

# A critique of irrigation efficiency modeling

R code

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```

# Function to read in all required packages in one go:
loadPackages <- function(x) {
  for(i in x) {
    if(!require(i, character.only = TRUE)) {
      install.packages(i, dependencies = TRUE)
      library(i, character.only = TRUE)
    }
  }
}

# Load the packages
loadPackages(c("data.table", "tidyverse", "sensobol", "wesanderson",
              "cowplot", "parallel", "foreach", "doParallel",
              "countrycode", "ggribes", "scales"))

# Create custom theme
theme_AP <- function() {
  theme_bw() +
    theme(panel.grid.major = element_blank(),
          panel.grid.minor = element_blank(),
          legend.background = element_rect(fill = "transparent",
                                             color = NA),
          legend.key = element_rect(fill = "transparent",
                                     color = NA),
          legend.position = "top",
          strip.background = element_rect(fill = "white"))
}

# Set checkpoint

dir.create(".checkpoint")
library("checkpoint")

checkpoint("2021-08-02",
          R.version = "4.0.3",
          checkpointLocation = getwd())

```

# 1 Read in data

```
# READ IN DATA -----

# Rohwer data
rohwer <- fread("rohwer_data_all.csv")
rohwer[rohwer == ""] <- NA
rohwer <- rohwer[, Large_fraction := Large_fraction / 100]

# Bos data
bos <- fread("bos_data.csv")
bos <- bos[, Scale := ifelse(Irrigated_area < 10000, "<10.000 ha", ">10.000 ha")]

# Create data set with E_a values as defined by Rohwer
bos.rohwer.ea <- data.table("Irrigation" = c("Surface", "Sprinkler"),
                           "Value" = c(0.6, 0.7),
                           "variable" = "E_a")

# Create data set with E_c values as defined by Rohwer
bos.rohwer.ec <- data.table("Irrigation" = c("Surface", "Sprinkler"),
                           "Value" = c(0.8, 0.95),
                           "variable" = "E_c")

bos.rohwer.all <- rbind(bos.rohwer.ec, bos.rohwer.ea)

# As a function of scale
bos.rohwer.mf.ec <- data.table("Scale" = c("<10.000 ha", ">10.000 ha"),
                              "Value" = c(0.85, 0.59),
                              "variable" = "E_c")

bos.rohwer.mf.ed <- data.table("Scale" = c("<10.000 ha", ">10.000 ha"),
                              "Value" = c(0.81, 0.72),
                              "variable" = "E_d")

bos.rohwer.mf.all <- rbind(bos.rohwer.mf.ec, bos.rohwer.mf.ed)

# PLOT -----

# Field and conveyance efficiency -----

efficiencies_labeller <- c("E_c" = "$E_c$",
                          "E_a" = "$E_a$")

a <- bos %>%
  melt(., measure.vars = c("E_a", "E_c")) %>%
  ggplot(., aes(value, fill = Irrigation, color = Irrigation)) +
  geom_histogram(position = "identity", alpha = 0.4, bins = 15) +
  facet_wrap(~variable, labeller = as_labeller(efficiencies_labeller)) +
```

```

geom_vline(data = bos.rohwer.all, aes(xintercept = Value,
                                     color = Irrigation,
                                     group = variable),
           lty = 2,
           size = 1) +
labs(x = "", y = "Count") +
theme_AP()

# As a function of scale -----

efficiencies_labeller <- c("E_c" = "$E_c$",
                          "E_a" = "$E_a$",
                          "E_d" = "$E_d$")

b <- melt(bos, measure.vars = c("E_c", "E_a", "E_d")) %>%
na.omit() %>%
ggplot(., aes(value, fill = Scale, color = Scale)) +
geom_histogram(bins = 15, position = "identity", alpha = 0.6) +
labs(x = "Value", y = "Counts") +
scale_fill_manual(values = wes_palette(2, name = "Chevalier1"),
                  name = "Scale") +
facet_wrap(~ variable, labeller = as_labeller(efficiencies_labeller)) +
geom_vline(data = bos.rohwer.mf.all, aes(xintercept = Value,
                                     color = Scale,
                                     group = variable),
           lty = 2,
           size = 1) +
scale_color_manual(values = wes_palette(2, name = "Chevalier1"),
                  name = "Scale",
                  labels = c("<10.000$ ha", ">10.000$ ha")) +
scale_fill_manual(values = wes_palette(2, name = "Chevalier1"),
                  name = "Scale",
                  labels = c("<10.000$ ha", ">10.000$ ha")) +
theme_AP()

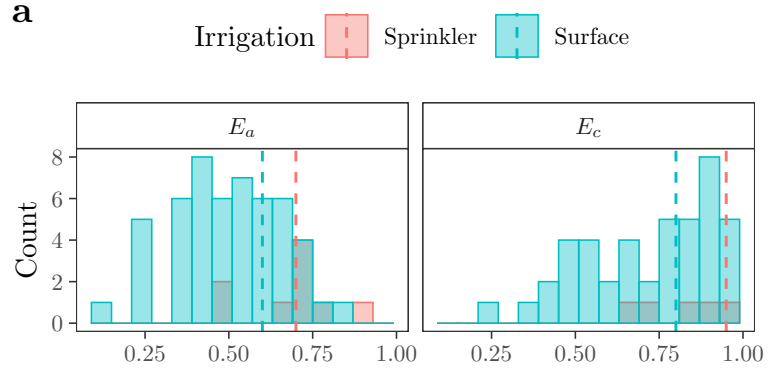
## Scale for 'fill' is already present. Adding another scale for 'fill', which
## will replace the existing scale.

# PLOT MERGED -----

plot_grid(a, b, ncol = 1, labels = "auto")

## Warning: Removed 74 rows containing non-finite values (stat_bin).

```

**a****b**