

Computer programming to solve environmental problems

CdeC 2022 - La Paz

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Gabriela Espino

Goals of the club

To have fun!!

Learn about ecology, invasive species, and environmental justice

Get hands-on experience with some of the best technology for ecology

Ask any questions!

Final presentations to show off what you learned

The final project

Show off your learning on Saturday :)

- Presentation, movie, performance, you can be creative!
- Every club gets 10 minutes for presentation as well as a poster, all materials finished Friday @ 4pm

Day 1

Morning

- Getting to know each other
- Intro to ecology and invasive species (discussion)

Afternoon

- Introduction to computer programming
(discussion)
- Our first computer programming activities (lab)

What is ecology?



Ecology

The study of organisms and environment

This means living (**biotic**) and non-living (**abiotic**)

Let's talk about some examples of these

So, the **environment** is everything that surrounds an organism

What does a plant/animal need to survive?

What does a plant/animal need to survive?

Food

Water

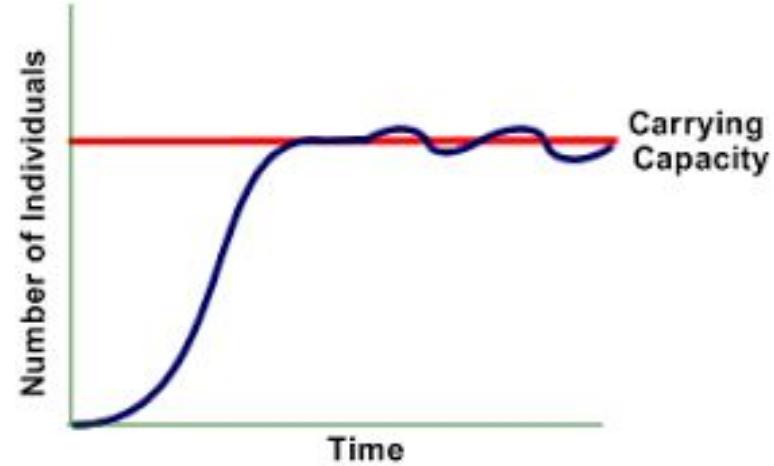
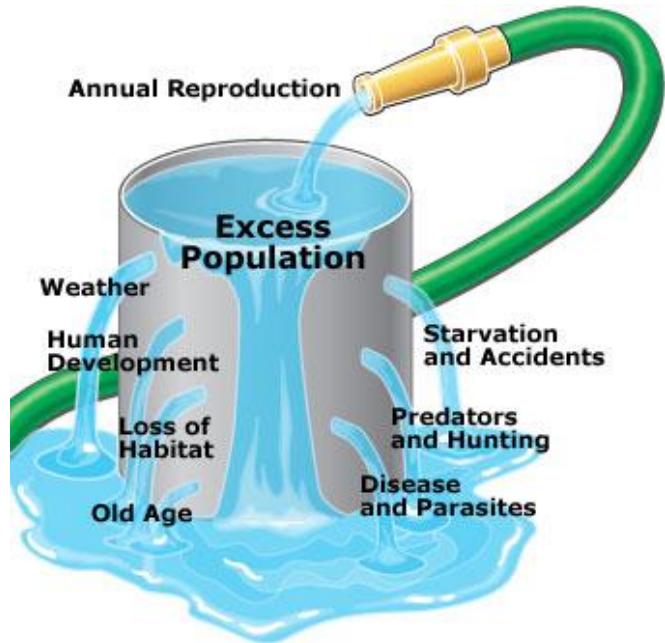
Shelter

Sunlight

But--if any of these are limited, we get competition for resources!



Carrying capacity



Which leads us to ... invasive species

What are invasive species



Invasive species video

https://www.youtube.com/watch?v=spTWwqVP_2s

What are some ways that invasive species move around?

Let's come up with some ideas



Mecanismos de dispersión



Corrientes



Casco de los barcos



Boyas



Agua de lastre



Cultivos



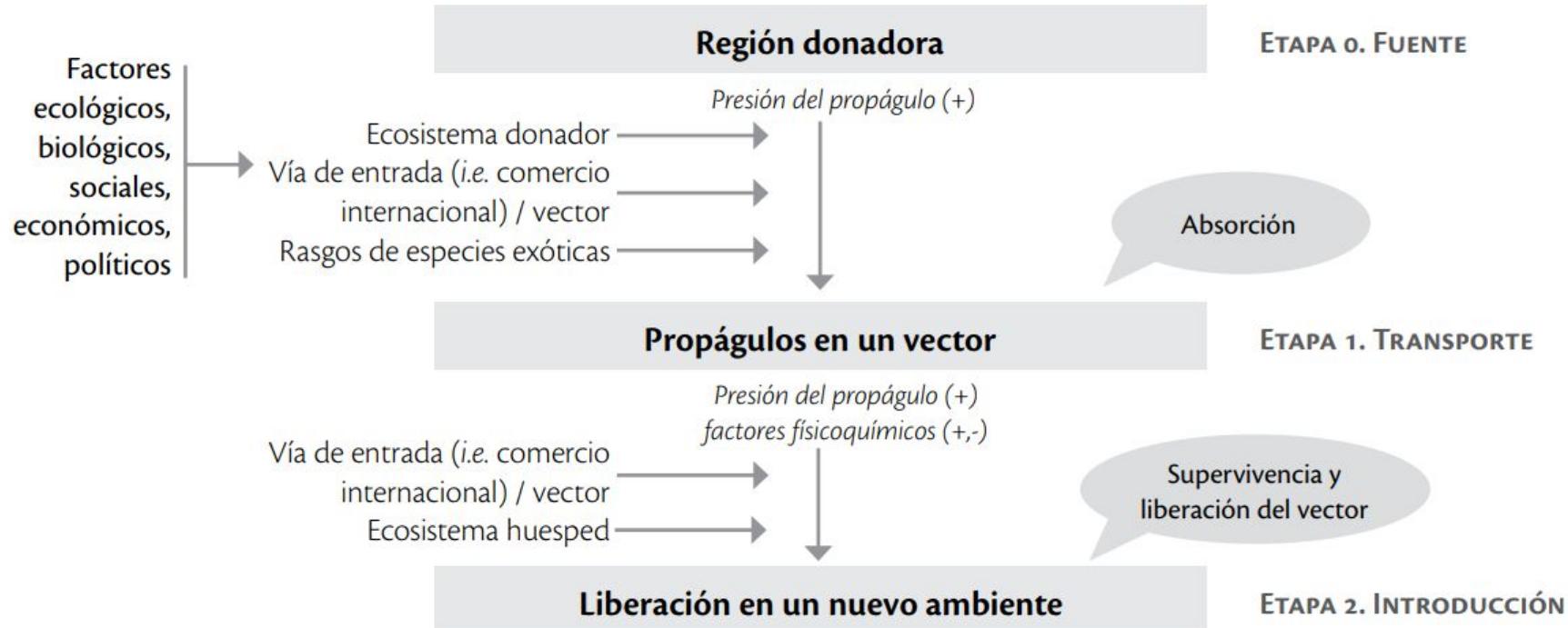
Adherirse a organismos

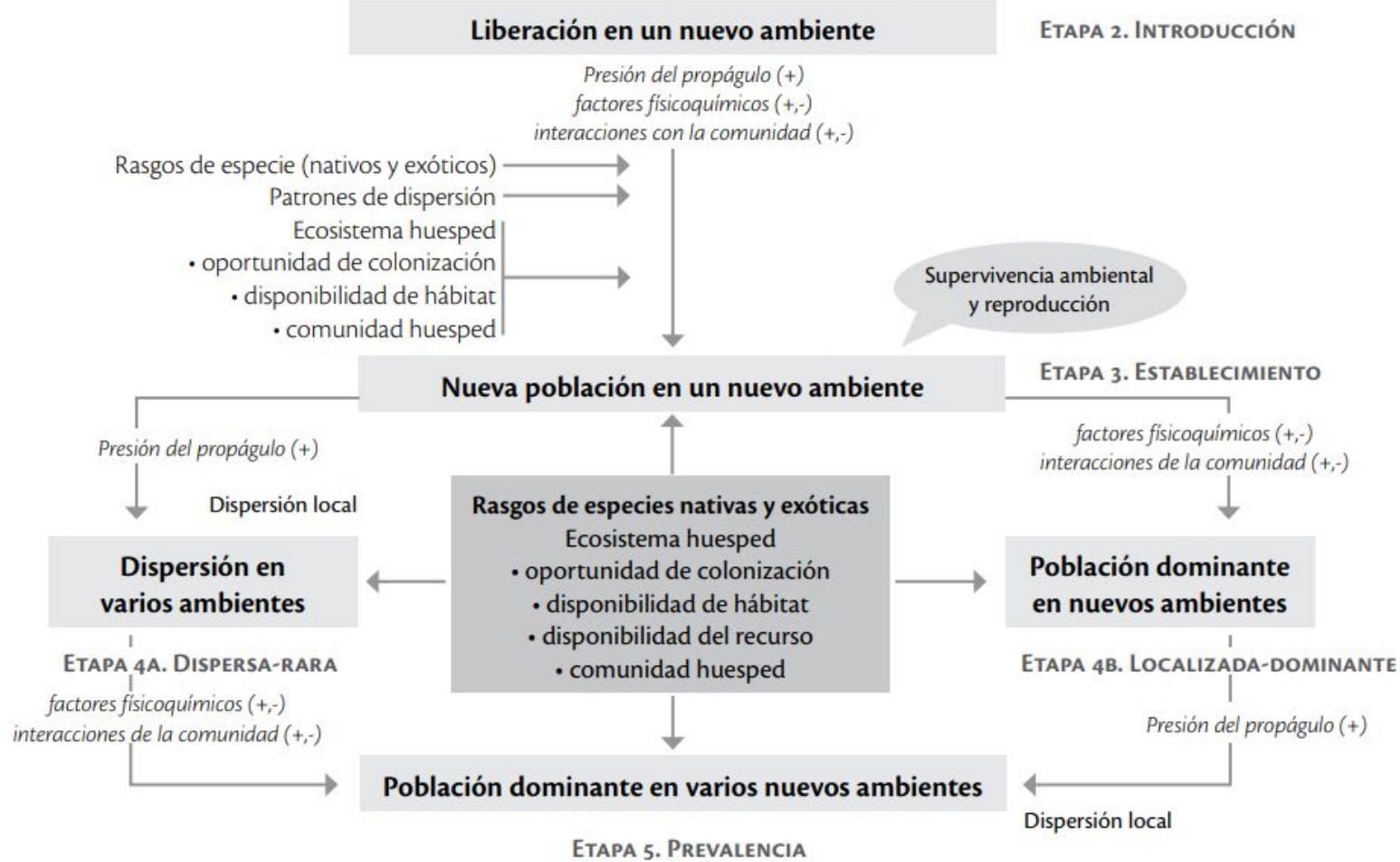


© Eduardo Iata

What are some ways that species become invasive?

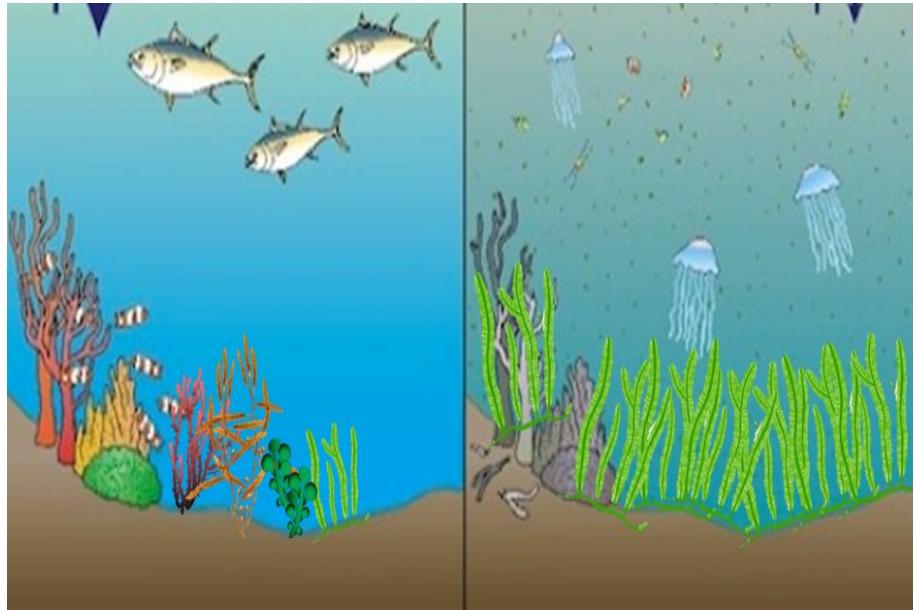






Impactos ecológicos

- Pérdida y degradación de la biodiversidad
- Cambio en la estructura y composición de las comunidades
- Alteración en las redes tróficas
- Reducción de la diversidad genética
- Transmisión de enfermedades que afectan a la salud humana, flora y fauna marina



Impactos económicos

- Afectando el crecimiento de especies importantes
- Impidiendo la actividad humana



Pterois antennata

Impactos del función ecosistema



Chapparal in US



Tropical dry forest in GDL



Invasive species
(scotch broom) in GDL





What are some consequences?



Invasive species in Mexico

One way to measure where fires will happen is to see where fire-causing species exist.



Invasive species
scotch broom

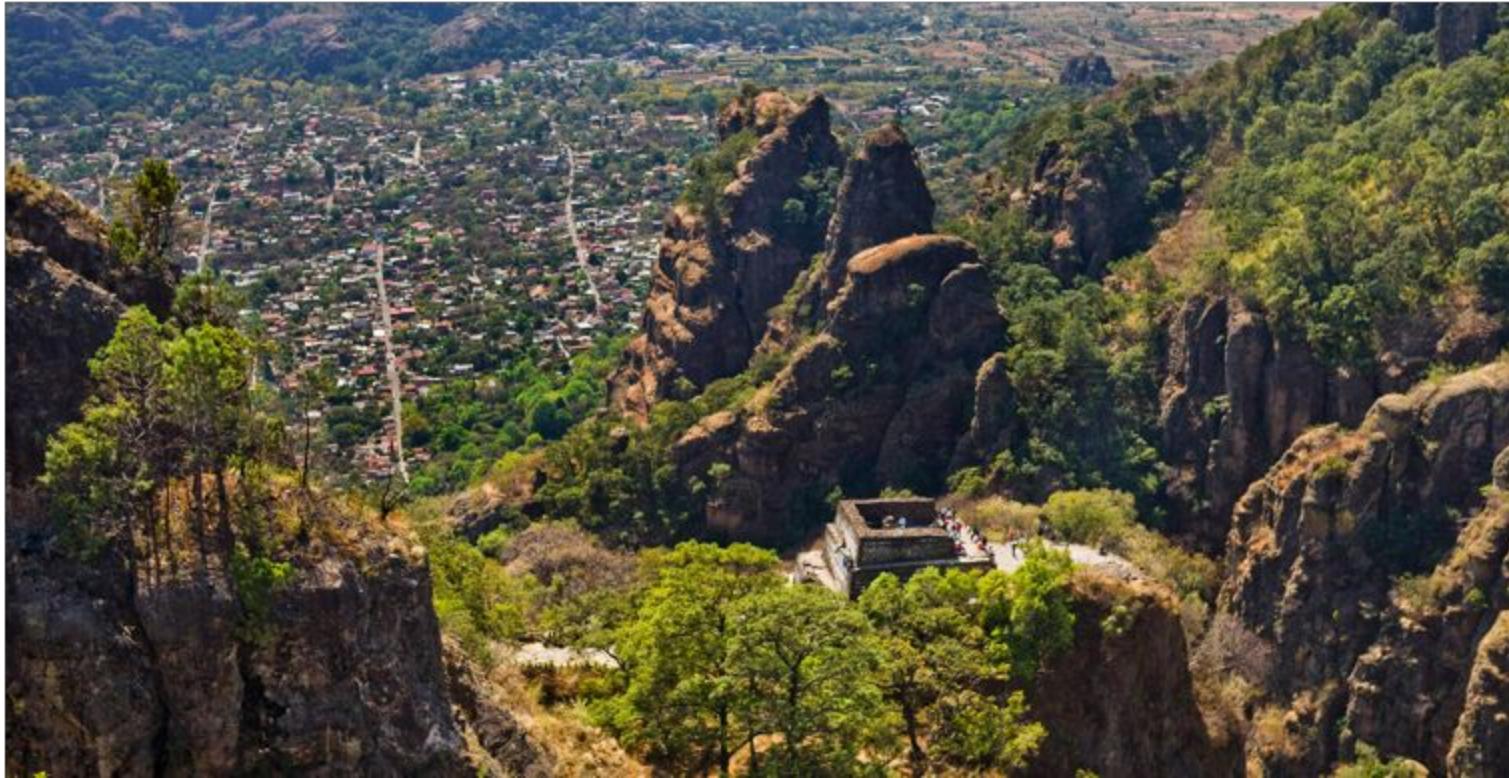


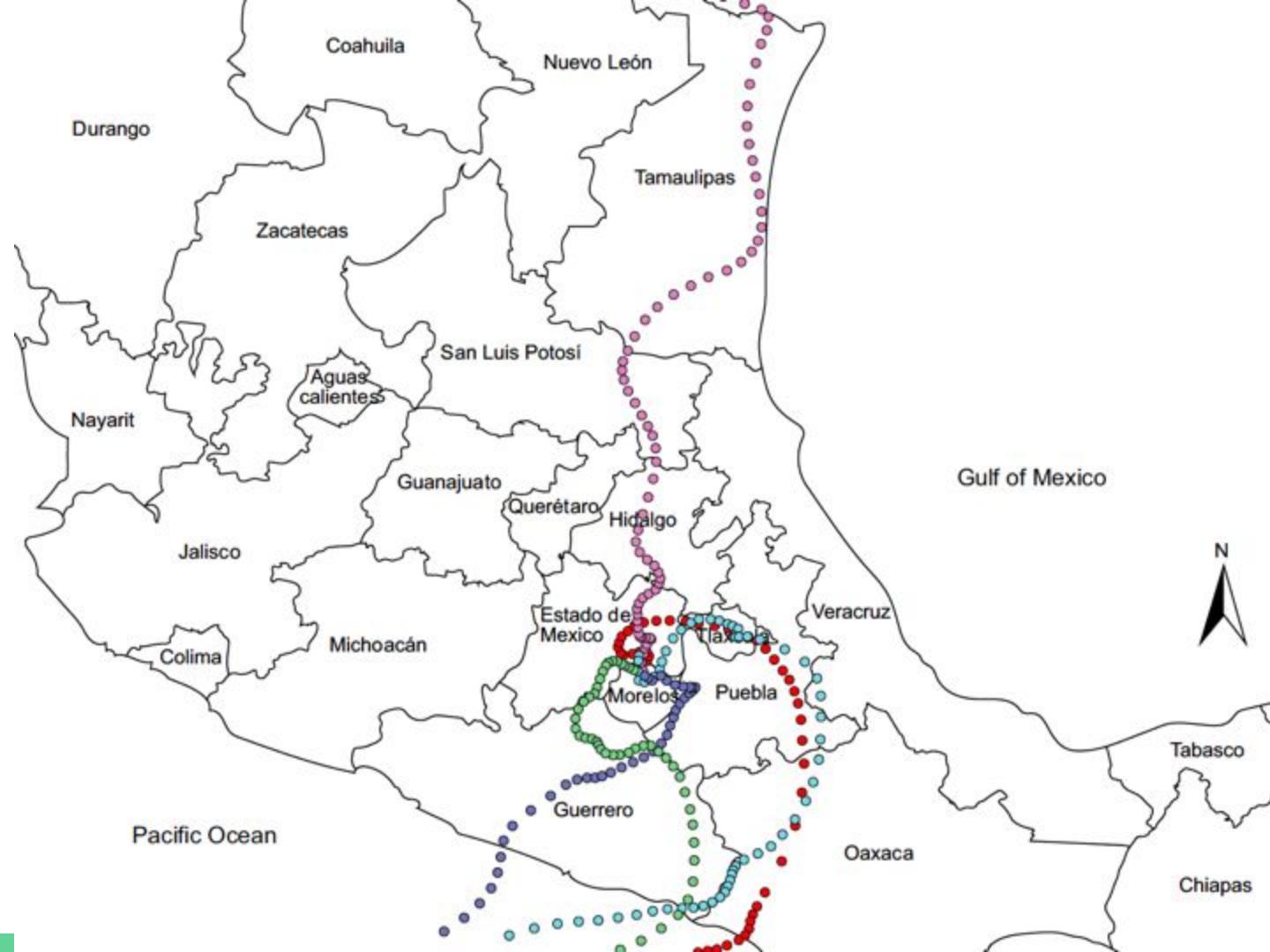
Prof. Luis Zavala

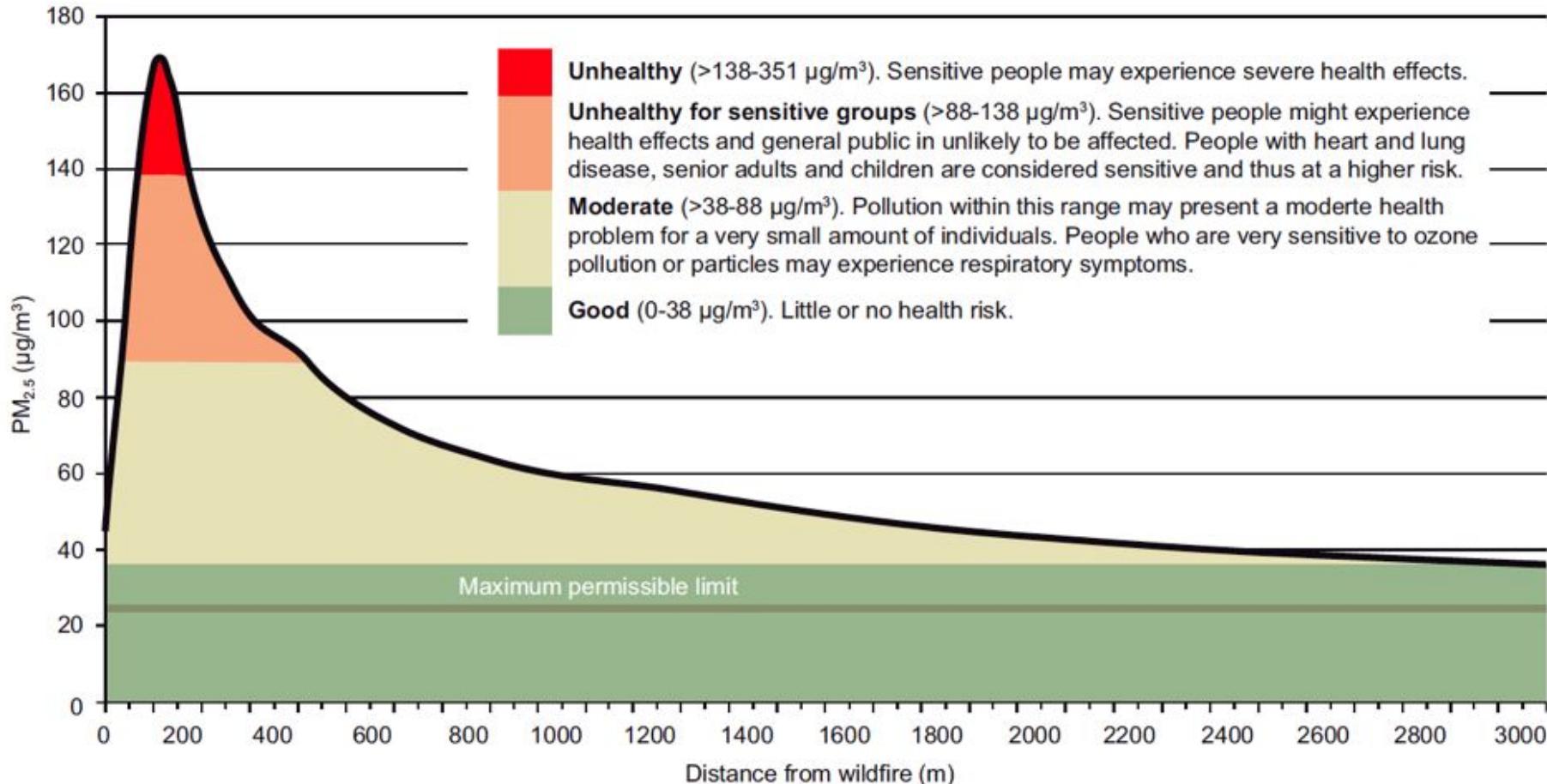


Dr. Cruz-Núñez

Tepozlan wildfire 2016



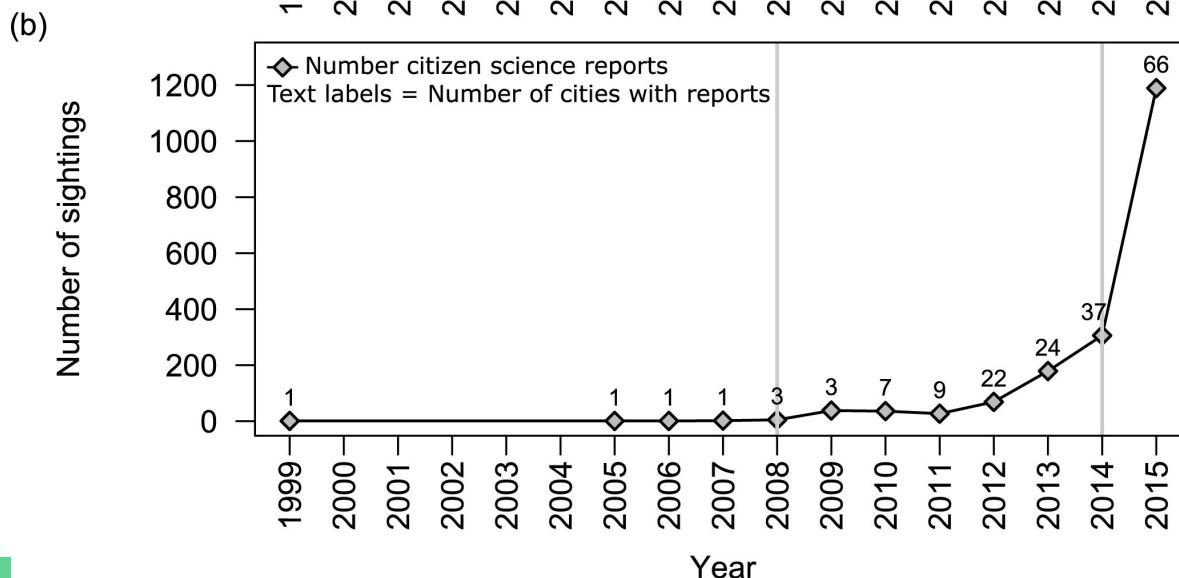
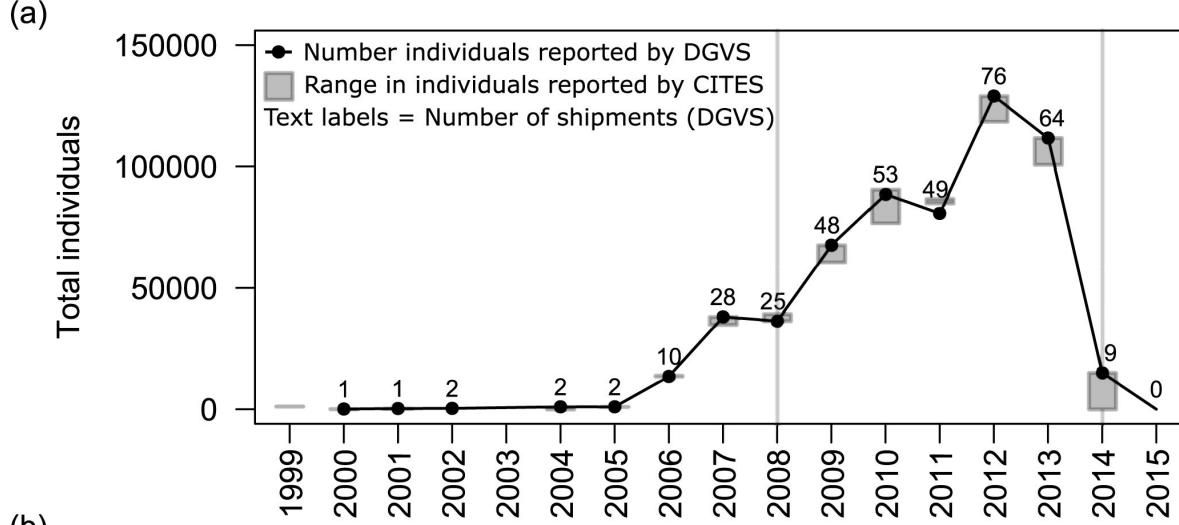


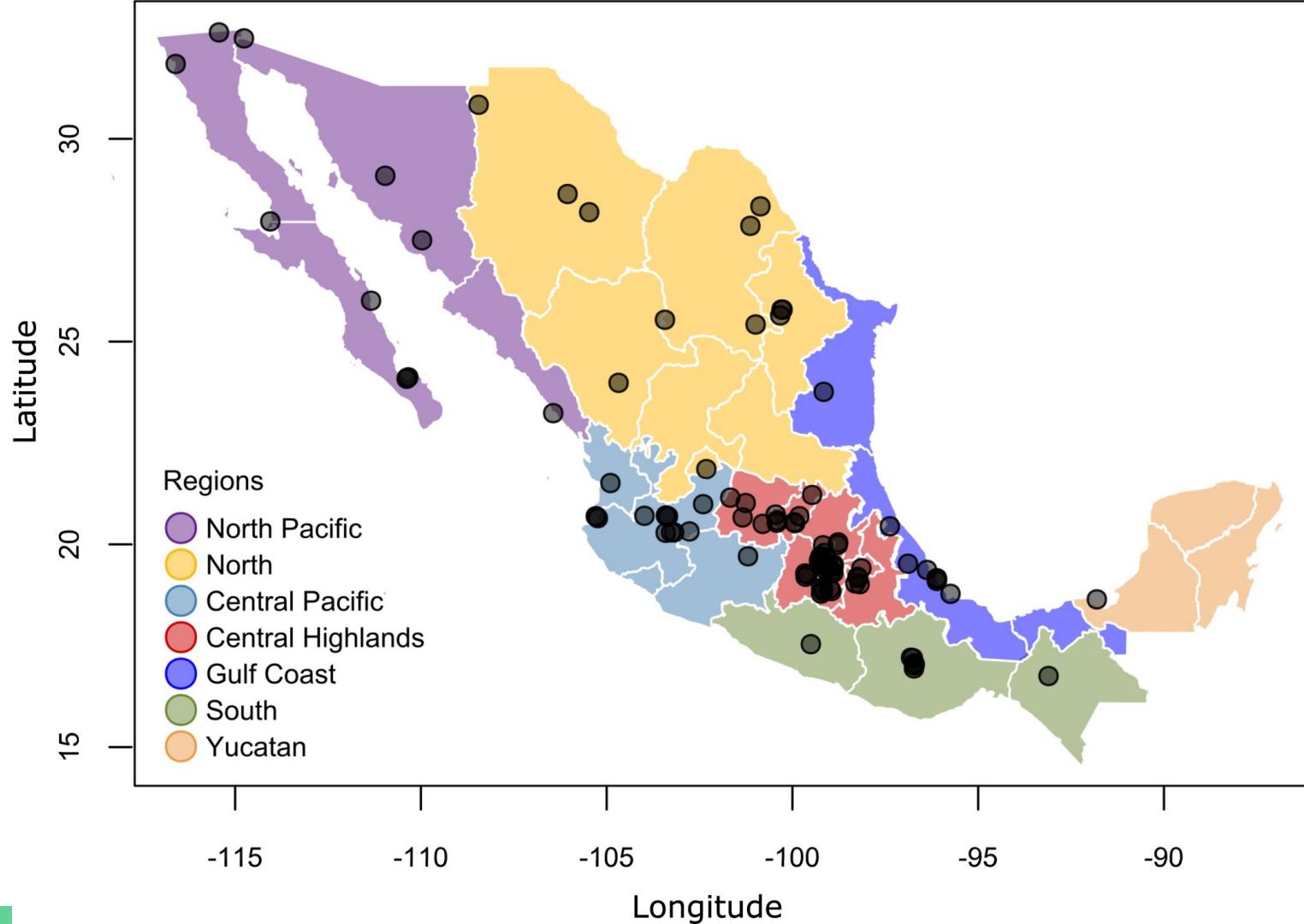


Monk Parakeets

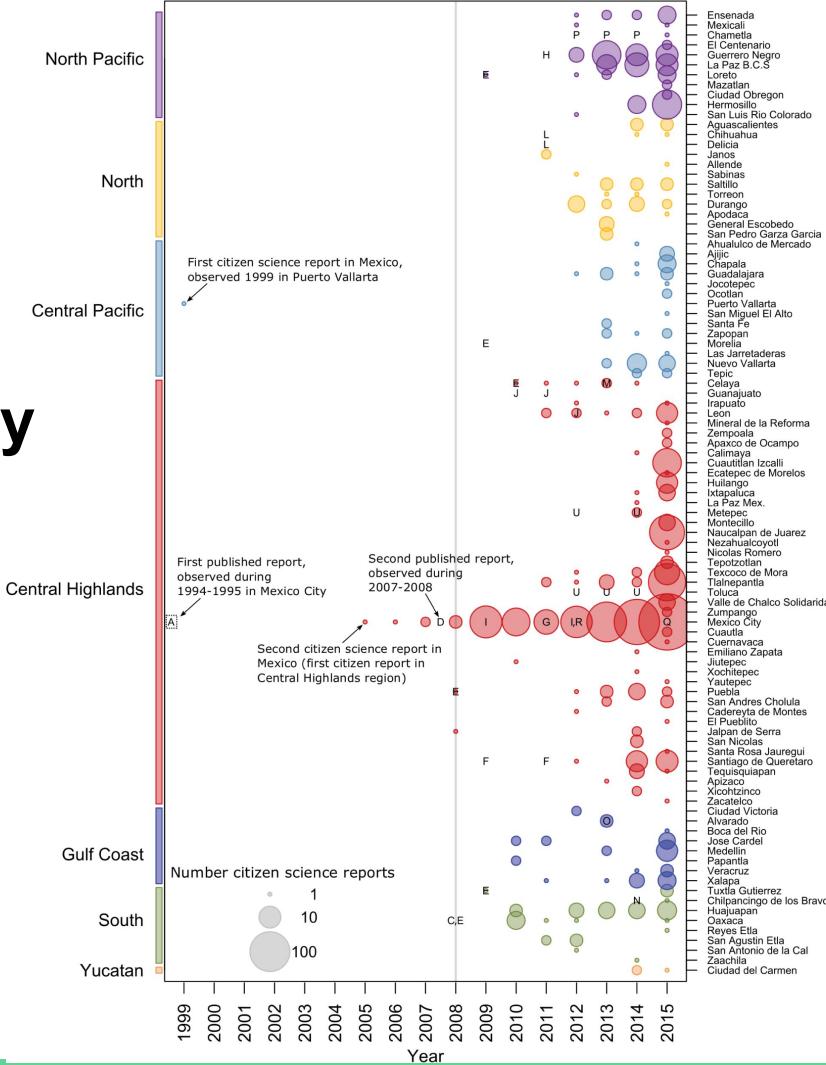


(Hobson et al. 2017)

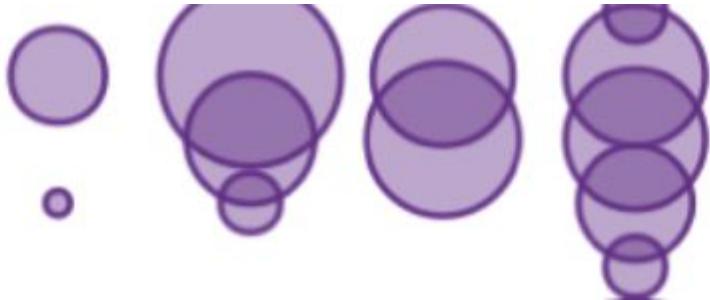




First seen in Mexico City in 1999



H



El Centenario
Guerrero Negro
La Paz B.C.S
Loreto
Mazatlan

First seen in La Paz in **2012!** And now
100+ reports each year!

What other IS?



American bullfrog



House gecko



lionfish



Common eastern bumble bee



Eucalyptus globulus

What to do about invasive species

Make sure they don't get here in the first place (PREVENTION)

Control

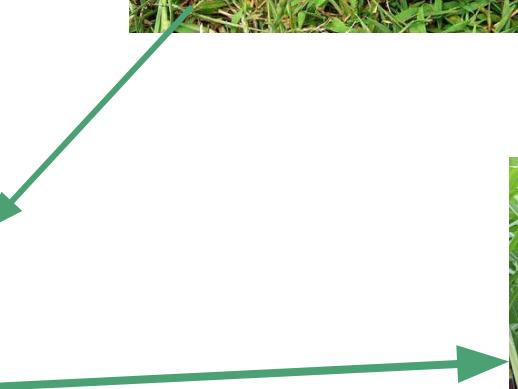
Biological control

Cane Toad
(Australia)



Bio Control

Pest





Cane Toad



Bio Control

Now a MAJOR
invasive species

Pest



Rosy wolf snail (Hawaii)



Bio control



Invasive species

Rosy wolf snail



Invasive species



Bio control to
invasive



Native
Snails
:(

Estrategia Nacional para especies invasoras en México: Prevención, control y erradicación

- 1. Revisar, adecuar y desarrollar el marco legal y normativo** →
 - 1. Prevenir, detectar y reducir el riesgo de introducción, establecimiento y dispersión de especies invasoras.**
- 2. Desarrollar capacidades científicas, técnicas, humanas e institucionales**
- 3. Establecer la coordinación entre poderes, intergubernamental, interinstitucional y con la sociedad** →
 - 2. Establecer programas de control y erradicación de poblaciones de especies invasoras que minimicen o eliminen sus impactos negativos y favorezcan la restauración y conservación de los ecosistemas.**
- 4. Impulsar la divulgación, la educación y la concientización de la sociedad en general** →
 - 3. Informar oportuna y eficazmente a la sociedad para que asuma responsablemente las acciones a su alcance en la prevención, control y erradicación de las especies invasoras.**
- 5. Generar conocimiento para la toma de decisiones informadas**

Acciones para prevenir sus impactos



Antes de adquirir a una mascota investiga su origen.



Evita transportar tierra a otros lugares, evitaras dispersar insectos, semillas o enfermedades.

con tu familia y amigos.



Si ves algún organismo que no conoces, regístraloo en Naturalista (www.naturalista.mx).

How can we help this week?

We'll do our own research and show areas with the biggest invasive species risks.



¡Conoce la asombrosa biodiversidad de México y cómo protegerla! (www.biodiversidad.gob.mx).



What are some invasive species in Mexico

Spend some time research what invasive species are present in Mexico or in BCS.

How did they arrive?

What are their ecological or economic impacts?

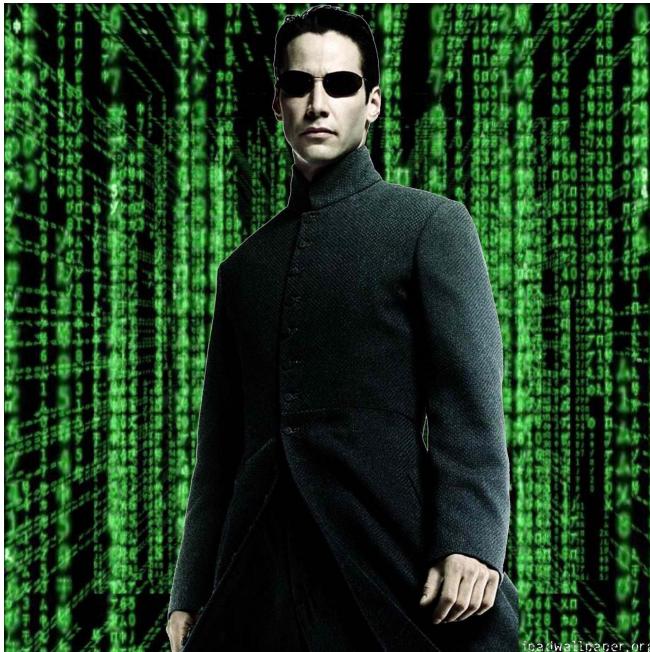
Introduction to computer programming

CdeC 2022 - La Paz

Programming languages

They tell computers what to do!

Medicine, movies, games,
websites, robots, self driving cars,
maps and statistics!



Why do we program in biology and ecology

Process lots of data -- Fast!

Share the code / software you write (yay open science!)

Want to re-do or repeat something? Easy

Programming languages

So many options!



Why R?

R is 100% free!

As a result, such a big community of users → a google search solves most issues

Compared to other programming languages, R is growing

Makes data analysis transparent.

What else?

For people who work with data (ecology, biology, psychology, business)

Instead of building software programs or websites, people who use R **analyze data**

We'll be learning some tool for analyzing data

R is kind of like the belt, and there are many different tools that are attached. The tools are called **packages**.



If you can think of it, there is a package for it!



Want to analyze
marine biology data?

Want to analyze every tweet
ever made by Steph Curry?

Want to predict
where species will
move with climate
change?



Programming takes time, and can be frustrating!

But it is so useful and we'll make it fun!

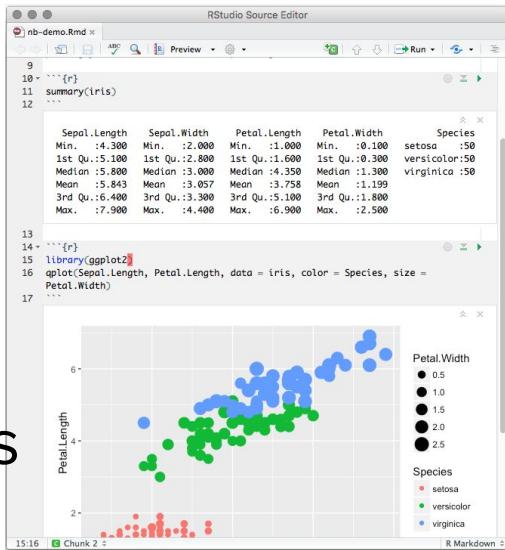
How will we work with R? 3 ways to program in R



Called “Base R”



Called “R Studio”



Within R Studio you
have an R Notebooks

Try opening Base R

What do you see?

Kind of like big text editor, so most people use R Studio

deer_ABUND_subgroup_forest_plot.R x Untitled1 x

Go to file/function Addins

deer_ma

```
1 ---  
2 title: "R Notebook"  
3 output: html_notebook  
4 ---  
5  
6 This is an [R Markdown](http://rmarkdown.rstudio.com) Notebook. When you execute code within the notebook, the results appear beneath the code.  
7  
8 Try executing this chunk by clicking the *Run* button within the chunk or by placing your cursor inside it and pressing *Cmd+Shift+Enter*.  
9  
10 ````{r}  
11 plot(cars)  
12 ````  
13  
14 Add a new chunk by clicking the *Insert Chunk* button on the toolbar or by pressing *Cmd+Option+I*.  
15  
16 When you save the notebook, an HTML file containing the code and output will be saved alongside it (click the *Preview* button or press *Cmd+Shift+K* to preview the HTML file).  
17  
18 The preview shows you a rendered HTML copy of the contents of the editor. Consequently, unlike *Knit*, *Preview* does not run any R code chunks. Instead, the output of the chunk when it was last run in the editor is displayed.  
19  
20
```

4:1 R Notebook R Markdown

Console

Environment History Connections Git

Diff Commit Pull Push master

Staged Status Path

- .gitignore
- Rplot.jpeg
- deer_ABUND_random_effects.R
- deer_RICH_random_effects.R
- deer_ma.Rproj
- nesting_location_ordered.csv

Files Plots Packages Help Viewer

deer_ABUND_subgroup_forest_plot.R Untitled1

1 ---
2 title: "R Notebook"
3 output: html_notebook
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6 This is an [R Markdown](http://rmarkdown.rstudio.com) Notebook. When you execute code within the notebook, the results appear beneath the code.
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4:1 R Notebook R Markdown

Console

deer_ma - master - RStudio

deer_ma

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4:1 R Notebook R Markdown

Console

deer_ma

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- nesting_location_ordered.csv

Files Plots Packages Help Viewer

Zoom Export

~/Desktop/side_projects/Crystal-Ornelas_et_al_deer_meta/scripts/deer_ma - RStudio deer_ma

deer_ABUND_subgroup_forest_plot.R Untitled1

Insert Run Addins

```
1 ---  
2 title: "R Notebook"  
3 output: html_notebook  
4 ---  
5  
6 This is an [R Markdown](http://rmarkdown.rstudio.com) Notebook. When you execute code within the notebook, the results appear beneath the code.  
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9  
10 ````{r}  
11 plot(cars)  
12 ````  
13  
4:1 R Notebook R Markdown
```

Console Terminal

~/Desktop/side_projects/Crystal-Ornelas_et_al_deer_meta/scripts/deer_ma

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"  
Copyright (C) 2018 The R Foundation for Statistical Computing  
Platform: x86_64-apple-darwin15.6.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.  
You are welcome to redistribute it under certain conditions.  
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.  
Type 'contributors()' for more information and  
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or  
'help.start()' for an HTML browser interface to help.
```

Environment History Connections Git

Diff Commit Pull Push master

Staged Status Path

- .gitignore
- Rplot.jpeg
- deer_ABUND_random_effects.R
- deer_RICH_random_effects.R
- deer_ma.Rproj
- nesting_location_ordered.csv

Files Plots Packages Help Viewer

Zoom Export

Run you first bit
of code in your R
notebook



You got this!!

Run your first bit of code in your R notebook

The screenshot shows an R Markdown notebook titled "Untitled1" in RStudio. The code editor contains the following content:

```
1 ---  
2 title: "R Notebook"  
3 output: html_notebook  
4 ---  
5 |  
6 This is an [R Markdown](http://rmarkdown.rstudio.com) Notebook. When you execute code within the notebook, the results appear beneath the code.  
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19 |  
20 |
```

The RStudio interface includes a toolbar with icons for file operations, a preview window, and a status bar at the bottom.

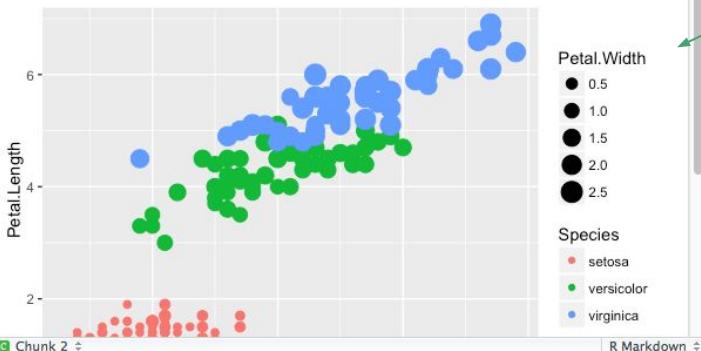
What can we do with R Notebooks

RStudio Source Editor

```
nb-demo.Rmd x
9
10 ````{r}
11 summary(iris)
12 ````

Sepal.Length Sepal.Width Petal.Length Petal.Width Species
Min. :4.300 Min. :2.000 Min. :1.000 Min. :0.100 setosa :50
1st Qu.:5.100 1st Qu.:2.800 1st Qu.:1.600 1st Qu.:0.300 versicolor:50
Median :5.800 Median :3.000 Median :4.350 Median :1.300 virginica :50
Mean :5.843 Mean :3.057 Mean :4.358 Mean :1.500
3rd Qu.:6.400 3rd Qu.:3.300 3rd Qu.:5.100 3rd Qu.:1.800
Max. :7.900 Max. :4.400 Max. :6.900 Max. :2.500

13 ````{r}
14 library(ggplot2)
15 ggplot(Sepal.Length, Petal.Length, data = iris, color = Species, size =
16 Petal.Width)
17 ````


```

1. Write computer code
2. See output and results
3. Write more code
4. See figures/plots/map
5. Output to webpage, pdf, or send to friend

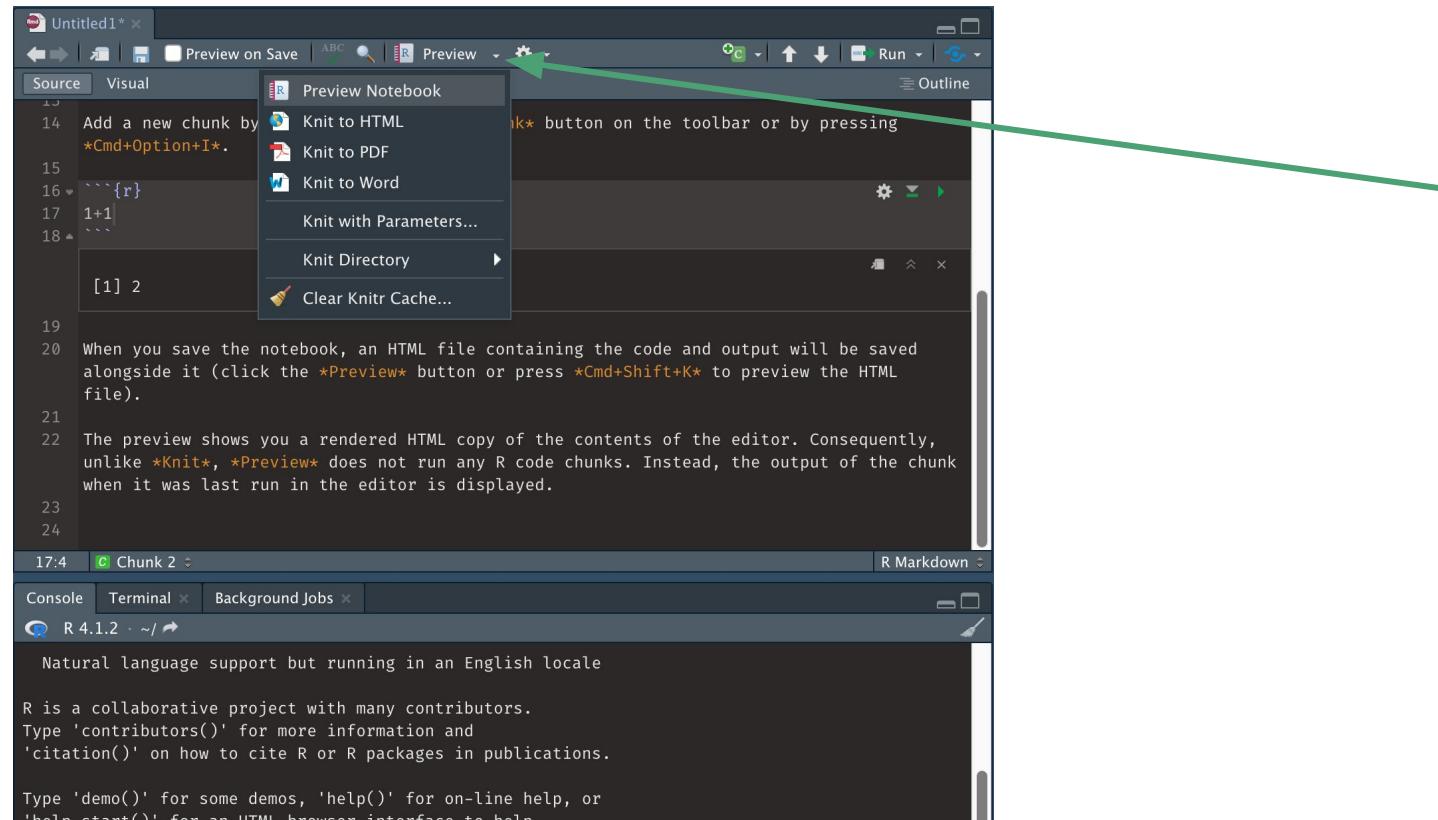
Writing some R code

1. Create a new code chunk
2. Write $1 + 1$
3. Hit the play button or “command + return”
4. See what happens, then check out the R console



Always write your code in your R Notebook

Now preview it as a PDF or website



R Packages

These are like all the different tools people have made

R comes with some tools like `mean()` or `max()`

R Packages

Try typing in `max(1,5,43,10)`

What happens?

Try function `min()`

R Packages

To install packages you need to use:

```
install.packages("yarrr")
```

To use packages you need to run:

```
library("yarrr")
```

R Packages



`install.package()` just once, but `library()` every time you want to use it!

Now let's open up first_R_programming.rmd

This file is in a folder on your desktop

Double click this, and R studio will open

https://github.com/robcrystalornelas/CdeC_2022

Downloading R

Base R: <https://www.r-project.org/>

R Studio: <https://www.rstudio.com/>

Want to see cool R graphs?

<https://plot.ly/r/>

More R practice using SWIRL!

{swirl}

Learn R, in R.

<https://www.youtube.com/watch?v=o0la0QqdyPA>

If you want to keep practicing R after this course,
knowing how to use swirl will be helpful!

Start up your R studio session

To use swirl, we need to be in the *console, not notebook*

```
install.packages("swirl")
```

```
library(swirl)
```

```
swirl()
```

<https://swirlstats.com/>

Console

Terminal 

~ / 

Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.

Type 'q()' to quit R.

> library(swirl)

| Hi! Type swirl() when you are ready to begin.

> swirl()

| Welcome to swirl! Please sign in. If you've been here before, use the same name as you did then. If you
| are new, call yourself something unique.

What shall I call you? |

In the console, swirl will ask for your name

| Welcome to swirl! Please sign in. If you've been here before, use the same name as you did
| new, call yourself something unique.

What shall I call you? Rob

| Thanks, Rob. Let's cover a couple of quick housekeeping items before we begin our first lesson.
| all, you should know that when you see '...', that means you should press Enter when you are
| and ready to continue.

... <-- That's your cue to press Enter to continue |

| Also, when you see 'ANSWER:', the R prompt (>), or when you are asked to select from a list, that means
| it's your turn to enter a response, then press Enter to continue.

Select 1, 2, or 3 and press Enter

1: Continue.

2: Proceed.

3: Let's get going!

Selection: 1

Press ANY NUMBER (1, 2, or 3) and then ENTER

In swirl...

You can hit escape to go back

Or type the code `bye()` to leave the session and
save where you're at.

Install a swirl course

```
| To begin, you must install a course. I can install a course for you from the internet, or  
| a web page (https://github.com/swirldev/swirl\_courses) which will provide course options  
| installing courses yourself. (If you are not connected to the internet, type 0 to exit.)
```

- 1: R Programming: The basics of programming in R
- 2: Regression Models: The basics of regression modeling in R
- 3: Statistical Inference: The basics of statistical inference in R
- 4: Exploratory Data Analysis: The basics of exploring data in R
- 5: Don't install anything for me. I'll do it myself.

Selection: 1

Let's install program 1, so type 1 and press ENTER

Start with lesson 1 and you can go through 1 or two lessons

```
|=====
```

| In its simplest form, R can be used as an interactive calculator. Type $5 + 7$ and press Enter

```
> |
```

Want more swirl courses?

https://github.com/swirldev/swirl_courses#swirl-courses

They have beginner, intermediate, and advanced!

```
library(swirl)
```

```
install_course("Course Name Here")
```

```
swirl()
```

More resources for learning R

Presentation in Spanish - Programacion con R

<https://www.rstudio.com/resources/webinars/programacion-con-r/>

R ladies mexico: <https://rladiesmx.netlify.app/>

Beginner in R resources:

<https://education.rstudio.com/learn/beginner/>

Reflection / Day 2 Preview

Reflection Question:

Do you consider that in the zone you live is there a good control of invasive species?

What species do you consider are invasive in the zone you live?

GitHub

- Sharing our computer code with th



Day 2

Morning Plan

- Meet new instructors
- What are species distribution models



Afternoon Plan

- More R coding practice
- Making species distribution models in R

¿Problemas hídricos en México?

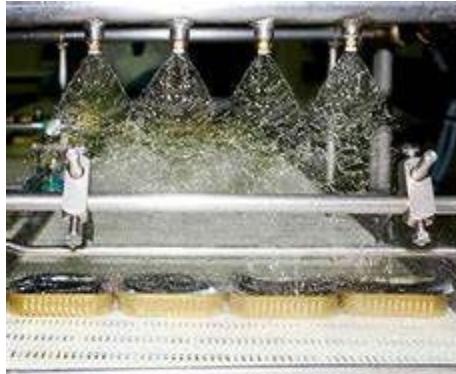
<https://www.facebook.com/watch/?v=805412736560525>



Causas de los problemas de contaminación de agua



¿Agua residual?



¿Quién lo regula?

SEMARNAT

SECRETARÍA DE MEDIO AMBIENTE
Y RECURSOS NATURALES



CONAGUA
Comisión Nacional del Agua

NOM-001-SEMARNAT-2021

Límites de contaminantes en descargas de aguas residuales

Que establece los límites permisibles de contaminantes en las descargas de aguas residuales en cuerpos receptores propiedad de la nación.

TABLA 3
Descargas municipales

Rango de población	Frecuencia de muestreo y análisis	Frecuencia de Informe de resultados de muestreo y análisis
Mayor de 50 000 habitantes	MENSUAL	TRIMESTRAL
de 10 001 a 50 000 habitantes	TRIMESTRAL	TRIMESTRAL
de 2 501 a 10 000 habitantes	SEMESTRAL	TRIMESTRAL

TABLA 4
Descargas no municipales**

Demanda Química de Oxígeno (toneladas/día)	Carbono Orgánico Total* (toneladas/día)	Sólidos Suspensidos Totales (toneladas/día)	Frecuencia de muestreo y análisis	Frecuencia de Informe de resultados de muestreo y análisis
Mayor a 3,0	Mayor a 0,75	Mayor a 3,0	MENSUAL	TRIMESTRAL
De 1,2 a 3,0	De 0,3 a 0,75	De 1,2 a 3,0	TRIMESTRAL	TRIMESTRAL
Menor a 1,2	Menor a 0,3	Menor a 1,2	SEMESTRAL	TRIMESTRAL

NORMA OFICIAL MEXICANA NOM-002-SEMARNAT-1996, QUE ESTABLECE LOS LIMITES MÁXIMOS PERMISIBLES DE CONTAMINANTES EN LAS DESCARGAS DE AGUAS RESIDUALES A LOS SISTEMAS DE ALCANTARILLADO URBANO O MUNICIPAL



TABLA 1

LIMITES MÁXIMOS PERMISIBLES			
PARÁMETROS (miligramos por litro, excepto cuando se especifique otra)	Promedio Mensual	Promedio Diario	Instantáneo
Grasas y aceites	50	75	100
Sólidos sedimentables (mililitros por litro)	5	7.5	10
Arsénico total	0.5	0.75	1
Cadmio total	0.5	0.75	1
Cianuro total	1	1.5	2
Cobre total	10	15	20
Cromo hexavalente	0.5	0.75	1
Mercurio total	0.01	0.015	0.02
Níquel total	4	6	8
Plomo total	1	1.5	2
Zinc total	6	9	12

FRECUENCIA DE MUESTREO

HORAS POR DÍA QUE OPERA EL PROCESO GENERADOR DE LA DESCARGA	NUMERO DE MUESTRAS SIMPLES	INTERVALO MÁXIMO ENTRE TOMA DE MUESTRAS SIMPLES (HORAS)	
		MÍNIMO	MÁXIMO
Menor que 4	Mínimo 2	-	-
De 4 a 8	4	1	2
Mayor que 8 y hasta 12	4	2	3
Mayor que 12 y hasta 18	6	2	3
Mayor que 18 y hasta 24	6	3	4

FECHA DE CUMPLIMIENTO A PARTIR DE:	RANGO DE POBLACIÓN
1 de enero de 1999	mayor de 50,000 habitantes
1 de enero de 2004	de 20,001 a 50,000 habitantes
1 de enero de 2009	de 2,501 a 20,000 habitantes

NORMA OFICIAL MEXICANA NOM-003-SEMARNAT-1997 QUE ESTABLECE LOS LÍMITES MÁXIMOS PERMISIBLES DE CONTAMINANTES PARA LAS AGUAS RESIDUALES TRATADAS QUE SE REUSEN EN SERVICIOS AL PÚBLICO



LÍMITES MÁXIMOS PERMISIBLES DE CONTAMINANTES

TIPO DE REUSO	PROMEDIO MENSUAL				
	Coliformes Fecales NMP/100 ml	Huevos de Helminto (h/l)	Grasas y Aceites mg/l	DBOs mg/l	SST mg/l
SERVICIOS AL PÚBLICO CON CONTACTO DIRECTO	240	≤ 1	15	20	20
SERVICIOS AL PÚBLICO CON CONTACTO INDIRECTO U OCASIONAL	1,000	≤ 5	15	30	30

Introduction to GitHub



GitHub

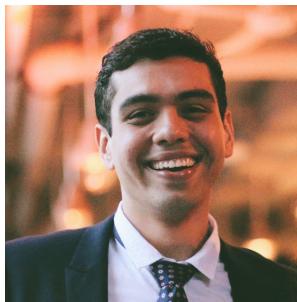
Special thanks to my GitHub collaborators



Rob Crystal-Ornelas
@rob_c_ornelas



Emma Hudgins
@emmajhudgins



Pedro Henrique P. Braga
@pedrohp_braga



Luna Sánchez Reyes
@LunaSare



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Brandon Edwards
brandonedwards.ca



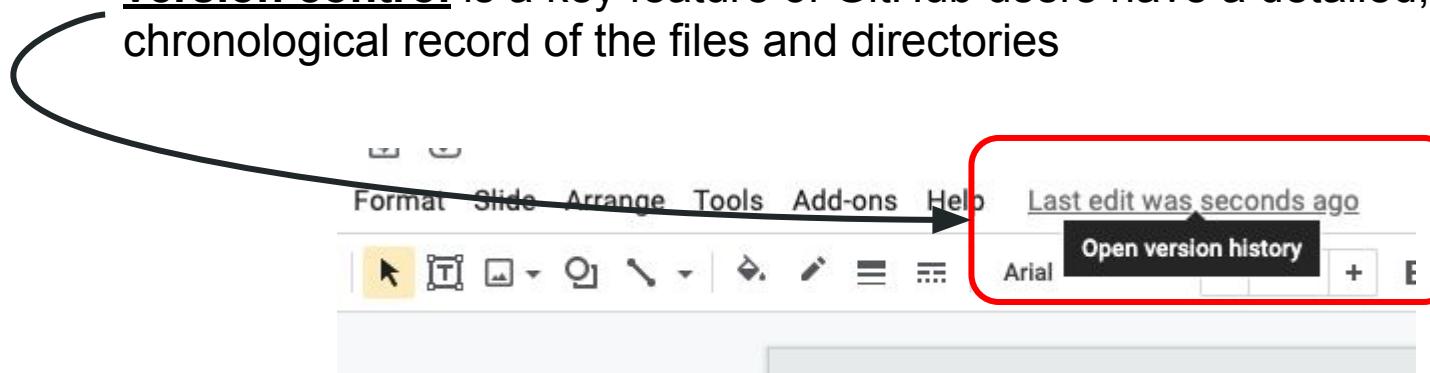
Ciera Martinez
@cierareports



What is GitHub

GitHub is an **online** service that can help anyone ***track, organize, discuss, share, and collaborate on software***

version control is a key feature of GitHub users have a detailed, chronological record of the files and directories

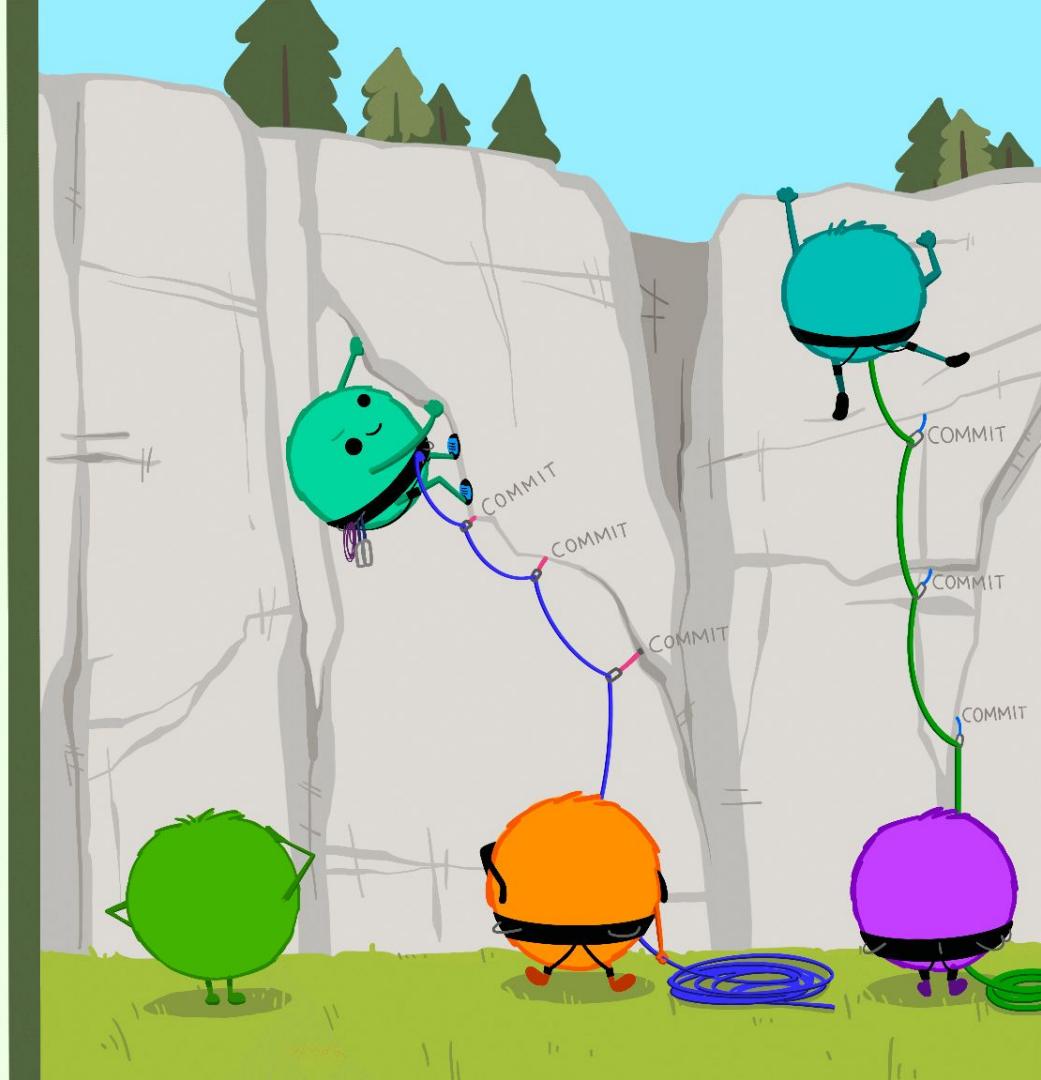


“

Using a Git commit is like using anchors and other protection when climbing...**if you make a mistake, you can't fall past the previous commit.**

Commits are also helpful to others, because **they show your journey, not just the destination.**

— HADLEY WICKHAM & JENNY BRYAN



A history of GitHub in one slide

- First launched in April 2008
- Git (a version control system) + GitHub (a website) = collaboration on **computer code**
- As of 2021, over 75 million registered users

Especially within the science research community, GitHub has so many uses beyond collaborating on computer code

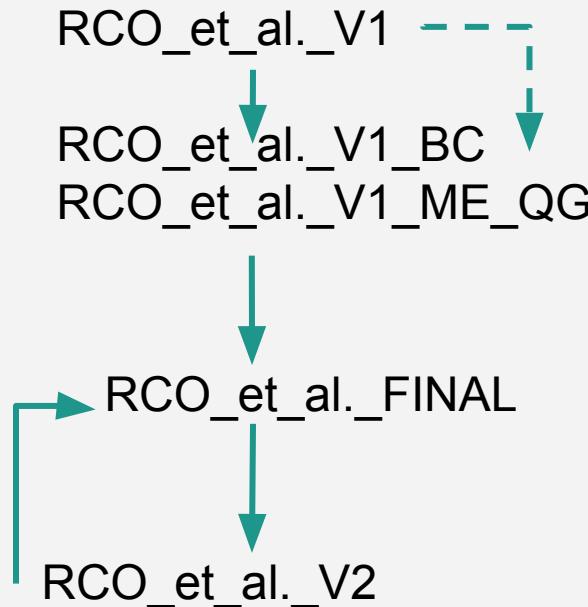
<https://github.com/>



GitHub's
'octocat'

GitHub is a place where **scientists** can collaborate on many things (docs, websites, etc.)

The ‘edit, save, attach’ method is inefficient



Version control

“Like track changes [...] but more rigorous, powerful, and **scaled up to multiple files**.”
(Bryan, 2018)

The GitHub user interface

The screenshot shows the GitHub user interface for the "ESS-DIVE Community Space" repository. At the top, there is a logo of a stylized blue and yellow shape, followed by the repository name "ESS-DIVE Community Space" and a brief description: "A workspace for code, tools, reporting formats and other products related to ESS-DIVE". Below this, there are links to the location ("Berkeley, CA USA"), website ("http://ess-dive.lbl.gov"), Twitter handle ("@ESSDIVE"), and email ("ess-dive-s"). The main navigation bar includes "Overview", "Repositories 15" (which is highlighted with a red box), "Packages", "People 5", and "Teams".

Below the navigation bar, the "Pinned" section displays two repositories:

- essdive-community-space-guide** (Public)
A guide to starting or contributing to ESS-DIVE community repositories
1 R, 2 F
- essdive-community-workshop-2021** (Public)
This is a repository that hosts content for ESS-DIVE's 2021 Community Data Workshop
1 F

At the bottom of the page, there is a sidebar for "ESS-DIVE" with a "Repositories" section, a search bar ("Find a repository..."), a type dropdown ("Type ▾"), and a repository card for "essdive-sample-id-metadata" (Public). This last repository is also highlighted with a red box.

READY TO USE. A reporting format for assigning sample identifiers and metadata to characterize collection details, and linkages to other samples and data.

GitHub **repositories** are the main ways we organize content on GitHub. Think of these as “folders” where you can keep and collaborate on your documents and code.

Ready to start working with GitHub ?

1. Create your *free* github account: <https://github.com/>

2. Become familiar with a few GitHub basics

A. [Quick intro to github terms and features.](#)

3. Set up your own **GitHub profile**.

A. [instructions from GitHub](#)

1. Create a repository with the same name as your user name
2. Make sure the repository is public
3. In that new repository, add a README.md file and create repo.
4. Introduce yourself (using markdown language)!



Rob Crystal-Ornelas
robcrystalornelas

PhD in Ecology & Evolution / Postdoc at
Lawrence Berkeley National Lab

Overview

Repositories 36

Projects

Packages

Stars 24

robcrystalornelas / README.md

Hi 🤙

I'm Rob Crystal-Ornelas. I work as a data science postdoc at Lawrence Berkeley National Lab (LBNL). At LBNL, I work for a data repository and help to build scientific consensus and community (meta)data standardization.

I recently published an [Open Access](#) paper about using GitHub to develop data standards in the journal *Earth & Space Science*.

- 💻 I'm currently working on community data standards and meta-analysis of diverse data types.
- 🌿 I'm learning how to write a collaborative paper with 17 co-authors entirely on GitHub (see below).
- ⚡ I root for the Golden State Warriors 🏀
- 😄 Pronouns: he/him/his

Where to find me



GITHUB



TWITTER



LINKEDIN



RESEARCHGATE

1. Create a repository with the same name as your user name



Screenshot of a GitHub repository page for a user named "meta-analysis_of_ecological_data".

The top navigation bar shows tabs: Overview, Repositories 17 (highlighted with a red border), Projects, Packages, Stars 18.

A search bar contains the placeholder "Find a repository...".

The repository card displays the following information:

- meta-analysis_of_ecological_data** (Public)
- Description: This is a repository for draft versions of a book called Meta-Analysis of Ecological Data in R (MaEDR).
- Tags: meta-analysis, ecology, systematic-review, meta-analyses, environmental-science
- Metrics: TeX, 4 stars, 2 forks, Creative Commons Attribution 4.0 International license, Updated on Oct 28.

A green "New" button is located in the top right corner of the header area, with a red box highlighting it.

1. Create a repository with the same name as your user name
2. Make the repository public

Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository](#).

Owner *

 robcrystalornelas

Repository name *

robcrystalornelas is available.



You found a secret! **robcrystalornelas/robcrystalornelas** is a      special   repository that you can use to add a README.md to your GitHub profile. Make sure it's public and initialize it with a README to get started.

Description (optional)



Public

Anyone on the internet can see this repository. You choose who can commit.

3. Add a README.md file and publish your repo

Initialize this repository with:

Skip this step if you're importing an existing repository.

Add a README file

This is where you can write a long description for your project. [Learn more.](#)

Add .gitignore

Choose which files not to track from a list of templates. [Learn more.](#)

Choose a license

A license tells others what they can and can't do with your code. [Learn more.](#)

This will set `main` as the default branch. Change the default name in your [settings](#).

Create repository

4. Open the README.md file, and introduce yourself!

The image shows a GitHub repository interface. On the left, there's a summary bar with 'main' (branch), '1 branch', '0 tags', 'Go to file', 'Add file', and a green 'Code' button. Below it is a commit history for 'robcrystalornelas Initial commit' with one commit. A green arrow points from the 'Code' button to the right side, where the 'README.md' file is shown in an editor.

Code Editor View:

```
1  ### Hi there 🤙
2
3  <!--
4  **robcrystalornelas/robcrystalornelas** is a
5  GitHub profile.
6
7  Here are some ideas to get you started:
8  - 🚗 I'm currently working on ...
9  - 🌱 I'm currently learning ...
10 - 🛠 I'm looking to collaborate on ...
11 - 🤔 I'm looking for help with ...
12 - 💬 Ask me about ...
13 - 📩 How to reach me: ...
14 - 😊 Pronouns: ...
15 - ↴ Fun fact: ...
16 -->
17
```

More ways to learn about GitHub

Illustrated series about GitHub:

<https://www.openscapes.org/blog/2022/05/27/github-illustrated-series/>

GitHub's Skills page: <https://skills.github.com/>

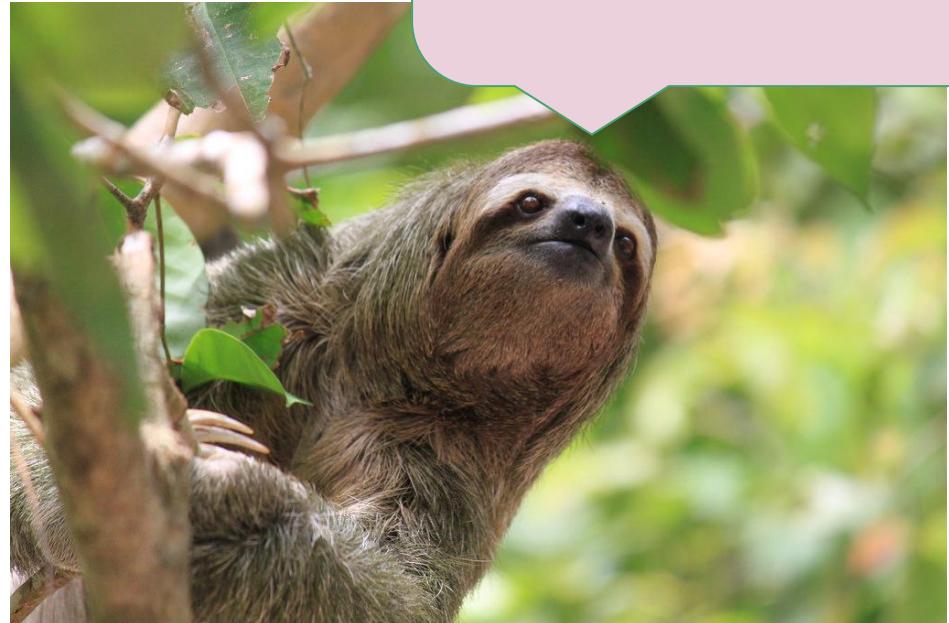
Free book about GitHub and R: <https://happygitwithr.com/>

See list of 10 resources from a scientific paper Rob wrote:

<https://sortee-github-hackathon.github.io/manuscript/v/latest/index.html#tips>

Making your first Species Distribution Model

Wooooohooo!



Niches

“ conditions, resources and interactions a species needs”

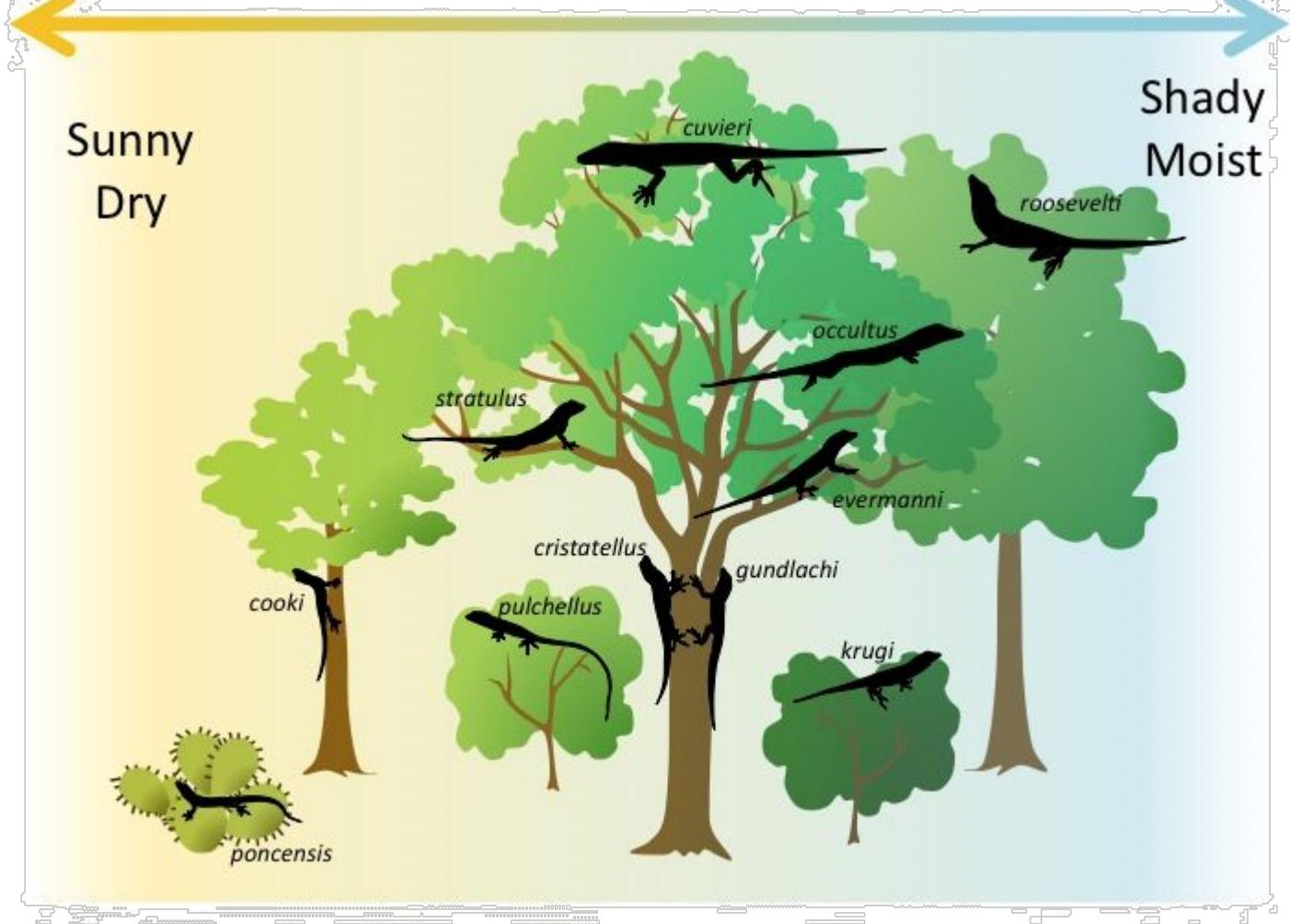
BUT two species CAN'T have the exact same requirements.

Famous experiment alert!

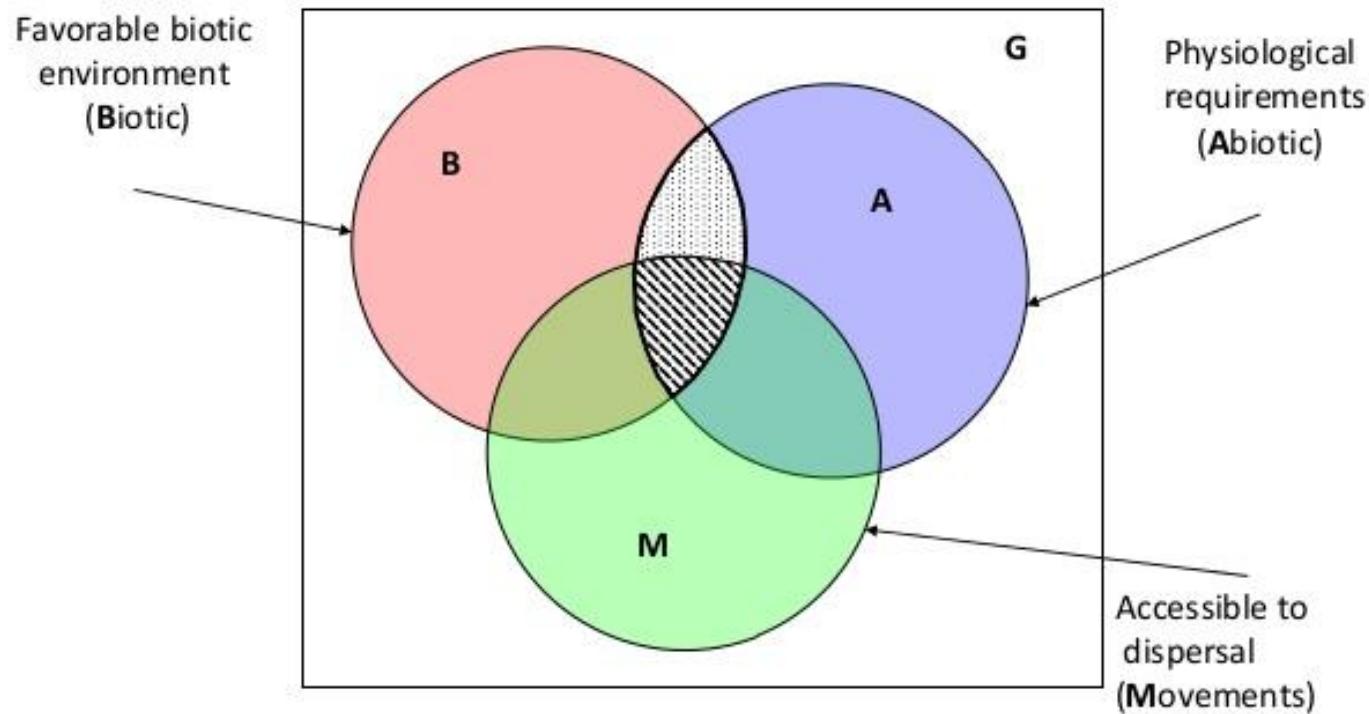


Anole lizards in Puerto Rico avoid population crashes (competitive exclusion) by **niche partitioning**

11 different species can all live in the same forest



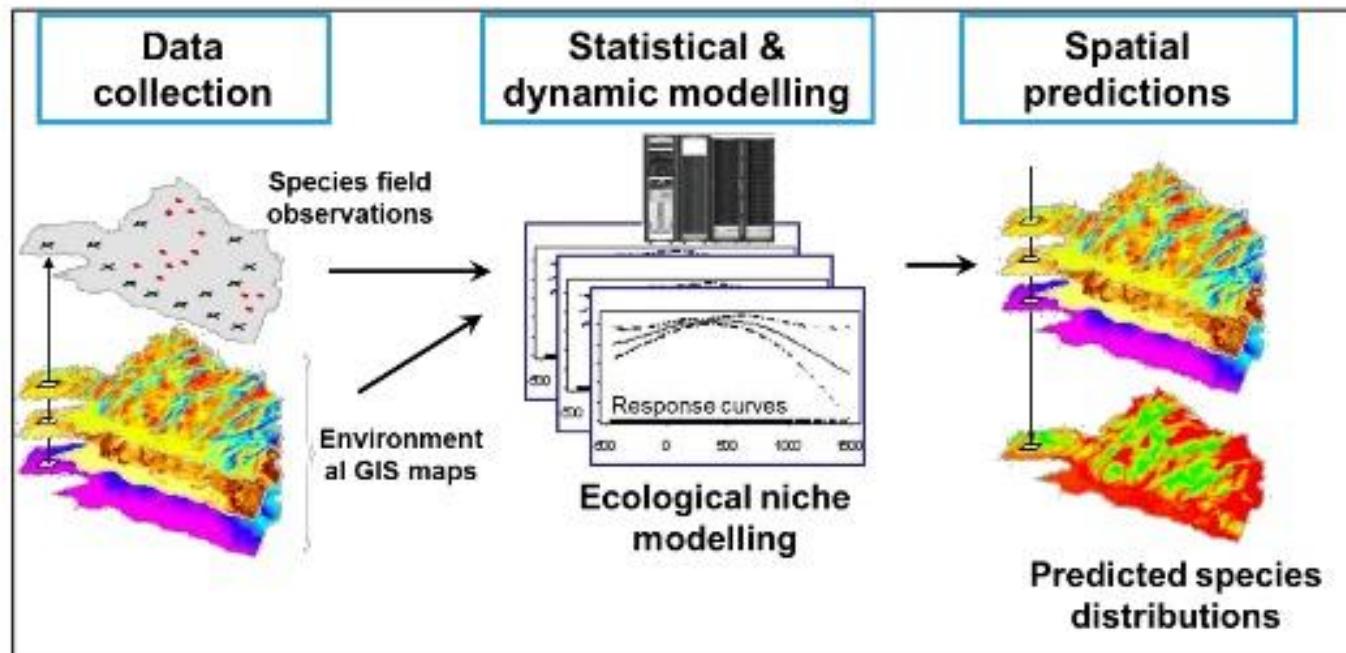
So, where can species exist?



How to we figure this out??

We make **niche models** or **species distribution models** (they are the same)

What are Species Distribution Models



Steps for your first SDM

You can find the code on GitHub of course :)

Go to our Clubes repository:

https://github.com/robcrytalornelas/CdeC_2022

The screenshot shows a GitHub repository page for 'robcrytalornelas' with the following details:

- Branch: main
- Branches: 1 branch
- Tags: 0 tags
- Clone options:
 - HTTPS: https://github.com/robcrytalornelas/CdeC_2022
 - SSH
 - GitHub CLI
- File list:
 - .gitignore: first commit of CdeC script
 - 1_first_R_programming.Rmd: first commit of CdeC script
 - 2_SDM tutorial.Rmd: first commit of CdeC script
 - 3_making_your_own_SDM.Rmd: first commit of CdeC script
 - 4_GIS_activity.Rmd: first commit of CdeC script
 - 5_Mexico Air Quality.Rmd: first commit of CdeC script
- Actions:
 - Open with GitHub Desktop
 - Download ZIP (button highlighted with a red box)

Then, find the file and open in Rstudio

Tutorial: “2. SDM tutorial_updated.Rmd”

Bradypus variegatus, the brown-throated
three-toed sloth :)



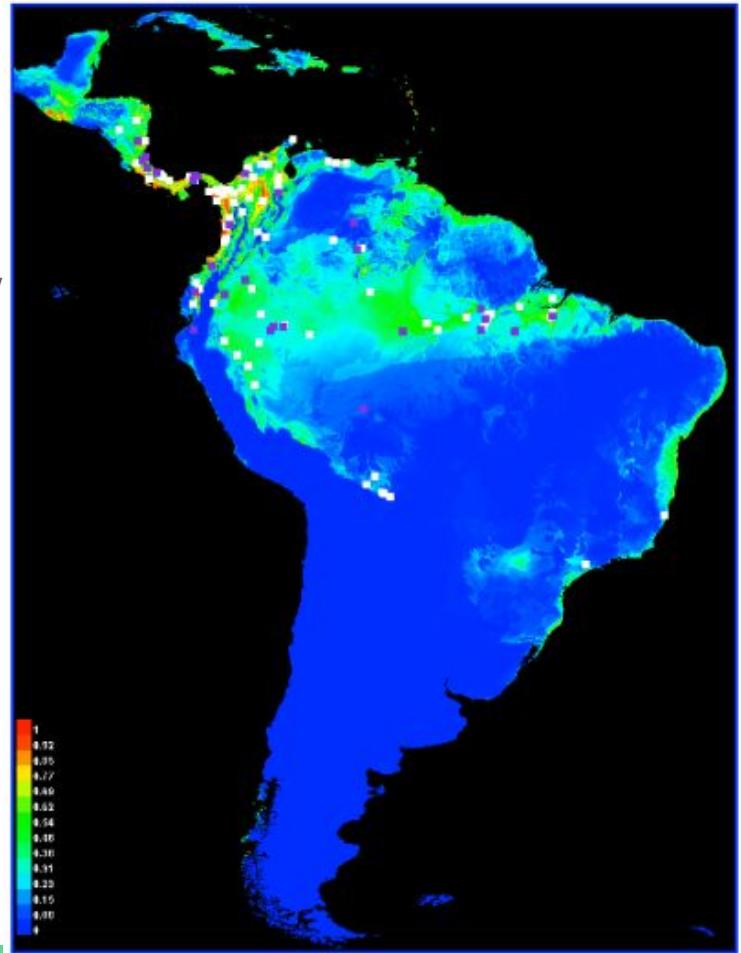
Suitability maps

Blue = low probability of suitability

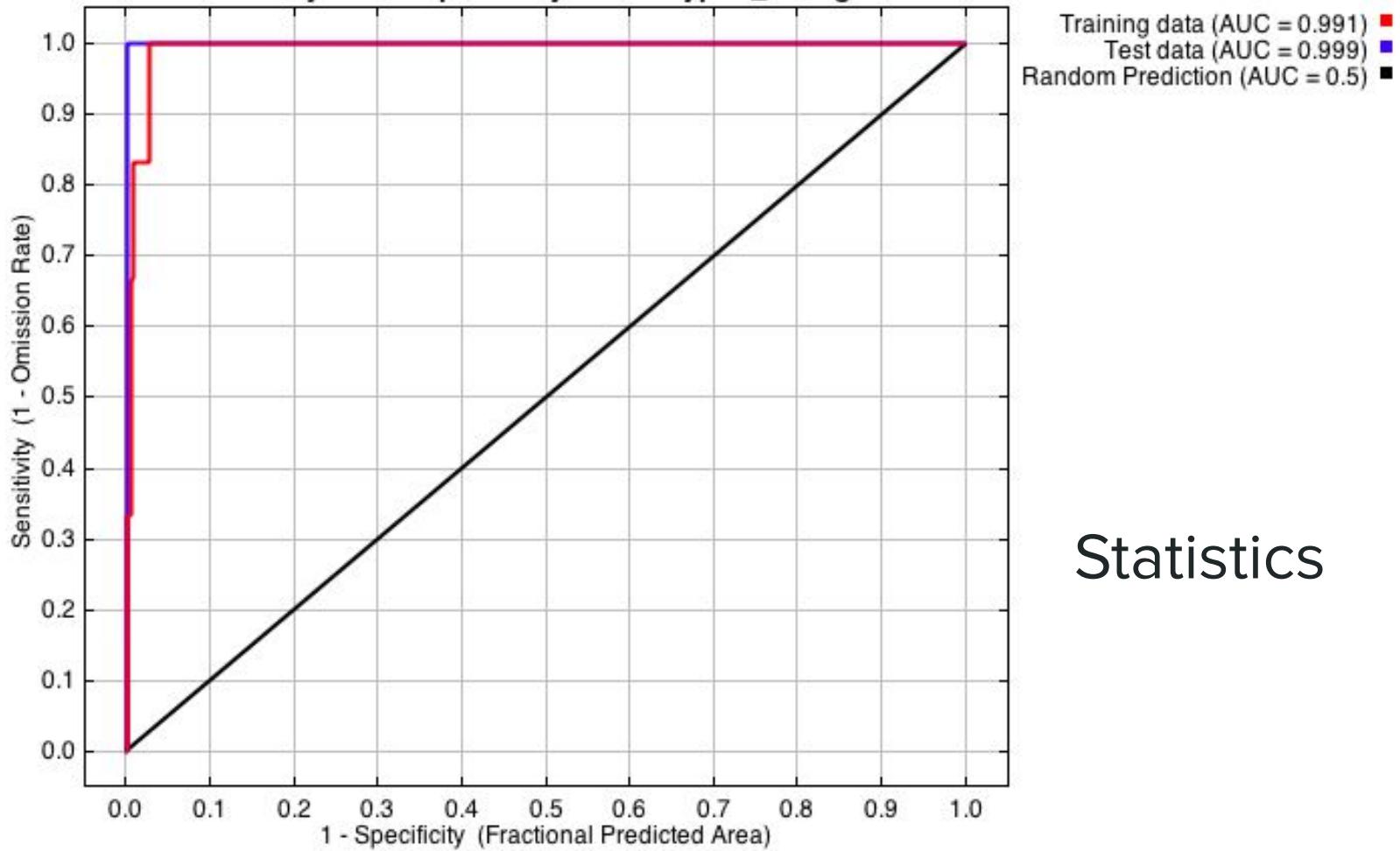
Green = suitability similar to where they occur now

Red = extremely suitable

What can we say about sloth distribution?



Sensitivity vs. 1 - Specificity for *bradypus_variegatus*



Statistics

Making your own SDM!

You'll use climate and precipitation data to predict suitable habitat for an invasive species

Pick your animal @ naturalista.mx

The screenshot shows the homepage of naturalista.mx. At the top left is the logo 'naturalista' with a magnifying glass icon. Navigation links include 'Explora', 'Comunidad', 'Más', and 'Em...'. A large image of a hawk perched in a tree dominates the center-left. On the right, an orange box contains the text 'Conéctate con la naturaleza' and 'Explora y comparte tus observaciones de la naturaleza.' Below this are 'REGÍSTRATE' and 'EXPLORA' buttons. At the bottom left is a circular profile picture and the text 'Francisco Farriols Sarabia ~ Gavilán pecho rufo de Mazatlán, Sinaloa'.

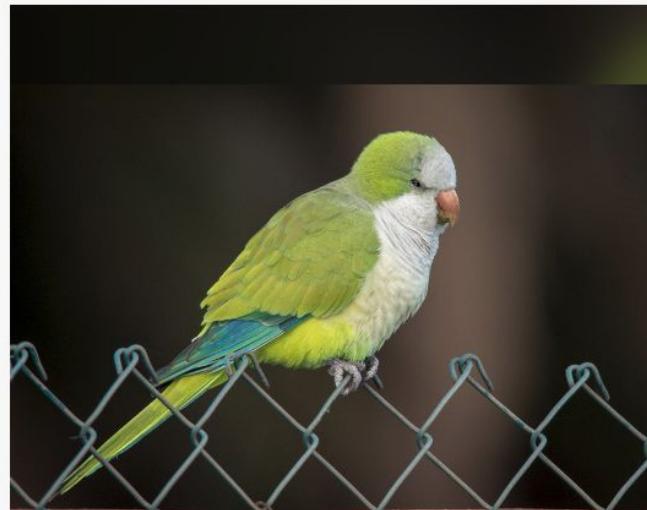
iNaturalist



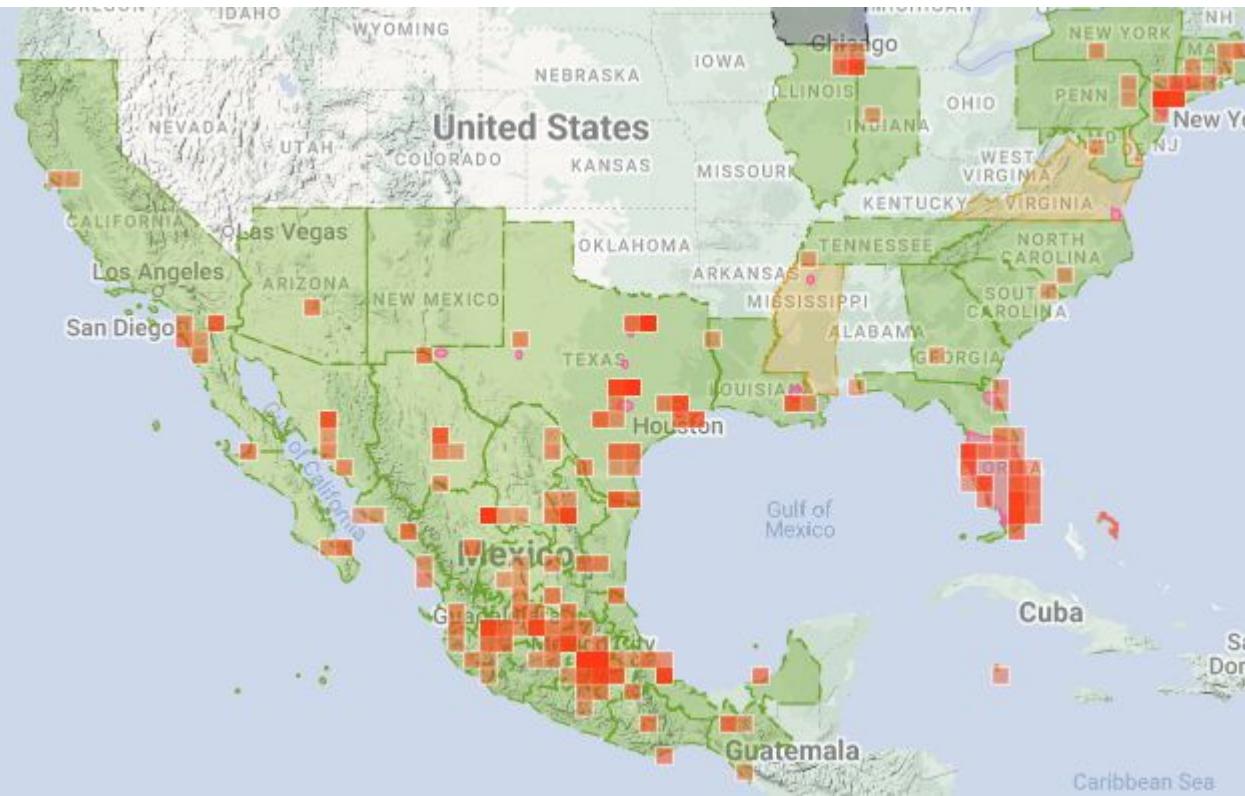
You can get the inaturalist app to upload data from your phone!

Perico Monje Argentino (*Myiopsitta monachus*)

▲ Introducida en Mexico (Lista de origen: Aves de México)



Searching for the Monk Parakeet on Naturalista



Caribbean Sea

Preparing for the field trip!

Community Science

What is it?

What are some examples?

Have you had experience with data collection and observing the natural world?

What are some potential problems with citizen science?

Examples of community science projects

Ebird (www.ebird.org) (awesome app!)

Ocean biogeographic Information systems (<http://www.iobis.org/>)

www.gbif.org

Inaturalist (awesome app!)

Watch video

<https://www.youtube.com/watch?v=87Sdml9botw>

Day 3!

- Análisis de agua



Day 4!

- Finish lessons 2&3 on SDMs
 - Create SDMs with species you choose!
 - Create your own website with GitHub!
 - Time to discuss your plan for final project. Brief presentation on plan for final projects
 - Project time :)
-

Plan for day 5

Final Projects: 9:30-12:30

Practice! 12:30-13:00

Finish projects: 14:00-16:00

More resources for learning R

Presentation in Spanish - Programacion con R

<https://www.rstudio.com/resources/webinars/programacion-con-r/>

R ladies mexico: <https://rladiesmx.netlify.app/>

Beginner in R resources:

<https://education.rstudio.com/learn/beginner/>

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