

Publication-quality figures with Inkscape

In **Lab 3** we briefly learnt about the different formats available to save the plots we create in *R* and how to modify them in *PowerPoint* and *Adobe Illustrator*. Today we will expand on this topic using the free vector graphics editor *Inkscape*. This software will allow you to tweak your plots with as much detail as *Adobe Illustrator* with the huge advantage of being free and open-source.

Once you are happy with your plot created in *R* you should select the best format in which you want to save your plot. There are two types of formats:

- Raster formats: Rasters are made of small units with called pixels. Rasters are very useful graphics since they are easy to create and reproduce. They are the best option for complex figures like photos or complicated maps. The quality of the image depends on the resolution and magnification. Common raster formats are: *png*, *jpg*, *tiff*, *bmp*, etc.
- Vector formats: Vectors are made of mathematical formulas that represent all the shapes and colors of the image. They are the best option when dealing with simple plots as they keep a perfect quality regardless of the magnification. Common vector formats are: *pdf*, *emf* or *wmf*, *eps*, *svg*, etc.

Section A. Saving your plot in the desired format.

There are many options to save your plot in *R*. The fastest way to save a plot is just by interacting with the interface of *R*. If you are using the base *R* software you save them as vector files with Save as metafile (*.emf*) or Save as postscript (*.eps*). If you use the *RStudio* interface the export window will give you a few more formats to choose from as well as the plot size in pixels. These are fine options for quickly check your plots.

If you want more control on the saving process, it is best to use an *R* command. Again we have several options to save your plot as `savePlot()` or `ggsave()` (this last one specific for *ggplot2* plots). The method I suggest in this lab is a bit more complex but gives you the highest control of the graphic parameters.

First we will create two plots that we will later modify with *Inkscape*, a Constrained Correspondance Analysis and a Multivariate Regression Tree.

- For the CCA plot we will be using the “*AB_Climate_Trees.csv*” dataset from **Lab 7**, then run the following code:

```
library(vegan)
means=read.csv("AB_Climate_Trees.csv")
rownames(means)=means$ECOSYS
trees=means[c(1:5, 8:10, 13:17), 11:23]
climate=means[c(1:5, 8:10, 13:17), 3:10]
```

```

output=cca(trees~MAT+MWMT+MCMT+lnMAP+lnMSP, data=climate)
output
plot(output, choices=c(1,2), scaling=3)

```

- For the MRT we need to use the older version R-2.15.3 to use the *mvpart* package. Then download the dataset "AB_Tree_Plots_Normalized.csv" from **Lab 8** and run the following code:

```

library(mvpart)
dat=read.csv("AB_Tree_Plots_Normalized.csv")
spec=as.matrix(dat[,8:10])
out2=mvpart(spec~MAT+MWMT+MCMT+MAP+MSP, dat, all.leaves=T)

```

- The saving process has three steps: 1) we start a graphic device in the desired format, 2) we run the plot command and 3) we close the graphic device so we don't add more plots to the same figure. In the graphic device we can specify some useful parameters that depend on the file format. We will save both figures as *pdf* and we will specify the size in inches for each plot (unfortunately `pdf()` only accepts inches as units and you might need to use a conversion factor for other units, here we use 2.54 to convert to cm).

```

pdf(file = "CCA.pdf", useDingbats = FALSE, width=15/2.54,
height=15/2.54)
plot(output, choices=c(1,2), scaling=3)
dev.off()

```

`useDingbats=FALSE` fixes a common problem that creates smaller points when saving the plot.

- Same procedure for the MRT:

```

pdf(file = "MRT.pdf", useDingbats = FALSE, width=14/2.54,
height=16/2.54)
mvpart(spec~MAT+MWMT+MCMT+MAP+MSP, dat, all.leaves=T)
dev.off()

```

- This method is also useful for saving raster images since it allows us to specify the resolution of the figure, giving us control over the file size and quality.

```

png(file = "CCA.png", width=15, height=15,units="cm",res=100)
plot(output, choices=c(1,2), scaling=3)
dev.off()



```

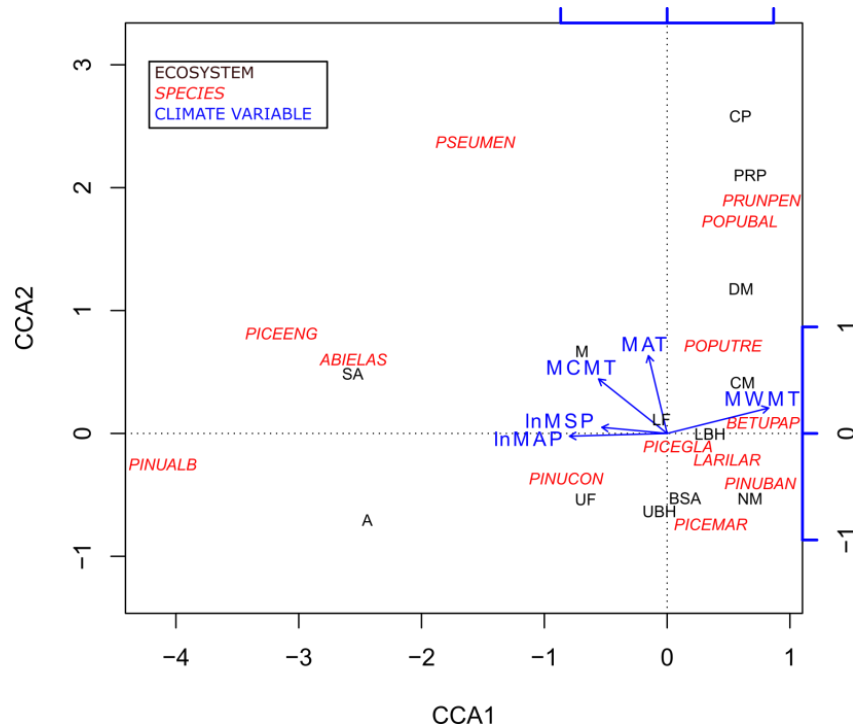
Section B. Making publication-quality figures with Inkscape

During the course we have learnt several methods that rely in a good visual representation to adequately show the results. Unfortunately, the default options in *R* are not always the best to create good figures, and they are difficult to modify. In this section we will learn how to do some touch up to our plots to make them good enough for publications and presentations.

Constrained Correspondence Analysis

- Before we start working with the plot, we will set the document properties so it matches our desired size. Open *Inkscape* and go to *File-Document Properties*. In the window select the units that you want to use and set the size to 15x15 cm. Close the window.
- Now we can import the figure we want to modify. Go to *File-Import*, select the *pdf* file of the CCA plot and click ok to use the default options.
- Next we will center the plot in the document. Go to *Object-Align and Distribute* and a new tool panel should appear in the right. Select page in the “*Relative to*” tab and center on both vertical and horizontal axes.
- Right click on the plot and select *Ungroup*, repeat three times. This will split the figure into the different elements (vectors, axes, labels...).
- Now it’s time to start modifying the figure. First we will reduce the size of the vector labels so they are a bit more proportionate to the rest of the figure. First select one label by clicking on it. Then to automatically select the rest of the vector labels, right click on it and go to *Select same-Fill and stroke*. When they are all selected, right click on any of them and select *Text and font*. On the tool panel on the right you can change the font size to 10.
- Repeat the same steps to select all species labels and turn them into italic font.
- We want to show more clearly the range of the vectors in the right and top axes. Select it (we just have to click on it to select both at the same time since we didn’t ungroup too much) and go to *Object-Fill and stroke*. In the right panel select the *Stroke style* tab and change the width to 0.5 mm.
- Finally we will move the overlapping labels to improve the readability of the plot. To move objects just drag them with the mouse. Here are a few tricks to select and move objects:
 - One click selects the object and allows changing the size, a second click allows to rotate it.
 - To select objects that are overlapped, use Alt+click.
 - If you want to select several objects together, use Shift+click.
 - If you want to move an object only horizontally or vertically, hold the Ctrl key while dragging it.
- Since moving labels around is actually modifying your results, you shouldn’t move objects too far. We would need to move LF ecosystem too out of position to avoid overlapping. Instead what we can do is to bring it to the top of the document to improve its readability. Select it and got to “*Raise selection to top*” in the top bar.


- Now that we are happy with our figure we can add a legend to clarify the different labels. Since we don't want to accidentally modify the figure, it is a good idea to use a different layer for the legend. Click the lock icon in the bottom to forbid any farther changes in this layer and create a new layer by going to *Layer-Add layer*.
- We can add the legend now. Select "Create and edit text objects"  in the left bar and write your whole legend. Now we can modify it using the text bar on top and the colors in the bottom.
- Finally we add a rectangle to the legend by selectin "Create rectangles and squares in the left panel" . Select the "No paint" option under the *Fill* tab of the *Fill and stroke* panel in the right. You might want to change the width of the *Stroke style* to 0.3 mm.
- And you are done! Your new figure should look similar to the figure in the right. Now you can go to *File-Save as...* to save it in a wide variety of file formats or convert it to raster by going to *File-Export PNG image*, where you will be able to choose the size and resolution of your image.



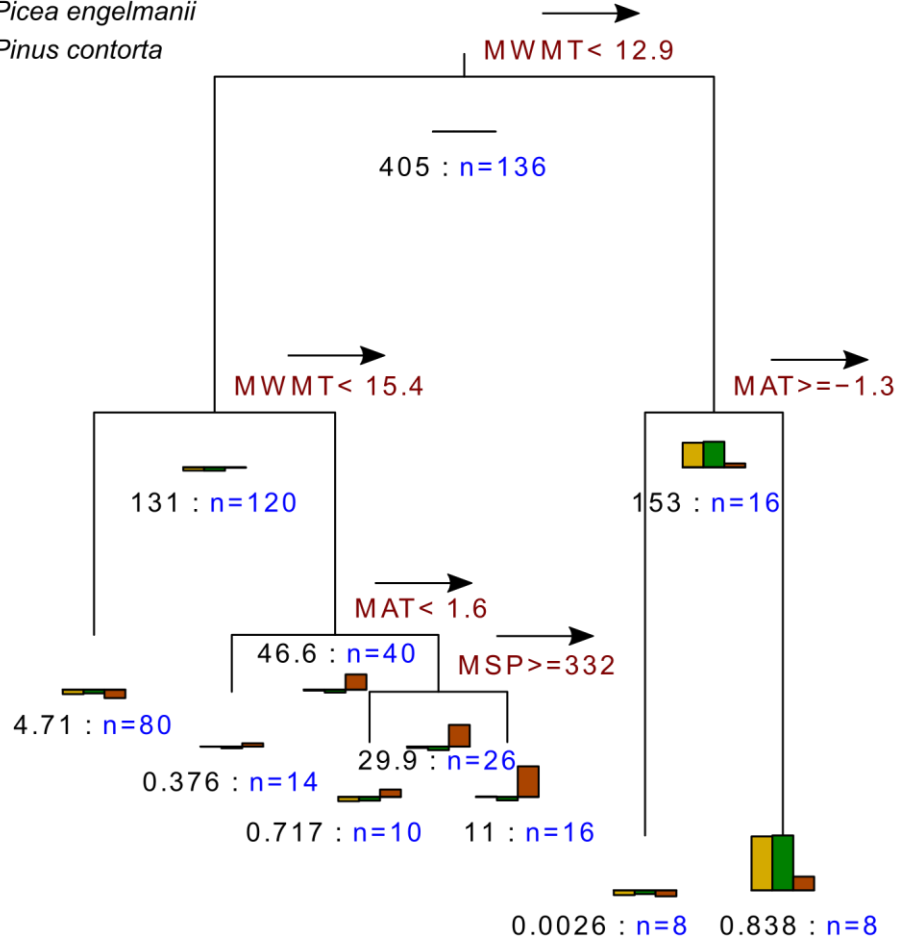
Multivariate Regression Tree

If you have time and energy, try to reproduce the image at the end of the text by modifying the MRT plot that you created at the beginning of the lab (check the online version to see the colors).

Here are a couple of tips that might be helpful:

- To create an arrow draw a straight line with "Draw Bezier curves and straight lines"  in the left bar (Use Ctrl to make it horizontal). Then, in *Fill and stroke-Stroke style-End Markers* select arrow.
- To paste multiple times the same object, you can drag it and press space in any point you want to "leave a stamp".

- *Abies lasiocarpa*
- *Picea engelmannii*
- *Pinus contorta*



Error : 0.0437 CV Error : 0.0966 SE : 0.0325