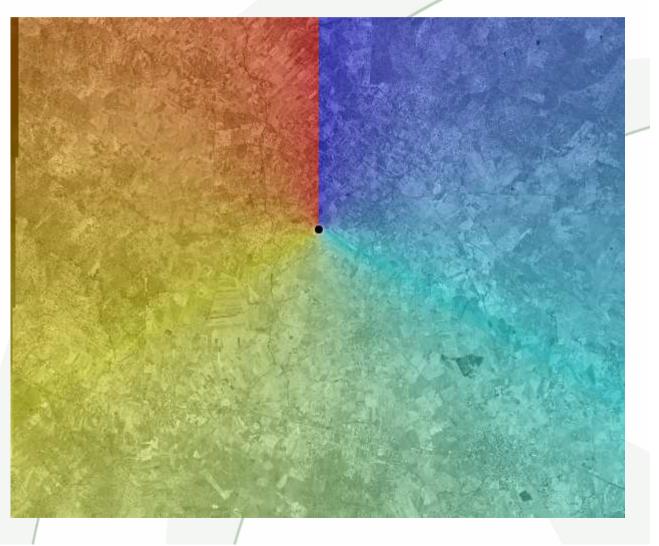


What can we derive from the height?

1.1- The **Slope** 1.2- The **aspect**

And related to a point (source):

1.3- The distance between any point and the source.
1.4- The azimuth between any point and the source.

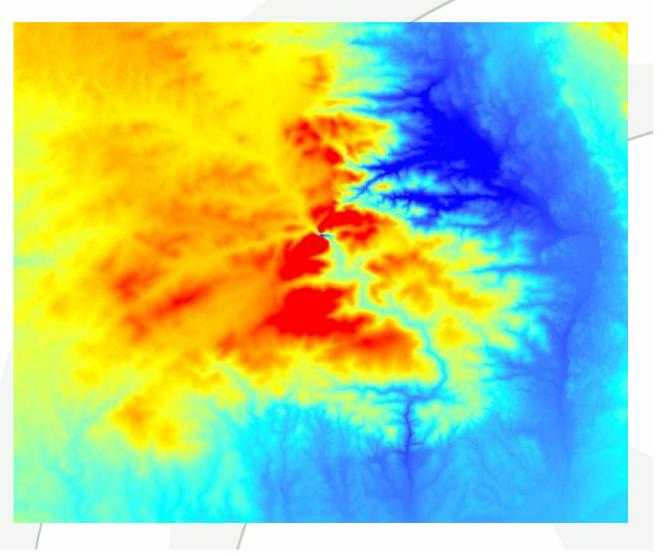


What can we derive from the height?

1.1- The **Slope** 1.2- The **aspect**

And related to a point (source):

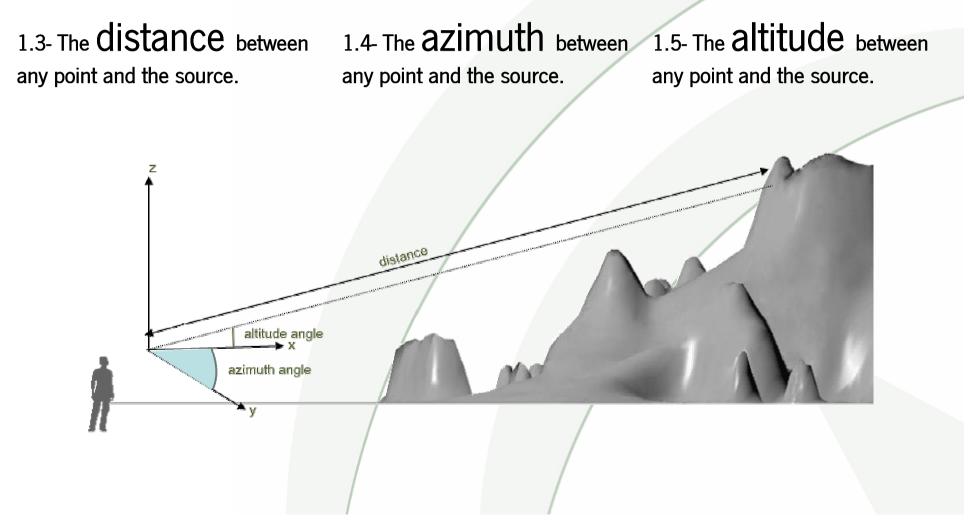
1.3- The distance between any point and the source.
1.4- The azimuth between any point and the source.
1.5- The altitude between any point and the source.



What can we derive from the height?

METHODOLOGY

And related to a point (source):



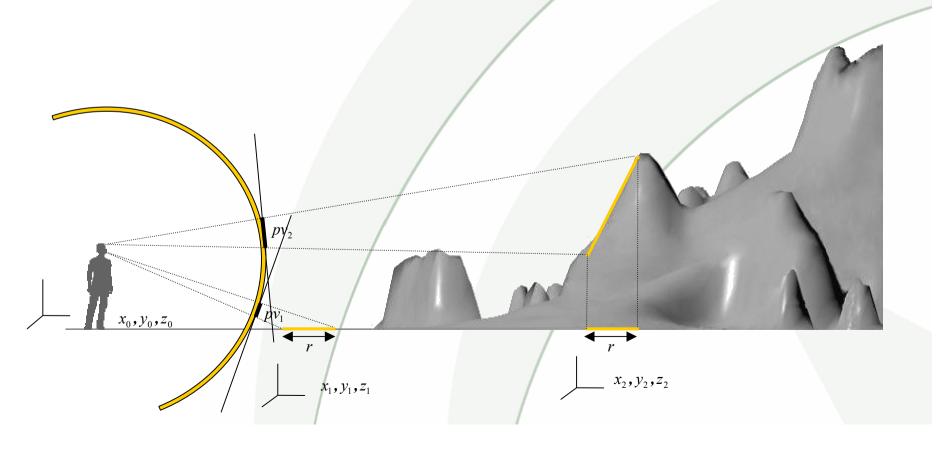
What else can we derive from the height?

METHODOLOGY

Related to a point (source) too:

1.6- The **Visual projection**

of any point into the source.

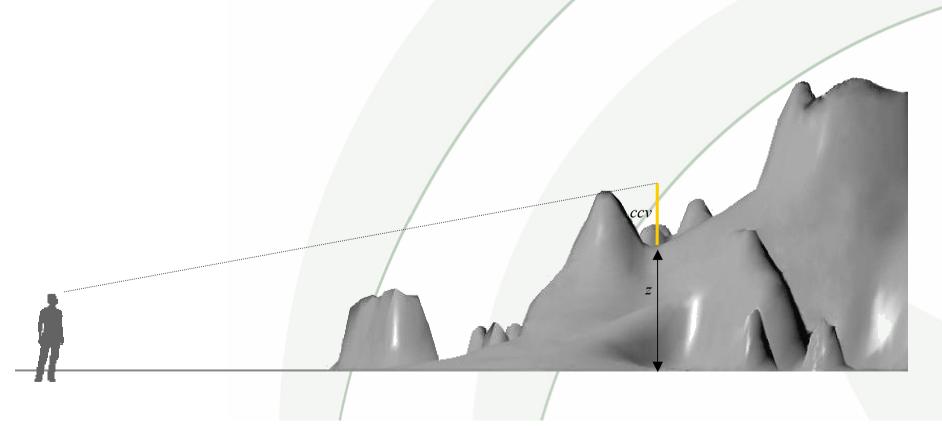


What else can we derive from the height?

METHODOLOGY

Related to a point (source) too:

1.6- The Visual projection1.7- The additional height we must add to anyof any point into the source.point to see it .



What else can we derive from the height?

Related to a point (source) too:

1.6- The **Visual projection** of any point into the source.

1.7- The additional height we must add to any

point to see it

Additional height is useful in visual impact assessment, because it tell us if an object placed at the target point's coordinates would be seen or not

What else can we derive from the height?

Related to a point (source) too:

1.6- The **Visual projection** of any point into the source. 1.7- The **additional height** we must add to any point to see it

If this value is <=0, the source can see the target point naturally, so we can obtain Viewsheds from it.

What else can we derive from the height?

METHODOLOG

Related to a point (source) too:

1.6- The Visual projection1.7- The additional height we must add to anyof any point into the source.point to see it

1.8- The horizon points that limit the viewshed.

What else can we derive from the height?

1.1- The Slope

1.2- The **aspect**

1.4- The azimuth between 1.5- The altitude between 1.6- The visual projection any point and the source.

any point and the source. of any point into the source.

1.7- The additional height

we must add to any point to see it

1.8- The horizon points that limit the viewshed.

1.3- The distance between

any point and the source.

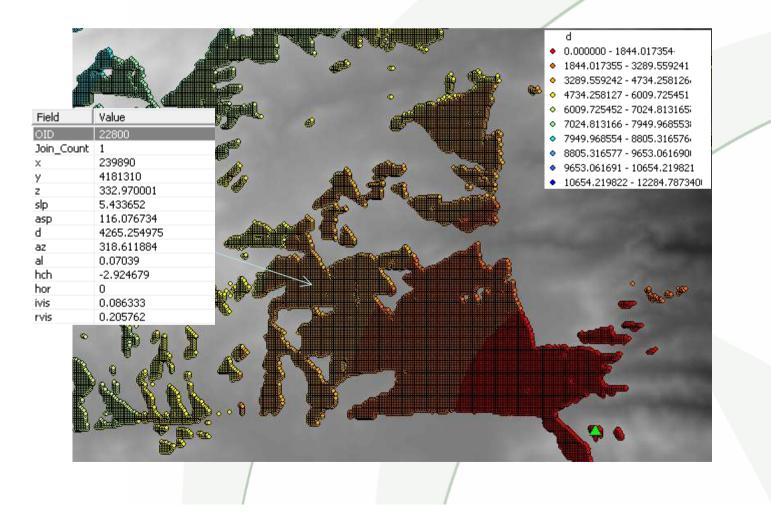
We can store all this info into tables:

| FID | x | У | z | slp | asp | d | az | al | hch | hor | ivis | rvis |
|-----|--------|---------|------------|-----------|------------|--------------|------------|----------|-----------|-----|----------|-------|
| 0 | 232710 | 4183790 | 460.350006 | 14.971813 | 177.602385 | 13574.69705 | 312.551931 | 0.867557 | -4.836949 | 1 | 0.172161 | -9999 |
| 1 | 232710 | 4183810 | 465.450012 | 13.490663 | 177.222635 | 13588.230201 | 312.614055 | 0.888192 | -5.156064 | 1 | 0.155331 | -9999 |
| 2 | 232710 | 4183830 | 470.049988 | 11.630769 | 178.399228 | 13601.779295 | 312.676055 | 0.90668 | -4.717698 | 1 | 0.129907 | -9999 |
| 3 | 232710 | 4183850 | 473.670013 | 9.709006 | 181.109284 | 13615.344285 | 312.737932 | 0.921007 | -3.750259 | 1 | 0.101491 | -9999 |
| 4 | 232710 | 4183870 | 476.820007 | 8.171239 | 183.943364 | 13628.925123 | 312.799686 | 0.933328 | -2.903867 | 1 | 0.079042 | -9999 |
| 5 | 232710 | 4183890 | 479.470001 | 6.591408 | 183.690309 | 13642.521761 | 312.861316 | 0.943524 | -2.228646 | 1 | 0.062162 | -9999 |
| 6 | 232710 | 4183910 | 481.470001 | 4.721741 | 177.224148 | 13656.134153 | 312.922824 | 0.950973 | -1.754901 | 1 | 0.047066 | -9999 |
| 7 | 232710 | 4183930 | 482.720001 | 2.644058 | 155.620262 | 13669.762251 | 312.984209 | 0.955263 | -1.22233 | 1 | 0.027201 | -9999 |

Viewing the source point's associated info:

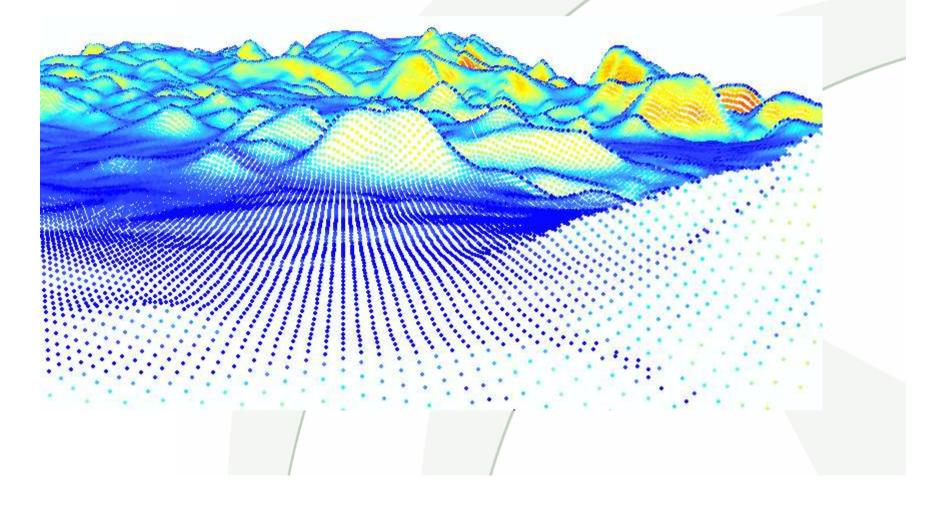
METHODOLOGY

EG1 - The Cartesian view of viewshed, the colour relates to the distance from source :



Viewing the source point's associated info:

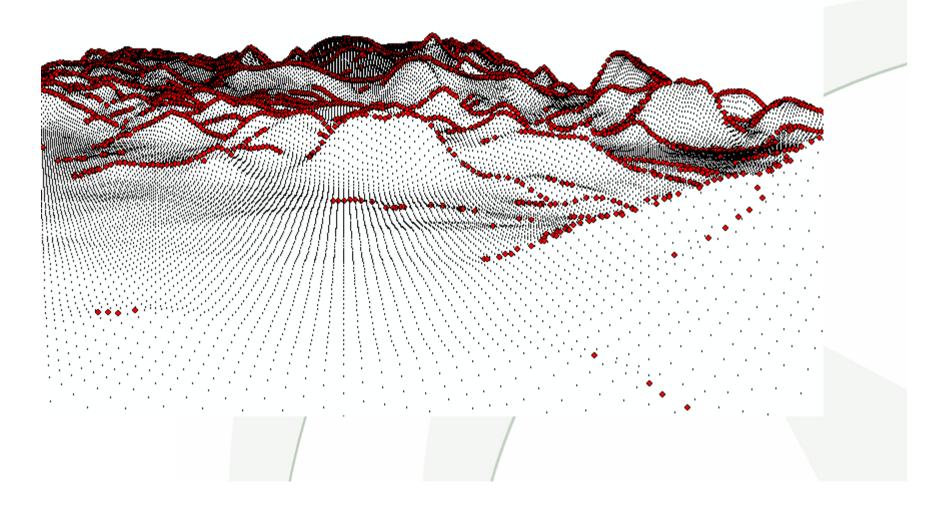
EG2 - The **polar view** of viewshed, the colour relates to the visual projection:



Viewing the source point's associated info:

METHODOLOG

EG3 - The **polar view** of viewshed, red points are horizon points:



What can we know about tracks, roads and railroads?

METHODOLOGY

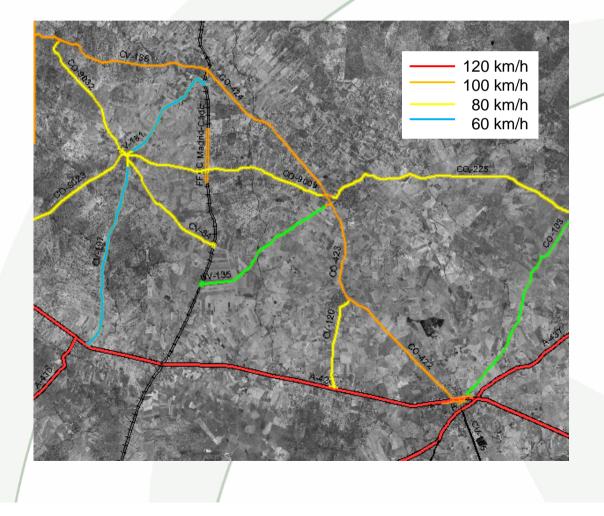
We can evaluate them attending to:

1.- Number of people that Intensidad media diaria (IMD) uses each one 0-3144 Red de Carreteras 3% de Andalucía (vehículos/día) hasta 500 El Viso de 500 a 1.000 de 1.000 a 2.000 de 2.000 a 5.000 CO-7405 Dos Torres -3002 CO-7413 de 5.000 a 10.000 de 10.000 a 15.000 c0 CO-3105 de 15.000 a 25.000 3495 2% más de 25.000 Red de Interés General del Estado (vehículos/día) ava del Duque Ma hasta 500 Pozoblanc Alcaraceio de 500 a 1.000 KS. pT-09 de 1.000 a 2.000 6654 15% CO-3075 de 2.000 a 5.000 5039 2% de 5.000 a 10.000 de 10.000 a 15.000 $I \downarrow I$ CO-6410 de 15.000 a 25.000 1 1 1 más de 25.000

What can we know about tracks, roads and railroads?

We can evaluate them attending to:

- 1.- Number of people that uses each one
- 2.- Max speed allowed

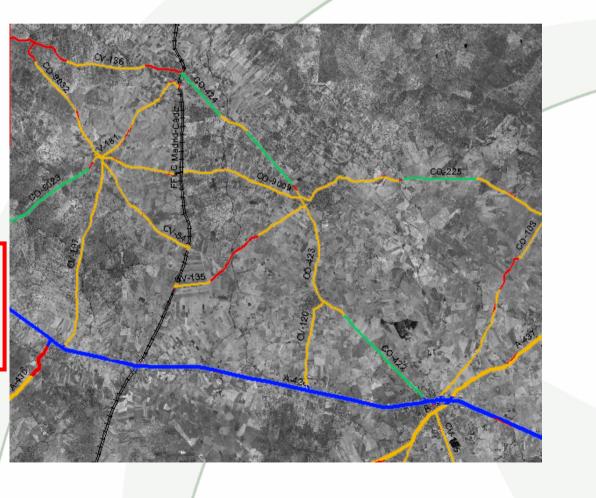


What can we know about tracks, roads and railroads?

We can evaluate them attending to:

- 1.- Number of people that uses each one
- 2.- Max speed allowed
- 3.- Twisted/straight sections

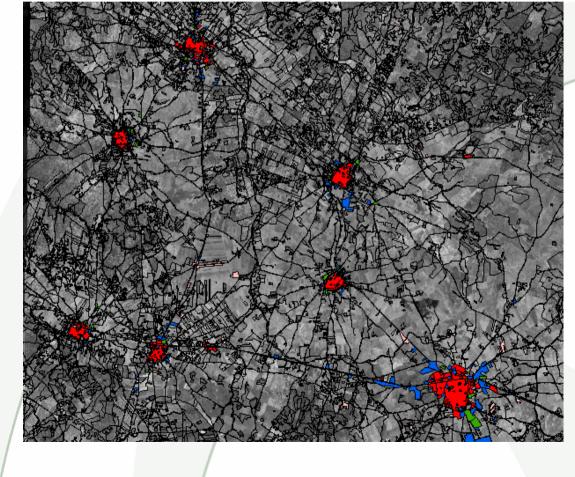
All this in order to obtain information about how probable is to find people observing from every point



What can we know about land use and coverage?

We can extract from them:

1.- Where people live , work and spend free time.



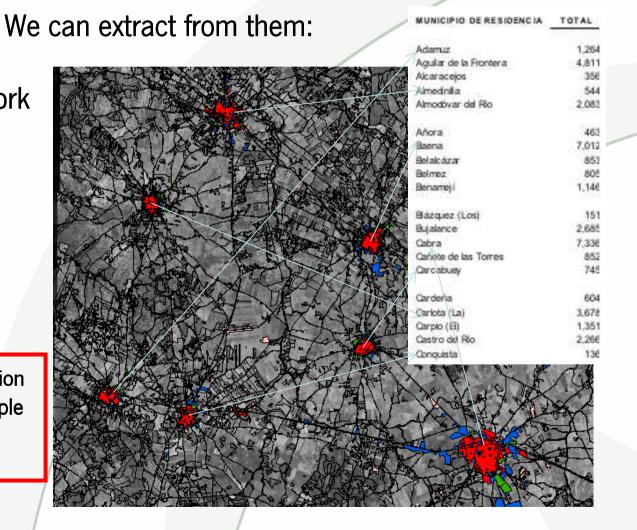
What can we know about land use and coverage?

1.- Where people live , work and spend free time.

...and after...

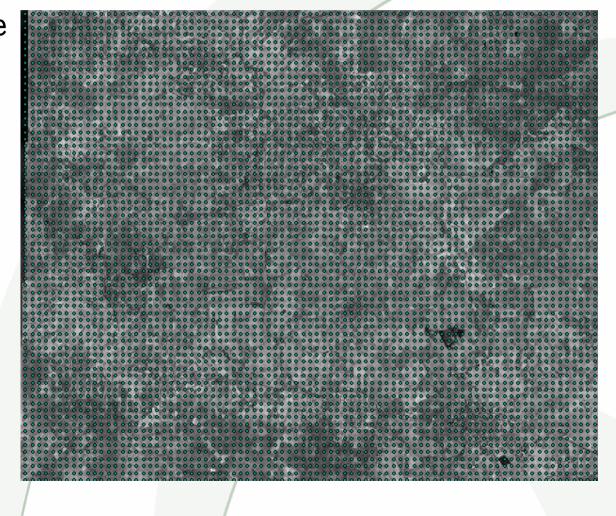
2.- How many people do (population, capacities...)

All this in order to obtain information about how probable is to find people observing from every point



What could we do now?

1.- We can extend a dense grid of points over the territory



1.- We can extend a dense grid of points over the territory

2.- And obtain the relative values of each one to every other, including its viewshed and the additional heights

| 1 124960 4171570 192.92 7064.000283 -135.057353 0.278609 237.784061 - 2 124960 4171580 192.94 7056.939847 -135.114821 0.27905 237.492064 - 3 124960 4171590 193.05 7049.886524 -135.172404 0.280223 237.110341 - 4 124960 4171600 193.21 7042.840336 -135.230102 0.281805 236.678893 - 5 124960 4171610 193.35 7035.801305 -135.287916 0.283227 236.267721 - 6 124960 4171620 193.42 7028.769451 -135.345846 0.284081 235.926826 - 7 124960 4171630 193.35 7021.744797 -135.403891 0.283794 235.726207 - 8 124960 4171640 193.25 7014.727365 -135.462053 0.283261 235.555867 - 9 124960 4171650 193.84 7007.717175 -135.52031 0.28369 234.695806 - 1 | | OID | x | У | z | d | az | al | hch | hor |
|--|---|------|--------|---------|--------|---|-------------|----------|------------|-----|
| 1 124960 4171570 192.92 7064.000283 -135.057353 0.278609 237.784061 -1 2 124960 4171580 192.94 7056.939847 -135.114821 0.27905 237.492064 -1 3 124960 4171590 193.05 7049.886524 -135.172404 0.280223 237.110341 -1 4 124960 4171600 193.21 7042.840336 -135.230102 0.281805 236.678893 -1 5 124960 4171610 193.35 7035.801305 -135.287916 0.283227 236.267721 -1 6 124960 4171620 193.42 7028.769451 -135.435846 0.284081 235.926826 -1 7 124960 4171630 193.35 7021.744797 -135.403891 0.283794 235.726207 -1 8 124960 4171640 193.25 7014.727365 -135.462053 0.283261 235.555867 -1 9 124960 4171650 193.84 7007.717175 -135.520331 0.28369 234.695806 -1 | Þ | 0 | 124960 | 4171560 | 192.2 | 7071.067812 | -135 | 0.272497 | 238.776331 | -1 |
| 3 124960 4171590 193.05 7049.886524 -135.172404 0.280223 237.110341 -1 4 124960 4171600 193.21 7042.840336 -135.230102 0.281805 236.678893 -1 5 124960 4171610 193.35 7035.801305 -135.287916 0.283227 236.267721 -1 6 124960 4171620 193.42 7028.769451 -135.345846 0.284081 235.926826 -1 7 124960 4171630 193.35 7021.744797 -135.403891 0.283794 235.726207 -1 8 124960 4171650 193.35 7014.727365 -135.462053 0.283261 235.555867 -1 9 124960 4171650 193.84 7007.717175 -135.520331 0.288369 234.695806 -1 10 14496 1 1 1 1 1 5 5 78726 0.281455 238.317097 4 10 14496 1 1 1 1 5 5 5 7 <td< td=""><td></td><td>1</td><td>124960</td><td>4171570</td><td>192.92</td><td>7064.000283</td><td>-135.057353</td><td>0.278609</td><td>237.784061</td><td>-1</td></td<> | | 1 | 124960 | 4171570 | 192.92 | 7064.000283 | -135.057353 | 0.278609 | 237.784061 | -1 |
| 4 124960 4171600 193.21 7042.840336 -135.230102 0.281805 236.678893 5 124960 4171610 193.35 7035.801305 -135.287916 0.283227 236.267721 6 124960 4171620 193.42 7028.769451 -135.345846 0.284081 235.926826 7 124960 4171630 193.35 7021.744797 -135.403891 0.283794 235.726207 8 124960 4171640 193.25 7014.727365 -135.462053 0.283261 235.555867 9 124960 4171650 193.84 7007.717175 -135.520331 0.288369 234.695806 9 124960 4171650 193.84 7007.714249 135.578726 0.281455 238.317007 Record: I I I I I Show: All Selected Records (0 out of 1002 | | 2 | 124960 | 4171580 | 192.94 | 7056.939847 | -135.114821 | 0.27905 | 237.492064 | -1 |
| 5 124960 4171610 193.35 7035.801305 -135.287916 0.283227 236.267721 - 6 124960 4171620 193.42 7028.769451 -135.345846 0.284081 235.926826 - 7 124960 4171630 193.35 7021.744797 -135.403891 0.283794 235.726207 - 8 124960 4171640 193.25 7014.727365 -135.462053 0.283261 235.555867 - 9 124960 4171650 193.84 7007.717175 -135.52031 0.283261 235.555867 - 9 124960 4171650 193.84 7007.717175 -135.520331 0.28369 234.695806 - 10 1424960 4171650 193.84 7000.714249 135.578726 0.281455 238.317097 Record: 1 1 1 1 5how: All Selected Records (0 out of 1002 | | 3 | 124960 | 4171590 | 193.05 | 7049.886524 | -135.172404 | 0.280223 | 237.110341 | -* |
| 6 124960 4171620 193.42 7028.769451 -135.345846 0.284081 235.926826 - 7 124960 4171630 193.35 7021.744797 -135.403891 0.283794 235.726207 - 8 124960 4171640 193.25 7014.727365 -135.462053 0.283261 235.555867 - 9 124960 4171650 193.84 7007.717175 -135.520331 0.28369 234.695806 - 9 124960 4171650 193.84 7007.714249 135.578726 0.281455 238.317097 Record: I I III Show: All Selected Records (0 out of 1000) | | 4 | 124960 | 4171600 | 193.21 | 7042.840336 | -135.230102 | 0.281805 | 236.678893 | - |
| 7 124960 4171630 193.35 7021.744797 -135.403891 0.283794 235.726207 - 8 124960 4171640 193.25 7014.727365 -135.462053 0.283261 235.555867 - 9 124960 4171650 193.84 7007.717175 -135.520331 0.288369 234.695806 - 10 14360 192.96 7007.717175 -135.520331 0.288369 234.695806 - 10 14360 192.96 7007.714249 135.578726 0.281455 238.317097 Record: 14 1 1 14 Show: All Selected Records (0 out of 100) | | 5 | 124960 | 4171610 | 193.35 | 7035.801305 | -135.287916 | 0.283227 | 236.267721 | - |
| 8 124960 4171640 193.25 7014.727365 -135.462053 0.283261 235.555867 - 9 124960 4171650 193.84 7007.717175 -135.520331 0.288369 234.695806 - 10 147650 193.84 7007.717175 -135.520331 0.288369 234.695806 - 10 147650 193.84 7007.717175 -135.578726 0.281455 238.317067 Record: 14 1 ▶1 Show: All Selected Records (0 out of 100) | | 6 | 124960 | 4171620 | 193.42 | 7028.769451 | -135.345846 | 0.284081 | 235.926826 | - |
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| 10 10 10 10 135 578726 0.281455 238.317097 1 Record: 1 1 1 1 5how: All Selected Records (0 out of 100) | | 9 | 124960 | 4171650 | 193.84 | 7007.717175 | -135.520331 | 0.288369 | 234.695806 | - |
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| | | 3/00 | 00000 | | \$:::: | 000000000000000000000000000000000000000 | | 00000000 | ***** | 000 |

1.- We can extend a dense grid of points over the territory

2.- And obtain the relative values of each one to every other, including its viewshed and the additional heights

3.- We can also assess the source point's local accesibility

....SO....



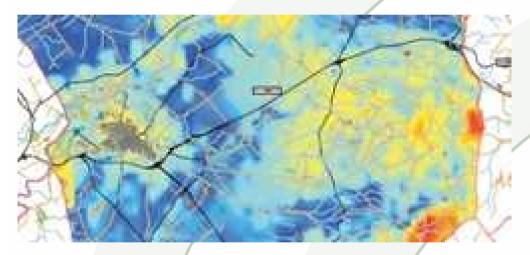
4.- Adding to every visible (or becoming visible if we add a given height) point the source point's local accesibility, weighted by the distance, the visual projection (and evenly by the azimuth, on roads and railroads), and iterating the process through every source point we could obtain the given area's **remote accesibility** map for objects with that height that could be placed over that area.

4.- Adding to every visible (or becoming visible if we add a given height) point the source point's local accesibility, weighted by the distance, the visual projection (and evenly by the azimuth, on roads and railroads), and iterating the process through every source point we could obtain the given area's **remote accesibility** map for objects with that height that could be placed over that area.

The remote accesibility map means how much an hypotetical object affects depending on its situation – isn't it the visual impact?

What do we expect?

The remote accesibility map for a given area and for objects of a given height should look like:



Where red and orange mean places where we can expect a high visual impact and cyan and blue mean places where it will be low.

1.- Where do we place it?



PROSPEC

What do we expect?

We can repeat the procedure for the same area, with another height for the objects, and compare the results, choosing between extensive o intensive systems.

2.- What kind of system?3.- Which system specifically?

Zooming to the desired location and assessing its remote accesibility values, we can place objects accurately, or suggest some rules for placing them.

4.- HOW do we place it?



