Pre- Post-Fire FIA Analysis

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DO NOT DISTRIBUTE THIS SCRIPT

- This script contains confidential FIA plot numbers - DO NOT DISTRIBUTE

Libraries

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.2.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```

```
library(DBI)
```

```
## Warning: package 'DBI' was built under R version 4.2.2
```

```
library(RSQLite)
```

Import data

```
#########################################################
## Time 2 Carbon from 2023 sampled plots
#########################################################
# source('Time 2 Carbon.R')
Time2Carbon <- read.csv('Data/Time2Carbon.csv', head= T)

#########################################################
## SQLITE database
#########################################################

#database path
sqlite_path <- file.path('Data/SQLite_FIADB_CO/SQLite_FIADB_CO.db')

## connection to db
conn <- DBI::dbConnect(RSQLite::SQLite(), sqlite_path)

DBI::dbListTables(conn)
```

```
##   [1] "BEGINEND"                     "COND"
##   [3] "COND_DWM_CALC"                "COUNTY"
##   [5] "DATAMART_MOST_RECENT_INV"     "DWM_COARSE_WOODY_DEBRIS"
##   [7] "DWM_DUFF_LITTER_FUEL"         "DWM_FINE_WOODY_DEBRIS"
##   [9] "DWM_MICROPLOT_FUEL"           "DWM_RESIDUAL_PILE"
##  [11] "DWM_TRANSECT_SEGMENT"         "DWM_VISIT"
##  [13] "EVALIDATOR_ESTIMATE_GRP"      "EVALIDATOR_POP_ESTIMATE"
##  [15] "EVALIDATOR_VARIABLE_LIBRARY"  "FVS_GROUPADDFILESANDKEYWORDS"
##  [17] "FVS_PLOTINIT_PLOT"            "FVS_STANDINIT_COND"
##  [19] "FVS_STANDINIT_PLOT"           "FVS_TREEINIT_COND"
##  [21] "FVS_TREEINIT_PLOT"            "GRND_CVR"
##  [23] "INVASIVE_SUBPLOT_SPP"         "LICHEN_LAB"
##  [25] "LICHEN_PLOT_SUMMARY"          "LICHEN_SPECIES_SUMMARY"
##  [27] "LICHEN_VISIT"                 "OZONE_BIOSITE_SUMMARY"
##  [29] "OZONE_PLOT"                   "OZONE_PLOT_SUMMARY"
##  [31] "OZONE_SPECIES_SUMMARY"        "OZONE_VALIDATION"
##  [33] "OZONE_VISIT"                  "P2VEG_SUBPLOT_SPP"
##  [35] "P2VEG_SUBP_STRUCTURE"         "PLOT"
##  [37] "PLOTGEOM"                     "PLOTSNAP"
##  [39] "PLOT_REGEN"                   "POP_ESTN_UNIT"
##  [41] "POP_EVAL"                     "POP_EVAL_ATTRIBUTE"
##  [43] "POP_EVAL_GRP"                 "POP_EVAL_TYP"
##  [45] "POP_PLOT_STRATUM_ASSGN"       "POP_STRATUM"
##  [47] "PROJECT"                      "REF_CITATION"
##  [49] "REF_DIFFERENCE_TEST_PER_ACRE" "REF_DIFFERENCE_TEST_TOTALS"
##  [51] "REF_FIADB_VERSION"            "REF_FOREST_TYPE"
##  [53] "REF_FOREST_TYPE_GROUP"        "REF_FVS_LOC_NAME"
##  [55] "REF_FVS_VAR_NAME"             "REF_GRM_TYPE"
##  [57] "REF_HABTYP_DESCRIPTION"       "REF_HABTYP_PUBLICATION"
##  [59] "REF_INVASIVE_SPECIES"         "REF_LICHEN_SPECIES"
##  [61] "REF_LICHEN_SPP_COMMENTS"      "REF_NVCS_HIERARCHY_STRCT"
##  [63] "REF_NVCS_LEVEL_1_CODES"       "REF_NVCS_LEVEL_2_CODES"
##  [65] "REF_NVCS_LEVEL_3_CODES"       "REF_NVCS_LEVEL_4_CODES"
##  [67] "REF_NVCS_LEVEL_5_CODES"       "REF_NVCS_LEVEL_6_CODES"
##  [69] "REF_NVCS_LEVEL_7_CODES"       "REF_NVCS_LEVEL_8_CODES"
```

```
##  [71] "REF_OWNGRPCD"                "REF_PLANT_DICTIONARY"
##  [73] "REF_POP_ATTRIBUTE"           "REF_POP_EVAL_TYP_DESCR"
##  [75] "REF_RESEARCH_STATION"        "REF_SIEQN"
##  [77] "REF_SPECIES"                 "REF_SPECIES_GROUP"
##  [79] "REF_STATE_ELEV"              "REF_UNIT"
##  [81] "SEEDLING"                    "SEEDLING_REGEN"
##  [83] "SITETREE"                    "SOILS_EROSION"
##  [85] "SOILS_LAB"                   "SOILS_SAMPLE_LOC"
##  [87] "SOILS_VISIT"                 "SUBPLOT"
##  [89] "SUBPLOT_REGEN"               "SUBP_COND"
##  [91] "SUBP_COND_CHNG_MTRX"         "SURVEY"
##  [93] "TREE"                        "TREE_GRM_BEGIN"
##  [95] "TREE_GRM_COMPONENT"          "TREE_GRM_ESTN"
##  [97] "TREE_GRM_MIDPT"              "TREE_GRM_THRESHOLD"
##  [99] "TREE_REGIONAL_BIOMASS"       "TREE_WOODLAND_STEMS"
## [101] "VEG_PLOT_SPECIES"            "VEG_QUADRAT"
## [103] "VEG_SUBPLOT"                 "VEG_SUBPLOT_SPP"
## [105] "VEG_VISIT"
```

```
# DBI::dbListFields(conn, 'TREE')


## Tree table
#########################################################
TREE <- DBI::dbReadTable(conn, "TREE")


## Disconnect from db
DBI::dbDisconnect(conn)
```

Attach non-classified plot numbers to post-fire plots

```
Time2Carbon2 <- Time2Carbon |>
  dplyr::mutate(PREV_PLOT = dplyr::case_when(PLOT == 3023 ~ 82897,
                                             PLOT == 3001 ~ 82199,
                                             PLOT == 149 ~ 85498,
                                             PLOT == 104 ~ 87545,
                                             PLOT == 3031 ~ 90710,
                                             PLOT == 83 ~ 88772,
                                             PLOT == 66 ~ 84364,
                                             PLOT == 38 ~ 87154,
                                             PLOT == 37 ~ 91181,
                                             PLOT == 20 ~ 87420,
                                             PLOT == 3040 ~ 80171)) |>
  dplyr::filter((PREV_PLOT == 82897 & SUBP == 1) |
                  (PREV_PLOT == 82897 & SUBP == 4) |

                  (PREV_PLOT == 82199 & SUBP == 1) |
                  (PREV_PLOT == 82199 & SUBP == 2) |
                  (PREV_PLOT == 82199 & SUBP == 3) |
                  (PREV_PLOT == 82199 & SUBP == 4) |

                  (PREV_PLOT == 85498 & SUBP == 1) |
                  (PREV_PLOT == 85498 & SUBP == 4) |
```

```
                  (PREV_PLOT == 87545 & SUBP == 1) |
                  (PREV_PLOT == 87545 & SUBP == 2) |
                  (PREV_PLOT == 87545 & SUBP == 3) |

                  (PREV_PLOT == 90710 & SUBP == 2) |

                  (PREV_PLOT == 88772 & SUBP == 1) |
                  (PREV_PLOT == 88772 & SUBP == 2) |
                  (PREV_PLOT == 88772 & SUBP == 3) |
                  (PREV_PLOT == 88772 & SUBP == 4) |

                  (PREV_PLOT == 84364 & SUBP == 1) |
                  (PREV_PLOT == 84364 & SUBP == 2) |
                  (PREV_PLOT == 84364 & SUBP == 3) |

                  (PREV_PLOT == 87154 & SUBP == 1) |
                  (PREV_PLOT == 87154 & SUBP == 4) |

                  (PREV_PLOT == 91181 & SUBP == 1) |
                  (PREV_PLOT == 91181 & SUBP == 2) |
                  (PREV_PLOT == 91181 & SUBP == 3) |

                  (PREV_PLOT == 87420 & SUBP == 1) |
                  (PREV_PLOT == 87420 & SUBP == 4) |

                  (PREV_PLOT == 80171 & SUBP == 1)
                  )
```

Subset subplots sampled from FIA database

```
TREE2 <- TREE |>
  dplyr::filter((PLOT == 82897 & SUBP == 1) |
                  (PLOT == 82897 & SUBP == 4) |

                  (PLOT == 82199 & SUBP == 1) |
                  (PLOT == 82199 & SUBP == 2) |
                  (PLOT == 82199 & SUBP == 3) |
                  (PLOT == 82199 & SUBP == 4) |

                  (PLOT == 85498 & SUBP == 1) |
                  (PLOT == 85498 & SUBP == 4) |

                  (PLOT == 87545 & SUBP == 1) |
                  (PLOT == 87545 & SUBP == 2) |
                  (PLOT == 87545 & SUBP == 3) |

                  (PLOT == 90710 & SUBP == 2) |

                  (PLOT == 88772 & SUBP == 1) |
                  (PLOT == 88772 & SUBP == 2) |
                  (PLOT == 88772 & SUBP == 3) |
                  (PLOT == 88772 & SUBP == 4) |
```

```
                  (PLOT == 84364 & SUBP == 1) |
                  (PLOT == 84364 & SUBP == 2) |
                  (PLOT == 84364 & SUBP == 3) |

                  (PLOT == 87154 & SUBP == 1) |
                  (PLOT == 87154 & SUBP == 4) |

                  (PLOT == 91181 & SUBP == 1) |
                  (PLOT == 91181 & SUBP == 2) |
                  (PLOT == 91181 & SUBP == 3) |

                  (PLOT == 87420 & SUBP == 1) |
                  (PLOT == 87420 & SUBP == 4) |

                  (PLOT == 80171 & SUBP == 1)
                  )|>
  dplyr::group_by(PLOT, SUBP, TREE) |>
  dplyr::filter(INVYR == max(INVYR)) |> ## This only keeps the most recent record of a tree being measu
  dplyr::ungroup()
```

Join records from new carbon to FIA plots Filter only plots that we have scanned trees for:

```
TreeJoined <- TREE2 |>
  dplyr::full_join(Time2Carbon2, by = c('PLOT' = 'PREV_PLOT', 'SUBP', 'TREE')) |>
  dplyr::filter(PLOT == 87420 | # 8_49_20
                PLOT == 82199 # 8_57_3001
                )
```

Mortality Stats

```
# Original Trees with Carbon
TreesOriginal <- TreeJoined |>
  dplyr::filter(is.na(SPCD.x) == F & is.na(SPCD.y) == F,
                is.na(CARBON_AG.x) == F)

# Remaining Trees with Carbon
TreesRemaining <- TreeJoined |>
  dplyr::filter(is.na(CARBON_AG.y) == F)

paste('number of pre-fire trees remaining:', nrow(TreesRemaining))
```

```
## [1] "number of pre-fire trees remaining: 45"
```

```
paste('out of', nrow(TreesOriginal))
```

```
## [1] "out of 87"
```

- The number of pre-fire trees remaining post-fire are: 45

383

```
TreesRemainingCarbon <- TreesRemaining |>
  dplyr::select(PLOT, SUBP, TREE, STATUSCD.x, STATUSCD.y, DECAYCD.x, DECAYCD.y, STANDING_DEAD_CD.x, STA
  ## Add some helpful classes
  dplyr::mutate(Change_Status = dplyr::case_when(
    (STATUSCD.x == 1 & STATUSCD.y == 1) ~ 'Survived',
    (STATUSCD.x == 1 & STATUSCD.y == 2) ~ 'Died',
    (STATUSCD.x == 2 & STATUSCD.y == 2) ~ 'Died Pre-Fire',
    (is.na(STATUSCD.x) == T & STATUSCD.y == 2) ~ 'New Growth',
    .default = "other"
    ))

TreesRemainingCarbon
```

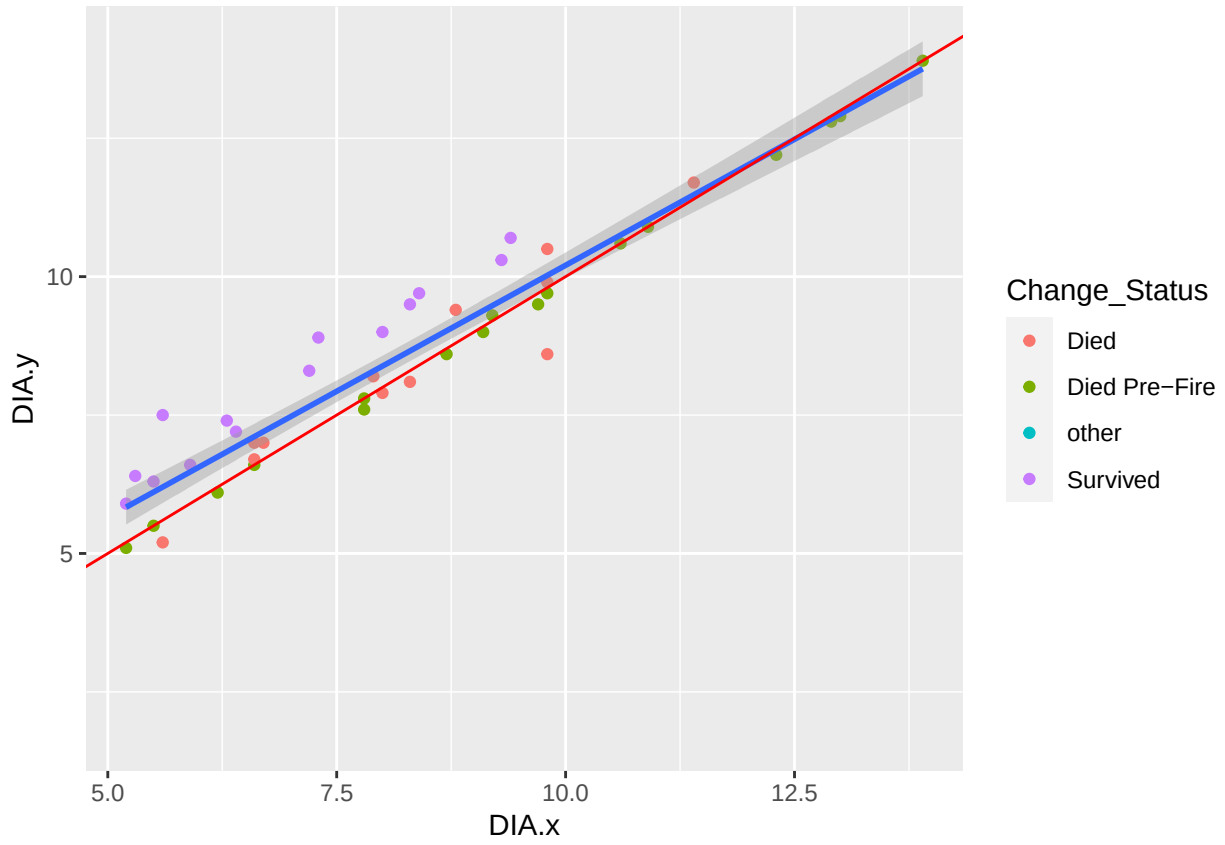
```
## # A tibble: 45 x 16
##     PLOT  SUBP  TREE STATUSCD.x STATUSCD.y DECAYCD.x DECAYCD.y
##    <dbl> <int> <int>      <int>      <int>     <int>     <int>
##  1 87420     1     1          2          2         1         2
##  2 87420     1     2          2          2         1         2
##  3 87420     1     3          2          2         1         2
##  4 87420     1     4          2          2         1         2
##  5 87420     1     5          2          2         1         2
##  6 87420     1     7          2          2         1         2
##  7 87420     1     8          2          2         1         2
##  8 87420     1     9          1          1        NA        NA
##  9 87420     1    10          1          1        NA        NA
## 10 87420     4     1          1          1        NA        NA
## # i 35 more rows
## # i 9 more variables: STANDING_DEAD_CD.x <int>, STANDING_DEAD_CD.y <int>,
## #   DIA.x <dbl>, DIA.y <dbl>, HT.x <int>, HT.y <int>, CARBON_AG.x <dbl>,
## #   CARBON_AG.y <dbl>, Change_Status <chr>
```

Plot of pre and post fire stats and carbon

```
ggplot(data = TreesRemainingCarbon) +
  geom_point(aes(x = DIA.x, y = DIA.y, color = Change_Status)) +
  geom_smooth(aes(x = DIA.x, y = DIA.y),method='lm', formula= y~x) +
  geom_abline(intercept = 0, slope = 1, color = 'red')
```

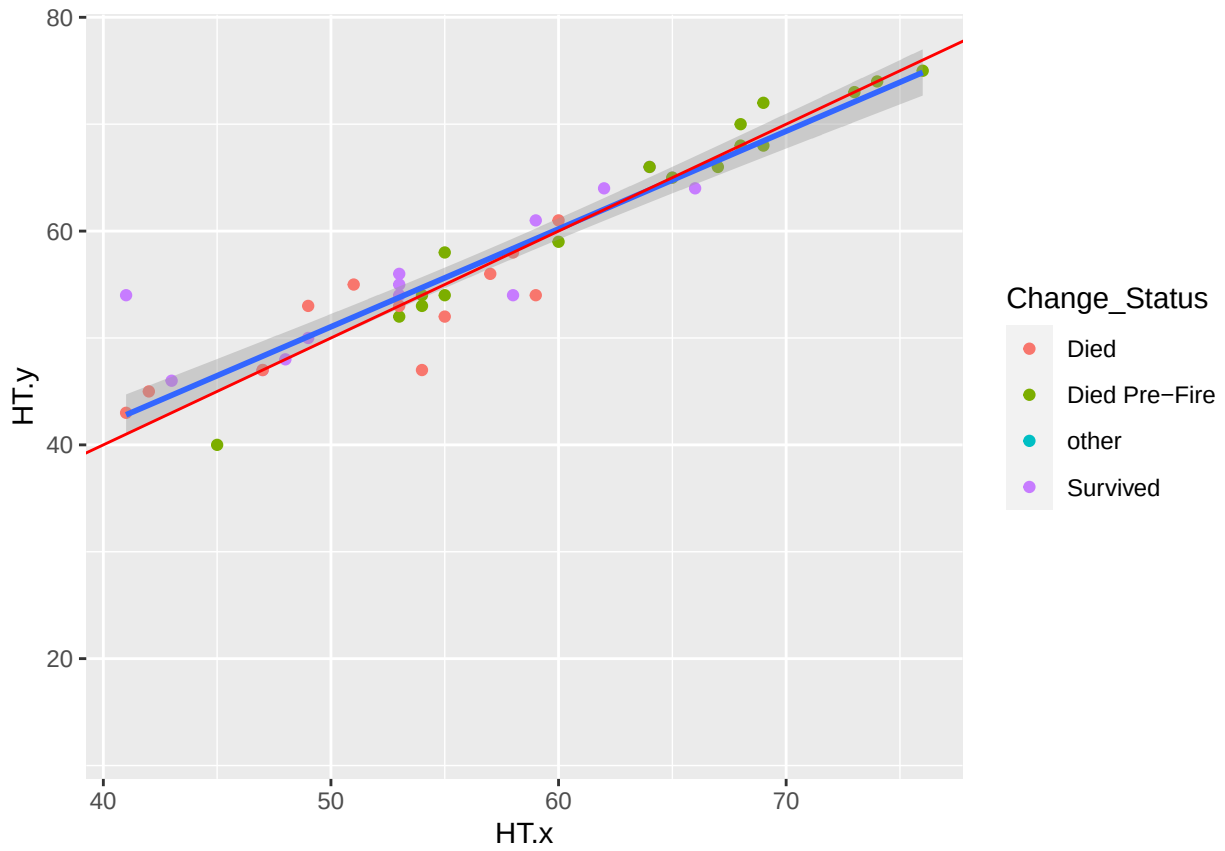
```
## Warning: Removed 2 rows containing non-finite values (‘stat_smooth()‘).
```

```
## Warning: Removed 2 rows containing missing values (‘geom_point()‘).
```



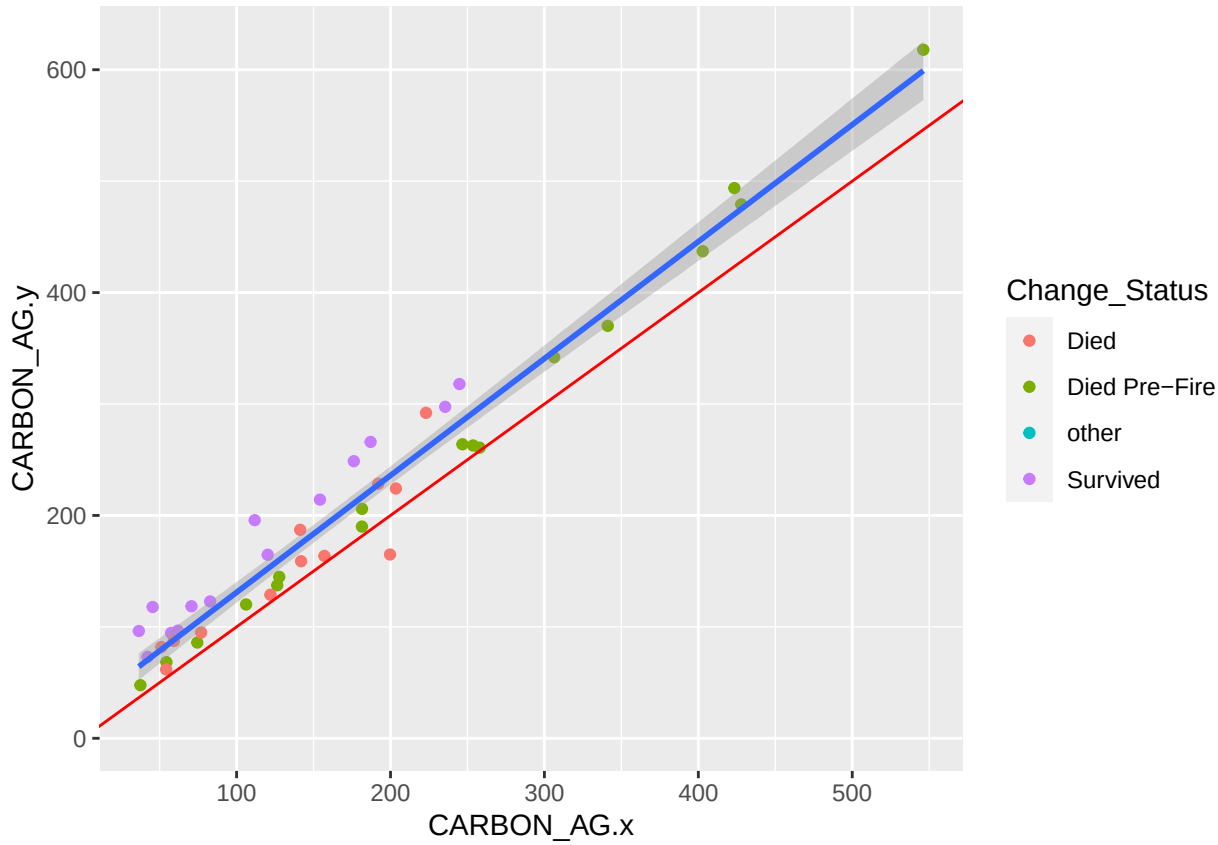

```
ggplot(data = TreesRemainingCarbon) +
  geom_point(aes(x = HT.x, y = HT.y, color = Change_Status)) +
  geom_smooth(aes(x = HT.x, y = HT.y),method='lm', formula= y~x) +
  geom_abline(intercept = 0, slope = 1, color = 'red')
```

```
## Warning: Removed 2 rows containing non-finite values (‘stat_smooth()‘).
## Removed 2 rows containing missing values (‘geom_point()‘).
```




```
ggplot(data = TreesRemainingCarbon) +
  geom_point(aes(x = CARBON_AG.x, y = CARBON_AG.y, color = Change_Status)) +
  geom_smooth(aes(x = CARBON_AG.x, y = CARBON_AG.y),method='lm', formula= y~x) +
  geom_abline(intercept = 0, slope = 1, color = 'red')
```

```
## Warning: Removed 2 rows containing non-finite values (‘stat_smooth()‘).
## Removed 2 rows containing missing values (‘geom_point()‘).
```




```
# Trees lost
# Original Trees with Carbon
TreesLost <- TreeJoined |>
  dplyr::filter(#is.na(SPCD.x) == F & is.na(SPCD.y) == T,
                is.na(CARBON_AG.x) == F,
                is.na(CARBON_AG.y) == T) |>
  dplyr::select(PLOT, SUBP, TREE, STATUSCD.x, STATUSCD.y, STANDING_DEAD_CD.x, STANDING_DEAD_CD.y, DIA.x
```

- The number of trees with carbon lost was: 44
- The amount of carbon lost was 3952.289946