# Kick the Costly Software Habit: Free/Libre and Open Source Software (FLOSS) for Classroom and Laboratory

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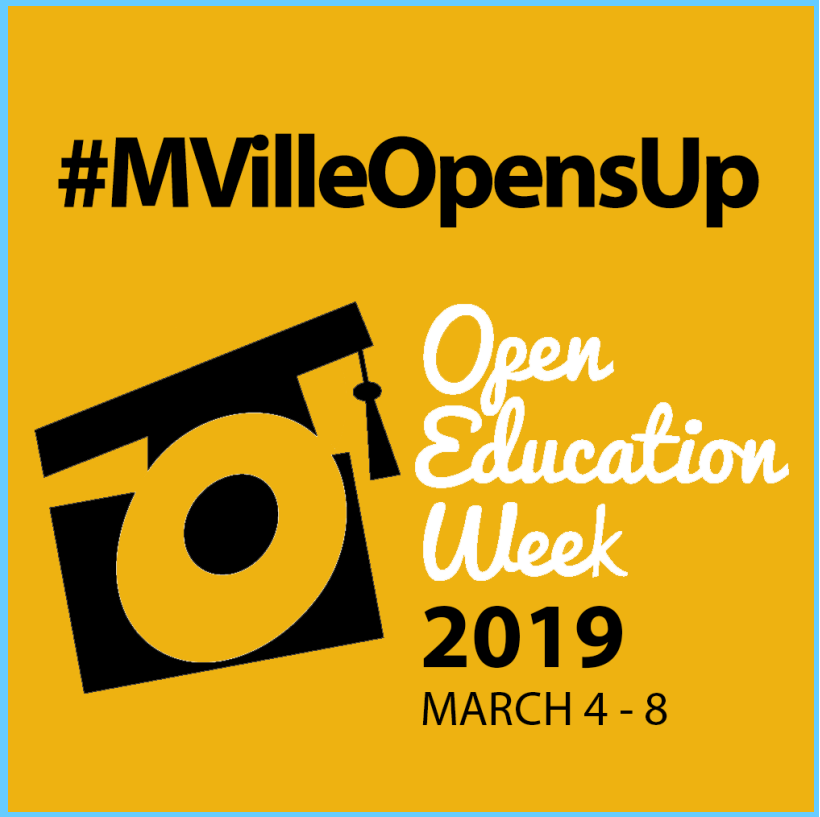
13 August 2019
Teaching and Learning Symposium




https://www.millersville.edu/cae/open-education-week/index.php

# Where I am going to take you today

- What is FLOSS?
- Pros and Cons of FLOSS
- Where to find FLOSS
- Examples of FLOSS for everyday activities and some non-everyday activities
- My use of FLOSS in teaching and research
  - Image Manipulation
  - Diagram and Handout Creation
  - Statistics
  - Population Modeling

# What is Free/Libre and Open Source Software (FLOSS) Mean?

**Free as in No Cost, gratis**

Often no or minimal cost to download

Community-driven as opposed to company-driven

Companies can charge for support or more services

**Free/Libre as in Freedom**

Free to use as you wish

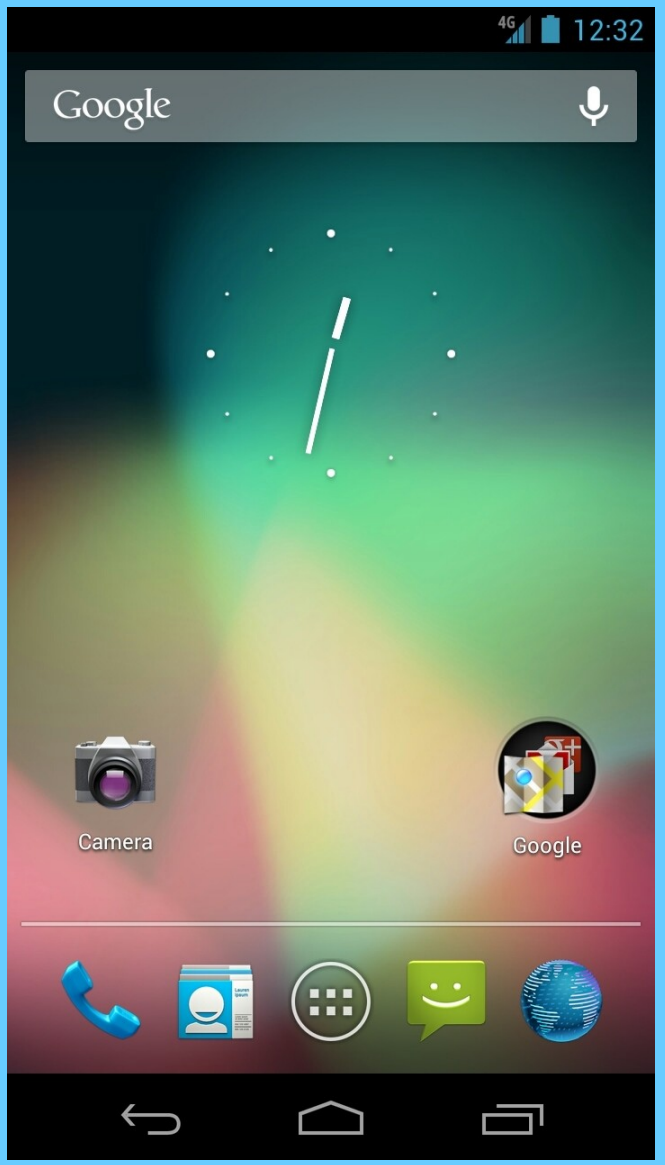
Open source: can view the source code

Free to pass it along

Free to modify it

https://www.gnu.org/philosophy/free-sw.html

# You Already Have Experience with FLOSS


Apple iOS: works on Apple hardware
Cannot view source code

Google Android: works on many devices
Can view source code
Each company has a flavor
CyanogenMod/LineageOS

# Pros and Cons of FLOSS

## Advantages

- Free cost (often)
- Free to view code
- Free to modify and distribute
- Save files often standardized
- Skills and concepts transfer
- Community-driven
- Agile and adaptive
- Always have access (even after graduation)

## Disadvantages

- No company support
  - other companies may fill the gap
- Documentation often sparse
  - Users create tutorials
- May not help with legacy files
  - some cross compatibility
- Collaboration and cross-OS compatibility
  - getting much better

# How to Find Software

## alternativeto.net

alternativeTo
Crowdsourced software recommendations

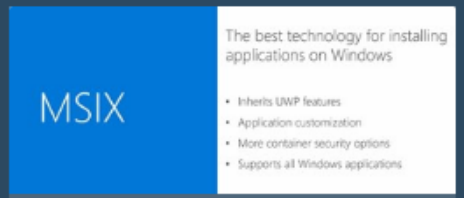
Which app do you want to replace?

I want to replace...

Find apps

66,709 apps 623,543 likes 422,785 opinions about alternatives.

Reviews, comments and recommendations. Sign up with Facebook, Twitter, GitHub and and more.




### New MSIX package format supports Win32 packages for Microsoft Store and more

2 hours ago · March 7th was Microsoft's [Windows Developer Day]

Read more ›

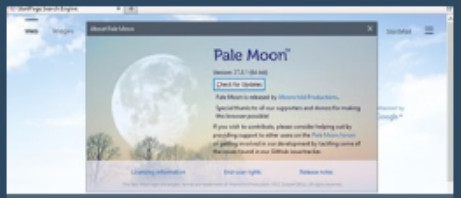
MSIX Packaging SDK alternatives ›


### Google Chrome 65 released, includes tab-under blocking

Yesterday · Google has started to roll out the latest version of its Chrome web browser. Desktop

Read more ›

Google Chrome alternatives ›




### Pale Moon version 27.8 released, improves autocorrect and emoji support

2 days ago · Moonchild Productions has released a new update to its flagship web browser

Read more ›

Pale Moon alternatives ›

Windows 10 Spring Creators Update will implement Windows Timeline and more

Featured User List: Best Personal Media Apps

GitHub survived the largest DDoS attack in history

Privacy-conscious email providers to keep your correspondence safe

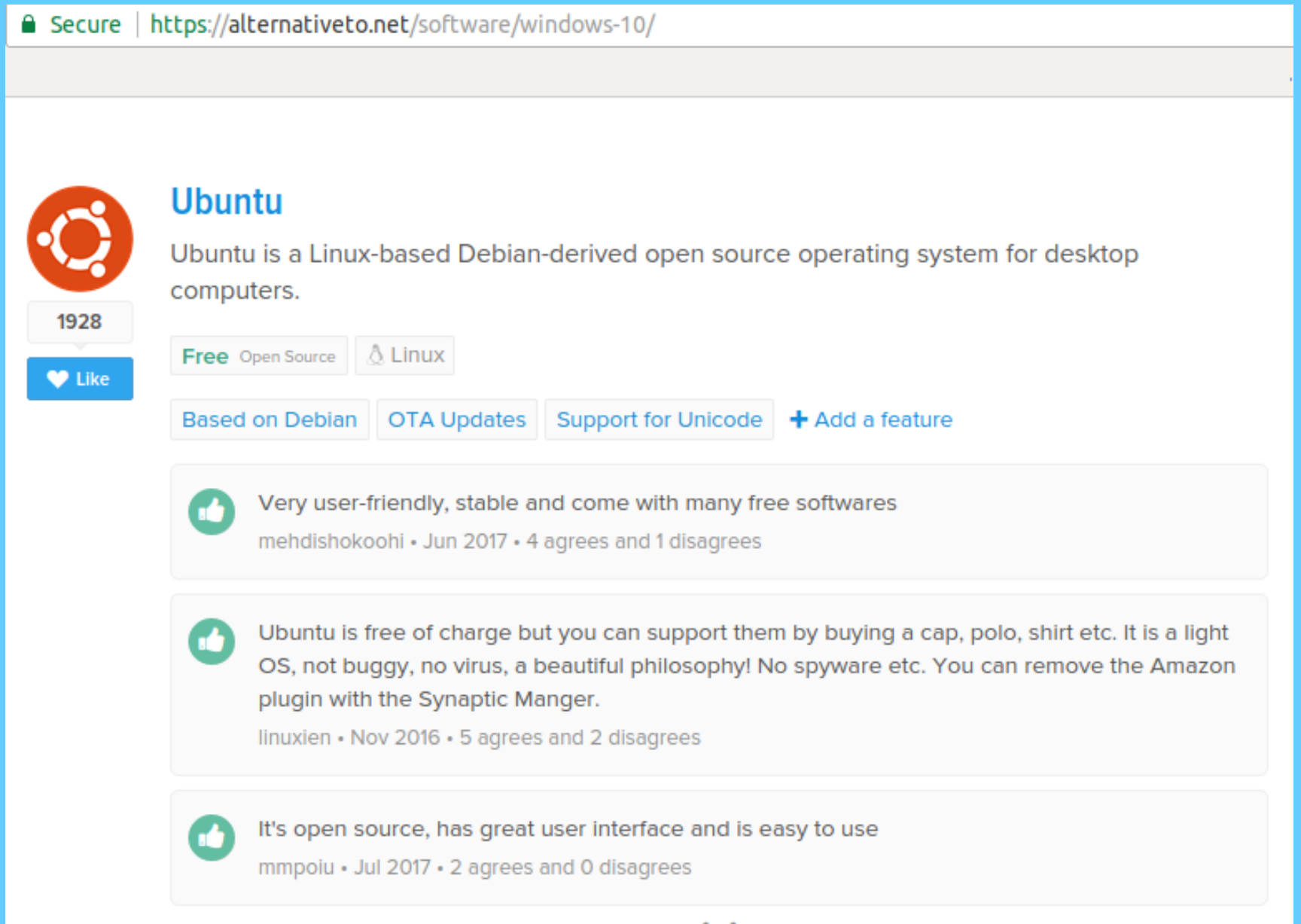
Swype is dead, long live the alternative Android keyboards!

AlternativeTo: Your Awesome Feedback = More Improvements

News archive

# How to Find Software

## alternativeto.net



# How to Find Software

## alternativeto.net

# Ubuntu

**Ubuntu is a Debian Linux-based open source operating system for desktop computers.** Created by Canonical Ltd.

2091

Like

Free Open Source | Windows | Linux | Windows S

Ubuntu is a community developed, Linux-based operating system that is perfect for laptops, desktops and servers. It contains all the applications you need - a web browser, presentation, document and spreadsheet software, instant messaging and much more.

The latest release is 19.04 ("Disco Dingo"), and the most recent long-term support release is 18.04 LTS ("Bionic Beaver"), which is supported until 2023 under public support and until 2028 as a paid option.

**Ubuntu is listed in**

Linux Apps, Runtime & OS, Web Dev for Windows, Switching from Windows to Linux, and My top linux software

**Apps for Ubuntu**

Ubuntu is also a platform with 45 apps listed on AlternativeTo. Browse all 45 apps for Ubuntu.

**Links to official Ubuntu sites**

Official Website | Facebook | Twitter | </> Source

# Free Software Foundation, fsf.org

FREE SOFTWARE FOUNDATION

Log in Help! Members forum JOIN FSF NOW

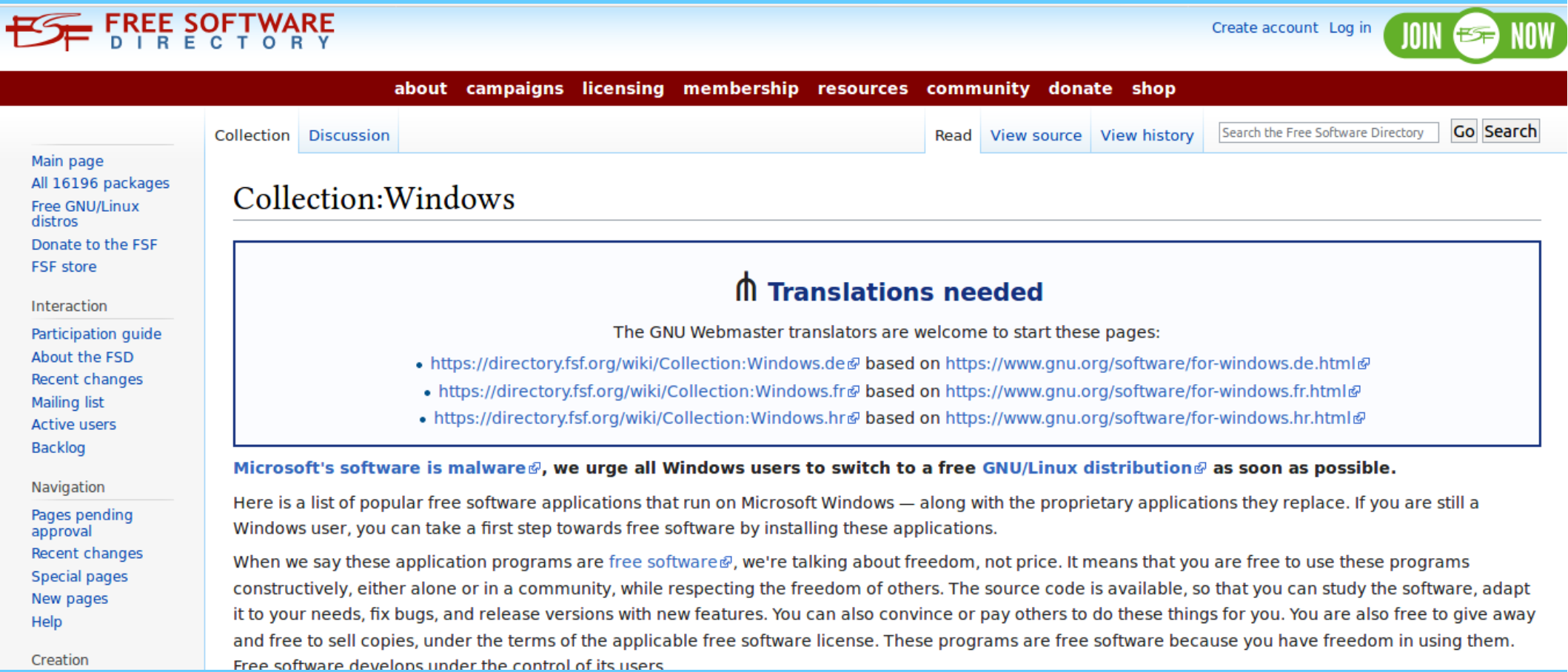
about campaigns licensing membership resources community donate shop

**The Free Software Foundation (FSF) is a nonprofit with a worldwide mission to promote computer user freedom. We defend the rights of all software users. Read more.**


Free software developers guarantee everyone equal rights to their programs; any user can study the source code, modify it, and share the program. By contrast, most software carries fine print that denies users these basic rights, leaving them susceptible to the whims of its owners and vulnerable to surveillance.

- The FSF provides critical infrastructure and funding for the GNU Project, the foundation of the popular GNU/Linux family of free operating systems and the keystone of the Internet.
- Our Campaigns Team creates educational materials about free software, convenes the yearly LibrePlanet conference and goes toe to toe against powerful interests that threaten computer user rights.
- Our Licensing & Compliance Lab defends freely licensed software from proprietary hoarding, advises on licensing issues, and certifies devices that Respect Your Freedom

# Free Software Foundation, fsf.org



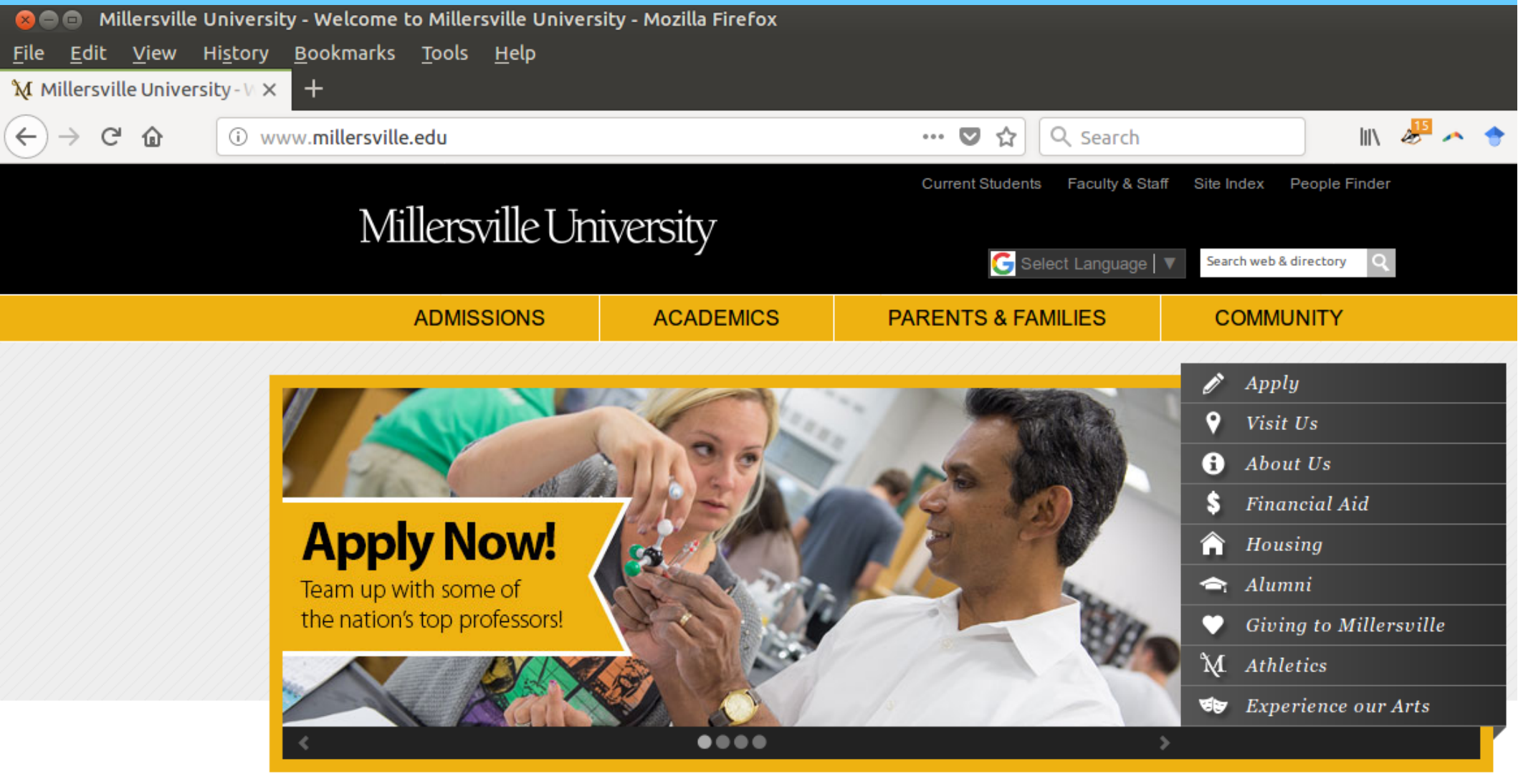

https://directory.fsf.org/wiki/Collection:Windows

# FLOSS Software

(programs that I am familiar with)

- Operating Systems
  - Phones: Android
  - Computers: Linux
- Web browsing
  - Firefox and Chromium
- Office Software
  - Office Suite: LibreOffice
  - Desktop Publishing: Scribus
- Image Manipulation
  - Raster: GIMP
  - Vector: Inkscape
- Consuming Audio/Video
  - VLC
- Manipulating Audio
  - Audacity
- Scientific Computing
  - Statistics: R
  - Programming: Octave
- Geographical Information System
  - QGIS, GrassGIS, Diva-GIS

# Web Browsing
# Firefox: www.mozilla.org



# Web Browsing

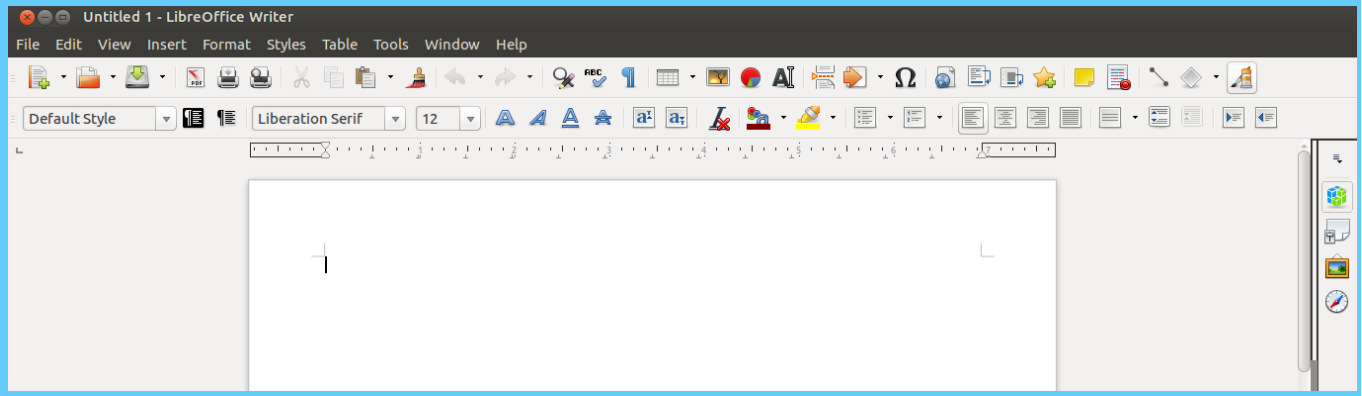
## Chromium (Open-source Chrome)

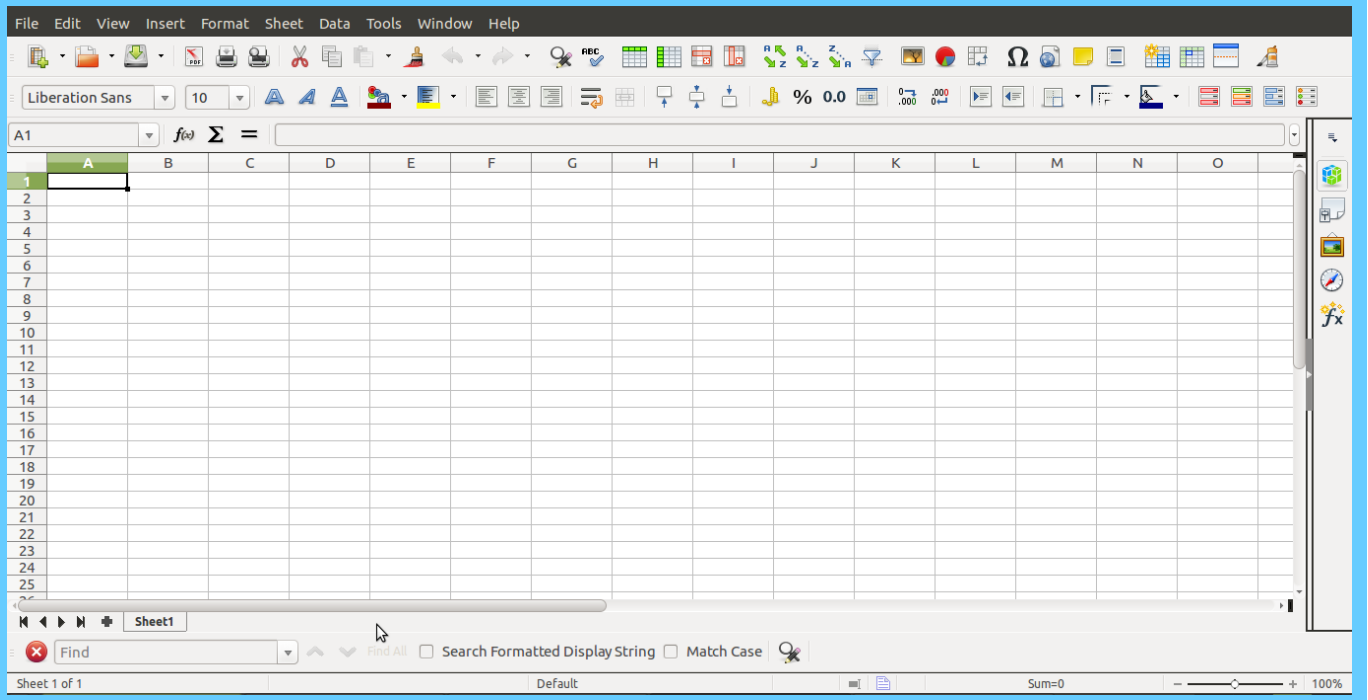
## https://www.chromium.org/

# Office Software: Office Suite
# LibreOffice: libreoffice.org

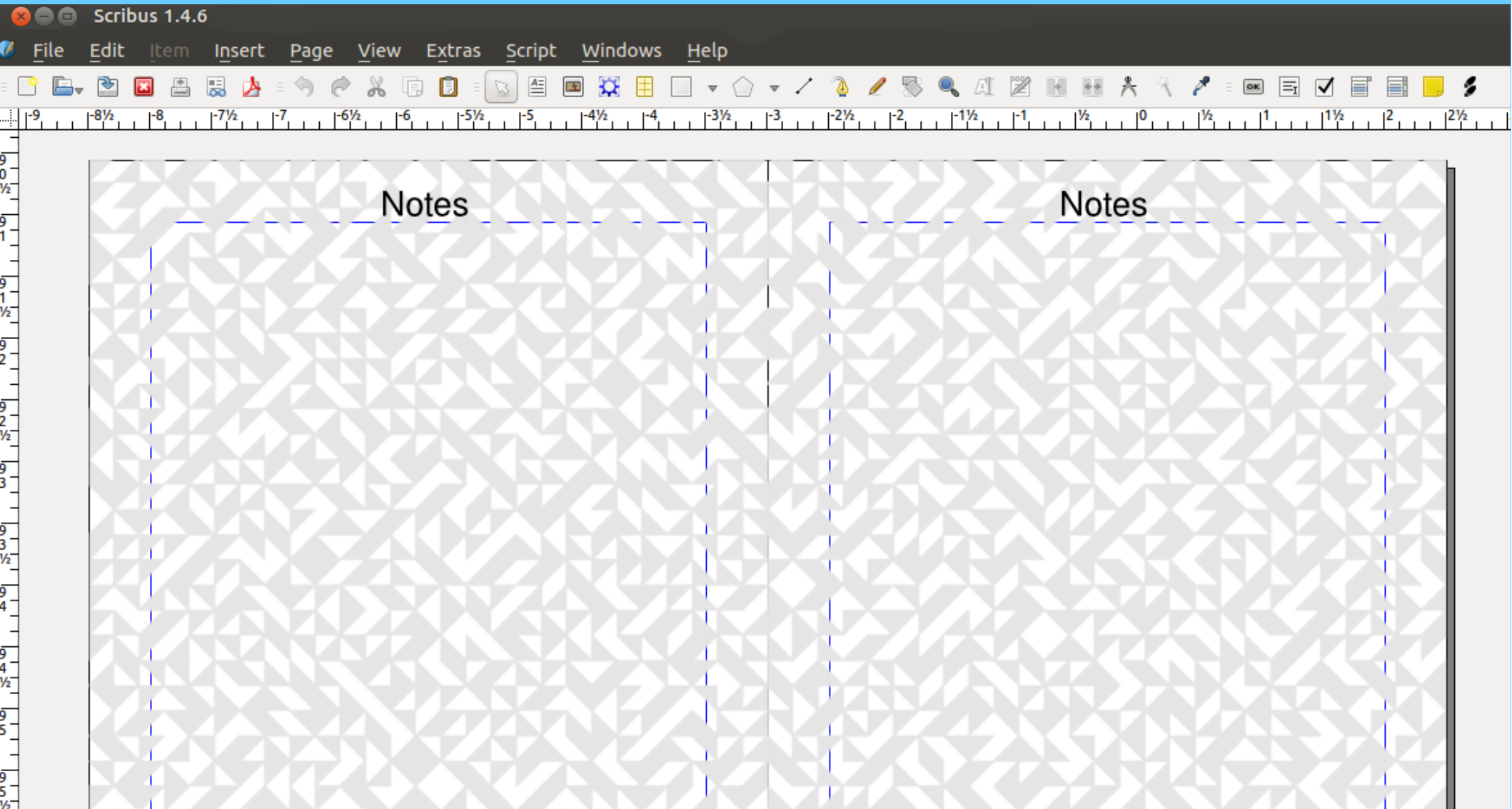
Create:

- Writer Document
- Calc Spreadsheet
- Impress Presentation
- Draw Drawing
- Math Formula
- Base Database

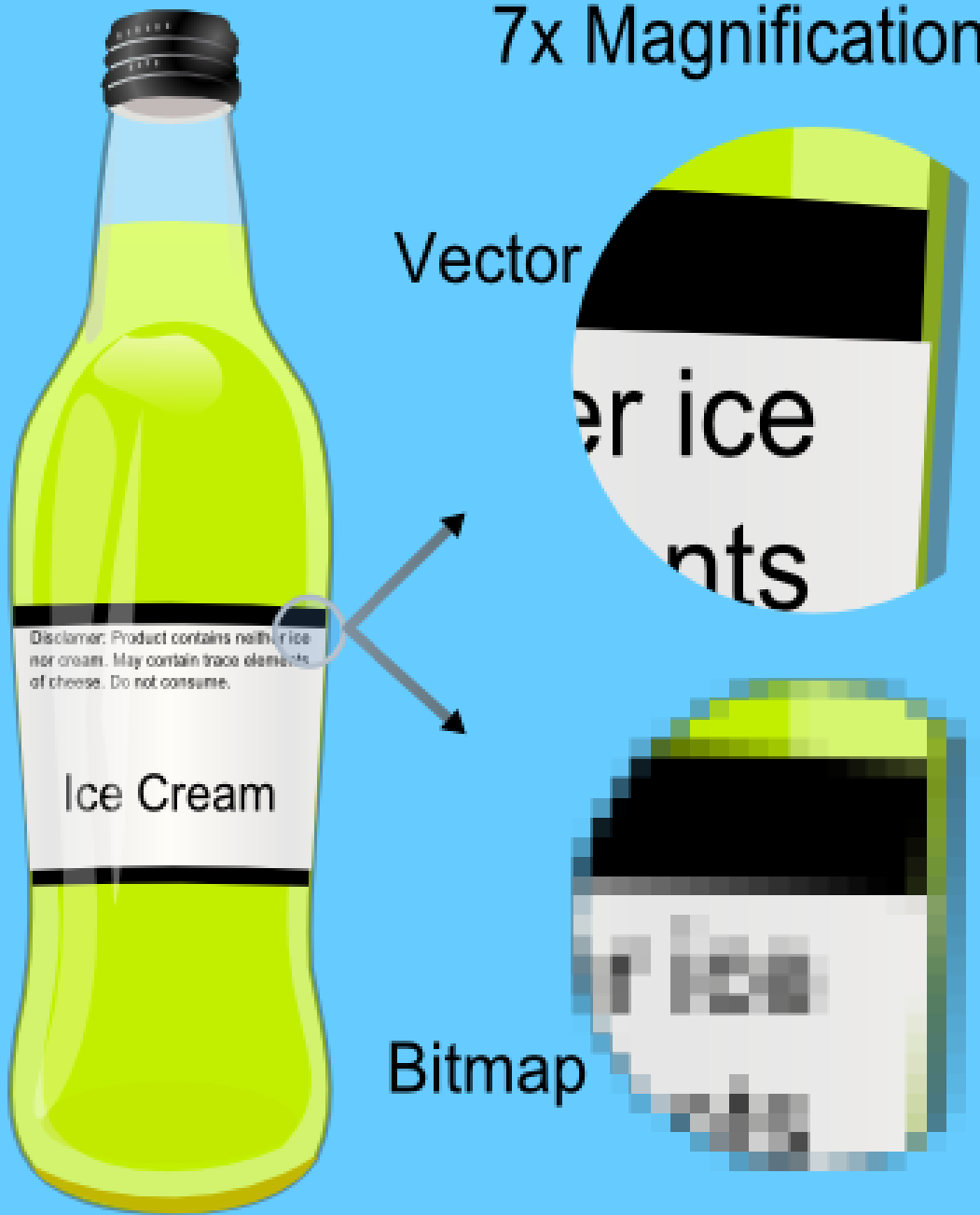


# Office Software: Desktop Publishing
# Scribus: www.scribus.net



# Image Manipulation: Rasters vs Vectors



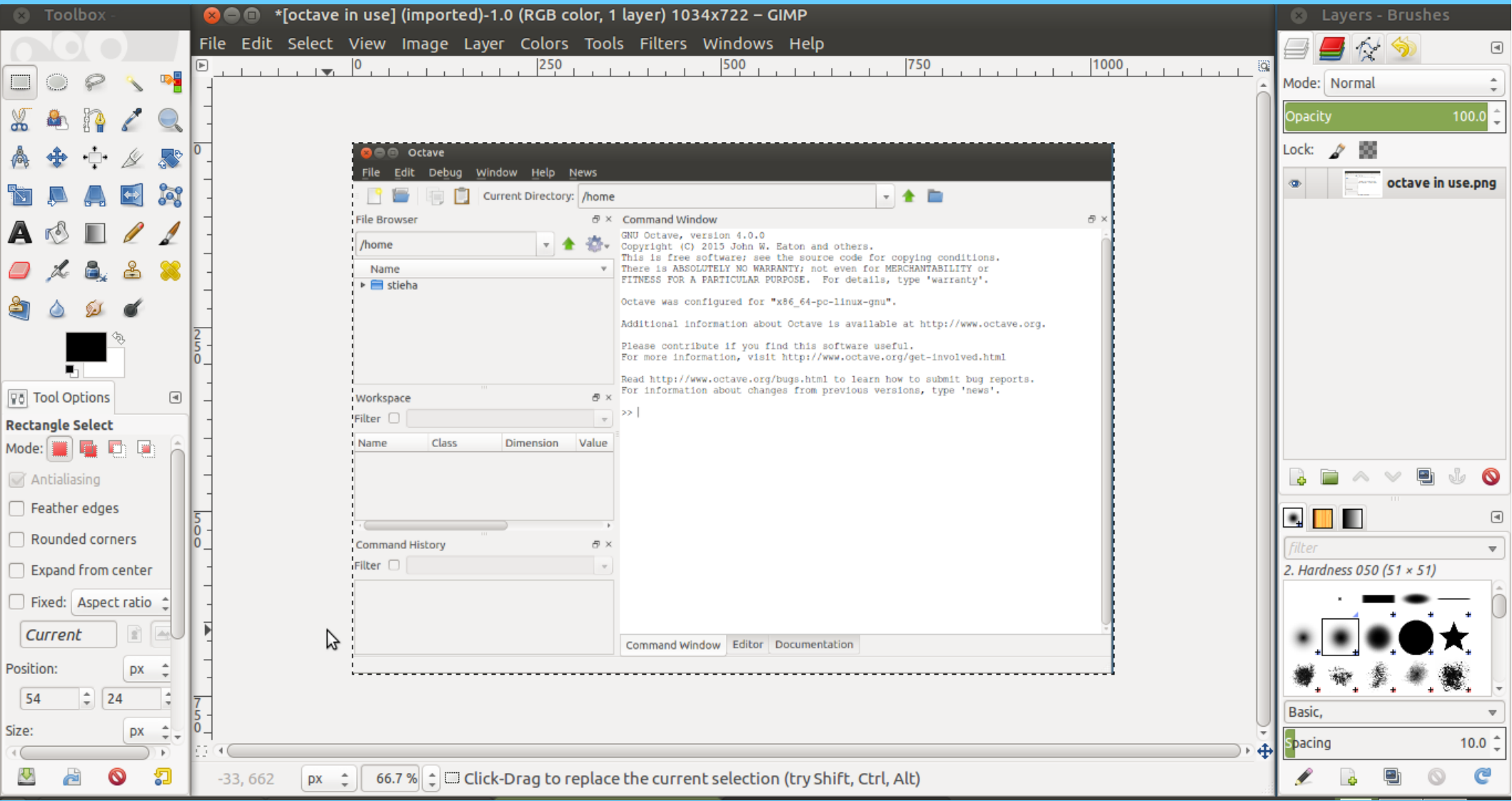

.svg
Maybe .pdf

.bmp
.jpg
.png
.gif

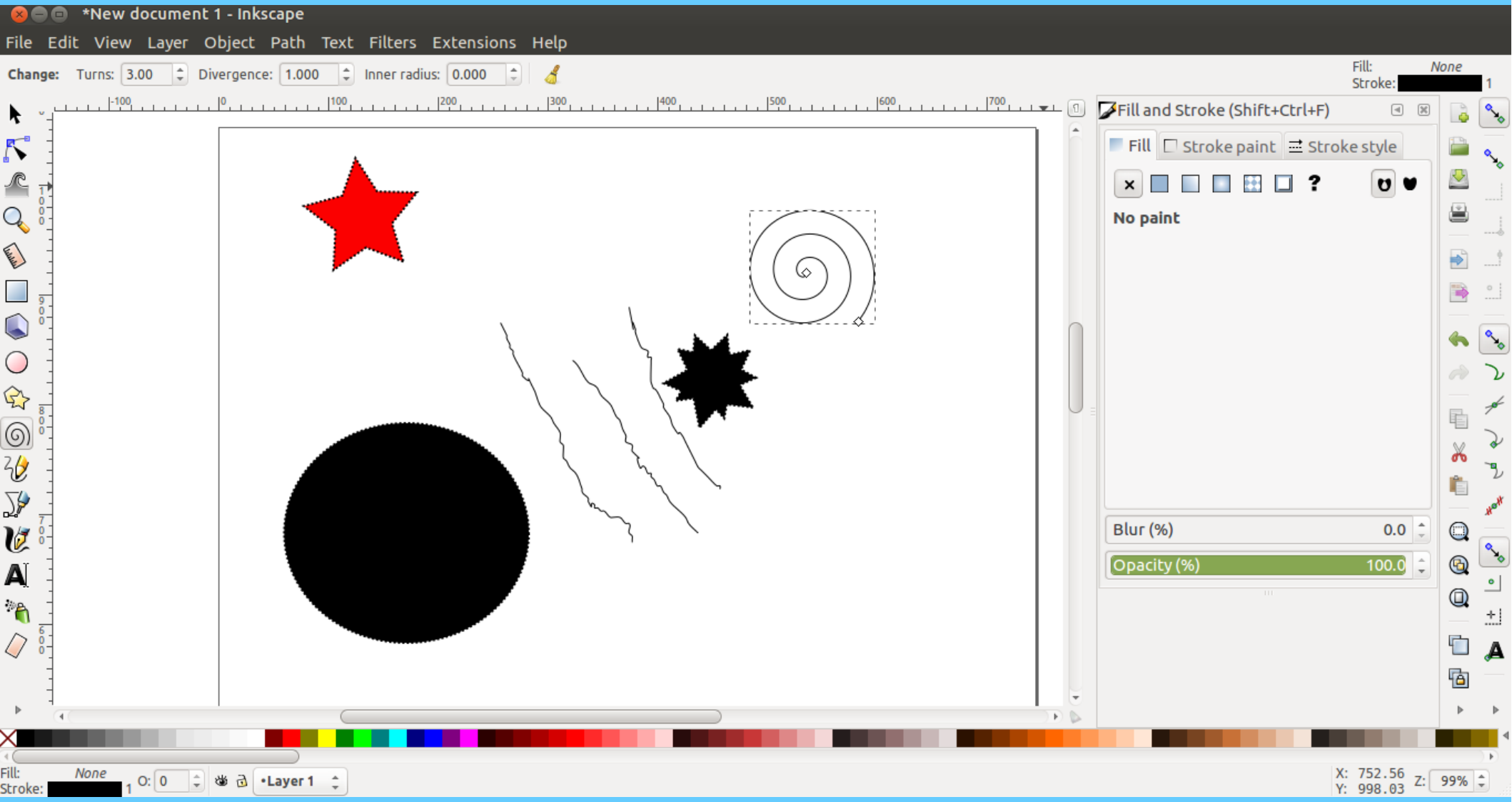
# Image Manipulation: Rasters

## GIMP: GNU Image Manipulation Program

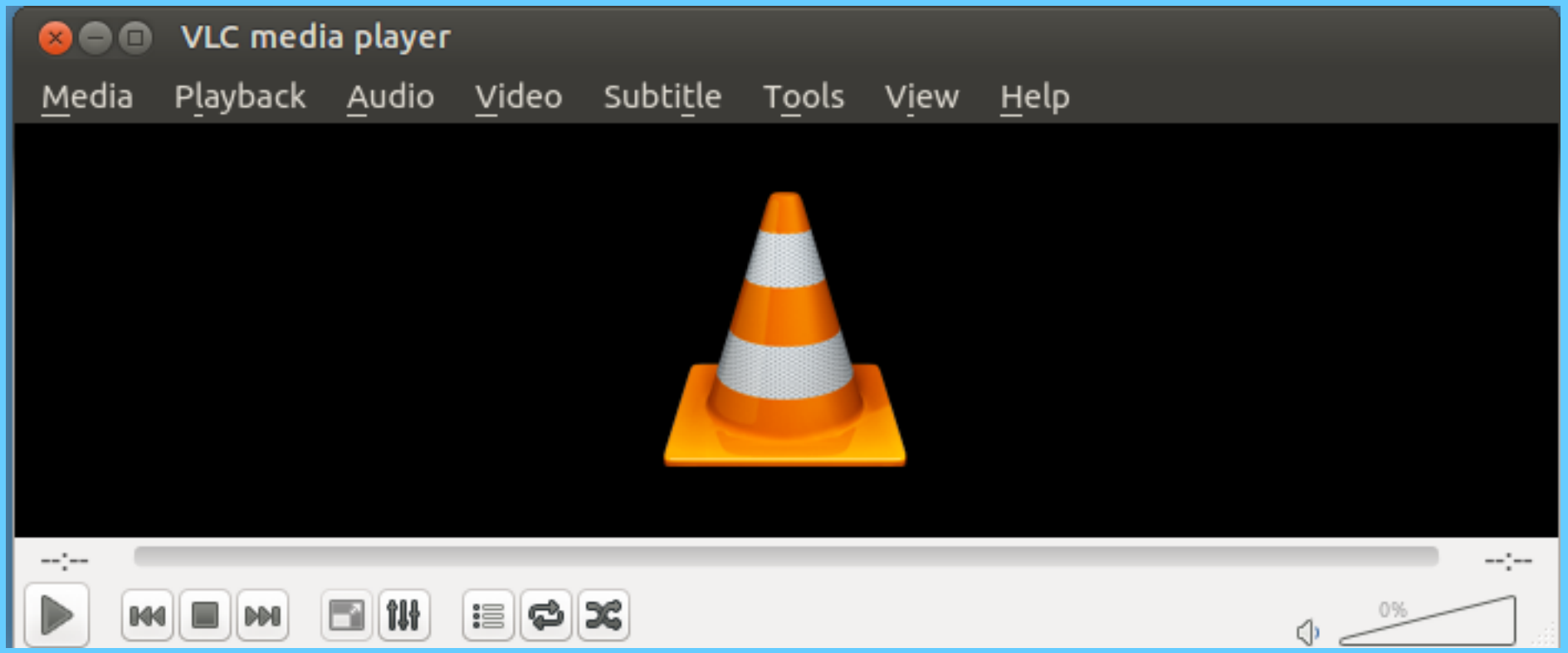
## www.gimp.org



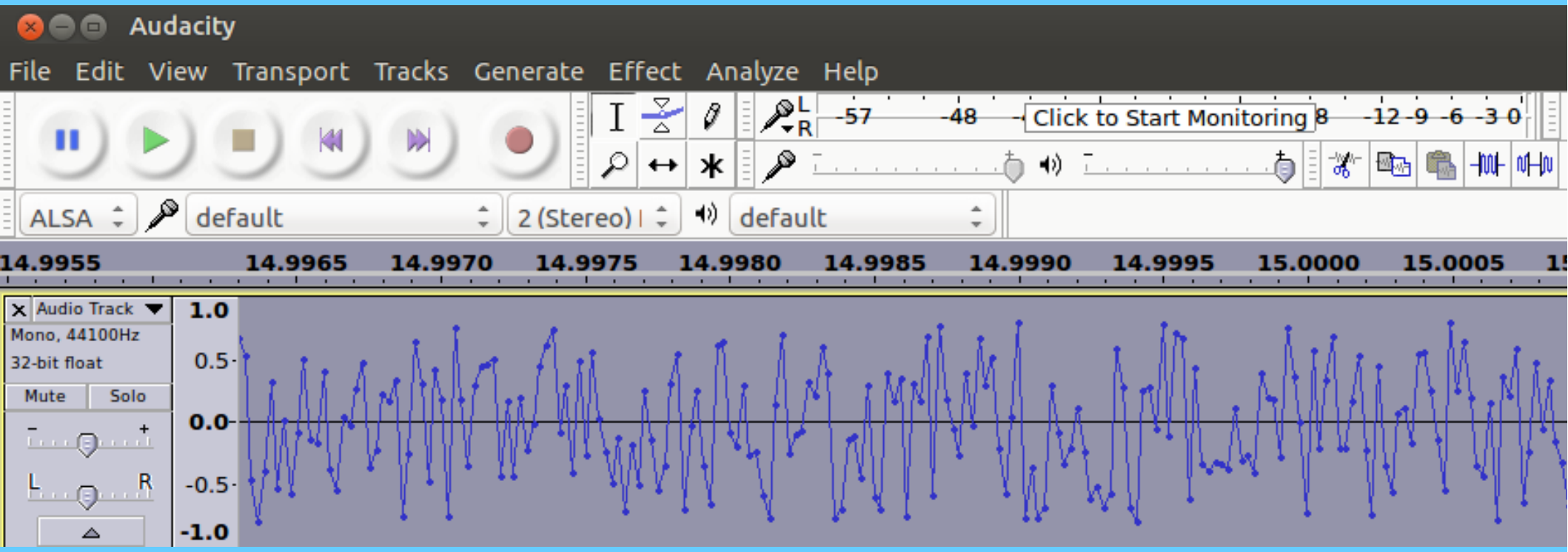
# Image Manipulation: Vectors
# Inkscape: inkscape.org



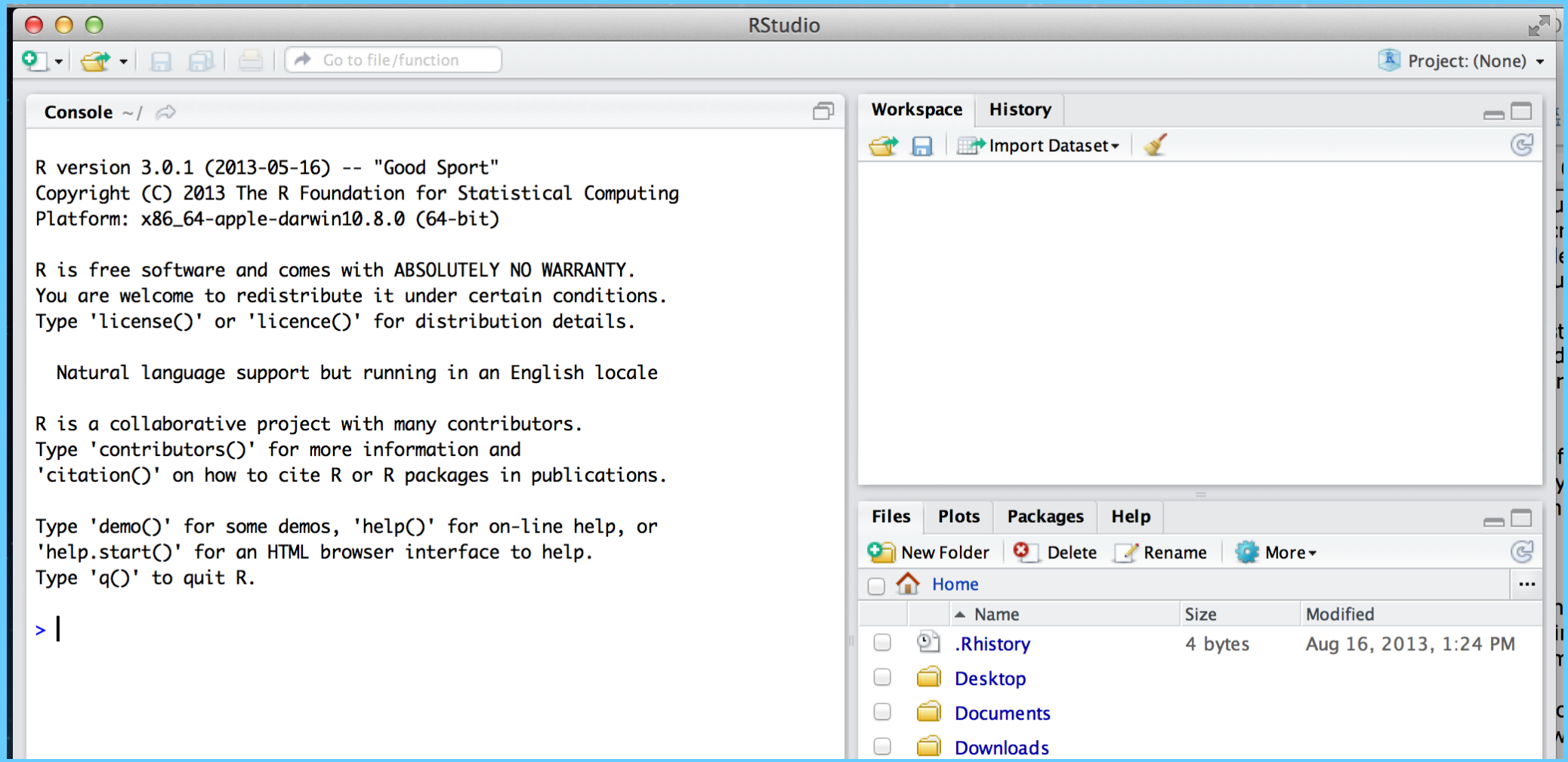
# Audio/Video Consuming
# VLC
# www.videolan.org



# Audio: Manipulation
# Audacity
# www.audacityteam.org

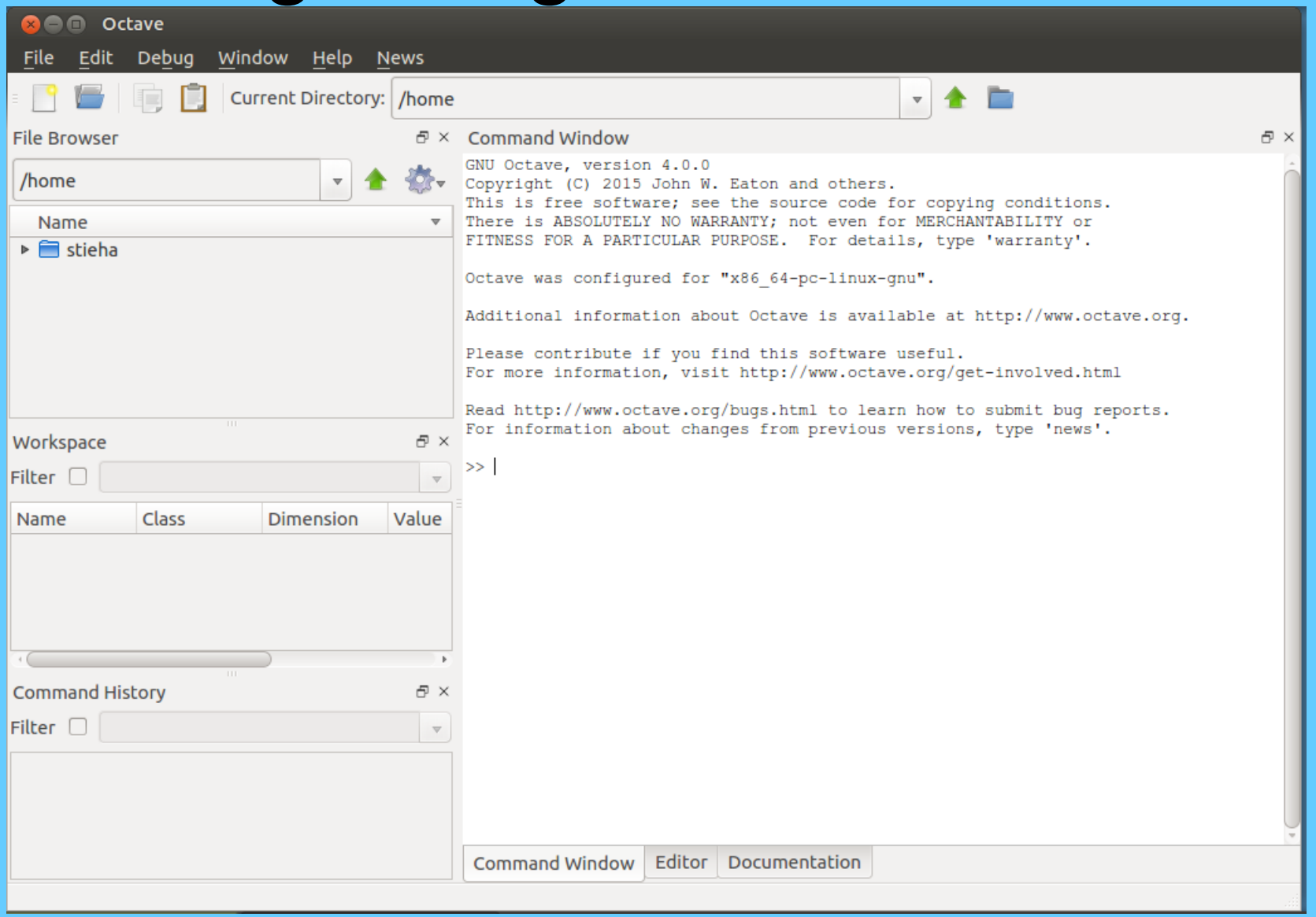


# Scientific Computing: Statistics
# R: cran.r-project.org
# RStudio: www.rstudio.com



# Scientific Computing: Programming Octave

# www.gnu.org/software/octave/

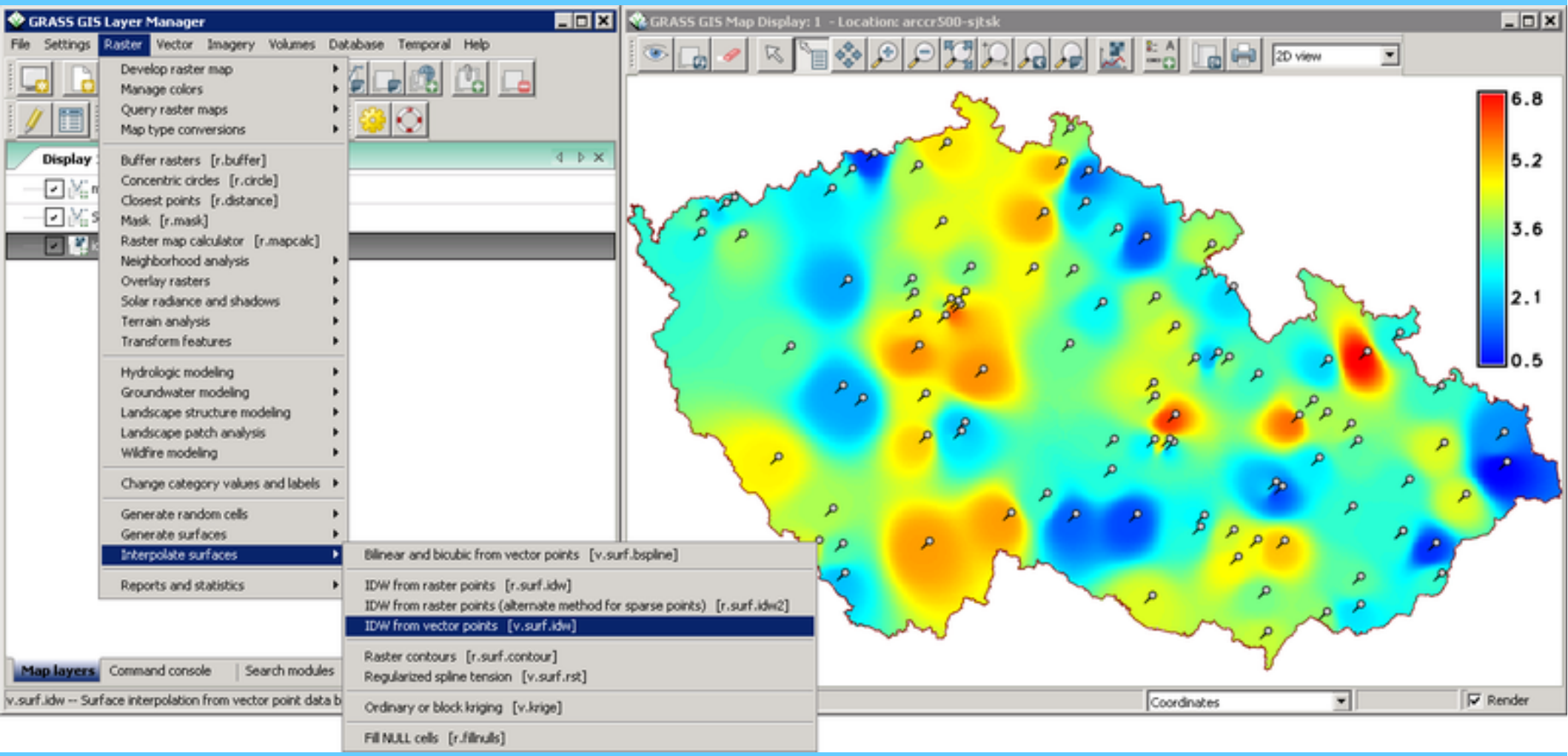


# Geographical Information Systems

## Grass GIS: grass.osgeo.org

## DIVA-GIS: diva-gis.org

## QGIS: qgis.org



# FLOSS in my classroom

**Image Manipulation: Rasters**

- GIMP: GNU Image Manipulation Program
- Modifying images for lectures
- Adding information to images: markers and contrast

**Image Manipulations: Vectors**

- Inkscape
- Image and diagram development
- Handout development

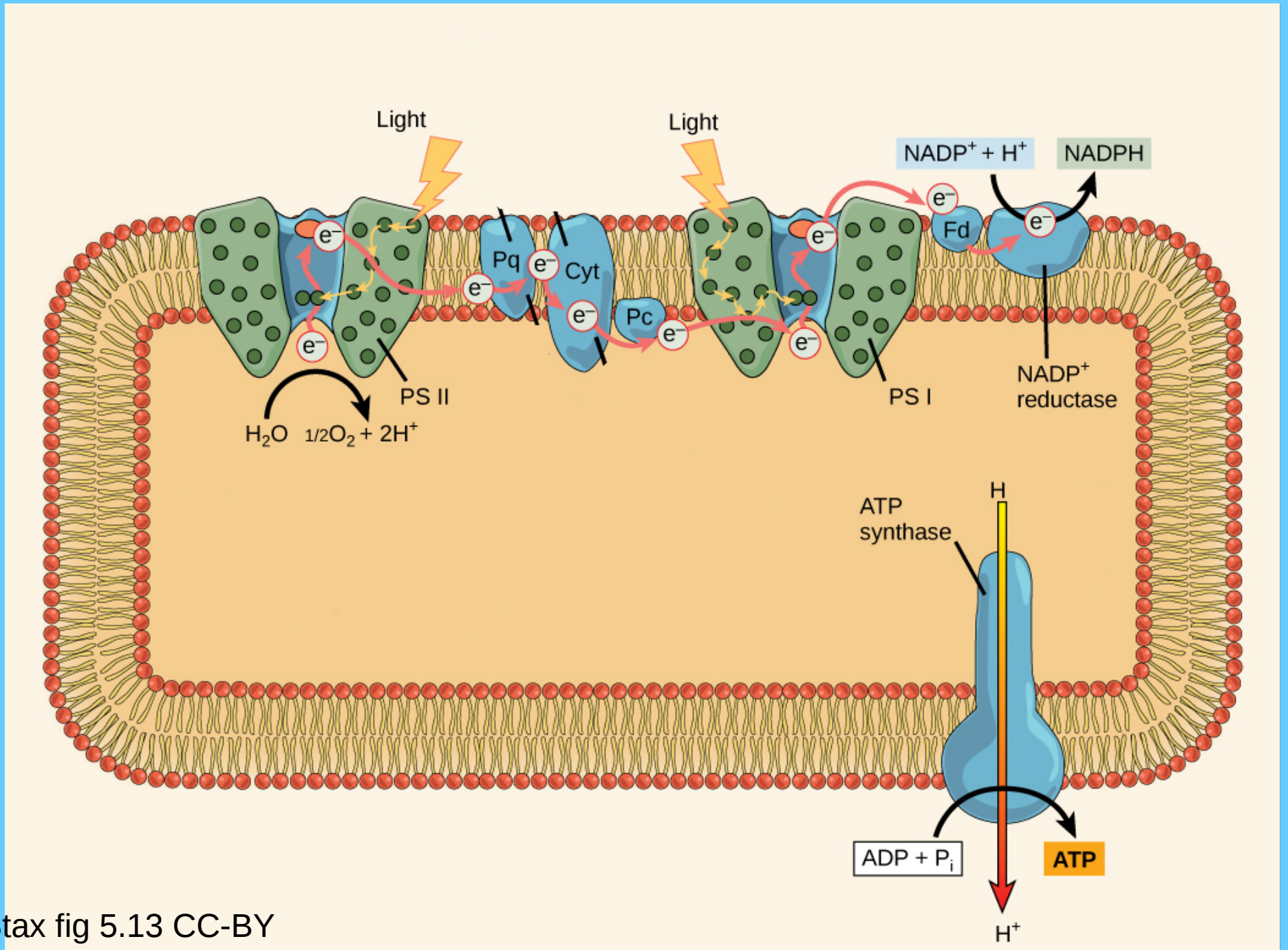
**Running Statistical Analyses and Making Figures**

- R Statistical Software and LibreOffice
- Class Activities and Publications

**Programming Population Models**

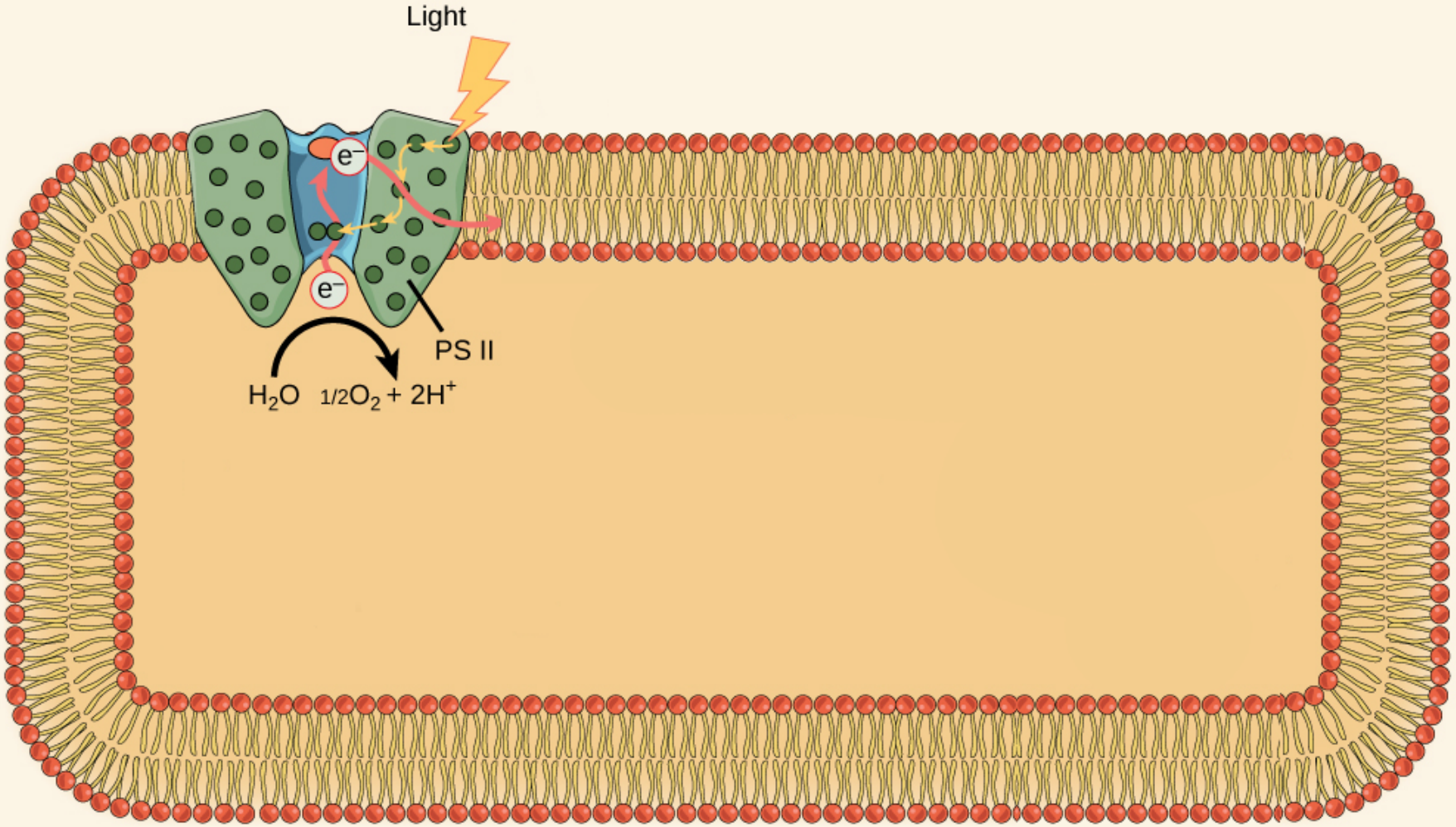
- R Statistical Software
- A Field Guide to Programming

# Image Manipulation: Rasters in GIMP



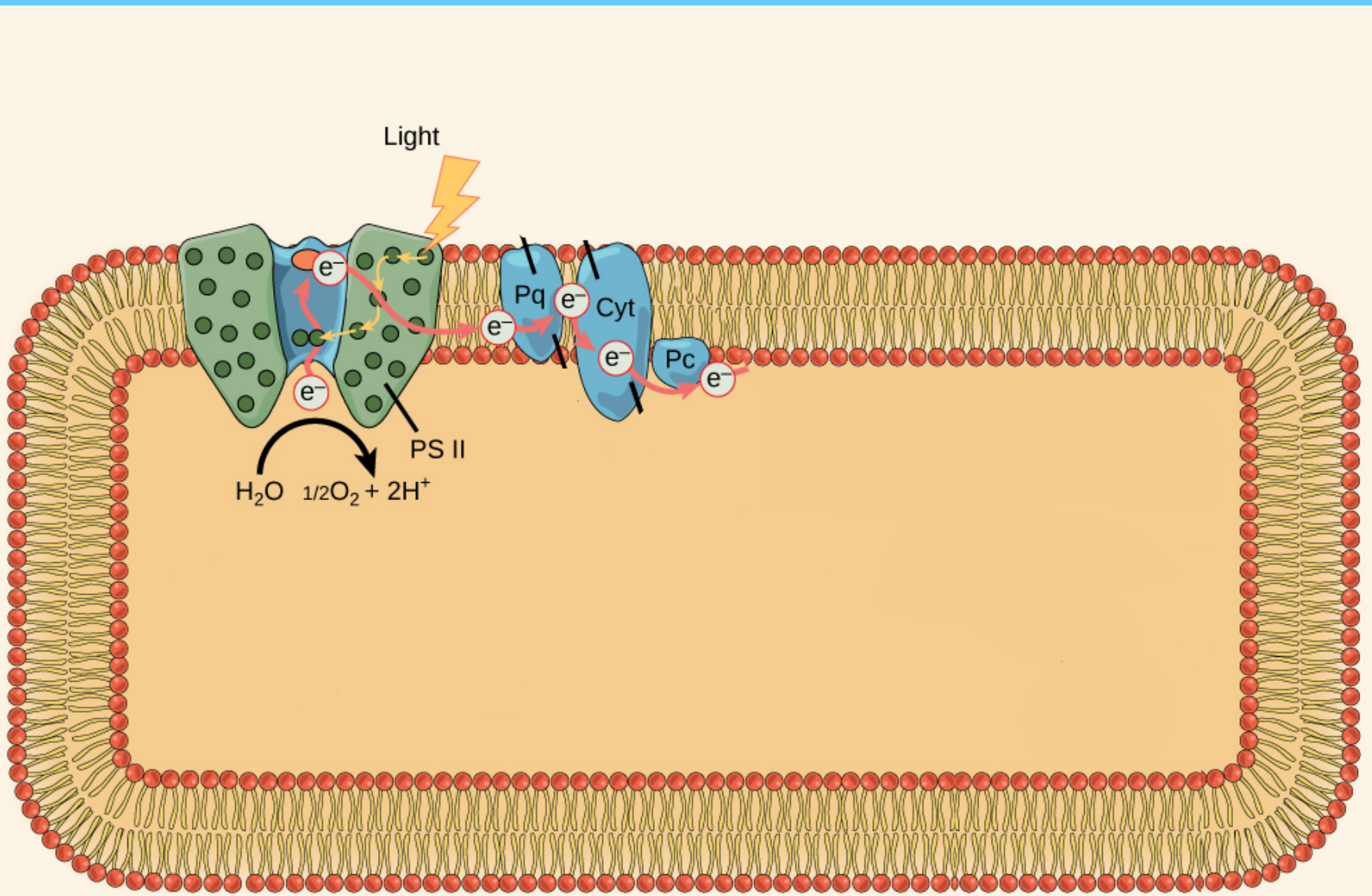

OpenStax fig 5.13 CC-BY

# Image Manipulation: Rasters in GIMP



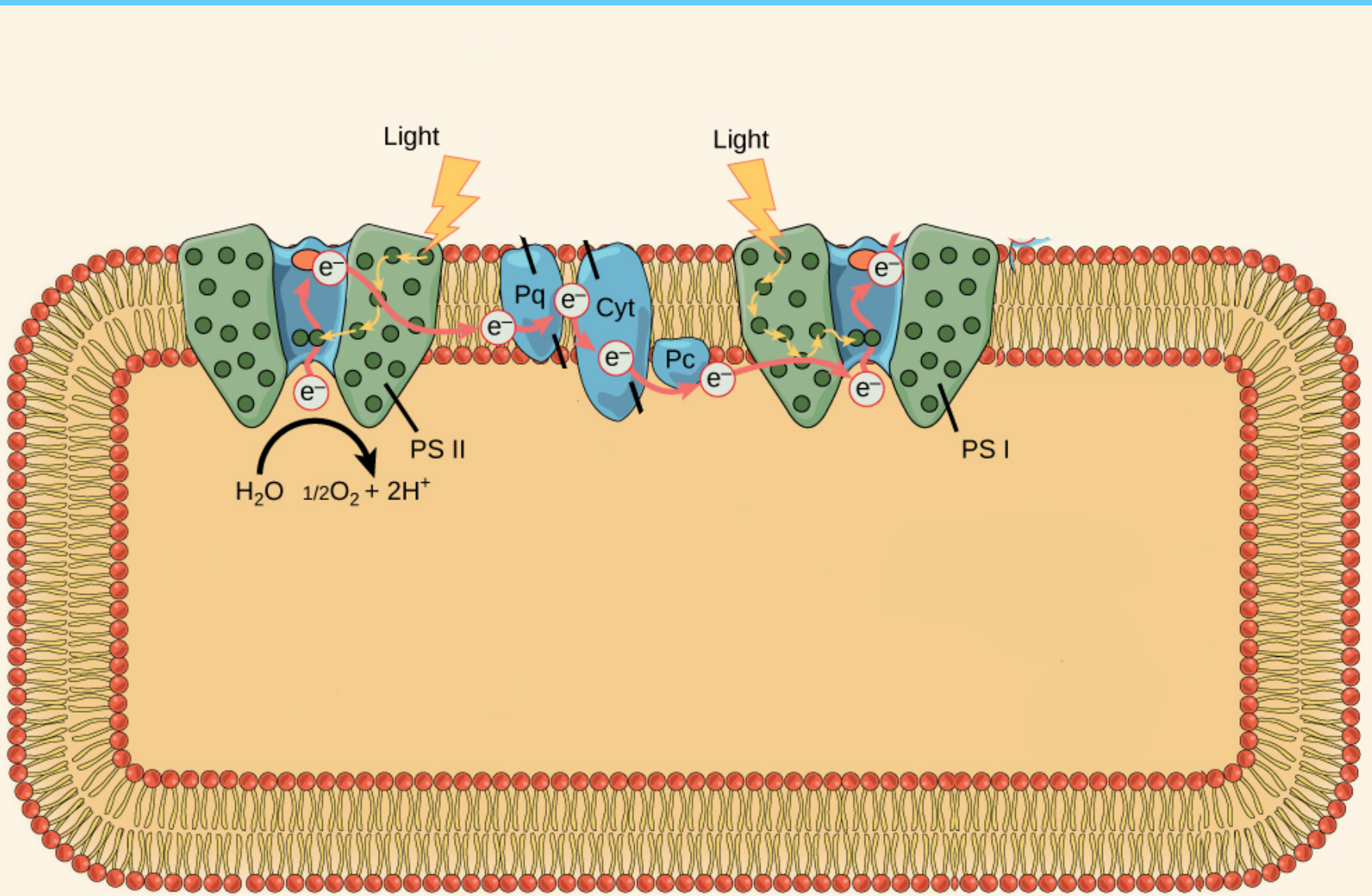

OpenStax fig 5.13 CC-BY

# Image Manipulation: Rasters in GIMP



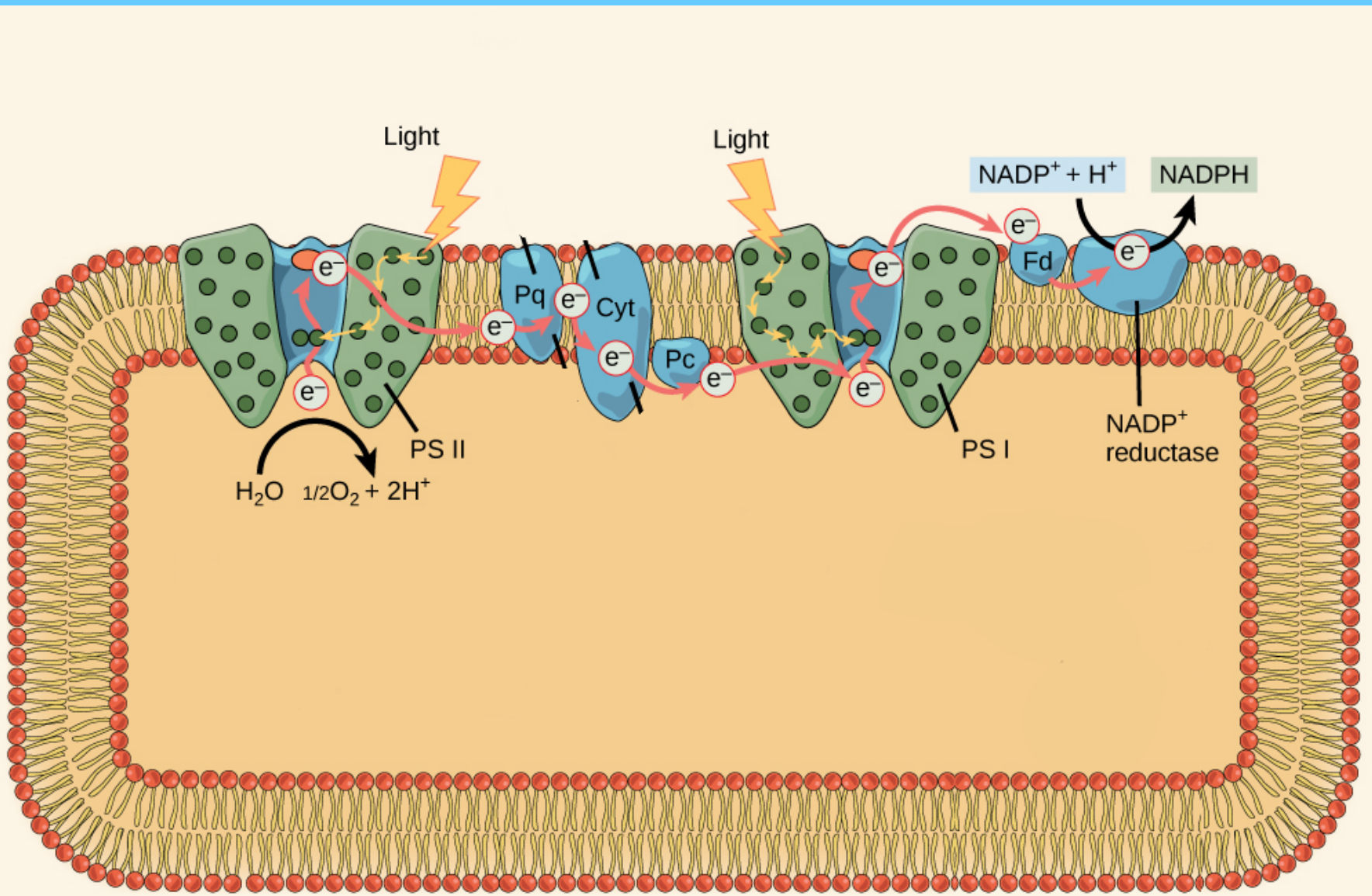

OpenStax fig 5.13 CC-BY

# Image Manipulation: Rasters in GIMP



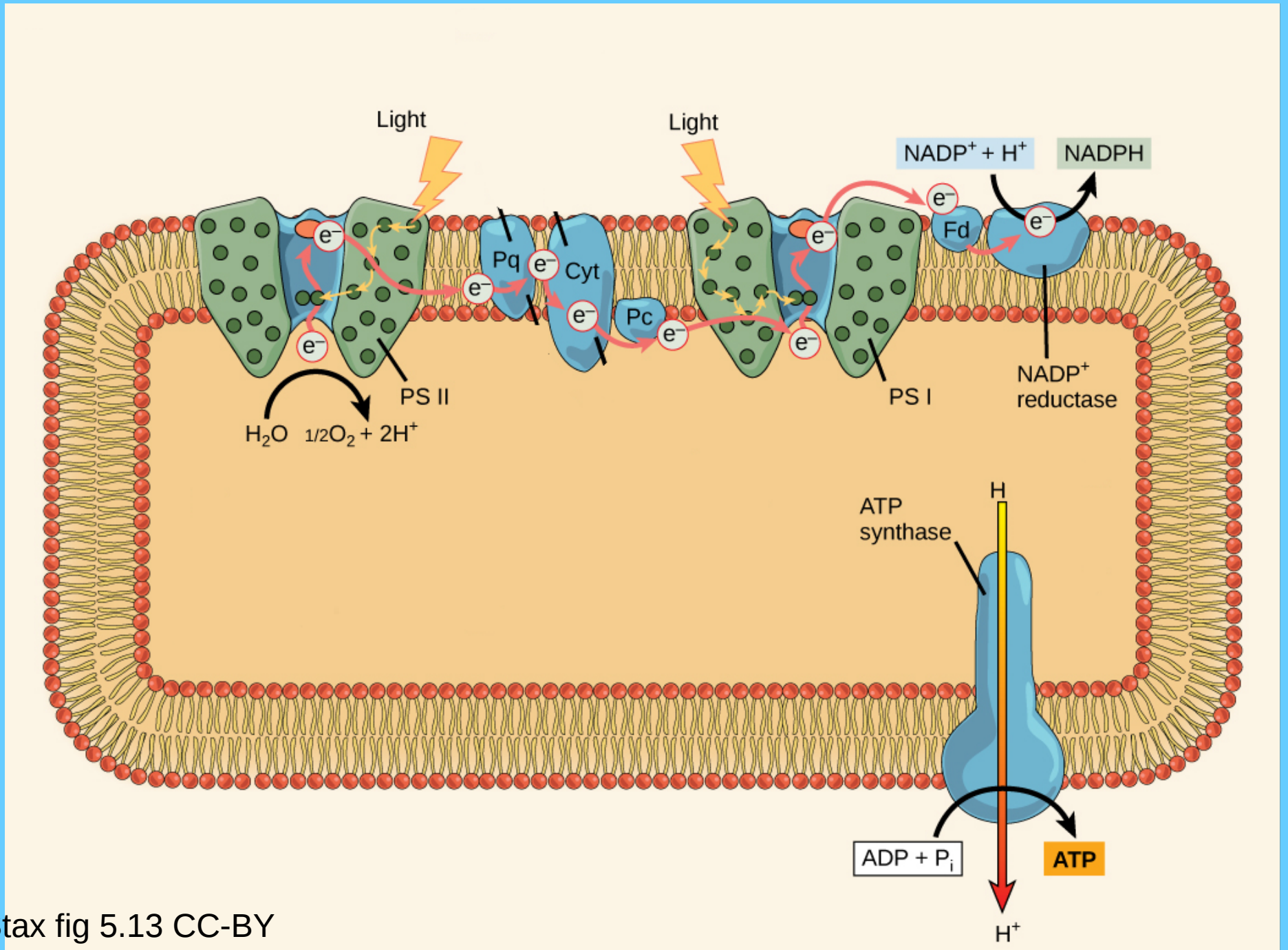

OpenStax fig 5.13 CC-BY

# Image Manipulation: Rasters in GIMP




OpenStax fig 5.13 CC-BY

# Image Manipulation: Rasters in GIMP




OpenStax fig 5.13 CC-BY

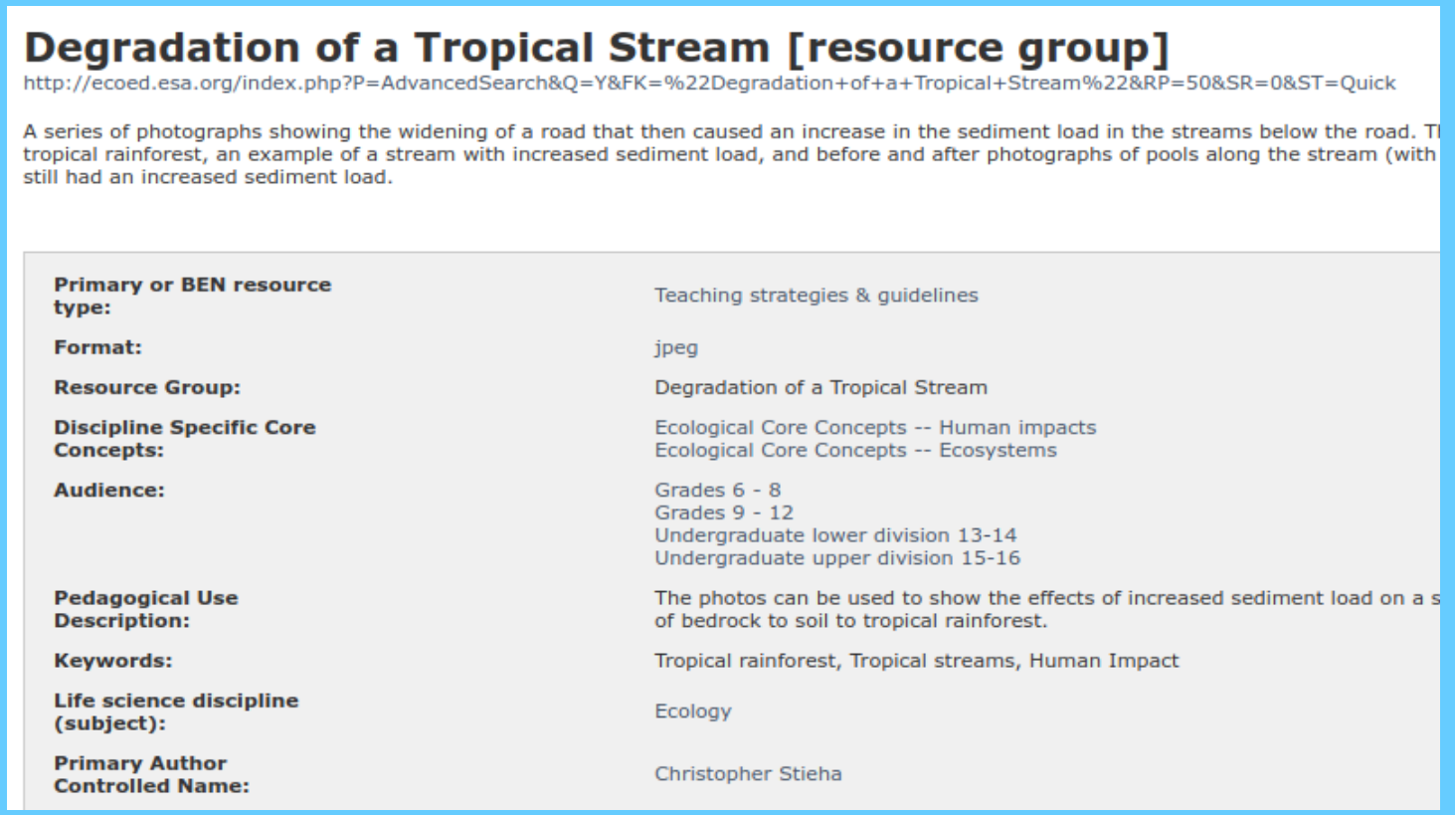
# Image Manipulation: Rasters in GIMP Markers and Contrast

Resource Group,
a series of photos

Before and after photos of streams impacted by construction

We told a story
We commented on each photo

We did have to change the contrast and brightness of some photos



**Degradation of a Tropical Stream [resource group]**

http://ecoed.esa.org/index.php?P=AdvancedSearch&Q=Y&FK=%22Degradation+of+a+Tropical+Stream%22&RP=50&SR=0&ST=Quick

A series of photographs showing the widening of a road that then caused an increase in the sediment load in the streams below the road. T
tropical rainforest, an example of a stream with increased sediment load, and before and after photographs of pools along the stream (with
still had an increased sediment load.

| | |
|---|---|
| **Primary or BEN resource type:** | Teaching strategies & guidelines |
| **Format:** | jpeg |
| **Resource Group:** | Degradation of a Tropical Stream |
| **Discipline Specific Core Concepts:** | Ecological Core Concepts -- Human impacts<br>Ecological Core Concepts -- Ecosystems |
| **Audience:** | Grades 6 - 8<br>Grades 9 - 12<br>Undergraduate lower division 13-14<br>Undergraduate upper division 15-16 |
| **Pedagogical Use Description:** | The photos can be used to show the effects of increased sediment load on a s of bedrock to soil to tropical rainforest. |
| **Keywords:** | Tropical rainforest, Tropical streams, Human Impact |
| **Life science discipline (subject):** | Ecology |
| **Primary Author Controlled Name:** | Christopher Stieha |

https://ecoed.esa.org/index.php?P=FullRecord&ID=492

# Image Manipulation: Rasters in GIMP
# **Markers** and Contrast

Resource Group,
a series of photos

Before and after photos of streams impacted by construction

We told a story
We commented
on each photo

2005

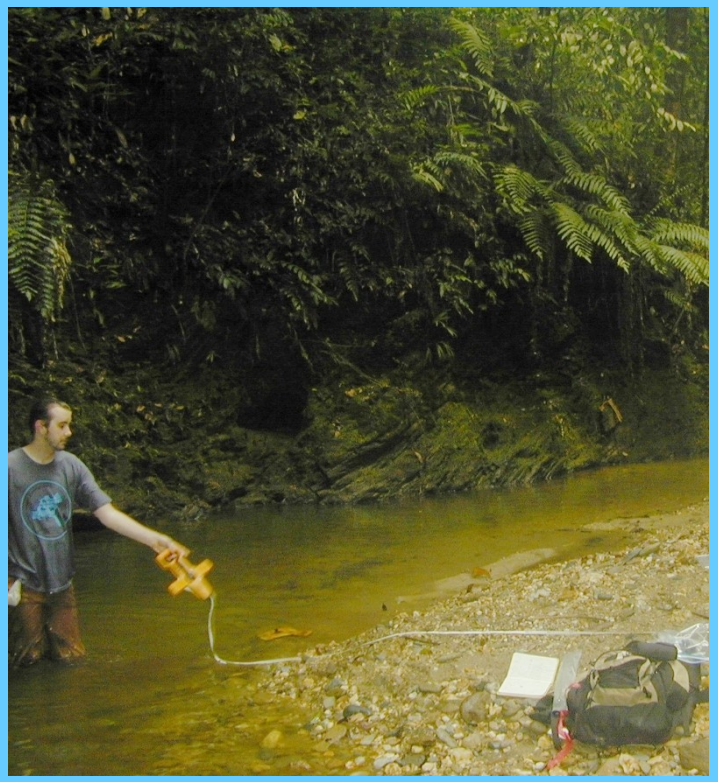
2007

We did have to change the contrast and brightness of some photos

https://ecoed.esa.org/index.php?P=FullRecord&ID=492

# Image Manipulation: Rasters in GIMP
# Markers and **Contrast**

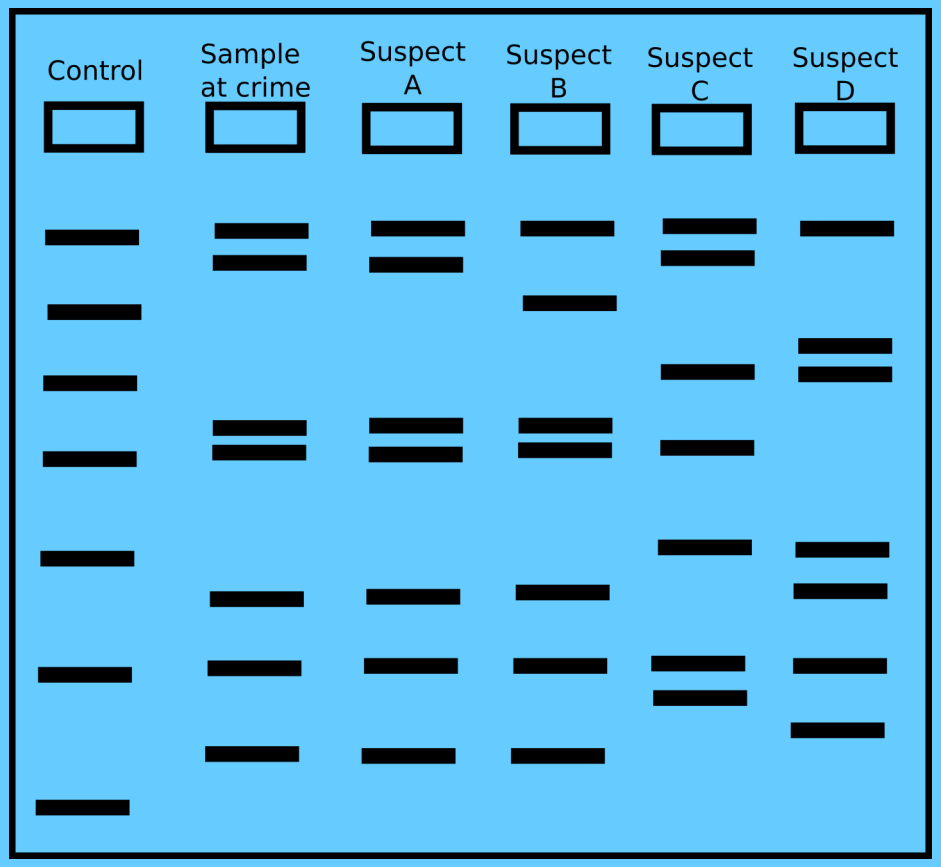
Original
Focus on the foreground



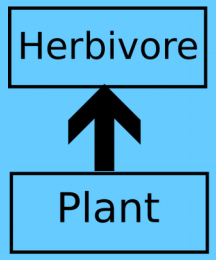
Focus on the background

# Image Manipulation: Rasters in GIMP
# Markers and **Contrast**

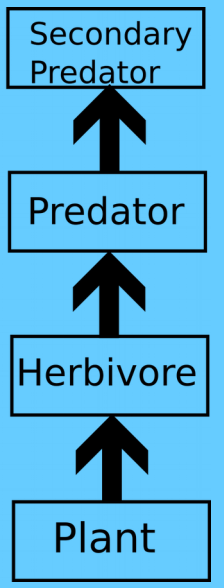
# Vector Images in Inkscape
# Image and Diagram Development




Introductory Biology for Non-majors








Population and Community Ecology

# Vector Images in Inkscape
# Image and Diagram Development

Tick ID

## OHIO STATE UNIVERSITY EXTENSION

### Tick Identification and Disease Information:

Ticks are blood-feeding parasites that may infect people and pets with diseases. Preventing tick bites is the best protection from tickborne disease. The risk of infection is much higher if tick is attached for more than one day.

For more information: u.osu.edu/bite

Unless indicated, photos courtesy of TickEncounter Resource Center

### Black-Legged 'Deer' Tick

Can transmit Lyme Disease (most often by the nymph), Anaplasmosis, Babesiosis

**Actual Size**

Adult

2-3 mm unfed

Nymph

1.5 mm unfed

Nymph Adult male Adult female

### How to remove a tick

1. Apply rubbing alchohol to bite area.
2. Using POINTY TWEEZERS, grab the tick as close to the skin as possible.
3. Pull straight upward with steady, even pressure.
4. Apply more rubbing alcohol.
5. Store tick

Sarah Short, OSU

# Statistics and Biometry in R

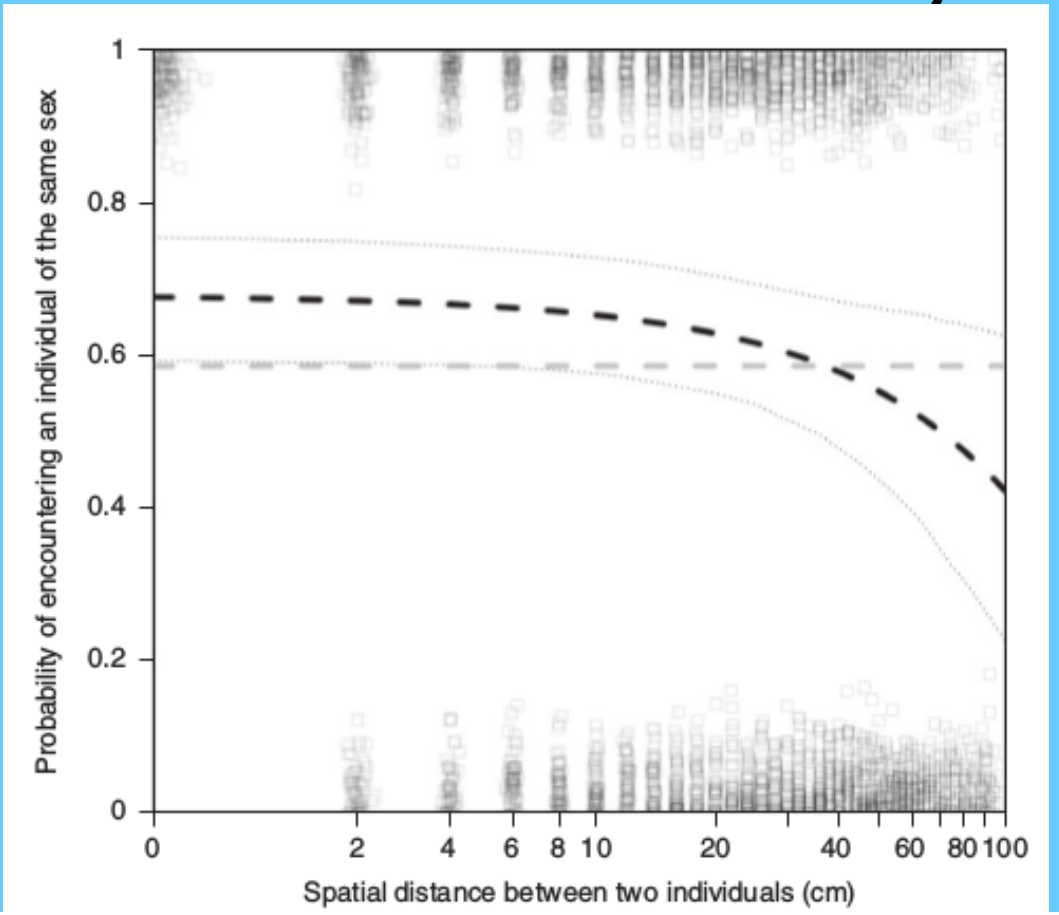



TABLE 3. *Statistical tests for both the comparison between the sexes and the comparison among genotypes*

| | Term | Base model | Δdeviance | d.f. | *P* |
|---|---|---|---|---|---|
| Comparison between the sexes | Distance × sex × size | Distance + sex + size + distance × sex + distance × size + sex × size | 1.0756 | 1 | 0.2997 |
| | Sex × size | Distance + sex + size + distance × sex + distance × size | 0.2151 | 1 | 0.6428 |
| | Distance × sex | Distance + sex + size + distance × size | 1.0556 | 1 | 0.3042 |
| | Distance × size | Distance + sex + size | 1.6034 | 1 | 0.2054 |
| | **Size** | Distance + sex | 7.4035 | 1 | **0.00651** |
| | **Ssex** | Distance + size | | | |
| | **Distance** | Sex + size | | | |

Brzyski et al. 2018 Annals of Botany

# Statistics and Biometry in R
# Biometry: 6-sided dice experiment

six-sided dice.ods - LibreOffice Calc

File Edit View Insert Format Sheet Data Tools Window Help

Liberation Sans 10

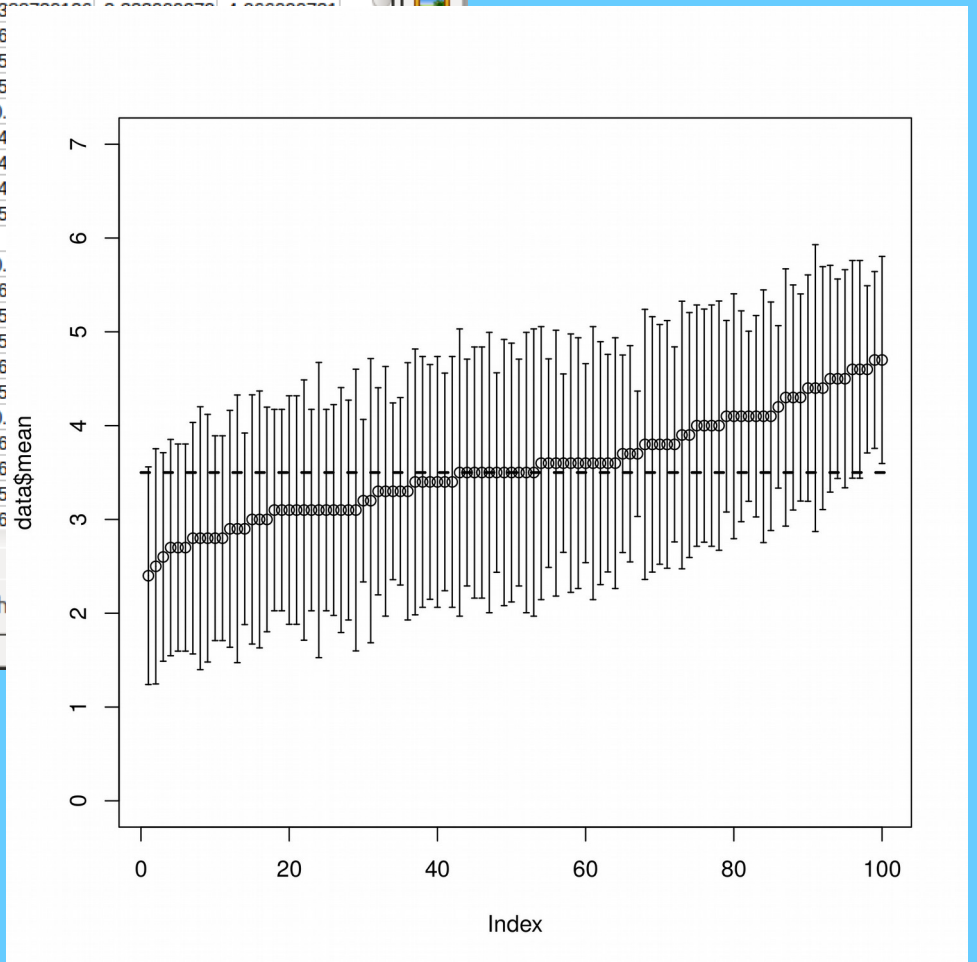
B92 4

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | sample | roll1 | roll2 | roll3 | roll4 | roll5 | roll6 | roll7 | roll8 | roll9 | roll10 | mean | stddev | stderror | lower95CI | upper95CI |
| 2 | 1 | 4 | 6 | 2 | 1 | 1 | 5 | 1 | 6 | 6 | 3 | 3.5 | 2.173067468 | 0.687184271 | 1.968953444 | 5.031046556 |
| 3 | 2 | 4 | 6 | 2 | 1 | 5 | 1 | 3 | 2 | 6 | 6 | 3.6 | 2.065591118 | 0.653197265 | 2.144676494 | 5.055323506 |
| 4 | 3 | 3 | 2 | 4 | 4 | 1 | 5 | 1 | 5 | 3 | 5 | 3.3 | 1.567021236 | 0.495535625 | 2.195946628 | 4.404053372 |
| 5 | 4 | 5 | 3 | 4 | 5 | 3 | 2 | 4 | 2 | 2 | 2 | 3.2 | 1.229272594 | 0.3 | | |
| 6 | 5 | 2 | 4 | 5 | 4 | 6 | 4 | 1 | 6 | 1 | 1 | 3.4 | 2.011080417 | 0.6 | | |
| 7 | 6 | 6 | 2 | 4 | 1 | 2 | 1 | 1 | 3 | 3 | 1 | 2.4 | 1.646545205 | 0.5 | | |
| 8 | 7 | 2 | 2 | 4 | 3 | 6 | 1 | 1 | 1 | 5 | 4 | 2.9 | 1.791957341 | 0.5 | | |
| 9 | 8 | 1 | 1 | 2 | 3 | 3 | 2 | 2 | 5 | 6 | 2 | 2.7 | 1.636391694 | 0. | | |
| 10 | 9 | 2 | 4 | 3 | 5 | 6 | 3 | 1 | 4 | 5 | 4 | 3.7 | 1.494434118 | 0.4 | | |
| 11 | 10 | 3 | 6 | 3 | 2 | 6 | 4 | 3 | 1 | 4 | 4 | 3.6 | 1.577621275 | 0.4 | | |
| 12 | 11 | 6 | 3 | 1 | 5 | 5 | 3 | 4 | 5 | 4 | 5 | 4.1 | 1.449137675 | 0.4 | | |
| 13 | 12 | 1 | 3 | 2 | 6 | 6 | 2 | 2 | 2 | 2 | 2 | 2.8 | 1.751190072 | 0.5 | | |
| 14 | 13 | 2 | 3 | 2 | 6 | 3 | 1 | 6 | 3 | 6 | 2 | 3.4 | 1.897366596 | | | |
| 15 | 14 | 2 | 4 | 4 | 5 | 1 | 4 | 5 | 2 | 3 | 1 | 3.1 | 1.523883927 | 0. | | |
| 16 | 15 | 5 | 2 | 3 | 1 | 6 | 6 | 1 | 3 | 6 | 3 | 3.6 | 2.011080417 | 0.6 | | |
| 17 | 16 | 3 | 5 | 3 | 6 | 2 | 6 | 1 | 6 | 3 | 5 | 4 | 1.825741858 | 0.5 | | |
| 18 | 17 | 6 | 2 | 2 | 4 | 1 | 5 | 2 | 3 | 5 | 5 | 3.5 | 1.715938357 | 0.5 | | |
| 19 | 18 | 3 | 5 | 3 | 1 | 1 | 6 | 6 | 5 | 2 | 3 | 3.5 | 1.900292375 | 0.6 | | |
| 20 | 19 | 3 | 2 | 6 | 4 | 5 | 1 | 6 | 2 | 2 | 3 | 3.4 | 1.776388346 | 0.5 | | |
| 21 | 20 | 1 | 4 | 2 | 6 | 3 | 3 | 3 | 2 | 2 | 5 | 3.1 | 1.523883927 | 0. | | |
| 22 | 21 | 1 | 1 | 1 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 3.8 | 2.043961296 | 0.6 | | |
| 23 | 22 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 4 | 6 | 6 | 2.9 | 2.024845673 | 0.6 | | |
| 24 | 23 | 1 | 1 | 1 | 3 | 3 | 3 | 4 | 4 | 5 | 6 | 3.1 | 1.728840331 | 0.5 | | |
| 25 | 24 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 6 | 6 | 2.8 | 1.988857852 | 0.6 | | |

Sheet1

Find Find All Search Formatted Display String Match

Sheet 1 of 1 Default



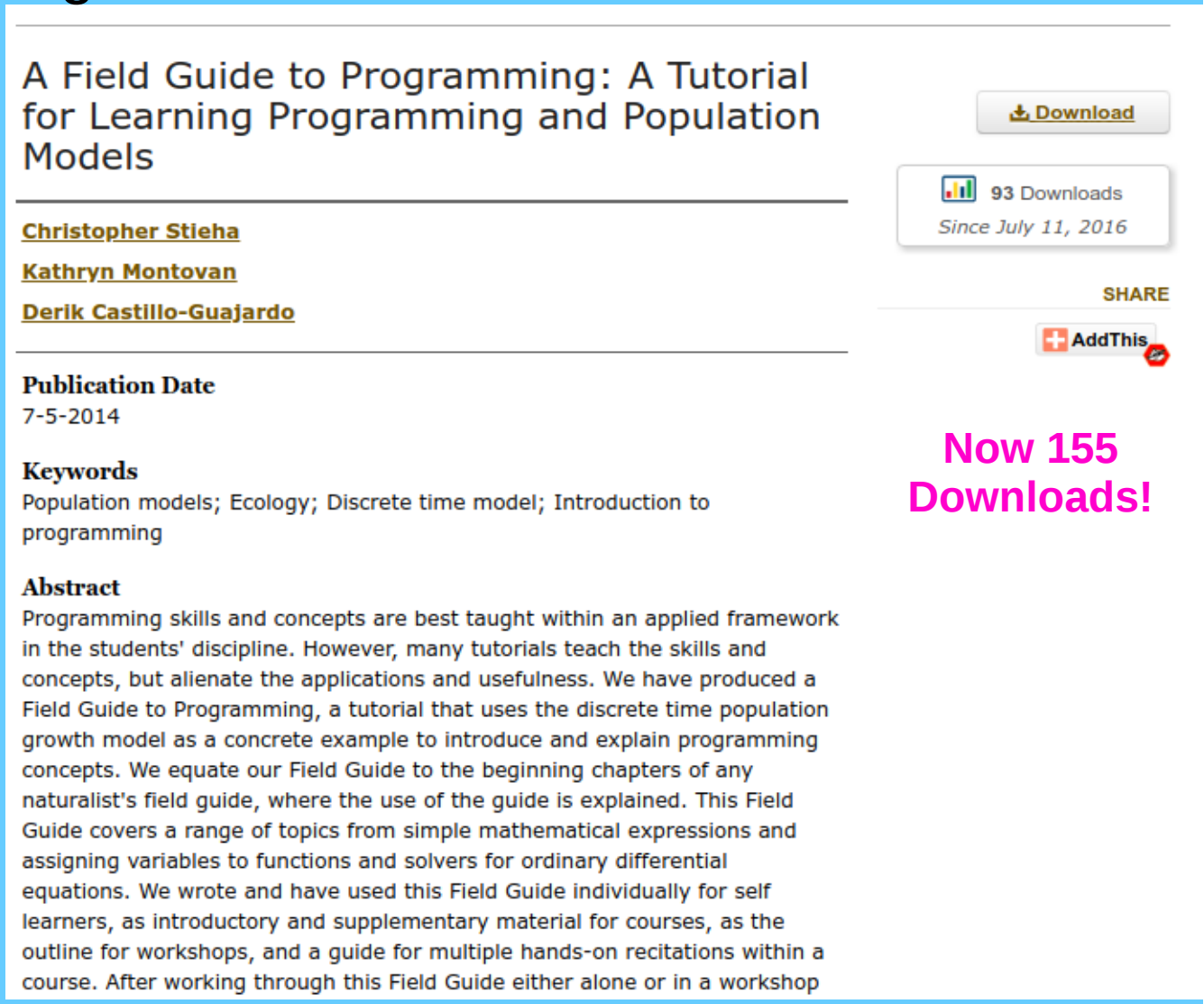
# Programming Population Dynamics in R
# Field Guide to Programming

## Upper-level undergraduate lecture and lab course

Introduction to
- the Field Guide

Field Guide to Programming
- MATLAB
- R
- Word Document
- PDF

Code
- Zip file for R
- Zip file for MATLAB



A Field Guide to Programming: A Tutorial for Learning Programming and Population Models

Christopher Stieha
Kathryn Montovan
Derik Castillo-Guajardo

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**Publication Date**
7-5-2014

**Keywords**
Population models; Ecology; Discrete time model; Introduction to programming

**Abstract**
Programming skills and concepts are best taught within an applied framework in the students' discipline. However, many tutorials teach the skills and concepts, but alienate the applications and usefulness. We have produced a Field Guide to Programming, a tutorial that uses the discrete time population growth model as a concrete example to introduce and explain programming concepts. We equate our Field Guide to the beginning chapters of any naturalist's field guide, where the use of the guide is explained. This Field Guide covers a range of topics from simple mathematical expressions and assigning variables to functions and solvers for ordinary differential equations. We wrote and have used this Field Guide individually for self learners, as introductory and supplementary material for courses, as the outline for workshops, and a guide for multiple hands-on recitations within a course. After working through this Field Guide either alone or in a workshop

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http://scholarship.claremont.edu/codee/vol10/iss1/2/

# Programming Population Dynamics in R

```
r = 2;
n0 = 20;    # initial population size
n1 = n0 * r; # population size at t = 1
n2 = n1 * r; # population size at t = 2
n3 = n2 * r; # population size at t = 3
n4 = n3 * r; # population size at t = 4
n5 = n4 * r; # population size at t = 5
```

# Programming Population Dynamics in R

```
r = 2;
n0 = 20; ⟶# ini
n1 = n0 * r; # po
n2 = n1 * r; # po
n3 = n2 * r; # po
n4 = n3 * r; # po
n5 = n4 * r; # po
```

```
#########################################################################
# Section 2: Time Series Analysis
#########################################################################

# these lines of code take the parameter values at the top of the script file
# and stick them in to our equations so that we can use them
parms.eqn.x <- Model2String(var.eqn.x, parms = model.parms, supress.print = TRUE)
parms.eqn.y <- Model2String(var.eqn.y, parms = model.parms, supress.print = TRUE)


model.state <- c(x = 1, y = 2) # initial condition
model.sigma <- 0#0.05 ⟶ ⟶ ⟶ ⟶# the level of noise
model.time <- 1000 #12500 ⟶ ⟶ ⟶ ⟶# the length of the simulation
model.deltat <- 0.025 ⟶ ⟶ ⟶# the time step

ts.ex1 <- TSTraj(y0 = model.state, time = model.time,
⟶deltat = model.deltat, x.rhs = var.eqn.x, y.rhs = var.eqn.y,
⟶parms = model.parms, sigma = model.sigma)

TSPlot(ts.ex1, deltat = model.deltat)

#We can view the times series plotted along on the state variables by setting dim = 2:
TSPlot(ts.ex1, deltat = model.deltat, dim = 2)

TSDensity(ts.ex1, dim = 2)


# with stochasticity

model.state <- c(x = 1, y = 2) # initial condition
model.sigma <- 0.05 ⟶ ⟶ ⟶# the level of noise
model.time <- 1000 #12500 ⟶ ⟶ ⟶ ⟶# the length of the simulation
model.deltat <- 0.025 ⟶ ⟶ ⟶# the time step

ts.ex1 <- TSTraj(y0 = model.state, time = model.time,
⟶deltat = model.deltat, x.rhs = var.eqn.x, y.rhs = var.eqn.y,
⟶parms = model.parms, sigma = model.sigma)

TSPlot(ts.ex1, deltat = model.deltat)
```

# FLOSS in Charlie's classroom


https://www.millersville.edu/cae/open-education-week/index.php

# FLOSS, OER, and me

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bit.ly/OERGuide

**Collexion**, Lexington, KY makerspace

**Ithaca Generator**, Ithaca, NY makerspace

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# Questions?

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