

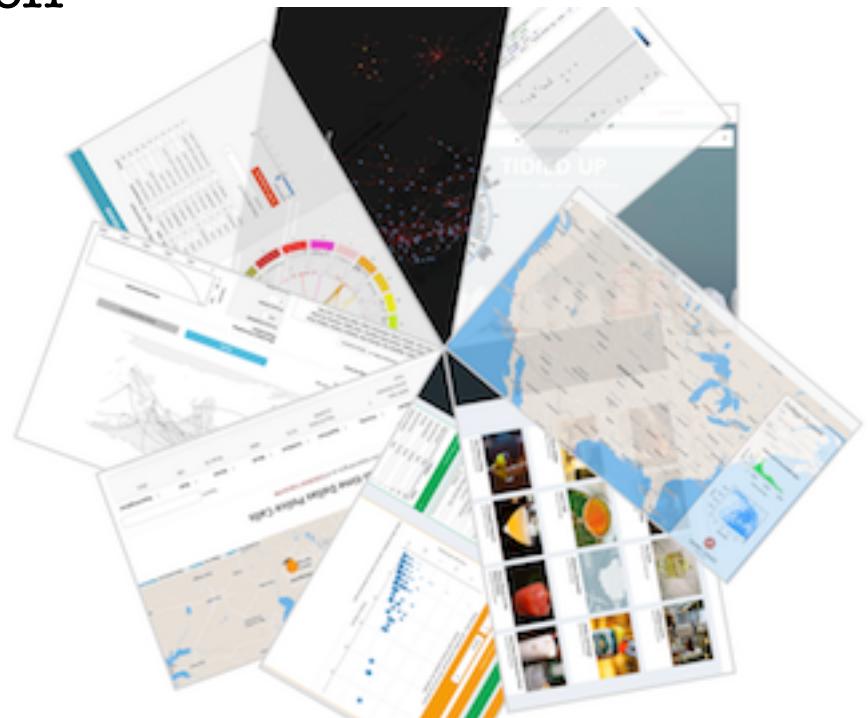
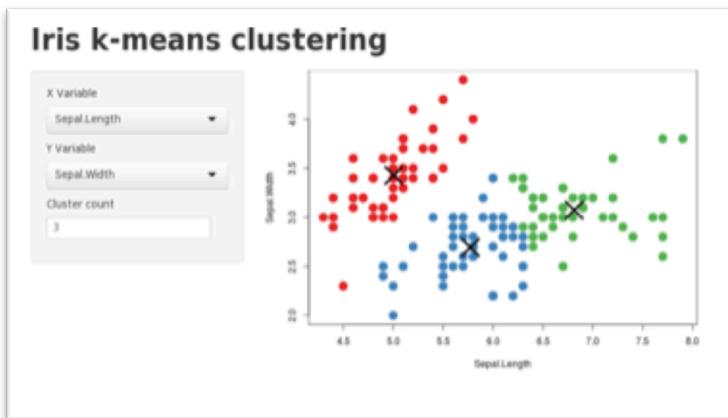
Louise Sing @sing\_louise

# How R made my PhD Shiny

Communicating research  
outputs using Shiny

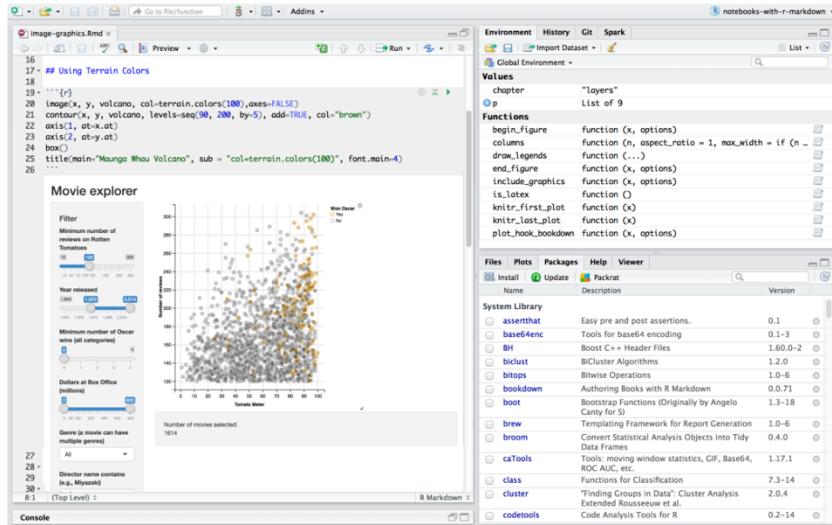
# Outline

- What is Shiny
- Communicating research
- Links



# What is R Shiny?

Shiny  
from  Studio

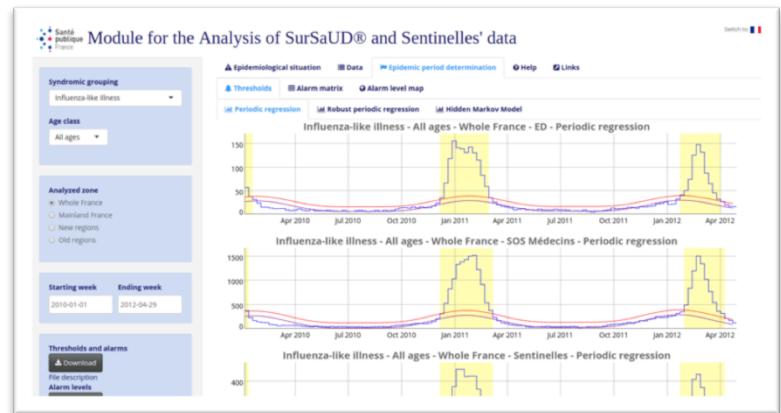
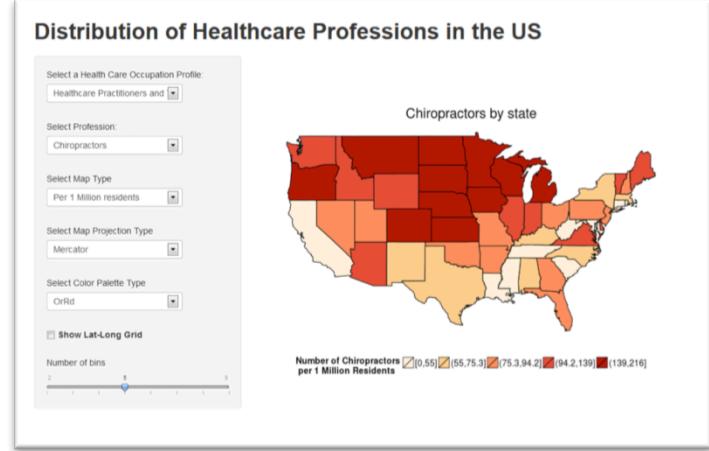


Shiny is an R package that makes it easy to build interactive web apps straight from R. You can host standalone apps on a webpage or embed them in [R Markdown](#) documents or build [dashboards](#). You can also extend your Shiny apps with [CSS themes](#), [htmlwidgets](#), and JavaScript [actions](#).

# What is R Shiny?

Shiny  
from  Studio

- An **interactive** tool for R analyses
- Designed for **sharing** R analysis with others in an interactive way via web browser
- I've also found it useful to **visually explore** my data
- Written in **HTML** (but you don't need to know HTML!)
- Very **customisable**



# Steps to create

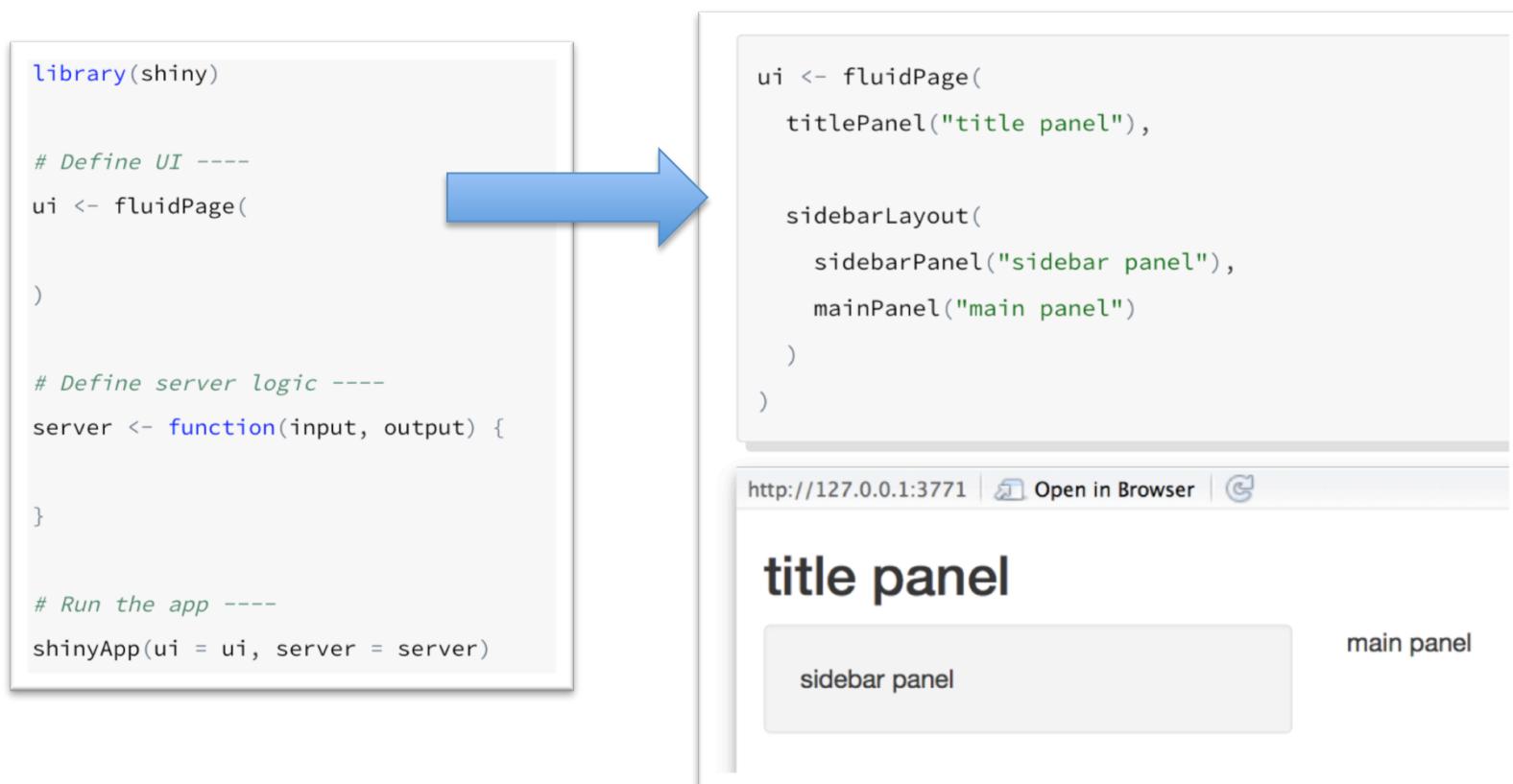
1. Build a user interface
2. Add control widgets
3. Display reactive output using R scripts and data
4. Share

Structure: app.R contains the R script to build the app, all data in a data folder in a **data** folder and images in a **www** folder



# Steps to create the app

## 1. Build a user interface



<https://shiny.rstudio.com/tutorial/written-tutorial/lesson2/>

# 2. Add control widgets

- User interacts with control widgets that update the reactive output (e.g. graph, map)

http://127.0.0.1:3771 | Open in Browser |

[Publish](#)

### Basic widgets

**Buttons**

Action

Submit

**Single checkbox**

Choice A

**Checkbox group**

Choice 1

Choice 2

Choice 3

**Date input**

2014-01-01

**Date range**

2017-06-21 to 2017-06-21

**File input**

Browse... No file selected

**Help text**

Note: help text isn't a true widget, but it provides an easy way to add text to accompany other widgets.

**Numeric input**

1

**Radio buttons**

Choice 1

Choice 2

Choice 3

**Select box**

Choice 1

**Sliders**

0 10 20 30 40 50 60 70 80 90 100

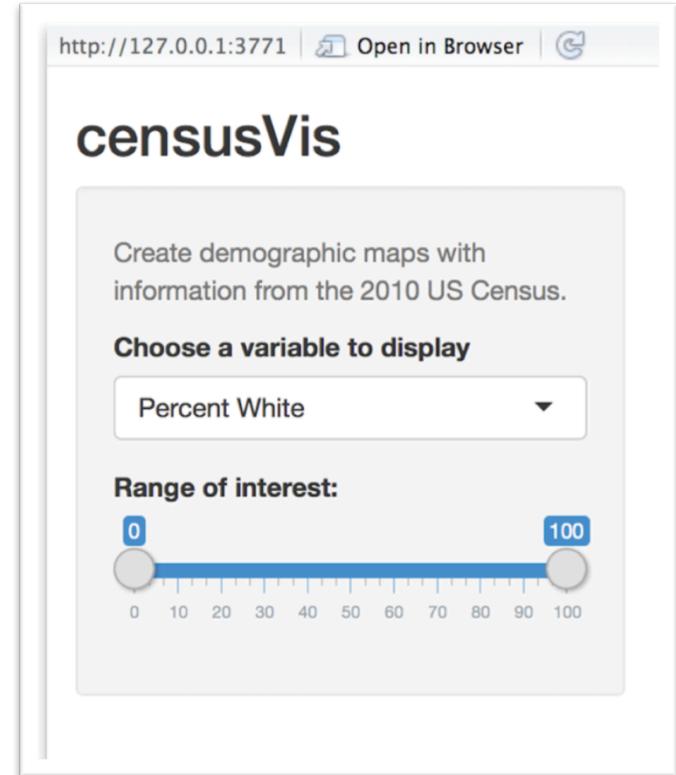
0 10 20 30 40 50 60 70 80 90 100

**Text input**

Enter text...

# 2. Add control widgets

```
ui <- fluidPage(  
  titlePanel("censusVis"),  
  
  sidebarLayout(  
    sidebarPanel(  
      helpText("Create demographic maps with  
               information from the 2010 US Census."),  
  
      selectInput("var",  
                 label = "Choose a variable to display",  
                 choices = c("Percent White",  
                            "Percent Black",  
                            "Percent Hispanic",  
                            "Percent Asian"),  
                 selected = "Percent White"),  
  
      sliderInput("range",  
                 label = "Range of interest:",  
                 min = 0, max = 100, value = c(0, 100))  
    ),  
  
    mainPanel(  
      textOutput("selected_var")  
    )  
  )  
)
```



### 3. Display reactive output using R scripts and data

```
library(shiny)

# Define UI ----
ui <- fluidPage(
)

# Define server logic ----
server <- function(input, output) {
}

# Run the app ----
shinyApp(ui = ui, server = server)
```

```
server <- function(input, output) {

  output$selected_var <- renderText({
    paste("You have selected", input$var)
  })

  output$min_max <- renderText({
    paste("You have chosen a range that goes from",
          input$range[1], "to", input$range[2])
  })
}
```

http://127.0.0.1:3771 | Open in Browser | Publish

## censusVis

Create demographic maps with information from the 2010 US Census.

Choose a variable to display

Percent White

Range of interest:

0 100

You have selected Percent White  
You have chosen a range that goes from 0 to 100

<https://shiny.rstudio.com/tutorial/written-tutorial/lesson4/>

# 4. Share

## LESSON 7

### Share your apps

You can now build a useful Shiny app, but can you share it with others? This lesson will show you several ways to share your Shiny apps.

When it comes to sharing Shiny apps, you have two basic options:

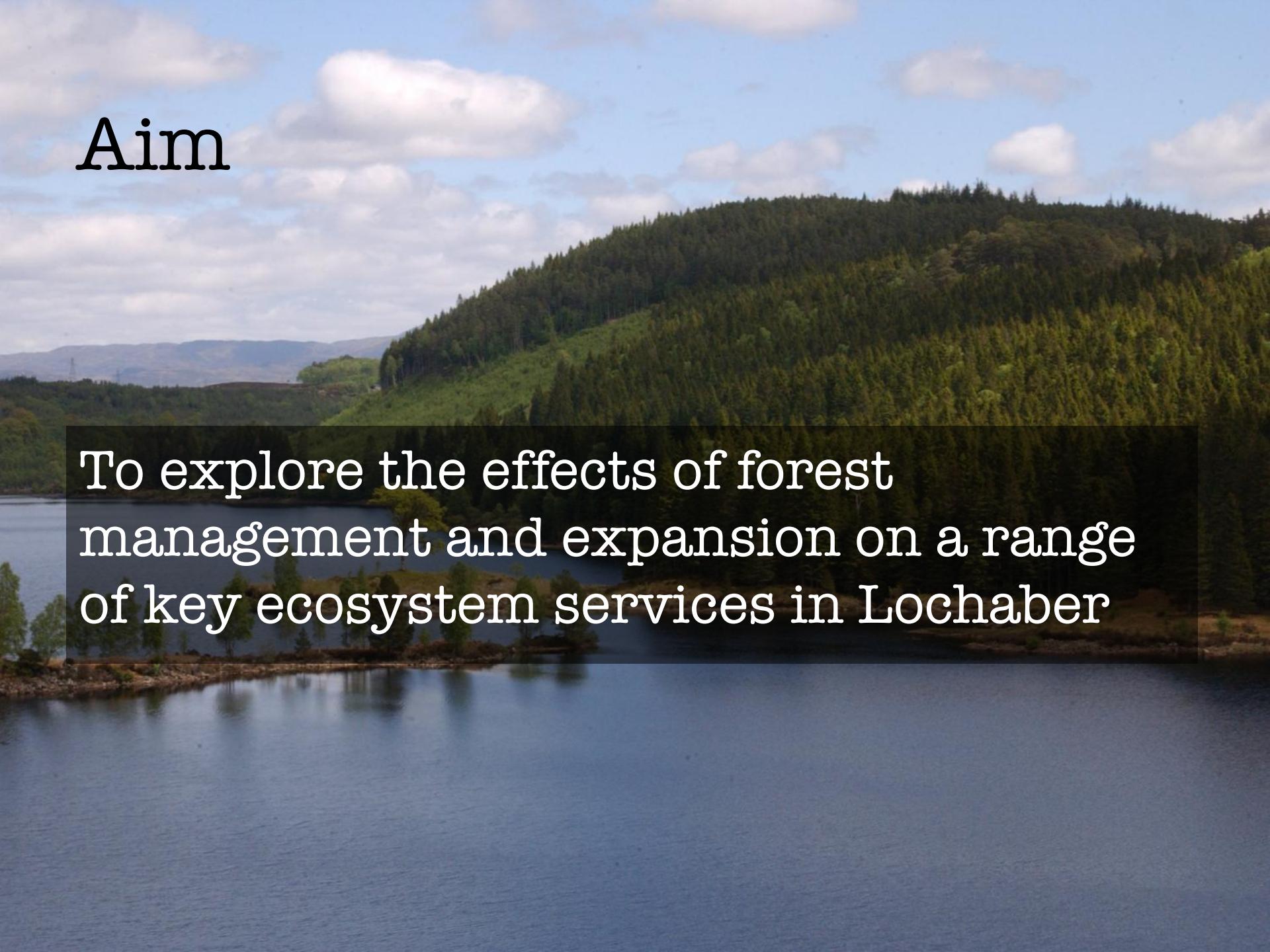
1. **Share your Shiny app as R scripts.** This is the simplest way to share an app, but it works only if your users have R on their own computer (and know how to use it). Users can use these scripts to launch the app from their own R session, just like you've been launching the apps so far in this tutorial.
2. **Share your Shiny app as a web page.** This is definitely the most user friendly way to share a Shiny app. Your users can navigate to your app through the internet with a web browser. They will find your app fully rendered, up to date, and ready to go.

<https://shiny.rstudio.com/tutorial/written-tutorial/lesson7/>

# Communicating research using shiny

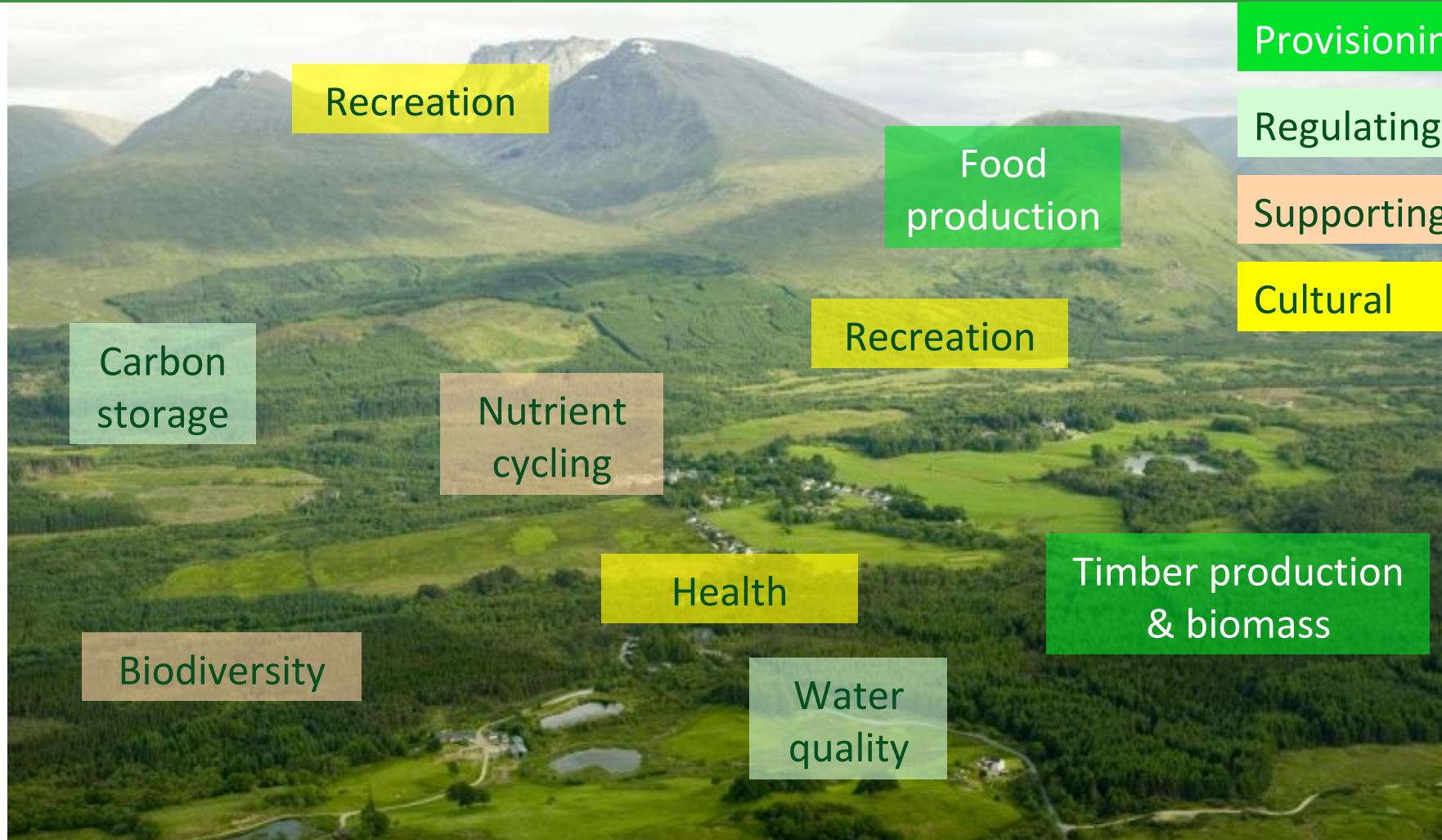


# Aim

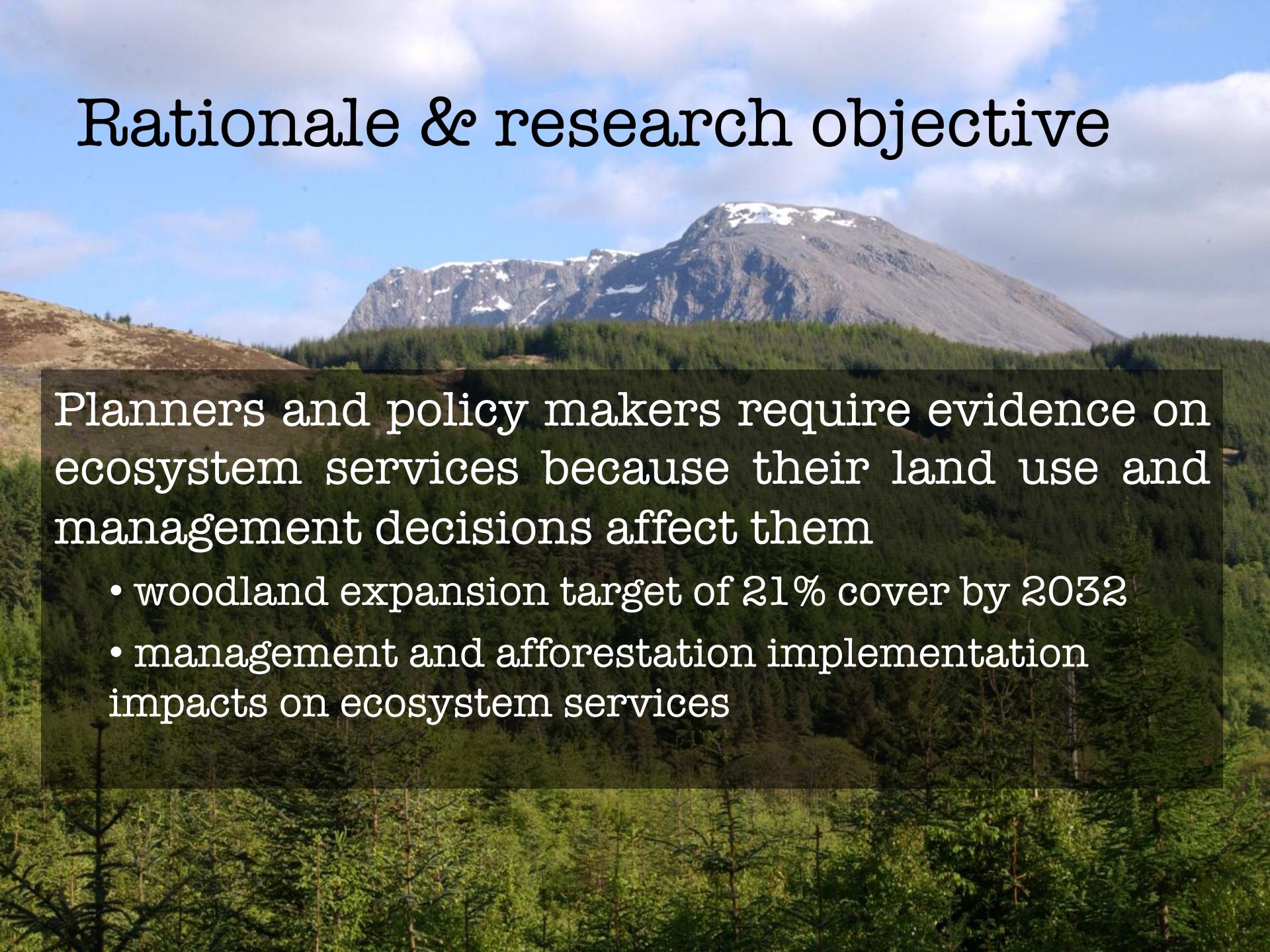
A wide-angle photograph of a natural landscape. In the foreground, there is a large body of water, possibly a lake or a wide river, with a small, dark, rocky island visible in the middle ground. The middle ground is dominated by a steep, densely forested hillside covered in green coniferous trees. In the background, more hills and mountains are visible under a blue sky with scattered white and grey clouds.

To explore the effects of forest management and expansion on a range of key ecosystem services in Lochaber

Ecosystem services: the goods and services provided by nature which benefit human well-being  
(Millennium Ecosystem Assessment, 2005)



# Rationale & research objective



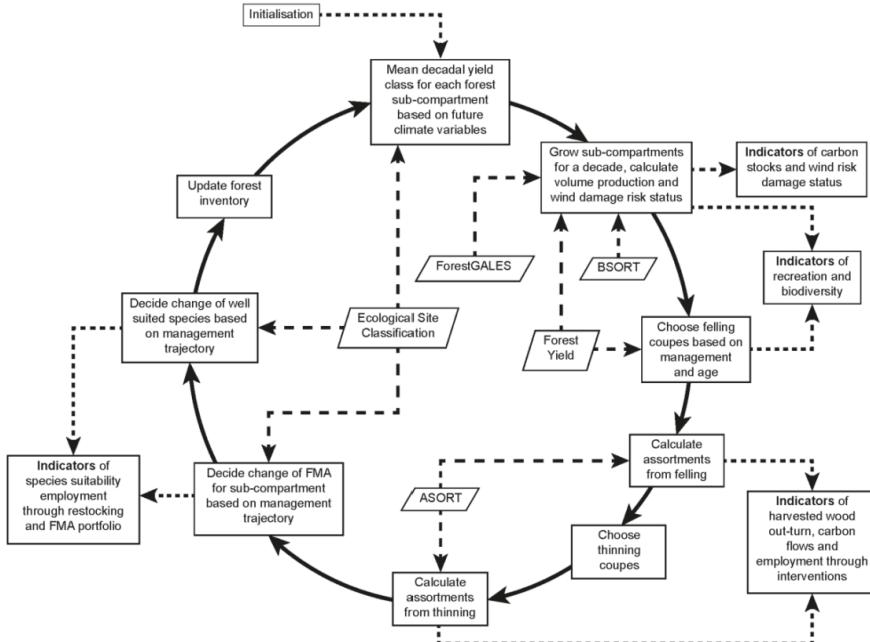
Planners and policy makers require evidence on ecosystem services because their land use and management decisions affect them

- woodland expansion target of 21% cover by 2032
- management and afforestation implementation impacts on ecosystem services

# Research objectives

1. Deliver evidence on the ecosystem services provided by contrasting forest management systems
2. Explore the influence of socio-economic and climatic futures on ecosystem services delivery
3. Investigate options for expanding woodlands

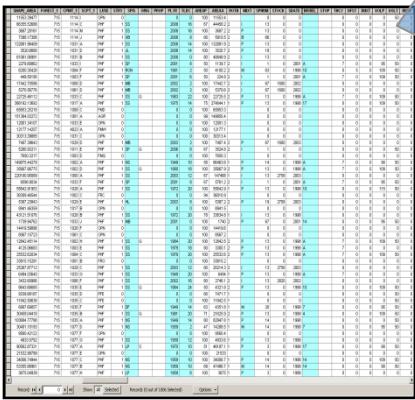
# Simulating forest growth in Leanachan forest



For each decadal time period and with each climate scenario:

**2. Assess which stands to fell based on age or a high wind risk status**

**1. Use growth models to grow each stand**



**3. Thin remaining stands as appropriate**

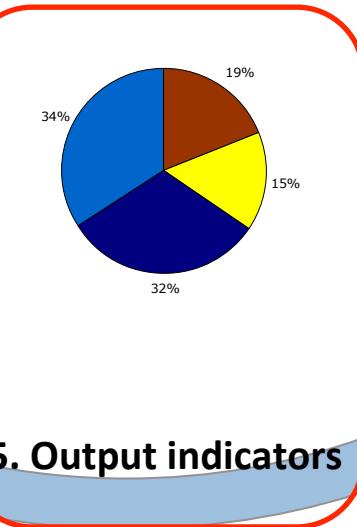


**7. Update database with changes and repeat process**



**6. For each felled stand, decide what species to replace it**

**5. Output indicators**



**4. Perform log and biomass assortments on thinnings and fellings**



- Model outputs (1080 csv files)
  - 15 decades \* 12 climate projections \* 6 management scenarios
- R processing script summarises the results by decade and forest zone (4 zones) 4320 rows
- *How to explore results of multiple decades/management scenarios/climate trajectories and visualise spatially?*

results\_processor\_zones.R

```

1 # post-processing calculate results by zones
2
3 # reads in dbf files from output(n) folder, gets the total ES indicators for
4 # zone and adds this to a new output dataframe, then writes the output to dbf
5
6 # libraries
7 library(tidyverse)
8 library(foreign)
9 library(plyr)
10
11 # path
12 folder <- "new_output/new_version/"
13 forest <- "ldp"
14 mgmt_types <- c("bau", "ldp1", "ldp2", "lis", "nat")
15 scenarios <- c("BAS", "3Q0")
16 decades <- c("2010", "2020", "2030", "2040", "2050", "2060", "2070", "2080", "2090")
17 zone_list <- c("1", "2", "3", "4") # ignore 519, these are points unassigned to a zone
18
19 # set up output dataframe
20 output <- setNames(data.frame(matrix(ncol = 19, nrow = 0)), c("Mgmt", "Scenario", "Decade", "Zone", "CarbonH", "BiomassH", "TDC17H", "OtherH", "OpsH", "RecH", "BiodivH", "Wdrsh", "SuitH", "SpruceH", "PineH", "OakH", "LarchH", "BirchH", "AshH", "ElmH", "HornbeamH"))
21
22 # scroll through each combination of mgmt types, scenarios and decades
23 for (z in zone_list) {
24   for (m in mgmt_types) {
25     for (s in scenarios) {
26       for (d in decades) {
27         # read in dbf file
28         dbf_file <- paste(folder, m, s, d, ".dbf", sep = "/")
29         dbf_data <- read.dbf(dbf_file)
30         # calculate total indicator values for each zone
31         dbf_data$Total <- rowSums(dbf_data[, 3:17])
32         # add total indicator column to output dataframe
33         output <- rbind(output, dbf_data)
34       }
35     }
36   }
37 }
38
39 # write output to dbf file
40 write.dbf(output, "output.dbf")

```

myat

zone	mgmt	scenario	decade	carbonH	biomassH	TDC17H	otherH	opsH	recH	biodivH	wdrsh	suitH	spruceH	pineH	oakH	larchH	birchH	ashH	elmH	hornbeamH	
1	4	nat	3Q0	2150	19062.967	38025.544	10329.830	3230.77641	343.00	1463.375	794.9250	2728.50	195.8265	0	0	0	0	0	0	0	
2	4	nat	3Q0	2140	17047.467	33638.570	15484.199	1300.87488	322.50	1362.125	710.7500	2865.50	195.8101	0	0	0	0	0	0	0	
3	4	nat	3Q0	2130	15973.612	31876.538	25401.548	5145.91692	476.25	1391.250	826.6500	3088.25	190.9941	0	0	0	0	0	0	0	
4	4	nat	3Q0	2120	19063.392	38019.135	4370.218	5274.97544	337.00	1521.125	789.6250	3003.00	188.5848	0	0	0	0	0	0	0	
5	4	nat	3Q0	2110	14235.168	28288.980	15290.296	3512.35783	316.25	1382.375	782.5000	2823.25	188.6253	0	0	0	0	0	0	0	
6	4	nat	3Q0	2100	15079.116	29780.531	14185.528	5087.61057	383.25	1341.250	726.5750	2749.00	184.4534	0	0	0	0	0	0	0	
7	4	nat	3Q0	2090	16889.536	33289.134	8828.455	3950.79685	390.50	1346.375	674.7500	2666.25	172.8057	0	0	0	0	0	0	0	
8	4	nat	3Q0	2080	15333.314	30282.098	7155.330	3214.19195	379.25	1275.000	608.8500	2558.00	168.9501	0	0	0	0	0	0	0	
9	4	nat	3Q0	2070	12473.850	2810.297	30329.032	5569.56577	483.50	1190.500	622.3500	2829.25	167.2510	0	0	0	0	0	0	0	
10	4	nat	3Q0	2060	14331.185	28170.219	7635.908	4168.69579	346.00	1260.875	580.6250	2829.25	169.9831	148.0000	0	0	0	0	0	0	0
11	4	nat	3Q0	2050	9631.899	17972.028	36376.953	3534.51071	289.00	1122.750	588.7500	3199.25	163.1537	154.0000	0	0	0	0	0	0	0
12	4	nat	3Q0	2040	13085.483	25135.938	56343.007	3456.09781	386.75	993.750	560.7000	3287.75	165.7844	349.0000	0	0	0	0	0	0	0
13	4	nat	3Q0	2030	20899.593	41552.908	35123.047	11490.69337	661.25	1038.500	651.3750	2884.75	165.5683	649.0000	0	0	0	0	0	0	0
14	4	nat	3Q0	2020	25059.538	49811.805	16132.905	2146.31386	474.25	1692.500	1089.9500	3581.25	169.5169	778.0000	0	0	0	0	0	0	0
15	4	nat	3Q0	2010	21077.120	41969.426	3456.742	1414.57158	231.50	1517.875	1137.2750	3280.50	169.3381	778.0000	0	0	0	0	0	0	0
16	4	nat	BAS	2150	18314.506	36512.652	8788.994	3360.81091	338.25	1500.375	821.4500	2765.25	184.3512	0	0	0	0	0	0	0	
17	4	nat	BAS	2140	15640.581	30854.000	15224.204	1412.94899	326.25	1407.250	739.4250	2928.75	184.5541	0	0	0	0	0	0	0	
18	4	nat	BAS	2130	15082.453	30095.609	23041.803	5776.43375	470.75	1440.125	858.2750	3301.00	179.9299	0	0	0	0	0	0	0	
19	4	nat	BAS	2120	18075.489	36027.380	3432.870	5079.38356	328.75	1569.375	824.7500	3269.00	173.6649	0	0	0	0	0	0	0	
20	4	nat	BAS	2110	13578.044	26981.151	14223.894	3688.82354	307.75	1431.375	817.5750	3081.25	173.7707	0	0	0	0	0	0	0	
21	4	nat	BAS	2100	14447.863	28526.847	11887.210	5994.51642	367.50	1391.000	762.4750	2991.50	168.9326	0	0	0	0	0	0	0	
22	4	nat	BAS	2090	16305.072	32159.325	7240.571	4304.11915	381.75	1397.500	711.3000	2855.00	154.6616	0	0	0	0	0	0	0	
23	4	nat	BAS	2080	14918.644	29485.952	6896.734	2934.41193	370.00	1329.000	648.0000	2713.00	150.0418	0	0	0	0	0	0	0	
24	4	nat	BAS	2070	12402.745	24490.125	24908.728	5245.45593	471.75	1244.500	661.5000	2767.00	150.0596	0	0	0	0	0	0	0	
25	4	nat	BAS	2060	13721.781	25929.280	6206.749	3774.25909	326.50	1314.625	619.7750	2698.25	149.9490	148.0000	0	0	0	0	0	0	0
26	4	nat	BAS	2050	9175.622	16676.627	31472.676	3592.70356	281.00	1178.500	627.9000	3041.25	150.0027	154.0000	0	0	0	0	0	0	0
27	4	nat	BAS	2040	12174.498	23460.216	50888.135	3788.01943	386.75	1051.750	599.8500	3039.00	150.3460	148.0000	0	0	0	0	0	0	0

# Leanachan shiny app

- Compare changes in ecosystem services of alternative management trajectories over time for each forest zone and climate scenario
- Map the species change over time (feeding into land management planning process)
- Impact for communicating research:
  - With research end user, ‘intuitive’, easy to share across locations, iterative development phase for the app and for the research
  - Within teams for sharing research outputs, writing paper
- [http://lochaber.shinyapps.io/leanachan\\_forest\\_totals\\_toolv2/](http://lochaber.shinyapps.io/leanachan_forest_totals_toolv2/)

# Links

Shiny  
from R Studio

- Tutorials
  - <https://shiny.rstudio.com/>
  - <https://shiny.rstudio.com/tutorial/>
- Examples
  - <https://www.showmeshiny.com/>
  - <https://shiny.rstudio.com/gallery/>

