GLUE-urbanQuant

Q1: City-Specific Regressions

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Contents

Load Data

```
## Load data
urban.quantification.full.data <- read_csv(
  file = "data/analysis_data/urbanQuant-full_data.csv",
  col_types = c("fffnnninnnnnnininnnnnnn"),
  show_col_types = FALSE
)

## Split the data into a list; one dataframe per city
city.specific.data.list <- urban.quantification.full.data %>%
  group_split(City) %>%
  setNames(unique(urban.quantification.full.data$City))
```

City-Specific Regressions

Set Functions

```
# Fit a linear model with an environmental variable as the response and distance,
# sampling design, and the two-way interaction as predictors.

## Set the function
fit_environmental_variable_by_distance_model <- function(df, response_variable) {
  # Set the response variable
  Response_Variable <- df %>% pull(response_variable)

  ## Fit the linear mixed-effects model
  fitted.regression <- lm(
    Response_Variable ~ Standardized_Distance + Sampling_Design + Standardized_Distance:Sampling_Design
    data = df
  )

  return(fitted.regression)
}
```

```
# Extract and format the ANOVA table for a fitted environmental
# variable-by-distance model

## Set the function
environmental_variable_by_distance_model_ANOVA <- function(fitted_model) {
  # ANOVA with Type III sums-of-squares
  regression.anova.table <- Anova(
    mod = fitted_model,
    type = "III"
  )

  # Format the ANOVA table for later data summaries
  formatted.regression.anova.table <- regression.anova.table %>%
    rownames_to_column(var = "Term") %>%
    select("Term", "Pr(>F)") %>%
    slice(2:4) %>%
    pivot_wider(names_from = "Term", values_from = "Pr(>F)") %>%
    rename(
      Distance = Standardized_Distance,
      Distance_by_Sampling_Design = `Standardized_Distance:Sampling_Design`
    ) %>%
    mutate_at(1:3, round, 5)

  return(formatted.regression.anova.table)
}
```

```r
# Calculate effect sizes for a fitted environmental variable-by-distance model

## Set the function
environmental_variable_by_distance_model_effect_sizes <- function(fitted_model) {
  # Get the adjusted R-squared
  regression.R.squared <- summary(fitted_model)$adj.r.squared

  # Effect sizes for the fixed effects
  regression.eta.squared <- eta_squared(fitted_model, partial = TRUE, ci = 0.95)

  # Combine the effect sizes into a summary table
  regression.effect.size.summary.table <- tibble(
    R2_adjusted = regression.R.squared,
    eta2_Predictor = regression.eta.squared[1, 2],
    eta2_Sampling_Design = regression.eta.squared[2, 2],
    eta2_Interaction = regression.eta.squared[3, 2]
  )

  return(regression.effect.size.summary.table)
}
```

```r
# Extract and format predictions (i.e., slopes) for a fitted environmental
# variable-by-distance model.

## Set the function
environmental_variable_by_distance_model_predictions <- function(fitted_model) {
  # Get the predictions from the fitted regression
  regression.predictions <- emtrends(
    fitted_model,
    specs = pairwise ~ Sampling_Design,
    var = "Standardized_Distance",
    weights = "cells",
    adjust = "none"
  )

  # Format the model predictions for later data summaries and figures
  formatted.regression.predictions <- regression.predictions$emtrends %>%
    as_tibble() %>%
    rename(Estimated_Slope = Standardized_Distance.trend) %>%
    select(Sampling_Design:SE)


  return(formatted.regression.predictions)
}
```

ISC

```
## Fit the regressions
ISC.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "ISC_Mean"
)

## ANOVA
ISC.regression.ANOVAs <- map_dfr(
  ISC.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
ISC.regression.effect.sizes <- map_dfr(
  ISC.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
ISC.regression.predictions <- map_dfr(
  ISC.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

HII

```
## Fit the regressions
HII.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "HII"
)

## ANOVA
HII.regression.ANOVAs <- map_dfr(
  HII.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
HII.regression.effect.sizes <- map_dfr(
  HII.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
HII.regression.predictions <- map_dfr(
  HII.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Mean NDVI

```
## Fit the regressions
mean.NDVI.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Mean_NDVI"
)

## ANOVA
mean.NDVI.regression.ANOVAs <- map_dfr(
  mean.NDVI.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
mean.NDVI.regression.effect.sizes <- map_dfr(
  mean.NDVI.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
mean.NDVI.regression.predictions <- map_dfr(
  mean.NDVI.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Min NDVI

```
## Fit the regressions
min.NDVI.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Min_NDVI"
)

## ANOVA
min.NDVI.regression.ANOVAs <- map_dfr(
  min.NDVI.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
min.NDVI.regression.effect.sizes <- map_dfr(
  min.NDVI.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
min.NDVI.regression.predictions <- map_dfr(
  min.NDVI.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Max NDVI

```
## Fit the regressions
max.NDVI.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Max_NDVI"
)

## ANOVA
max.NDVI.regression.ANOVAs <- map_dfr(
  max.NDVI.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
max.NDVI.regression.effect.sizes <- map_dfr(
  max.NDVI.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
max.NDVI.regression.predictions <- map_dfr(
  max.NDVI.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Mean Annual Temperature

```
## Fit the regressions
mean.annual.temperature.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Mean_Annual_Temperature"
)

## ANOVA
mean.annual.temperature.regression.ANOVAs <- map_dfr(
  mean.annual.temperature.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
mean.annual.temperature.regression.effect.sizes <- map_dfr(
  mean.annual.temperature.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
mean.annual.temperature.regression.predictions <- map_dfr(
  mean.annual.temperature.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Temperature Seasonality

```
## Fit the regressions
temperature.seasonality.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Temperature_Seasonality"
)

## ANOVA
temperature.seasonality.regression.ANOVAs <- map_dfr(
  temperature.seasonality.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
temperature.seasonality.regression.effect.sizes <- map_dfr(
  temperature.seasonality.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
temperature.seasonality.regression.predictions <- map_dfr(
  temperature.seasonality.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Range Annual Temperature

```
## Fit the regressions
range.annual.temperature.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Range_Annual_Temperature"
)

## ANOVA
range.annual.temperature.regression.ANOVAs <- map_dfr(
  range.annual.temperature.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
range.annual.temperature.regression.effect.sizes <- map_dfr(
  range.annual.temperature.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
range.annual.temperature.regression.predictions <- map_dfr(
  range.annual.temperature.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Annual Precipitation

```
## Fit the regressions
annual.precipitation.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Annual_Precipitation"
)

## ANOVA
annual.precipitation.regression.ANOVAs <- map_dfr(
  annual.precipitation.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
annual.precipitation.regression.effect.sizes <- map_dfr(
  annual.precipitation.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
annual.precipitation.regression.predictions <- map_dfr(
  annual.precipitation.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Precipitation Seasonality

```
## Fit the regressions
precipitation.seasonality.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Precipitation_Seasonality"
)

## ANOVA
precipitation.seasonality.regression.ANOVAs <- map_dfr(
  precipitation.seasonality.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
precipitation.seasonality.regression.effect.sizes <- map_dfr(
  precipitation.seasonality.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
precipitation.seasonality.regression.predictions <- map_dfr(
  precipitation.seasonality.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Aridity Index

```
## Fit the regressions
aridity.index.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "Aridity_Index"
)

## ANOVA
aridity.index.regression.ANOVAs <- map_dfr(
  aridity.index.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
aridity.index.regression.effect.sizes <- map_dfr(
  aridity.index.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
aridity.index.regression.predictions <- map_dfr(
  aridity.index.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(
    City = c(
      rep(names(city.specific.data.list[1:135]), each = 4), rep(names(city.specific.data.list[136]), ea
    )
  )
```

GDP 2005

```
## Fit the regressions
GDP.2005.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "GDP_2005"
)

## ANOVA
GDP.2005.regression.ANOVAs <- map_dfr(
  GDP.2005.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
GDP.2005.regression.effect.sizes <- map_dfr(
  GDP.2005.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
GDP.2005.regression.predictions <- map_dfr(
  GDP.2005.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

SSP1 2030

```
## Fit the regressions
SSP1.2030.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "SSP_1_2030"
)

## ANOVA
SSP1.2030.regression.ANOVAs <- map_dfr(
  SSP1.2030.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
SSP1.2030.regression.effect.sizes <- map_dfr(
  SSP1.2030.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
SSP1.2030.regression.predictions <- map_dfr(
  SSP1.2030.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

SSP1 2100

```
## Fit the regressions
SSP1.2100.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "SSP_1_2100"
)

## ANOVA
SSP1.2100.regression.ANOVAs <- map_dfr(
  SSP1.2100.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
SSP1.2100.regression.effect.sizes <- map_dfr(
  SSP1.2100.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
SSP1.2100.regression.predictions <- map_dfr(
  SSP1.2100.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

SSP2 2030

```
## Fit the regressions
SSP2.2030.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "SSP_2_2030"
)

## ANOVA
SSP2.2030.regression.ANOVAs <- map_dfr(
  SSP2.2030.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
SSP2.2030.regression.effect.sizes <- map_dfr(
  SSP2.2030.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
SSP2.2030.regression.predictions <- map_dfr(
  SSP2.2030.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

SSP2 2100

```
## Fit the regressions
SSP2.2100.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "SSP_2_2100"
)

## ANOVA
SSP2.2100.regression.ANOVAs <- map_dfr(
  SSP2.2100.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
SSP2.2100.regression.effect.sizes <- map_dfr(
  SSP2.2100.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
SSP2.2100.regression.predictions <- map_dfr(
  SSP2.2100.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

SSP5 2030

```
## Fit the regressions
SSP5.2030.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "SSP_5_2030"
)

## ANOVA
SSP5.2030.regression.ANOVAs <- map_dfr(
  SSP5.2030.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
SSP5.2030.regression.effect.sizes <- map_dfr(
  SSP5.2030.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
SSP5.2030.regression.predictions <- map_dfr(
  SSP5.2030.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

SSP5 2100

```
## Fit the regressions
SSP5.2100.regression.list <- map(
  city.specific.data.list,
  fit_environmental_variable_by_distance_model,
  response_variable = "SSP_5_2100"
)

## ANOVA
SSP5.2100.regression.ANOVAs <- map_dfr(
  SSP5.2100.regression.list,
  environmental_variable_by_distance_model_ANOVA
) %>%
  add_column(City = names(city.specific.data.list))

## Effect sizes
SSP5.2100.regression.effect.sizes <- map_dfr(
  SSP5.2100.regression.list,
  environmental_variable_by_distance_model_effect_sizes
) %>%
  add_column(City = names(city.specific.data.list))

## Predictions
SSP5.2100.regression.predictions <- map_dfr(
  SSP5.2100.regression.list,
  environmental_variable_by_distance_model_predictions
) %>%
  add_column(City = rep(names(city.specific.data.list), each = 4))
```

Summaries

Data Management

```
## Combine all ANOVA tables
combined.ANOVA.table <- bind_rows(
  ISC.regression.ANOVAs, HII.regression.ANOVAs, mean.NDVI.regression.ANOVAs,
  mean.annual.temperature.regression.ANOVAs, temperature.seasonality.regression.ANOVAs,
  range.annual.temperature.regression.ANOVAs, annual.precipitation.regression.ANOVAs,
  precipitation.seasonality.regression.ANOVAs, aridity.index.regression.ANOVAs,
  GDP.2005.regression.ANOVAs, SSP1.2030.regression.ANOVAs,
  SSP1.2100.regression.ANOVAs, SSP2.2030.regression.ANOVAs,
  SSP2.2100.regression.ANOVAs, SSP5.2030.regression.ANOVAs,
  SSP5.2100.regression.ANOVAs
) %>%
  add_column(
    urban_environmental_variable = rep(
      c(
        "ISC", "HII", "Mean_NDVI", "Mean_Annual_Temperature",
        "Temperature_Seasonality", "Range_Annual_Temperature",
        "Annual_Precipitation", "Precipitation_Seasonality",
        "Aridity_Index", "GDP_2005", "SSP_1_2030", "SSP_1_2100",
        "SSP_2_2030", "SSP_2_2100", "SSP_5_2030", "SSP_5_2100"
      ),
      each = 136
    )
  )

## Combine all effect size tables
combined.effect.size.table <- bind_rows(
  ISC.regression.effect.sizes, HII.regression.effect.sizes, mean.NDVI.regression.effect.sizes,
  mean.annual.temperature.regression.effect.sizes, temperature.seasonality.regression.effect.sizes,
  range.annual.temperature.regression.effect.sizes, annual.precipitation.regression.effect.sizes,
  precipitation.seasonality.regression.effect.sizes, aridity.index.regression.effect.sizes,
  GDP.2005.regression.effect.sizes, SSP1.2030.regression.effect.sizes,
  SSP1.2100.regression.effect.sizes, SSP2.2030.regression.effect.sizes,
  SSP2.2100.regression.effect.sizes, SSP5.2030.regression.effect.sizes,
  SSP5.2100.regression.effect.sizes
) %>%
  add_column(
    urban_environmental_variable = rep(
      c(
        "ISC", "HII", "Mean_NDVI", "Mean_Annual_Temperature",
        "Temperature_Seasonality", "Range_Annual_Temperature",
        "Annual_Precipitation", "Precipitation_Seasonality",
        "Aridity_Index", "GDP_2005", "SSP_1_2030", "SSP_1_2100",
        "SSP_2_2030", "SSP_2_2100", "SSP_5_2030", "SSP_5_2100"
      ),
      each = 136
    )
  )

## Combine ANOVA and effect size tables
full.regression.results <- combined.ANOVA.table %>%
```

```r
  full_join(combined.effect.size.table, by = c("City", "urban_environmental_variable")) %>%
  select(
    City, urban_environmental_variable, Distance:Distance_by_Sampling_Design,
    eta2_Predictor:eta2_Interaction, R2_adjusted
  )
```

Summary Tables

Table 1: Percent of models with P-values below specific thresholds for the distance term. Total number of models = 136.

urban_environmental_variable	P < 0.001	P < 0.025	P < 0.050	P < 0.100	P < 0.250
Annual_Precipitation	45.588	66.176	71.324	76.471	83.824
Aridity_Index	47.059	63.971	70.588	72.059	80.882
GDP_2005	94.118	96.324	97.794	98.529	99.265
HII	69.118	82.353	83.824	86.029	89.706
ISC	90.441	93.382	93.382	94.118	96.324
Mean_Annual_Temperature	74.265	83.824	86.029	88.235	88.971
Mean_NDVI	79.412	84.559	86.765	90.441	93.382
Precipitation_Seasonality	48.529	63.235	69.853	75.000	80.882
Range_Annual_Temperature	54.412	69.853	72.059	75.000	83.824
SSP_1_2030	90.441	94.853	97.059	97.794	98.529
SSP_1_2100	90.441	94.118	97.059	97.794	98.529
SSP_2_2030	90.441	94.853	97.059	97.794	98.529
SSP_2_2100	90.441	94.118	97.059	97.794	98.529
SSP_5_2030	90.441	94.853	97.059	97.794	98.529
SSP_5_2100	90.441	94.118	97.794	97.794	98.529
Temperature_Seasonality	55.882	71.324	72.794	77.941	83.088

Table 2: Percent of models with P-values below specific thresholds for the sample type term. Total number of models = 136.

urban_environmental_variable	P < 0.001	P < 0.025	P < 0.050	P < 0.100	P < 0.250
Annual_Precipitation	5.882	13.235	16.912	26.471	41.176
Aridity_Index	9.559	20.588	25.735	31.618	45.588
GDP_2005	56.618	80.147	83.088	88.971	94.118
HII	5.147	17.647	24.265	33.088	50.000
ISC	52.206	69.853	75.735	81.618	91.912
Mean_Annual_Temperature	5.882	24.265	31.618	41.176	50.735
Mean_NDVI	33.088	52.941	60.294	67.647	80.882
Precipitation_Seasonality	3.676	8.824	15.441	22.059	33.088
Range_Annual_Temperature	10.294	24.265	30.147	34.559	52.206
SSP_1_2030	60.294	83.824	85.294	91.176	94.853
SSP_1_2100	60.294	83.824	85.294	91.176	94.853
SSP_2_2030	60.294	83.824	85.294	91.176	94.853
SSP_2_2100	60.294	83.824	85.294	91.176	94.853
SSP_5_2030	60.294	83.824	85.294	91.176	94.853
SSP_5_2100	60.294	83.824	86.029	91.176	94.853
Temperature_Seasonality	6.618	20.588	23.529	30.147	50.000

Table 3: Percent of models with P-values below specific thresholds for the distance-by-sample-type interaction term. Total number of models = 136.

urban_environmental_variable	P < 0.001	P < 0.025	P < 0.050	P < 0.100	P < 0.250
Annual_Precipitation	41.912	58.824	63.235	71.324	83.824
Aridity_Index	35.294	56.618	63.235	69.118	79.412
GDP_2005	43.382	74.265	76.471	86.029	91.176
HII	29.412	53.676	61.029	68.382	79.412
ISC	38.971	58.824	67.647	73.529	85.294
Mean_Annual_Temperature	41.176	60.294	64.706	73.529	80.882
Mean_NDVI	27.206	49.265	58.088	66.176	79.412
Precipitation_Seasonality	30.882	58.088	64.706	69.118	80.882
Range_Annual_Temperature	30.147	52.206	60.294	68.382	75.735
SSP_1_2030	50.735	77.206	80.147	86.765	92.647
SSP_1_2100	51.471	77.206	80.147	86.765	92.647
SSP_2_2030	50.735	77.206	80.147	86.765	92.647
SSP_2_2100	50.735	77.206	80.147	86.765	92.647
SSP_5_2030	50.735	77.206	80.147	86.765	92.647
SSP_5_2100	51.471	77.206	80.147	87.500	92.647
Temperature_Seasonality	32.353	52.941	59.559	66.912	76.471

urban_environmental_variable	Distance_P_Value_Mean	Sampling_Design_P_Value_Mean	Interaction_P_Value_Mean	Distance_P_Value_SE	Sam
Annual_Precipitation	0.114	0.416	0.121	0.020	
Aridity_Index	0.129	0.371	0.148	0.021	
GDP_2005	0.009	0.045	0.061	0.007	
HII	0.065	0.347	0.145	0.015	
ISC	0.021	0.073	0.122	0.009	
Mean_Annual_Temperature	0.066	0.323	0.131	0.016	
Mean_NDVI	0.041	0.125	0.145	0.011	
Precipitation_Seasonality	0.123	0.451	0.132	0.020	
Range_Annual_Temperature	0.116	0.348	0.157	0.021	
SSP_1_2030	0.012	0.042	0.047	0.007	
SSP_1_2100	0.012	0.041	0.046	0.007	
SSP_2_2030	0.012	0.042	0.047	0.007	
SSP_2_2100	0.012	0.041	0.046	0.007	
SSP_5_2030	0.012	0.042	0.047	0.007	
SSP_5_2100	0.013	0.041	0.046	0.008	
Temperature_Seasonality	0.115	0.344	0.171	0.020	

urban_environmental_variable	Distance_Effect_Size_Mean	Sampling_Design_Effect_Size_Mean	Interaction_Effect_Size_Mean	Distance_Effect_Size_
Annual_Precipitation	0.161	0.197	0.105	0.
Aridity_Index	0.280	0.180	0.098	0.
GDP_2005	0.431	0.065	0.107	0.
HII	0.489	0.141	0.089	0.
ISC	0.523	0.114	0.102	0.
Mean_Annual_Temperature	0.505	0.201	0.107	0.
Mean_NDVI	0.352	0.092	0.077	0.
Precipitation_Seasonality	0.181	0.174	0.092	0.
Range_Annual_Temperature	0.265	0.173	0.081	0.
SSP_1_2030	0.357	0.057	0.114	0.
SSP_1_2100	0.357	0.057	0.114	0.
SSP_2_2030	0.357	0.057	0.114	0.
SSP_2_2100	0.357	0.057	0.114	0.
SSP_5_2030	0.357	0.057	0.114	0.
SSP_5_2100	0.357	0.057	0.114	0.
Temperature_Seasonality	0.291	0.169	0.089	0.

Export the Results

```
## Combined ANOVA and effect size tables
write_csv(
  full.regression.results,
  "data/analysis_data/city_specific_regressions/full_regression_results.csv"
)
```

Workspace Information

Table 6: Packages required for data management and analyses.

Package	Loaded Version	Date
bayestestR	0.13.2	2024-02-12
broom	1.0.5	2023-06-09
car	3.1-2	2023-03-30
carData	3.0-5	2022-01-06
correlation	0.8.4	2023-04-06
datawizard	0.9.1	2023-12-21
dplyr	1.1.4	2023-11-17
easystats	0.7.0	2023-11-05
effectsize	0.8.6	2023-09-14
emmeans	1.10.0	2024-01-23
forcats	1.0.0	2023-01-29
ggplot2	3.4.4	2023-10-12
insight	0.19.8	2024-01-31
kableExtra	1.4.0	2024-01-24
knitr	1.45	2023-10-30
lubridate	1.9.3	2023-09-27
modelbased	0.8.7	2024-02-15
parameters	0.21.5	2024-02-07
performance	0.10.9	2024-02-17
purrr	1.0.2	2023-08-10
readr	2.1.5	2024-01-10
report	0.5.8	2023-12-07
see	0.8.2	2024-02-14
stringr	1.5.1	2023-11-14
tibble	3.2.1	2023-03-20
tidyr	1.3.1	2024-01-24
tidyverse	2.0.0	2023-02-22

References