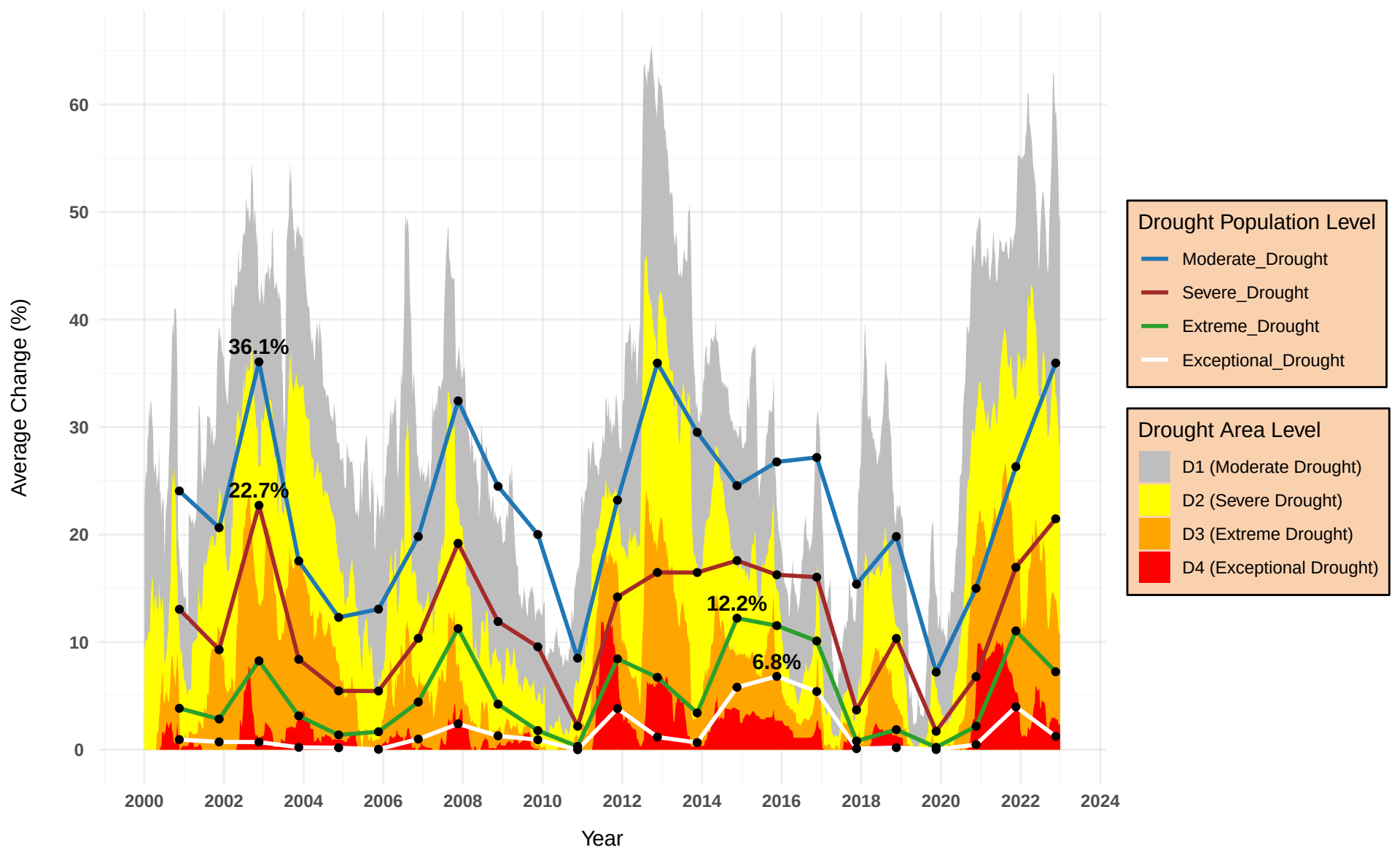

Population Trends: The line graph overlays the biennial shifts in the percentage of the U.S. population affected by exceptional drought from 2000 to 2023. The plotted peaks clearly demarcate the years when drought's impact on the populace reached its zenith, such as the notable rise around 2014−16, emphasizing the direct consequences of severe drought on human communities.
Area Trends: This area chart vividly captures the biennial fluctuations in the percentage of U.S. land experiencing drought from 2000 to 2023. It illustrates the variable nature of drought conditions across two decades.
Peaks in the filled regions, significantly in 2014−16, when drought conditions were most extensive and severe.

```
# Step 1: Load necessary libraries
library(tidyr)
library(ggplot2)
library(dplyr)
library(lubridate)
library(scales)

# Step 2: Load the dataset
data <- read.csv("E:/MSDS/SEMESTER-1/INFO-526-DATA VIZ & ANALYSIS-MEGHEAN/Wk-5-
Dimensionality/ASSIGNMENT-3-Multiple Questions/Drought Monitor Edited.csv")

# Step 3: Rename the columns for better understanding and convert MapDate to Date type
data <- data %>%
  rename(
    Abnormal_Dry = D0,
    Moderate_Drought = D1,
    Severe_Drought = D2,
    Extreme_Drought = D3,
    Exceptional_Drought = D4
  ) %>%
  mutate(
    MapDate = as.Date(as.character(MapDate), format = "%Y%m%d")
  )

# Step 4: Filter for 'data_area' and 'data_population'
data_area <- filter(data, Type == 'Percent Area')
data_population <- filter(data, Type == 'Percent Population')

# Step 5: Data summarization for line plot
drought_summary <- data_population %>%
  group_by(Year = year(MapDate)) %>%
  summarize(
    Moderate_Drought = mean(Moderate_Drought, na.rm = TRUE),
    Severe_Drought = mean(Severe_Drought, na.rm = TRUE),
    Extreme_Drought = mean(Extreme_Drought, na.rm = TRUE),
    Exceptional_Drought = mean(Exceptional_Drought, na.rm = TRUE),
    .groups = 'drop'
  )

# Step 6: Find the maximum value for each drought level and its corresponding year
max_values <- drought_summary %>%
  summarize(
    Year_Moderate = Year[which.max(Moderate_Drought)],
    Max_Moderate = max(Moderate_Drought),
```

```
  Year_Severe = Year[which.max(Severe_Drought)],
  Max_Severe = max(Severe_Drought),
  Year_Extreme = Year[which.max(Extreme_Drought)],
  Max_Extreme = max(Extreme_Drought),
  Year_Exceptional = Year[which.max(Exceptional_Drought)],
  Max_Exceptional = max(Exceptional_Drought)
 )

# Convert drought_summary to long format
drought_summary_long <- drought_summary %>%
 pivot_longer(cols = c(Moderate_Drought, Severe_Drought, Extreme_Drought, Exceptional_Drought),
         names_to = "DroughtLevel",
         values_to = "Value")

# Set the levels of the DroughtLevel factor in the order of increasing drought level
drought_summary_long$DroughtLevel <- factor(drought_summary_long$DroughtLevel,
                                levels = c("Moderate_Drought", "Severe_Drought",
                                      "Extreme_Drought", "Exceptional_Drought"))

# Step 7: Create a combined plot with area and line for all drought levels
combined_plot <- ggplot() +
 geom_area(data = data_area, aes(x = MapDate, y = Moderate_Drought, fill = "D1 (Moderate Drought)"))
+
 geom_area(data = data_area, aes(x = MapDate, y = Severe_Drought, fill = "D2 (Severe Drought)")) +
 geom_area(data = data_area, aes(x = MapDate, y = Extreme_Drought, fill = "D3 (Extreme Drought)")) +
 geom_area(data = data_area, aes(x = MapDate, y = Exceptional_Drought, fill = "D4 (Exceptional
Drought)")) +
 geom_line(data = drought_summary_long, aes(x = as.Date(as.character(Year), format = "%Y"), y =
Value, color = DroughtLevel), size = 1) +
 geom_point(data = drought_summary_long, aes(x = as.Date(as.character(Year), format = "%Y"), y =
Value), color = "black") +
 geom_text(data = max_values, aes(x = as.Date(as.character(Year_Moderate), format = "%Y"), y =
Max_Moderate, label = sprintf("%.1f%%", Max_Moderate)), vjust = -0.5, color = "black", fontface =
"bold") +
 geom_text(data = max_values, aes(x = as.Date(as.character(Year_Severe), format = "%Y"), y =
Max_Severe, label = sprintf("%.1f%%", Max_Severe)), vjust = -0.5, color = "black", fontface = "bold") +
 geom_text(data = max_values, aes(x = as.Date(as.character(Year_Extreme), format = "%Y"), y =
Max_Extreme, label = sprintf("%.1f%%", Max_Extreme)), vjust = -0.5, color = "black", fontface = "bold") +
 geom_text(data = max_values, aes(x = as.Date(as.character(Year_Exceptional), format = "%Y"), y =
Max_Exceptional, label = sprintf("%.1f%%", Max_Exceptional)), vjust = -0.5, color = "black", fontface =
"bold") +
 scale_fill_manual(values = c("D1 (Moderate Drought)" = "grey", "D2 (Severe Drought)" = "yellow", "D3
(Extreme Drought)" = "orange", "D4 (Exceptional Drought)" = "Red")) +
```

```
  scale_color_manual(values = c("Moderate_Drought" = "#1f77b4", "Severe_Drought" = "brown",
"Extreme_Drought" = "#2ca02c", "Exceptional_Drought" = "white")) +
  scale_x_date(date_breaks = "2 years", date_labels = "%Y") +
  theme_minimal() +
  scale_y_continuous(breaks = seq(0, 70, by = 10)) +
  labs(fill = "Drought Area Level",
       color = "Drought Population Level",
       x = "Year",
       y = "Average Change (%)",
       caption = "Population Trends: The line graph overlays the biennial shifts in the percentage of the U.S.
population affected by exceptional drought from 2000 to 2023.\n The plotted peaks clearly demarcate
the years when drought's impact on the populace reached its zenith, such as the notable rise around
2014-16,\n emphasizing the direct consequences of severe drought on human communities.\n Area
Trends: This area chart vividly captures the biennial fluctuations in the percentage of U.S. land
experiencing drought from 2000 to 2023. It illustrates the variable nature of drought conditions across
two decades. Peaks in the filled regions, significantly in 2014-16, when drought conditions were most
extensive and severe.") +
  theme(
    panel.grid.major = element_line(color = "#DDDDDD7F", size = 0.5, linetype = "solid"),
    panel.grid.minor = element_line(color = "#EEEEEE7F", size = 0.25, linetype = "solid"),
    axis.text.x = element_text(angle = 0, hjust = 0.5, face = "bold"),
    axis.text.y = element_text(angle = 0, hjust = 0.5, face = "bold"),
    axis.title.y = element_text(margin = margin(r = 20, unit = "pt")),
    axis.title.x = element_text(margin = margin(t = 10, unit = "pt")),
    plot.caption = element_text(hjust = 0), legend.position = "right") +
  theme(legend.background = element_rect(fill = "#FAD1AF", colour = "black"))

# Step 8: Print the combined plot
print(combined_plot)

# Step 9: Save the combined plot to a file
graphic_width <- 11 - (0.5 * 2) # Width with margins
graphic_height <- 8 - (0.5 * 2) # Height with margins

# Step 10: Save the combined plot to a PDF file with the adjusted size
ggsave("combined_plot.pdf", combined_plot, width = graphic_width, height = graphic_height, dpi = 900)
```