Exploring sequestration rates for trees in crop and pasture lands (global)

Millie Chapman

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Just a first pass at calcualting rates of sequestration for trees in crop and pasture lands.

```
library(tidyverse)
library(ggplot2)
library(splitstackshape)
library(stringr)
```

Pull in mean growth rates from (Feliciano et al. 2018)

```
growth_rates <- read_csv("../data/growth_rates.csv") %>%
  group_by(REGION_UN, CP) %>%
  summarize(mean = mean(mean))
```

Read in standing biomass histograms and do some data cleaning

```
vars<-c("NAME_EN", "min", "BIOME_NAME", "ECONOMY", "POP_EST", "INCOME_GRP", "ISO_A3", "REGION_UN")

crop_hist <- read_csv("../data/crop_hist_25.csv") %>%
  select(vars) %>% drop_na() %>%
  mutate(b1 = str_sub(min, 2, -2)) %>%
  mutate(b1 = as.character(b1))

crop_hist <- cSplit(crop_hist, "b1", sep = ",", direction = "long")
crop_hist <- cSplit(crop_hist, "b1", sep = "=", direction = "wide")

pasture_hist <- read_csv("../data/pasture_hist_25.csv") %>%
  select(vars) %>% drop_na() %>%
  mutate(b1 = str_sub(min, 2, -2)) %>%
  mutate(b1 = as.character(b1))

pasture_hist <- cSplit(pasture_hist, "b1", sep = ",", direction = "long")
pasture_hist <- cSplit(pasture_hist, "b1", sep = "=", direction = "wide")
```

```
GR_crop <- growth_rates %>% filter(CP == "crop") %>%
  select(REGION_UN, mean)

crop_country_GR <- crop_hist %>% left_join(GR_crop) %>%
  mutate(b1_1 = b1_1/2) %>%
```

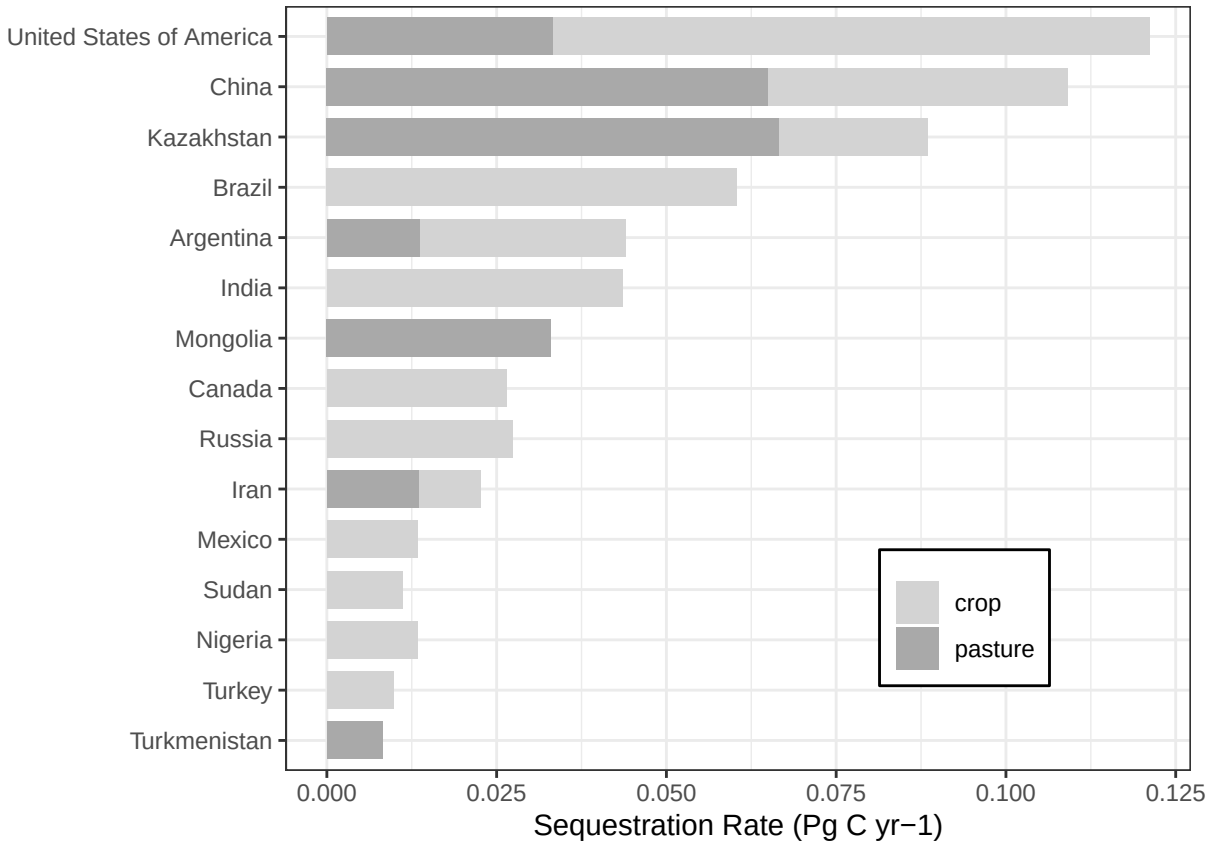
```
  filter(b1_1 < 6) %>%
  mutate(annual_sequestration = b1_2 * .09 * mean) %>% # number of 1 ha pixels * GR per ha
  group_by(NAME_EN) %>%
  summarise(annual_sequestration = sum(annual_sequestration)/10^9/10) %>%
  mutate(CP = "crop")
```

```
GR_pasture <- growth_rates %>% filter(CP == "pasture") %>%
  select(REGION_UN, mean)

pasture_country_GR <- pasture_hist %>% left_join(GR_pasture) %>%
  mutate(b1_1 = b1_1/2) %>%
  filter(b1_1 < 6) %>%
  mutate(annual_sequestration = b1_2 * .09 * mean) %>% # number of 1 ha pixels * GR per ha
  group_by(NAME_EN) %>%
  summarise(annual_sequestration = sum(annual_sequestration)/10^9/10) %>%
  mutate(CP = "pasture")
```

```
simple_SR <- bind_rows(pasture_country_GR, crop_country_GR) %>%
  spread(CP, annual_sequestration) %>%
  mutate(total = crop + pasture)

levels(simple_SR$NAME_EN) <- c(levels(simple_SR$NAME_EN), "China")
simple_SR$NAME_EN[simple_SR$NAME_EN == "People's Republic of China"] <- 'China'
```

```
write_csv(simple_SR, "../output/simple_SR..csv")
```

```
simple_SR %>% gather("CP", "sequestration", -c(NAME_EN, total)) %>%
  arrange(-total) %>%
  top_n(20) %>%
  ggplot(aes(reorder(NAME_EN, total), sequestration)) +
  geom_col(aes(fill = CP), width = 0.75) + coord_flip() + labs(x = "",y = "Sequestration Rate (Pg C yr-
  theme(legend.title = element_blank()) + theme(legend.position = c(0.75, 0.2)) +
    theme(legend.background = element_rect(colour = 'black', fill = 'white', linetype='solid')) +
  scale_fill_manual(values = c("lightgrey", "darkgrey"))
```



References

Feliciano, Diana, Alicia Ledo, Jon Hillier, and Dali Rani Nayak. 2018. "Which Agroforestry Options Give the Greatest Soil and Above Ground Carbon Benefits in Different World Regions?" *Agriculture, Ecosystems & Environment* 254. Elsevier: 117–29.