Environmental Change Across Continents: Exploring the Relationship Between Tree Cover Loss and Temperature/Humidity

we-**R**-good-at-stats

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Topic + motivation

Background:

- Our project explores if a known driver of climate change – **loss of tree cover** – relates to **temperature** and **humidity** levels.
- However, the effects of climate change are not experienced equally around the world, so we also look for varying patterns between the different continents.

Research Question: How is tree cover loss between 2024 and 2025 associated with the change in average humidity and temperature in June-September? How do the patterns differ for different continents around the world?





Get to know our data:

`country` - name of country for which weather and tree-cover-loss data was collected.

`location_name` - the primary location in the country where weather data was recorded.

`year` - year of the weather and tree-cover-loss measurement data observation for June-September (2024 or 2025).

`n_observations` – number of weather observations included in that country-year's summer averages.

`avg_june_sep_temp` - average daily recorded temperature in degrees Celsius (℃) during June–September for that country-location and year.

`avg_june_sep_humidity` - average daily recorded humidity (%) during June–September for that country-location and year.

`avg_june_sep_precip` - average daily recorded precip (mm) during June–September for that country-location and year.

`avg_june_sep_feels_like` - average daily recorded “feels like” temperature in degrees Celsius (℃) during June–September for that country-location and year.

`avg_june_sep_air_quality` - take the average daily recorded air quality index (pm2.5) during June–September for that country-location and year.

`threshold` – minimum tree-canopy-cover threshold used to define tree cover (we used 30%)

`extent_2000_ha` - total area of forest in the country in the year 2000 (starting area)

`tree_cover_loss_ha` - area of tree cover loss (hectares)

`continent` - continent name (Oceania, North America, South America, Africa, Europe, Asia)

`tc_percent_loss` - percent loss of tree cover *relative* to the 2000 baseline (extent_2000_ha)

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Data clean-up

Where we started:

- We started small and representative
- Why can't we include all the countries?

Take away:

- ❖ More countries = more representative
- ❖ More countries = bigger picture of relationship

Calculating averages

```r
#| label: average-data
weather_country_final <- weather_june_sep_clean |>
    group_by(country, location_name, year) |>
    summarise(
        n_observations = n(),
        avg_summer_temp = mean(temperature_celsius, na.rm = TRUE),
        avg_summer_precip = mean(precip_mm, na.rm = TRUE),
        avg_summer_humidity = mean(humidity, na.rm = TRUE),
        avg_summer_feels_like = mean(feels_like_celsius, na.rm = TRUE),
        avg_summer_air_quality = mean(air_quality_PM2.5, na.rm = TRUE)
    ) |>
    ungroup()

weather_country_final |>
    arrange(country, year)
```

Assigning names

```r
#| label: fix-last-updated
fixed_weather_data <- weather_data |>
    separate(
        last_updated,
        into = c("year", "month", "day_time"),
        sep = "-",
        convert = TRUE,
        remove = FALSE
    ) |>
    mutate(
        month_name = case_when(
            month == 6 ~ "June",
            month == 7 ~ "July",
            month == 8 ~ "August",
            month == 9 ~ "September",
            .default = "other"
        )
```

Pivoting

```r
#| label: pivot-forest-data
forest_country_pivot <- forest_threshold_
    pivot_longer(
        cols = c(tc_loss_ha_2024, tc_loss_ha_2025),
        names_to = "year",
        names_prefix = "tc_loss_ha_",
        values_to = "tree_cover_loss_ha"
    ) |>
    mutate(year = as.numeric(year))

forest_country_pivot |>
    arrange(country, year)
```



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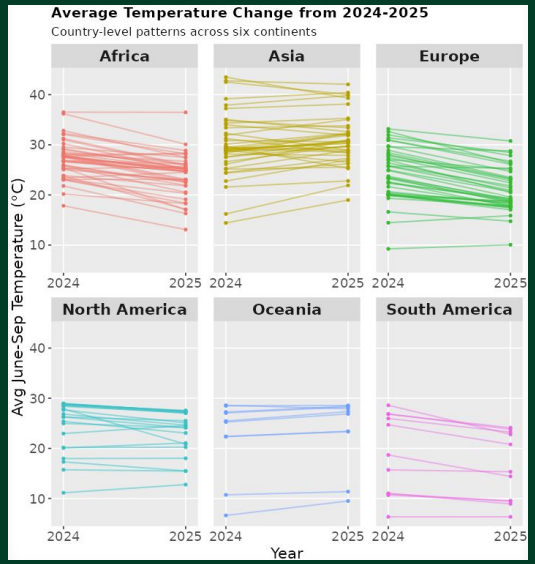
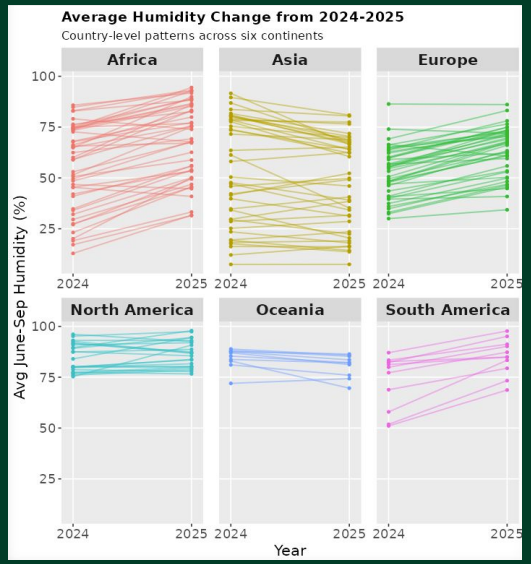
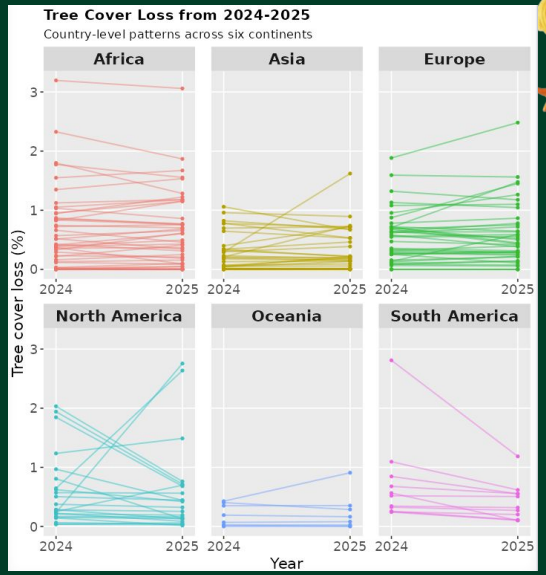
Preliminary Graphs



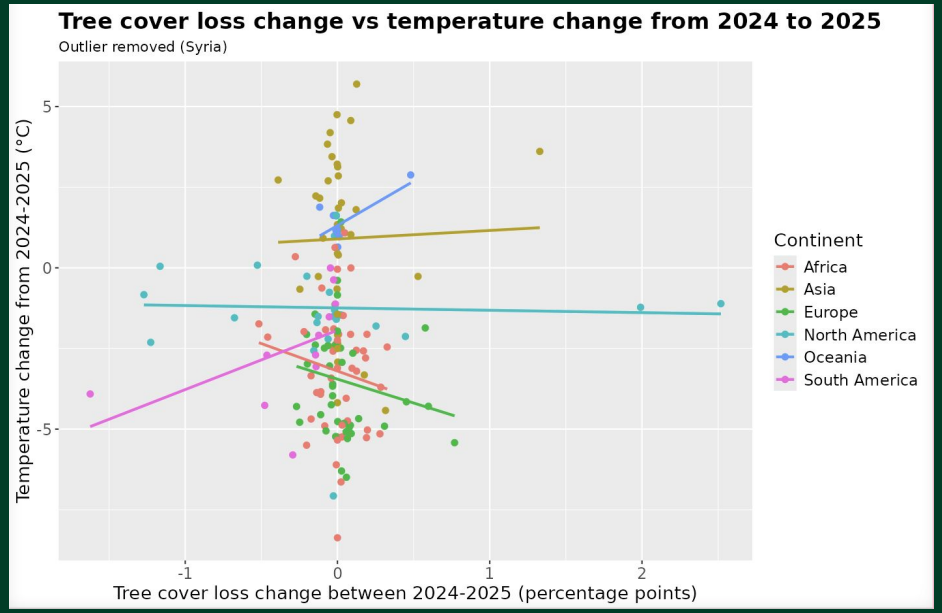


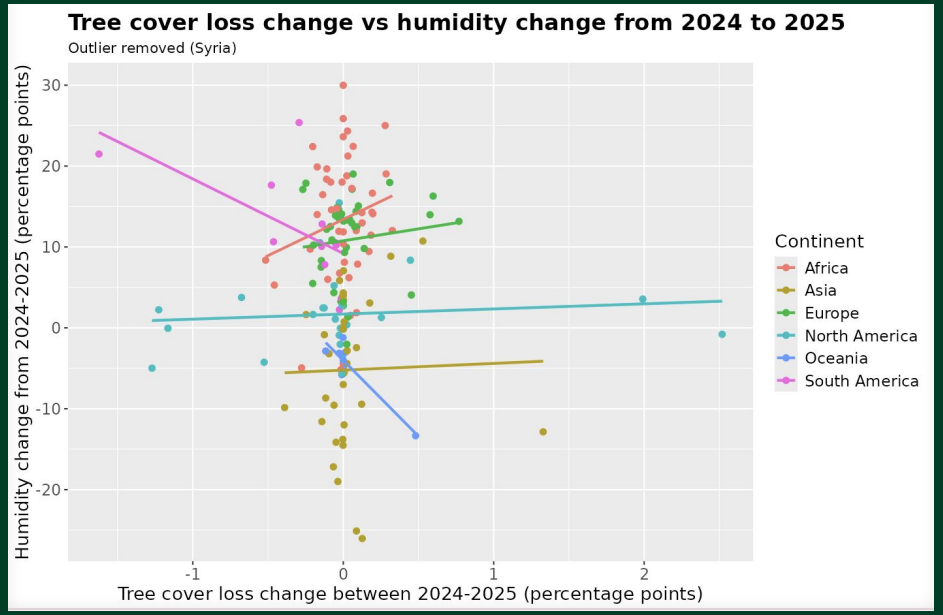


- Early exploration of trends for temperature/ humidity/ tree cover loss from 2024-2025 for each continent
- Temp: decrease for Africa, Europe, South America; increase for Oceania
- Humidity: increase for Africa, Europe, South America; decrease for Asia
- Tree cover loss: no clear trend(ish)

Results: by continent

n = 173 countries







No clear overall relationship…

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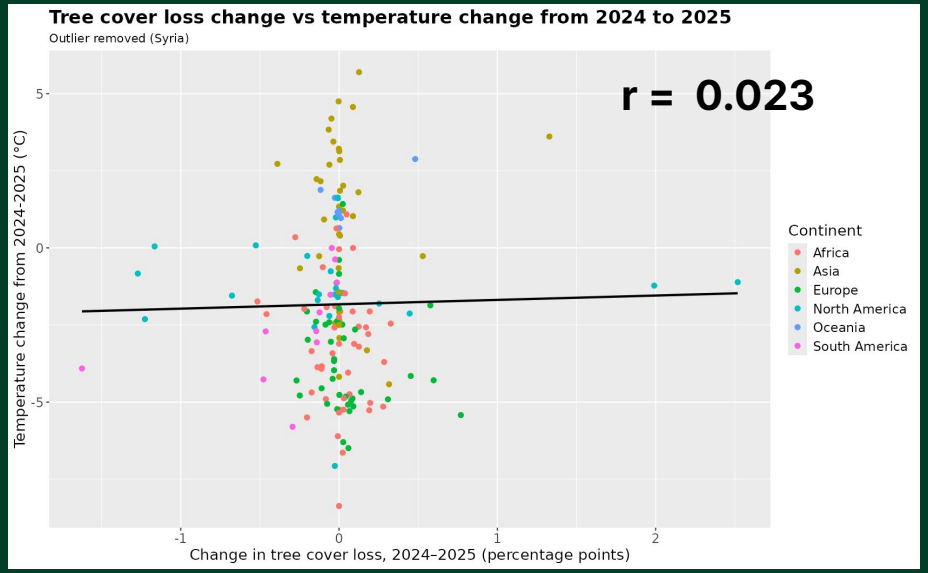
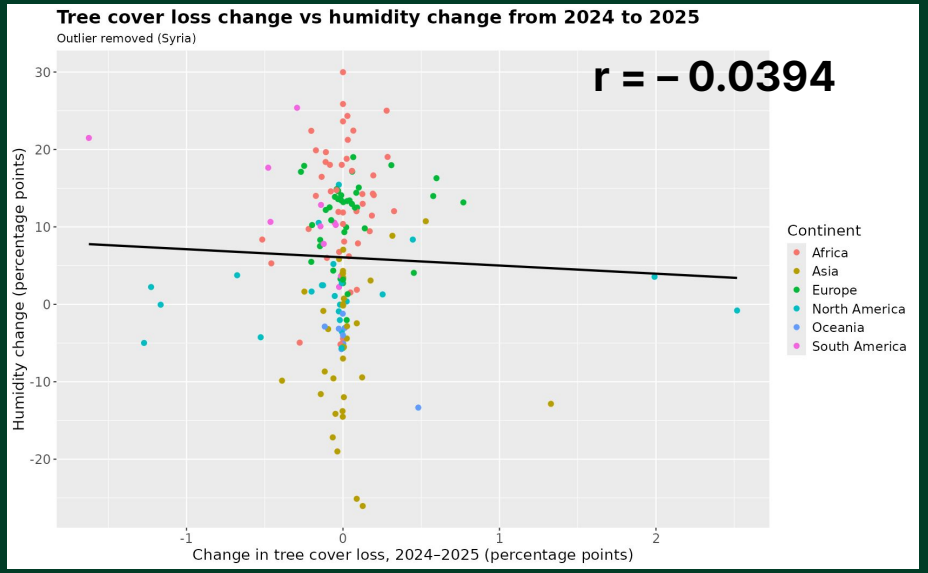
Results: worldwide

n = 173 countries







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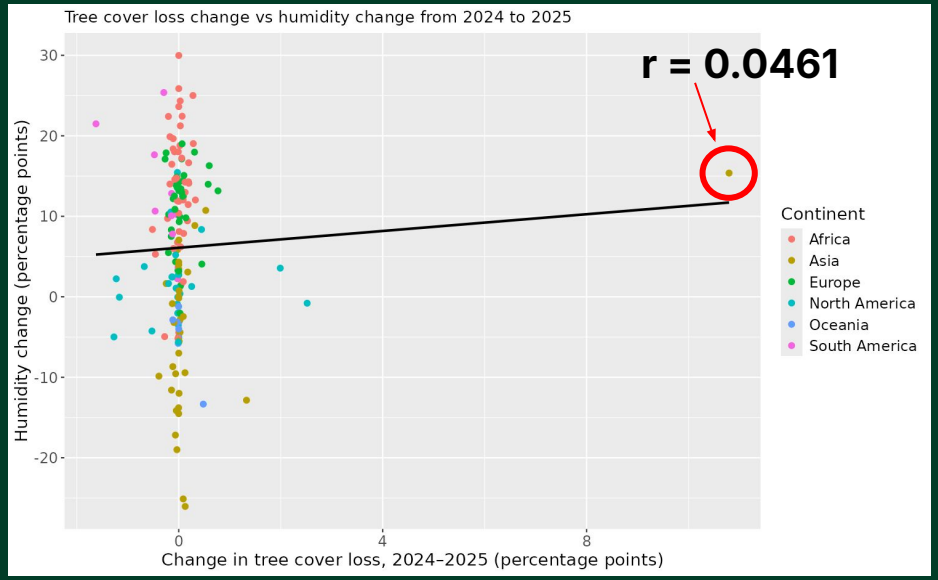
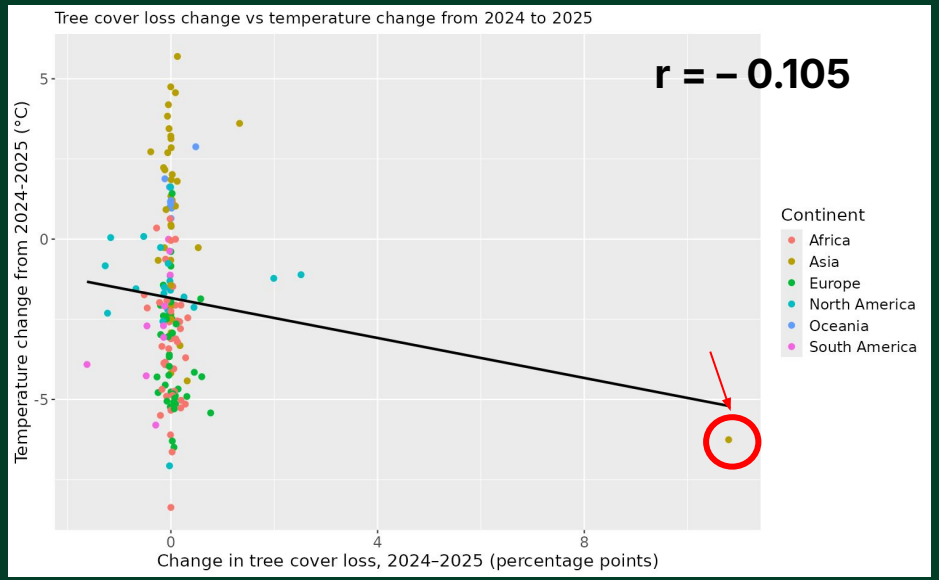
Conclusion, limitations, discussion







* including outlier (Syria)

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Thank you!

