Preliminary analyses for FIA fire work

8/26/2020

Update on FIA work - August 26, 2020

1. Gathered data for single burn and reburn plots from the periodic inventories, the R5 inventories and the annual inventories (with a ton of Jeremy's help - thank you!)
2. Began linking the data and trying to calculate biomass to begin looking at effects and differences in data
3. Lost a lot of plots due to the absence of either a pre- or post-fire measurement, mostly the pre-fire measurements
4. For reburn plots
    - Most pre-fire measurements come from periodic 1990s database
5. For single burn plots
    - Most pre-fire measurements come from R5 database. Very few pre-burn visits were found in the annual data - most are post-fire.
6. Have calculated biomass for the plots that are available, took some time to understand different designs and identify different variables
    - Calculating biomass estimate from each plot in Mg C haˆ-1
    - Cacluated at plot level rather than condition level - will need to go back and re-run things.
    - Filtered all tree records to just those that were > 1 in diameter (to align periodic and R5 with annual)
7. For plots with pre-burn and post-burn measurements of biomass, we had:
    - 154 reburn plots (78 softwood, 87 hardwood)
    - 161 single burn plots (98 softwood, 78 hardwood)
8. Calculated:
    - pre-fire biomass (Mg C ha-1)
    - post-fire biomass (Mg C ha-1)
    - percent change (100 * (post - pre / pre))
    - Post-Fire to Burn time (yrs)
    - Burn to Pre-Fire time (yrs)
9. Things get a bit weird with the percent change, so I was looking at things in terms of loss (i.e., precent change $>$ -100 & < 0) and gain (percent change > 0)

Difference in mean loss by burn type

First for plots that exhibited losses in biomass. Perhaps a significant difference...

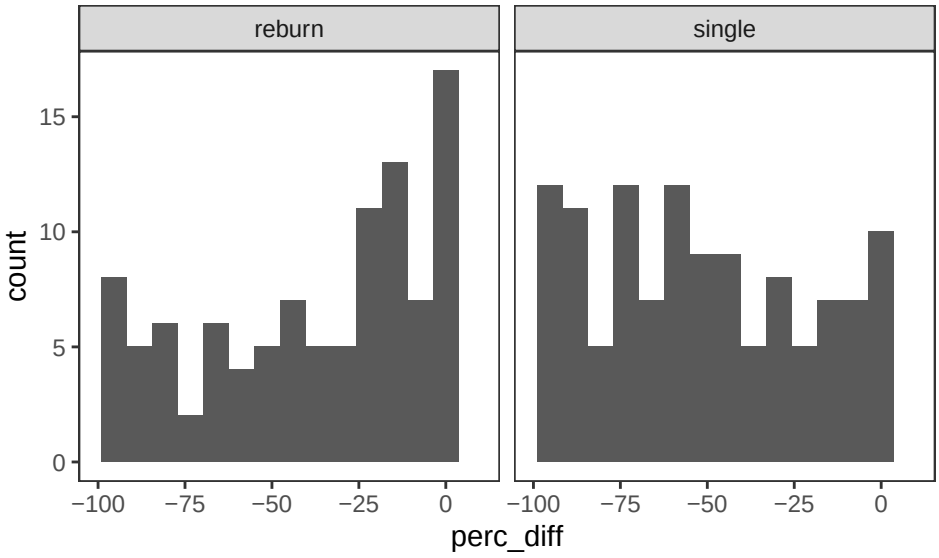
```
## # A tibble: 2 x 3
##   BURN   diff_avg diff_se
##   <chr>     <dbl>   <dbl>
## 1 reburn    -47.1    3.36
## 2 single    -57.1    2.76
```

Now for plots that exhibited gains in biomass.

```
## # A tibble: 2 x 3
##   BURN        diff_avg       diff_se
##   <chr>          <dbl>         <dbl>
## 1 reburn 12218090049.  10050881298.
## 2 single          72.1          13.1
```

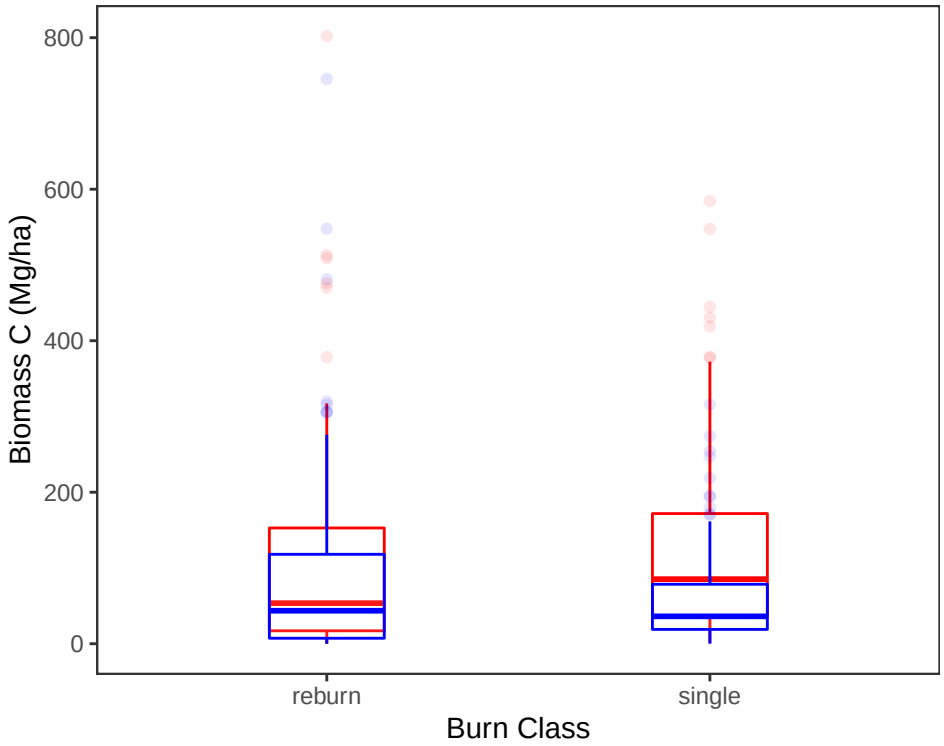
Plotting histograms of the percent differences by burn class

Doesn't seem to be much visual difference?



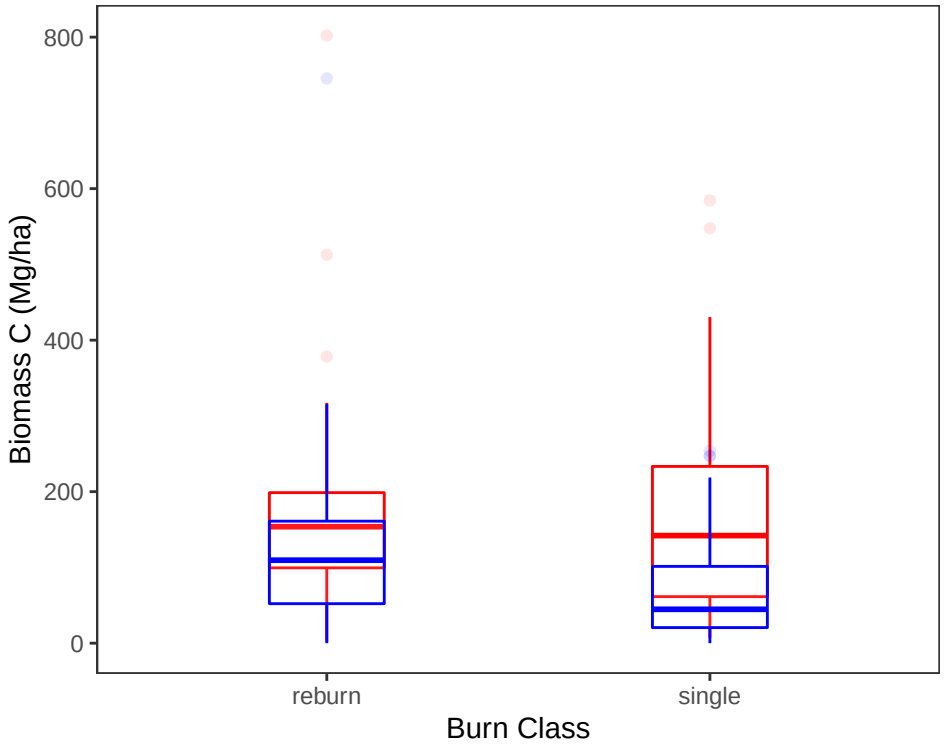
Plotting pre (red) & post (blue) biomass ~ burn class

Red is pre-fire visit whereas blue is post-fire visit biomass. No filter on SWHW or biomass gain/loss. Doesn't seem to be much difference there...



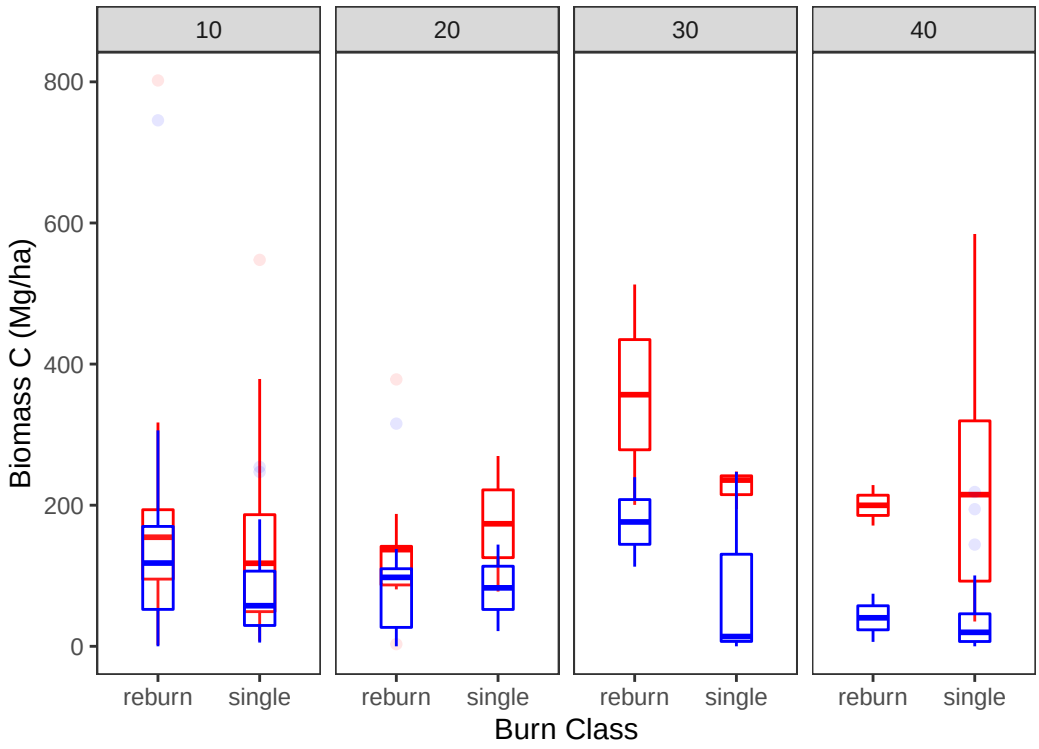
Repeating the same plot, but for softwoods and only those that experienced losses

Perhaps a trend of slightly greater loss in biomass post-fire (blue plots) for single-burn plots.



Looking at the differences in pre- vs. post-fire biomass by ownership group code & for softwoods only.

Post-fire biomass is definitely lower on state and private lands... bit of a wash on federal lands.



Running a few perhaps-too-early models

Data structure is as follows:

- POST = post-fire biomass
- PRE = pre-fire biomass
- BURN = burn class
- perc_diff = percent difference between POST and PRE
- TimeSinceFire = number of yrs between post-visit and fire
- TimeBeforeFire = number of yrs between pre-visit and fire

Example head of data:

```
## # A tibble: 6 x 8
##   PLOT_FIADB  POST   PRE BURN  perc_diff TimeSinceFire TimeBeforeFire
##        <dbl> <dbl> <dbl> <chr>     <dbl>         <dbl>          <dbl>
## 1      40143  17.8  84.3 sing~   -79.0               1              8
## 2      40143  17.8  84.3 sing~   -79.0               1              8
## 3      41138  42.9 216.  sing~   -80.1               1              8
## 4      41156  54.7 102.  sing~   -46.5               1              8
## 5      45532  19.4 226.  sing~   -91.4               1              8
## 6      46252  99.7 100.  sing~    -0.740             1              8
## # ... with 1 more variable: OWNGRPCD <dbl>
```

Run a simple model on the data, BOTH hardwood and softwood

Total of 230 distinct plots.

Find a very weak effect for burn class. Find strong effects for pre-fire biomass & ownership group.

```
##
## Call:
## glm(formula = POST ~ BURN + PRE + TimeSinceFire + TimeBeforeFire +
##     OWNGRPCD, data = mdl_dat)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -215.92   -25.59    -0.23    26.86   324.01
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)     55.21179    8.47699   6.513 4.36e-10 ***
## BURNsingle     -15.35255    8.67065  -1.771 0.077907 .
## PRE              0.50026    0.03147  15.895  < 2e-16 ***
## TimeSinceFire   -1.76425    1.48746  -1.186 0.236779
## TimeBeforeFire  -1.48134    0.86135  -1.720 0.086776 .
## OWNGRPCD        -1.45465    0.38831  -3.746 0.000226 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 3015.51)
##
##     Null deviance: 1533693  on 242  degrees of freedom
## Residual deviance:  714676  on 237  degrees of freedom
##   (1 observation deleted due to missingness)
## AIC: 2644.3
##
## Number of Fisher Scoring iterations: 2
```

Repeat for only softwoods

Total of 123 plots included in the model.

Seems to find a weak effect for burn class. Not particularly convincing and things are likely to change with additional data or changing calculations. Strong effects for both pre-fire biomass and ownership group code.

```
##
## Call:
## glm(formula = POST ~ BURN + PRE + TimeBeforeFire + TimeSinceFire +
##     OWNGRPCD, data = mdl_dat)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -219.772   -32.216    -1.892    29.280   264.185
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)     85.14041   15.01829   5.669  9.8e-08 ***
## BURNsingle     -30.49610   13.75251  -2.217  0.02844 *
## PRE              0.55906    0.04483  12.469  < 2e-16 ***
## TimeBeforeFire  -2.20285    1.52205  -1.447  0.15038
```

```
## TimeSinceFire   -2.88003    2.49728  -1.153  0.25106
## OWNGRPCD        -2.08527    0.63902  -3.263  0.00143 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 3740.295)
##
##     Null deviance: 1174577  on 127  degrees of freedom
## Residual deviance:  456316  on 122  degrees of freedom
## AIC: 1424.1
##
## Number of Fisher Scoring iterations: 2
```

Questions/points for further discussion

- Would appear to be pretty messy with variable results depending on what's included... but something might be there.
- Clear that there are strong effects for both pre-fire biomass and ownership group, will want to keep these in the modeling.
- Is there a better model form to be using?
- How do we refine the comparisons such that there would be stronger effects?
  - Likely need to go down to the condition level - ownership is a little bit messy in the table (multiple entries for some plots, though certainty the minority), adding in forest type code made things more significant, but mostly because of erroneously adding observations (pseudorep), might clear up at condition level.
  - Can look by region?
  - Better calculations of biomass?
- Stronger effects for other variables?
  - Seedlings?
  - Vegetation cover?
  - Number of species on plots?
  - Dead wood?