Using Git and GitHub with R

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June 3, 2020

Canadian Society for Hydrological Sciences

cshs.cwra.org

- Promote the science of hydrology and its sound application in effective water management
- Courses (Kananaskis, Waterloo & Sacré-Coeur)
- Modelling Tools (GreyJay and hydrology R package)
- Webinars
- Conferences
- Awards and Scholarships

CSHShydRology

- R package of functions for Canadian hydrologists
  github.com/CSHS-CWRA/CSHShydRology
- Undergoing development, hoping to deploy on CRAN this fall
- Many people interested in helping, but are having issues with git/GitHub
- Please join us!

Purpose of this webinar. . .

. . . is to get you comfortable *using* git and GitHub for your R projects, and enable you to collaborate on projects such as **CSHShydRology**.

It is *not* to make you an expert in version control software.

Webinar components

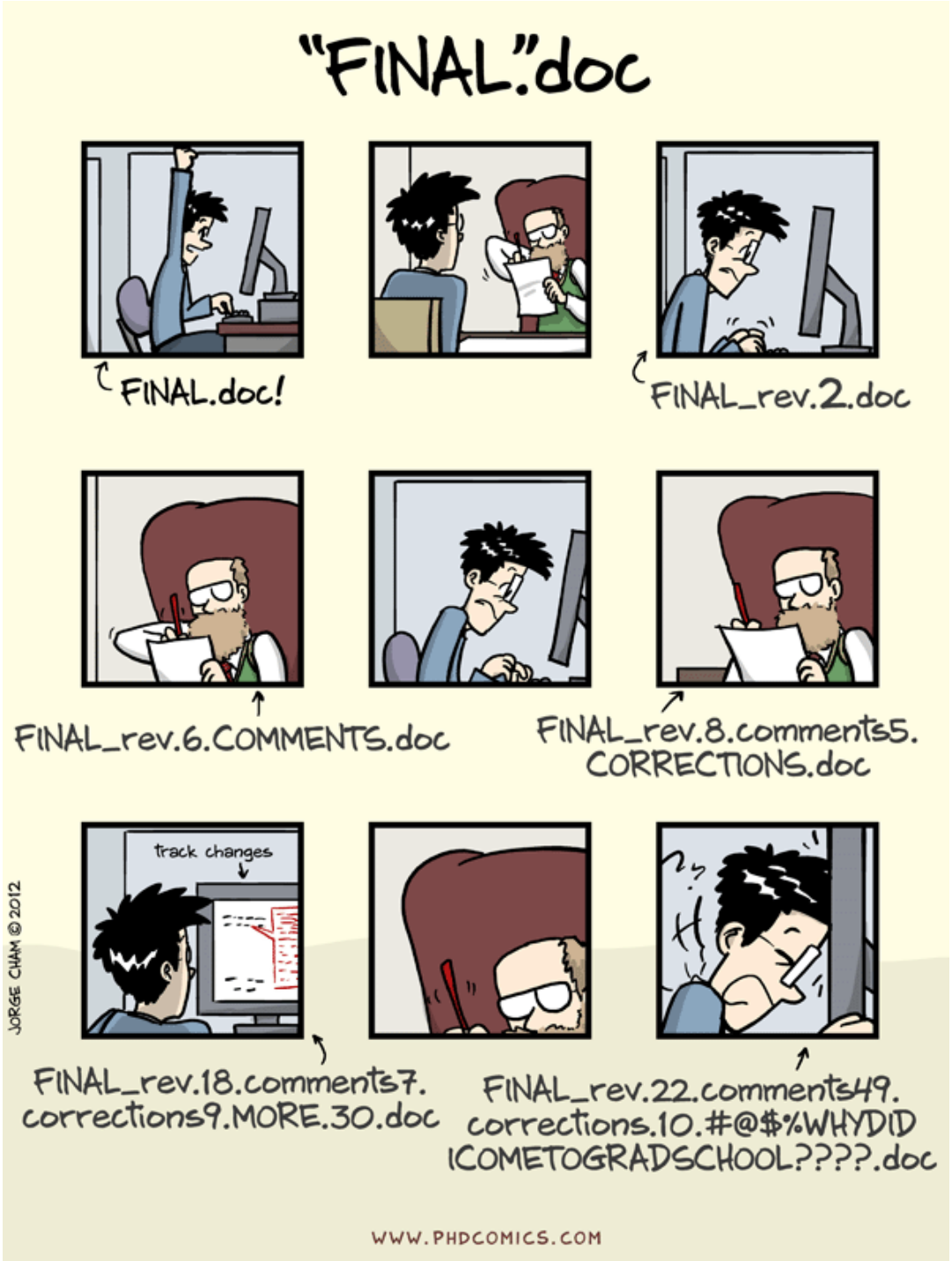
1. Introduction to git/GitHub (slides) - Kevin Shook
2. Using git/GitHub (demonstration) - Rob Chlumsky
3. Questions and wrap-up

All files are available at
github.com/CentreForHydrology/git_for_R

1. Introduction to git and GitHub

Outline

- Version control
- What are git and GitHub?
- How to set up git/GitHub
- Using git in R
- Working with GitHub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Version control programs

- When you create R files (code, notebooks, documents), there are always changes
- Changes sometimes damage the files
  - need to go back to older versions
- Need to add/test new features without damaging current version
- Especially true when working with other people
- Version control programs allow you to manage the versions of the files that you create.

git

- Most popular version control program
- Written by Linus Torvalds, creator of Linux
- Free Open Source Software (FOSS)
- *Distributed* version control
  - doesn't require a centralized server like SVN

GitHub

- Website running git
- Allows you to backup your git repository
- Also allows collaboration with others
- There are other similar sites like GitLab: https://about.gitlab.com/

Getting git

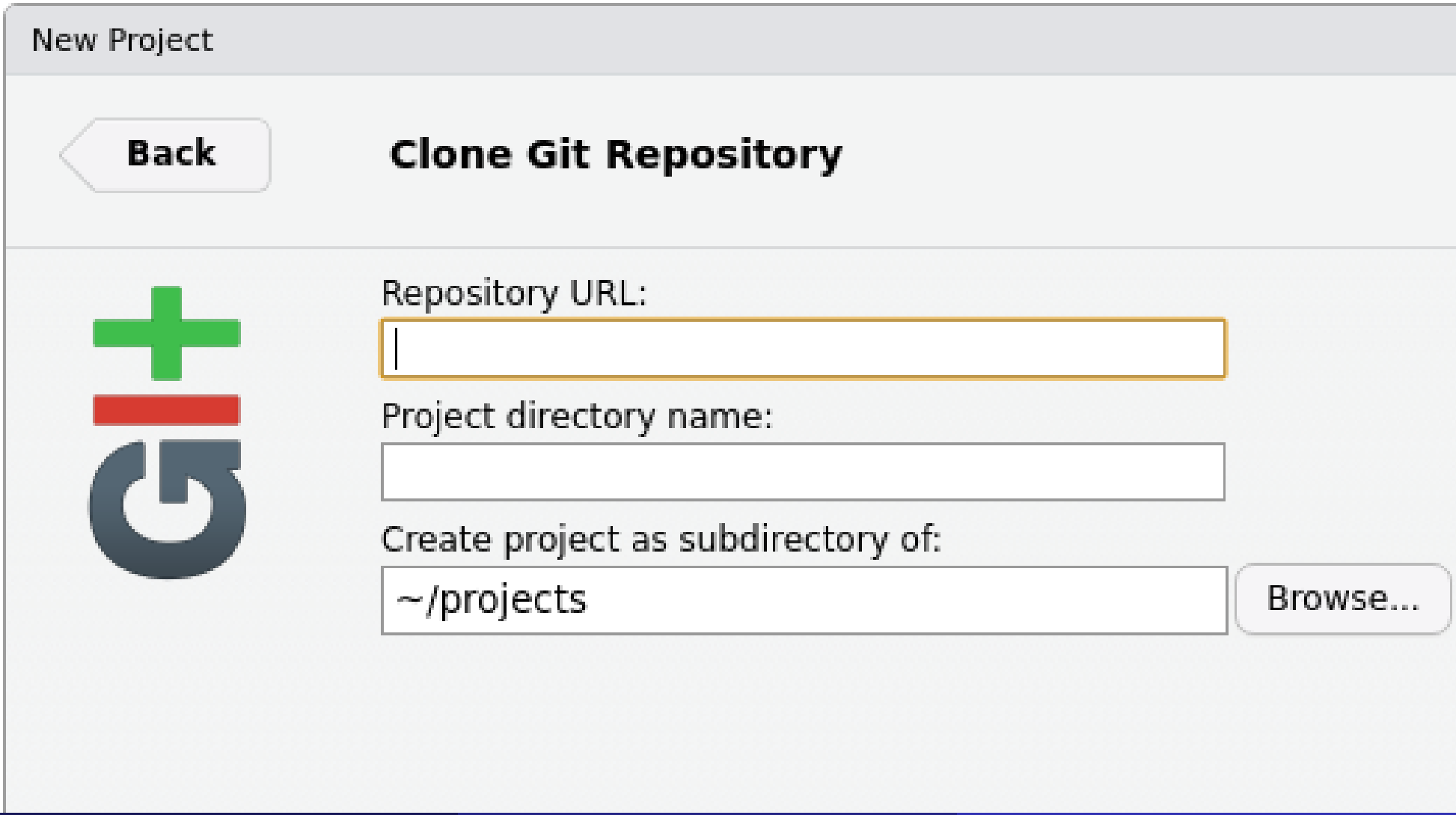
- Built into Linux
- For MacOS or Windows, you can download git from https://git-scm.com/

How git works

- A folder called **.git** is created in the directory holding your your project, the working directory
- This is the repository
  - It contains all versions, current and old, of your files
- When you make changes to the files, you add them to the repository
- You can retrieve old versions of the files into the working directory

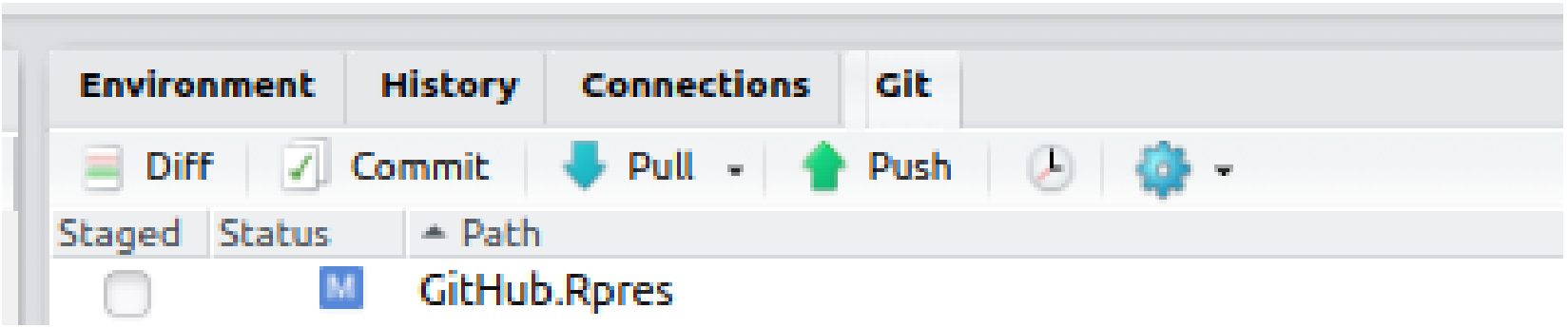
git and Rstudio

- When you clone a repository from GitHub through GitHub, a local repository is automatically created



Working with git

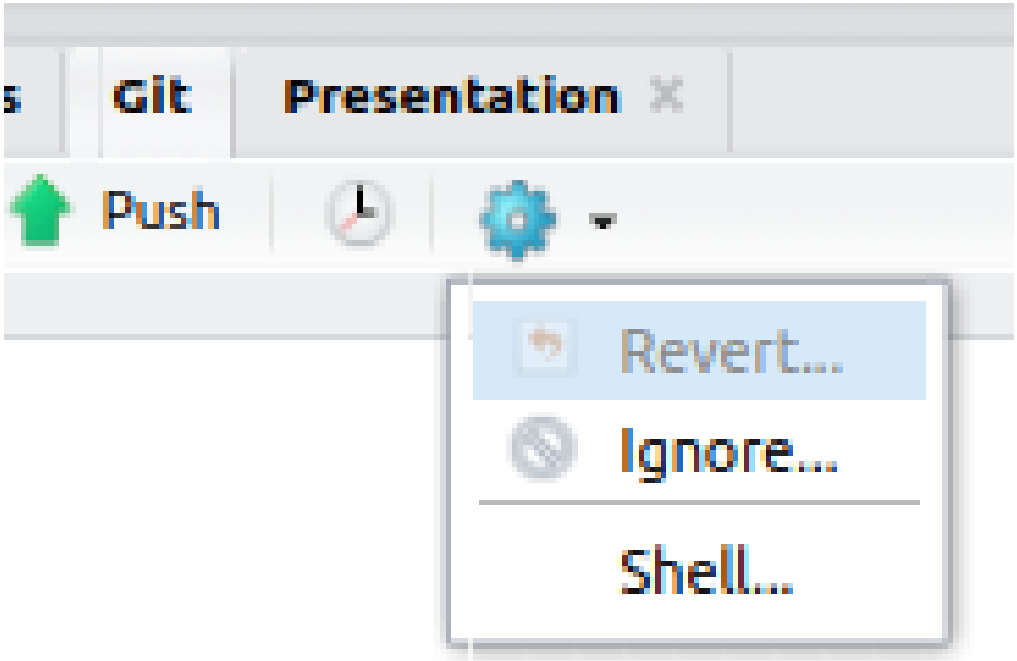
- git is a command-based program
- There are many GUIs for git, including Rstudio
  - makes working with git much easier
  - uses Git tab in top-right



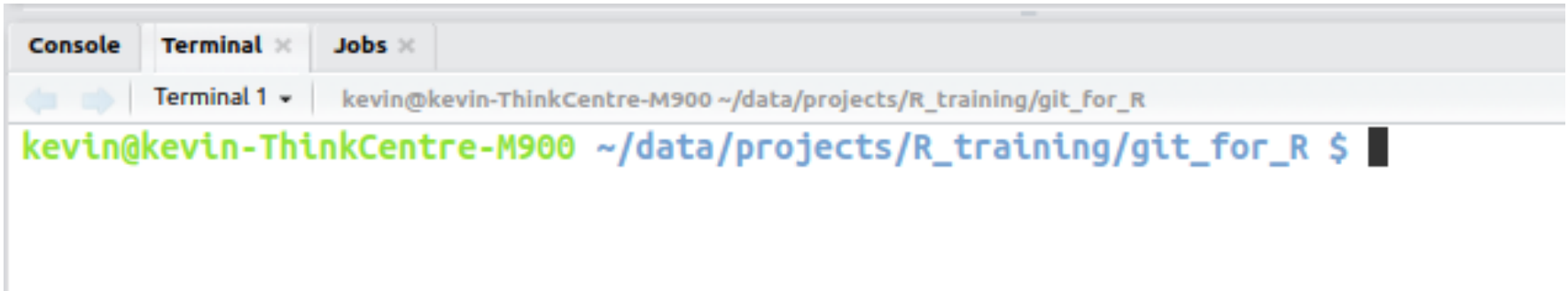
  - you will still have to type commands occasionally

Typing in commands

- You can use the git shell, which is accessed through a drop-down menu



- Or you can type in git commands in any terminal, including the terminal tab in Rstudio



Configuring git

The first step is to tell git who you are:

```
git config --global user.name "John Doe"
git config --global user.email johndoe@example.com
```

- You can list your current settings with the command

```
git config --list
```

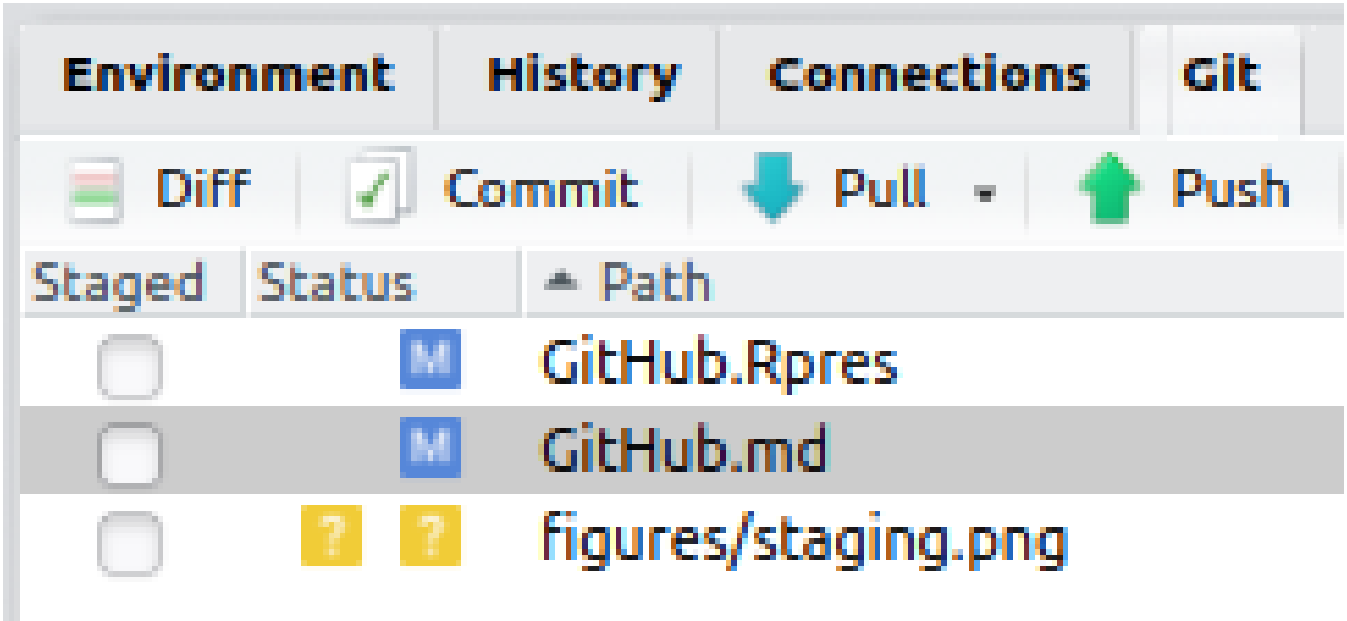
Version control

- As you create code, you will want to add it to the repository
  - generally done each time you have made a significant change to any file
- Adding takes 2 steps:

1. Staging (selecting the files to add), and
2. Committing (adding the files to the repository)

Files available for staging

The Git tab shows all of the files which can be staged - 2 files have been modified (blue M icon), - 1 file is new (yellow ? icon)

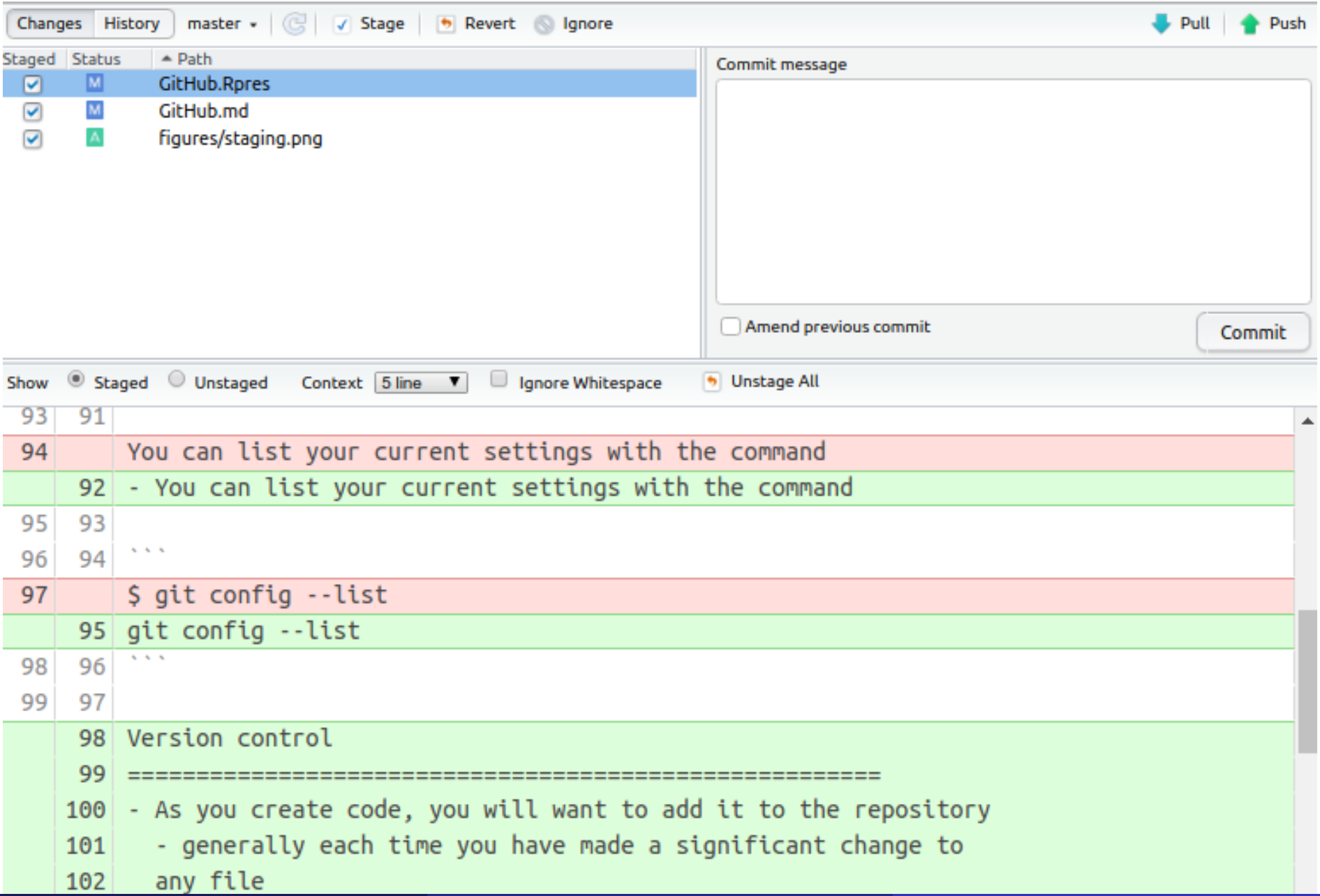


Committing

Select the files to be added

- the icons of the new files will change)
- and click on the commit icon
- The commit window will pop-up, giving you a chance to review the files before committing

Commit window

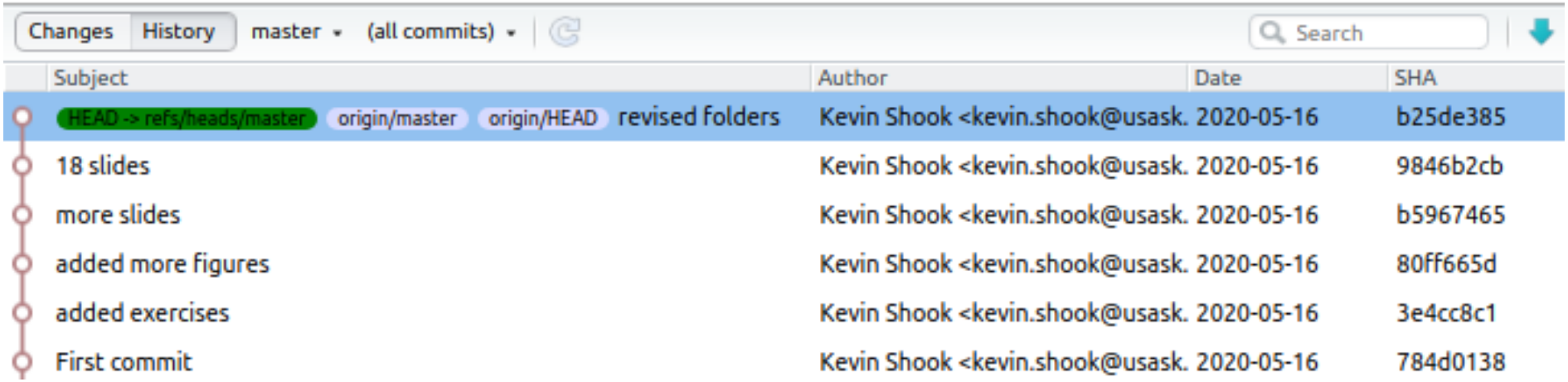


Commit window

- The bottom pane (Diff) shows the changes in all of the files
  - you can select or discard changes
- You **must** add a comment in the top-right panel before clicking on Commit

Git history

In the Commit window, clicking on the History button shows the history of all of your commits to the repository



- Each commit is identified by a unique SHA number

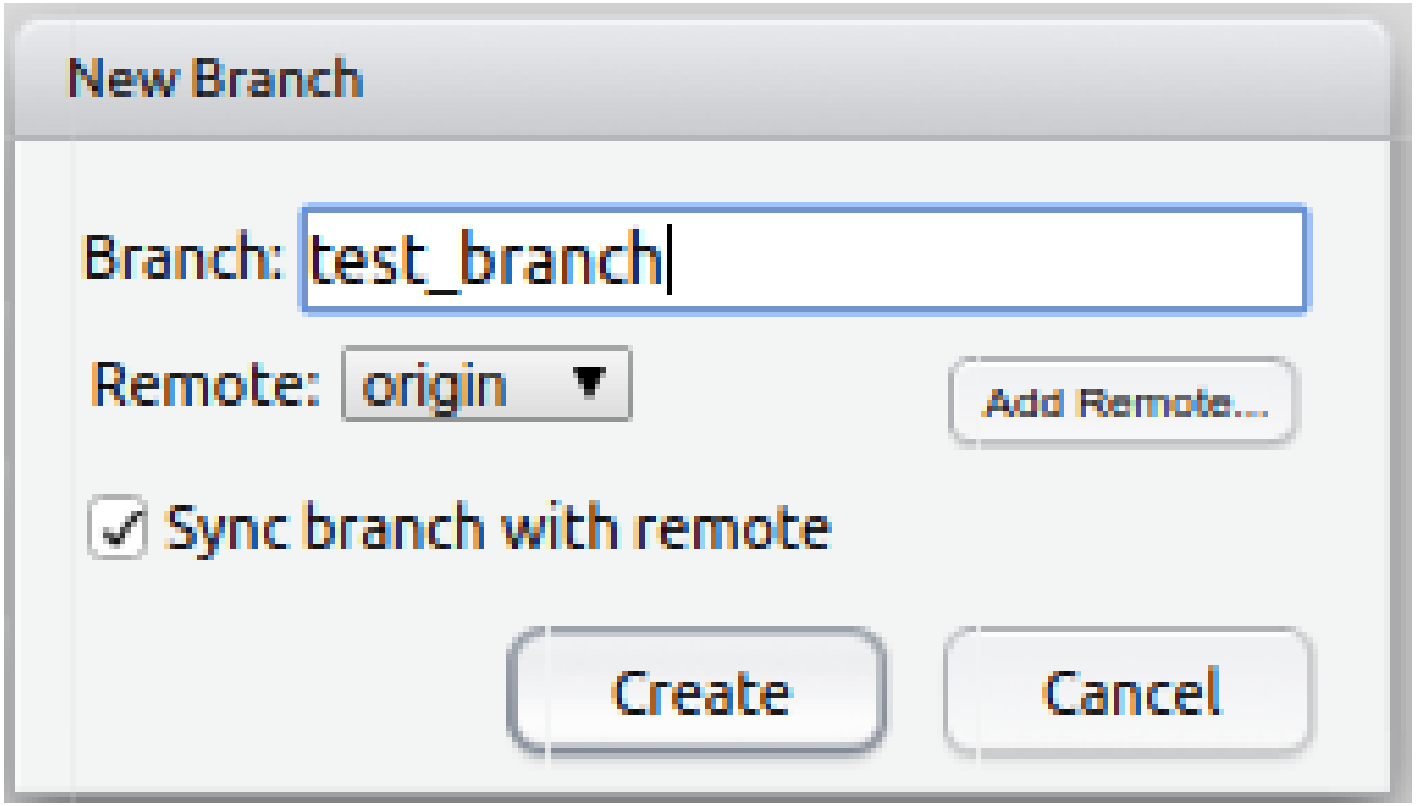
Branches

- git uses *branches* to organize your code/documents
- Each repository always has a branch called **master**
  - most up-to-date, best version of the code
- Each branch is separate, and can be changed/deleted
- The current branch is shown in the Git tab
- You can add branches at any time
- When you change the branch, the files in the working directory are updated

Creating branches

You can create a new branch at any time

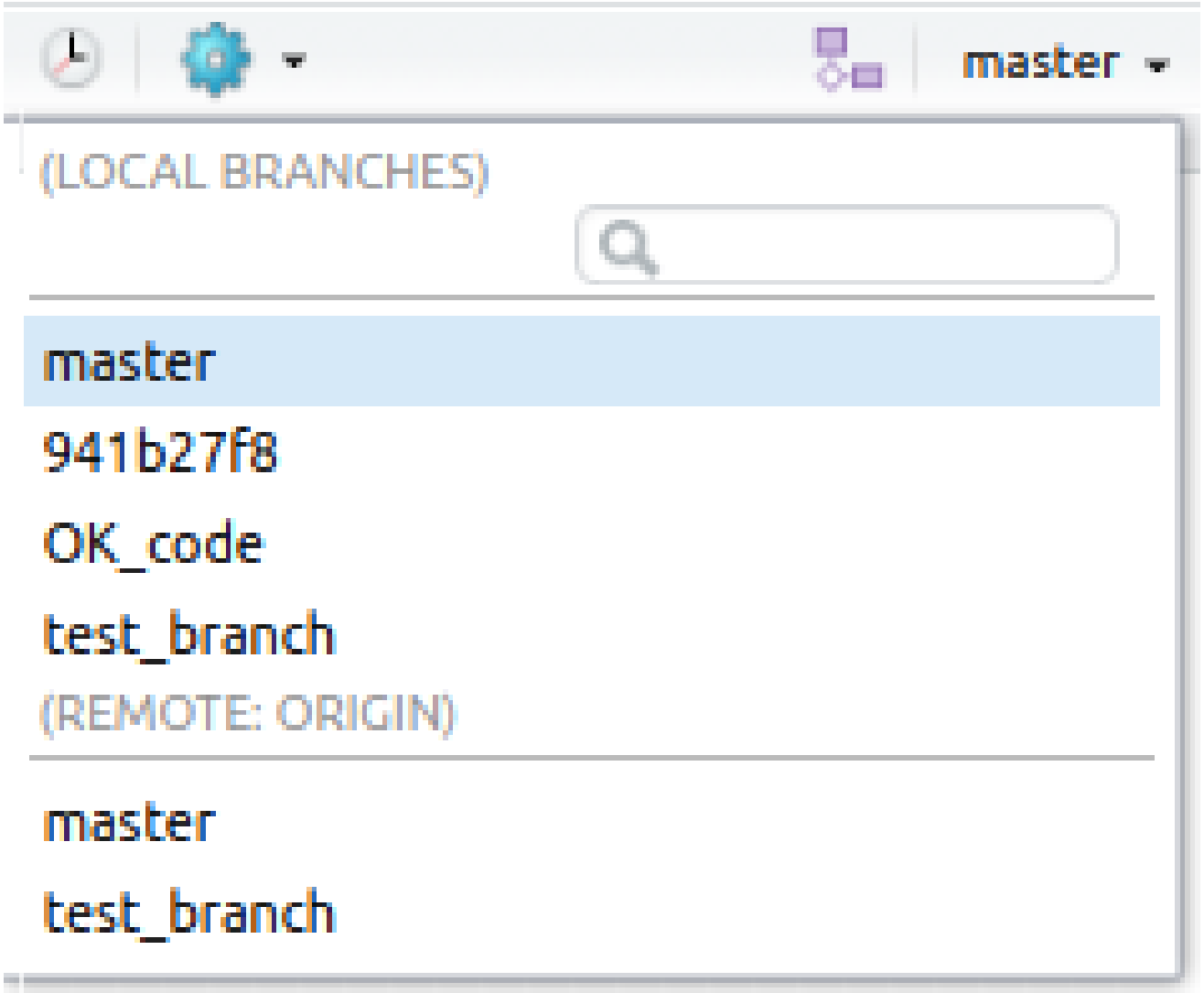
- Use the branch icon in RStudio:  to display the dialog box



- Current versions of all files are added to the new branch

Changing between branches

- You can switch between branches by selecting the branch name



Recovering from mistakes

There are *lots* of ways of screwing up your code!

- accidentally deleting files
- accidentally deleting many lines in a file (and saving)
- overwriting files

This is why it's a good idea to make a branch *before* making big changes to your project

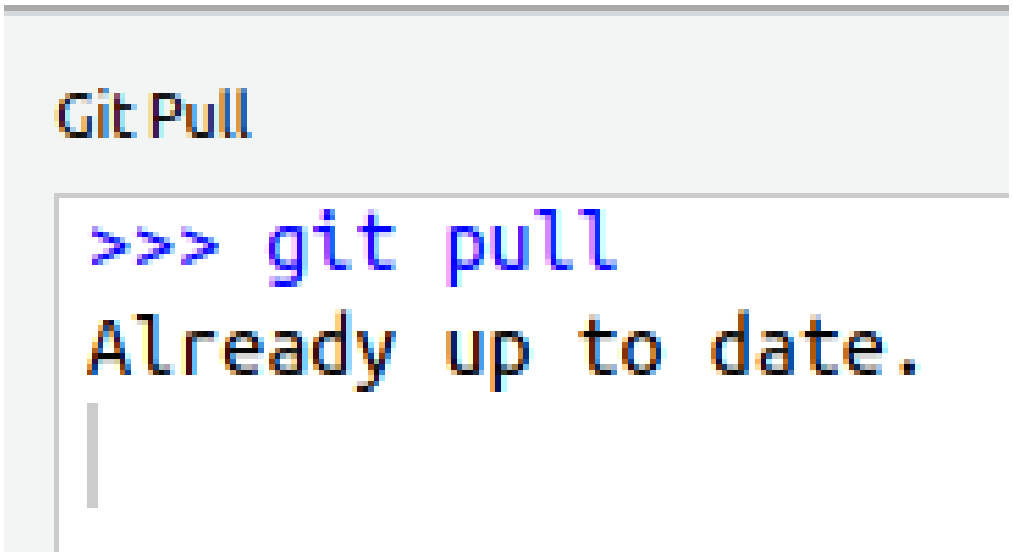
sethrobertson.github.io/GitFixUm shows how to recover from many different types of mistakes

Working with GitHub

- The GitHub/GitLab repository linked to your local repo is referred to as the "Remote"
  - i.e. the repo that is online is the remote one, the repo on your desktop is local

Pulling

- Pulling downloads the GitHub repo to your local repo
- It's a good idea to click on Pull to make sure that the local repo is up to date before doing any new work



Pushing

- Pushing uploads your local repository to GitHub
  - You should only push to your *own* GitHub repository

Git Push

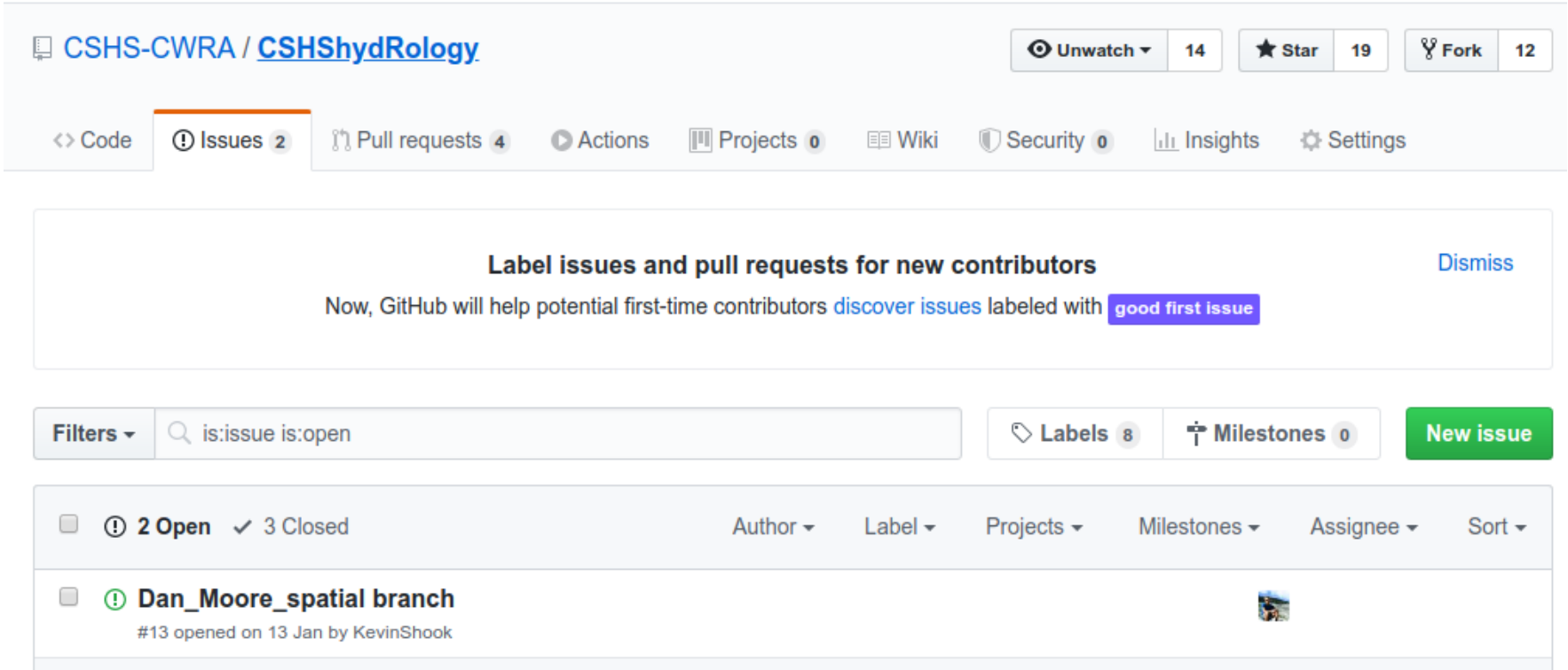
```
>>> git push origin HEAD:refs/heads/master
To github.com:CentreForHydrology/git_for_R.git
   3e4cc8c..b596746  HEAD -> master
```

Working with others

- The most important feature of GitHub is the way it enables people to work together on projects
- Each project will typically have an owner, and one or more people who can approve changes
- If you aren't one of these people (and even if you are!), you shouldn't be pushing changes to the **master** branch directly.

Bug reports (Issues)

- One of GitHub's most important features.
- Very easy to submit an Issue



- Writing a *good* bug report is an art - see github.com/rstudio/rstudio/wiki/Writing-Good-Bug-Reports

Forking

- A *fork* is complete copy of a GitHub repo
  - lets you copy other work to use as a basis for your own
  - also lets you make a working copy the repo files, without affecting the original repo
- A good way to create new features or fix bugs
- When you are finished, you can then submit a Pull Request

Pull requests

- Pull requests are submitted through GitHub
  - tell members of the project about your suggested changes
  - allows discussion
- Files can then be merged with the specified branch

ssh

- ssh is short for “secure shell”
- provides secure, encrypted communication between 2 computers
- if you set it up on your computer, you can avoid having to type in your user name and password every time
- part of Linux and Mac OS
- to add to Windows docs.microsoft.com/en-us/windows-server/administration/openssh/openssh_install_firstuse
- Once installed, you have to configure it to create a key and set up your GitHub account to use the key help.github.com/en/github/authenticating-to-github/connecting-to-github-with-ssh

Typical Workflow

1. Fork a repository of interest to your own GitHub account (creates a copy of this repo on your own account).
2. Checkout your version of this repo locally.
3. Make updates/ changes/ new branches/ etc. on your local account. Preferably in a new branch.
4. Merge/ push changes to the remote branch on your forked repo.
5. Make a pull request to bring these changes from your repo back to the original.
6. Celebrate in having made a contribution to another project!

2. Git and R Exercises

This will walk through the typical workflow above with two examples:

1. This presentation repository (CentreForHydrology/git_for_r)
2. The CSHS-hydRology package (CSHS-CWRA/CSHShydRology)

3. Questions?

Wrap-Up

- **lots** of resources online for git, GitHub, and R support
- many cool things that can be done with R, RStudio, and Git:
  - presentations, papers, reports, web pages, animated htmls...
  - Git pages, project landing pages websites, etc.

Post webinar

- please fill out our post-webinar survey (click on the url): docs.google.com/forms/d/e/1FAIpQLSeUf7iG_GZoxrKHkKrh6cqVs_baFS
- support the **CSHShydRology** project, as you can:
  - join our newsletter signup and monthly meetings
  - contribute function ideas, review code, tell your colleagues about this group
- stay tuned for free webinars on R and hydrology in the future