

reg_AIC_multInteraction

May 2, 2024

```
[1]: # Kristina Fauss
# April 19, 2024
# model selection by AIC testing all 1st order interactions

import warnings
warnings.filterwarnings("ignore")

import pandas as pd
import statsmodels.formula.api as smf

from ols_mixedef_custom import *

[2]: fp = '/Users/kristinafauss/BackupToBox/Git/lab-flammability-testing-2022/data/
      processed-data/main_dataset.csv'

      flamog = pd.read_csv(fp)

      # drop na's for flam metrics
      print(len(flamog))
      for col in ['fh', 'fd', 'pfg', 'temp_change', 'heat_flux_change']:
          flamog.dropna(subset=col, inplace=True)
      print(len(flamog))

      flamog['plant_id']=[str(a)+'_'+str(b) for a,b in zip(flamog['plant'],
      flamog['species'])]

      # report
      print(flamog.columns)
      flamog.head()
```

172

171

```
Index(['Unnamed: 0', 'species', 'plant', 'date', 'total_branch_mass',
      'total_leaf_mass', 'stem_mass_ratio', 'leaf_mass_ratio', 'leaf_lfm',
      'thickness', 'leaf_wet_mass', 'leaf_dry_mass', 'stem_lfm', 'stem_width',
      'stem_wet_mass', 'stem_dry_mass', 'stem_sav', 'lfm', 'leaf_dmc',
      'stem_dmc', 'dmc', 'leaf_area', 'leaf_sav', 'LMA', 'SLA', 'rep',
      'branch_length', 'branch_width', 'branch_height', 'sample_wt',
```

```

'no_branches', 'mpa', 'notes_on_plant_char', 'start_time',
'ambient_temp', 'ambient_humidity', 'pre_ignition_glow',
'first_glow_time', 'ignition', 'primary_ignition',
'primary_time_of_flame_end', 'secondary_ignition',
'secondary_time_of_flame_end', 'third_ignition',
'third_time_of_ignition_flame_end', 'time_fh', 'fh', 'time_of_glow_end',
'end_time', 'thermocoupler_height', 'hotplate_height',
'notes_on_flam_data', 'fd', 'tti', 'pfg', 'max_temp',
'time_at_max_temp', 'max_temp_sensor', 'start_temp',
'start_temp_sensor', 'stable_avg_temp', 'temp_change', 'avg_temp_ch3',
'max_heat_flux_loessCH7', 'time_at_max_heat_flux_loessCH7',
'max_heat_flux_loessCH8', 'time_at_max_heat_flux_loessCH8',
'avg_heat_flux_stableCH7', 'avg_heat_flux_stableCH8',
'heat_flux_change', 'prop_ig', 'wet_mass', 'dry_mass', 'gdw_gfw',
'dw_flam_sample', 'ww_flam_sample', 'branch_volume', 'branching',
'sample_density', 'dw_sppdev', 'plant_id'],
dtype='object')

```

```

[2]: Unnamed: 0 species plant date total_branch_mass total_leaf_mass \
0 1 ARCDEN 1 2022-08-10 20.347 19.505
1 2 ARCDEN 1 2022-08-10 20.347 19.505
2 3 ARCDEN 1 2022-08-10 20.347 19.505
3 4 ARCDEN 1 2022-08-10 20.347 19.505
4 5 ARCDEN 1 2022-08-10 20.347 19.505

stem_mass_ratio leaf_mass_ratio leaf_lfm thickness ... wet_mass \
0 0.510564 0.489436 251.06912 0.514 ... 1.151
1 0.510564 0.489436 251.06912 0.514 ... 1.151
2 0.510564 0.489436 251.06912 0.514 ... 1.151
3 0.510564 0.489436 251.06912 0.514 ... 1.151
4 0.510564 0.489436 251.06912 0.514 ... 1.151

dry_mass gdw_gfw dw_flam_sample ww_flam_sample branch_volume \
0 0.3683 0.242414 1.291195 4.035205 1082.04
1 0.3683 0.242414 1.429372 4.467028 1370.20
2 0.3683 0.242414 1.283923 4.012477 682.04
3 0.3683 0.242414 1.283923 4.012477 1262.25
4 0.3683 0.242414 0.811215 2.535185 819.00

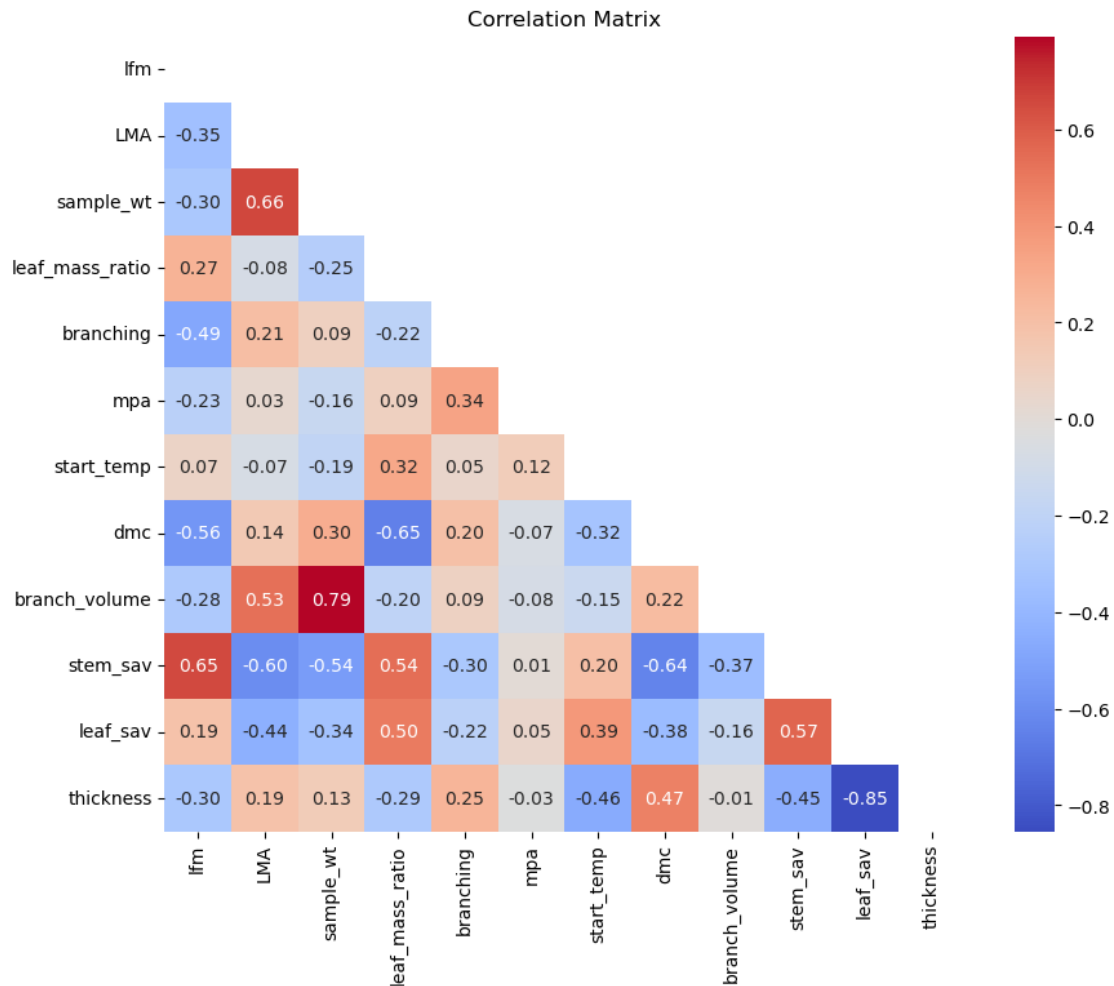
branching sample_density dw_sppdev plant_id
0 0.416667 0.004923 0.923122 1_ARCDEN
1 0.322581 0.004303 1.348152 1_ARCDEN
2 0.294118 0.007766 0.900752 1_ARCDEN
3 0.466667 0.004196 0.900752 1_ARCDEN
4 0.500000 0.004086 -0.553297 1_ARCDEN

```

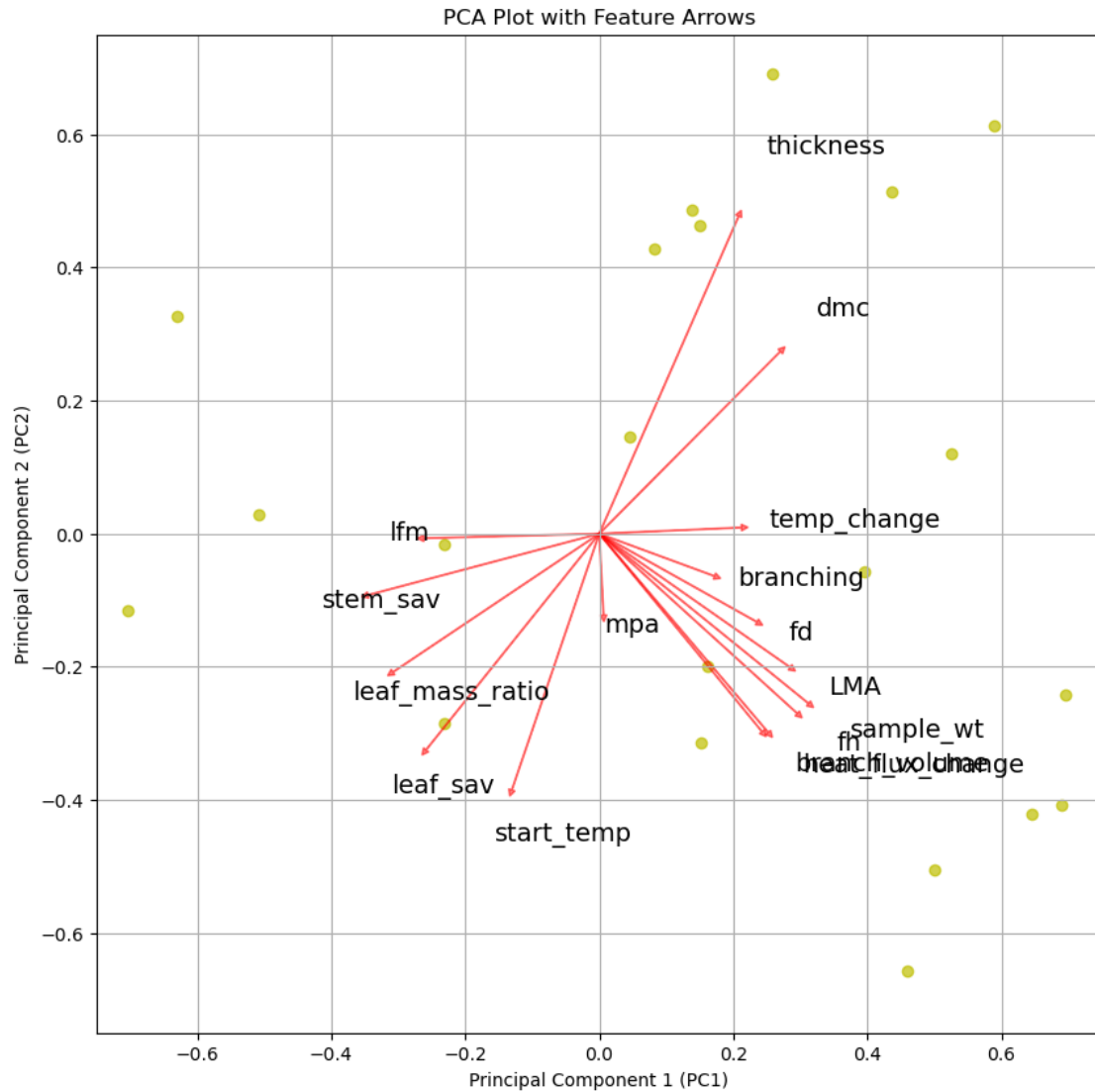
[5 rows x 81 columns]

1 Examine Correlation & Structure in Num. Var's

```
[3]: cols_num_use = ['lfm', 'LMA', 'sample_wt', 'leaf_mass_ratio', 'branching',  
    ↪ 'mpa', 'start_temp', 'dmc', 'branch_volume', 'stem_sav', 'leaf_sav',  
    ↪ 'thickness']  
  
corrplot(flamog, cols_num_use)
```



```
[4]: PCAplot(flamog, cols_num_use+['fh', 'fd', 'temp_change', 'heat_flux_change'])
```



2 Modeling Preprocessing

```
[5]: # scale and center
cols_all = ['fh', 'fd', 'temp_change', 'heat_flux_change'] + cols_num_use
flam = scale_and_center(flamog, cols_all, cols_no_change=['plant_id', 'species', 'ignition'])

# declare as factors
flam['species'] = pd.Categorical(flam['species'])
flam['plant_id'] = pd.Categorical(flam['plant_id'])
flam['ignition'] = pd.Categorical(flam['ignition'])
```

```

# drop na's
print(len(flam))
cols_all_dpna = cols_all + ['plant_id', 'species', 'ignition']
flam.dropna(subset=cols_all_dpna, inplace=True)
print(len(flam))

# declare all possible IV cols to model
cols_use = cols_num_use + ['species']
print(cols_use)

```

167

162

```

['lfm', 'LMA', 'sample_wt', 'leaf_mass_ratio', 'branching', 'mpa', 'start_temp',
'dmc', 'branch_volume', 'stem_sav', 'leaf_sav', 'thickness', 'species']

```

3 Run Model Selector

3.0.1 NOTE: Random effect is simply plant_id

- NO nested effects
- NO 'species'

It was not possible to test all combinations. Therefore, only combinations of significant interaction terms and all singletons will be tested.

```

[6]: mxs = len(cols_use) #5
      mns = 1
      mxi = 5 #5
      mni = 1

```

4 Flame Height

```

[7]: yvar='fh'
      cols=cols_use
      df=flam

      compare_predictors_mixedeff(df, cols, yvar)

```

	cols	aics	pvals	coefs	top_mod
0	mpa	348.953488	0.020467	7.757524e-01	True
1	leaf_sav	348.840407	-0.044770	6.604181e-01	True
2	thickness	348.832041	-0.040855	6.522019e-01	True
3	dmc	348.510981	0.068659	4.682279e-01	True
4	leaf_mass_ratio	347.832781	-0.120260	2.694377e-01	True
5	start_temp	345.657175	0.133740	6.423671e-02	False
6	lfm	344.576424	-0.306653	3.468785e-02	False
7	stem_sav	344.331290	-0.498367	6.173055e-04	False

8	LMA	341.248709	0.391200	2.603875e-03	False
9	branching	339.713739	0.199225	1.947306e-03	False
10	species	338.894950	-0.248310	5.202114e-01	False
11	branch_volume	334.006737	0.253649	6.808868e-05	False
12	sample_wt	306.849369	0.466529	4.664215e-12	False

```
[8]: AIC_iterator(flam, cols_use, Y_VAR='fh',
               minnumsingle=mns, maxnumsingle=mxs, minnumint=mni, maxnumint=mxi)
```

ERROR: Formula model error: fh ~ leaf_sav*thickness

Columns present in sig. interaction terms: {'species', 'sample_wt', 'branching'}

Total Num. Cols : Num. Sig. Int. Cols; 13 : 3

Significant Interactions:
 ('sample_wt', 'branching')
 ('sample_wt', 'species')

Number of formulas: 5120

```
fh ~ sample_wt*branching + mpa + start_temp + species
fh ~ sample_wt*branching + start_temp + stem_sav + species
fh ~ sample_wt*branching + mpa + start_temp + stem_sav + species
fh ~ sample_wt*branching + mpa + start_temp + stem_sav
fh ~ sample_wt*branching + mpa + start_temp + branch_volume + species
fh ~ sample_wt*branching + start_temp + branch_volume + stem_sav + species
fh ~ sample_wt*branching + mpa + start_temp + branch_volume + stem_sav + species
fh ~ sample_wt*branching + lfm + start_temp + species
fh ~ sample_wt*branching + LMA + start_temp + species
fh ~ sample_wt*branching + mpa + start_temp + branch_volume + stem_sav
fh ~ sample_wt*branching + mpa + start_temp + thickness + species
fh ~ sample_wt*branching + lfm + mpa + start_temp + stem_sav
fh ~ sample_wt*branching + mpa + start_temp + leaf_sav + species
fh ~ sample_wt*branching + LMA + mpa + start_temp + species
fh ~ sample_wt*species + branching + start_temp + stem_sav
fh ~ sample_wt*branching + leaf_mass_ratio + mpa + start_temp + species
fh ~ sample_wt*branching + leaf_mass_ratio + start_temp + stem_sav + species
fh ~ sample_wt*branching + lfm + mpa + start_temp + species
fh ~ sample_wt*branching + mpa + start_temp + dmc + species
```

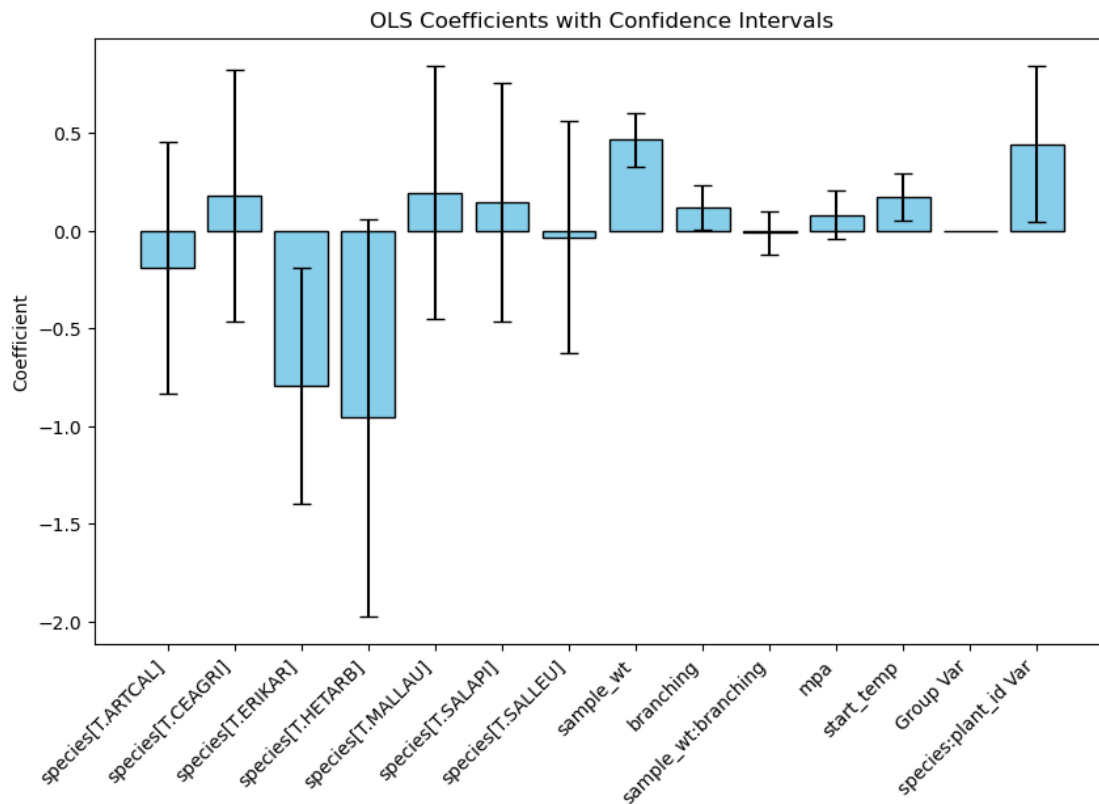
Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2290

Min. group size: 2 Log-Likelihood: -131.6215
 Max. group size: 37 Converged: No
 Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.146	0.262	0.557	0.578	-0.367	0.658
species[T.ARTCAL]	-0.191	0.329	-0.582	0.560	-0.835	0.453
species[T.CEAGRI]	0.181	0.328	0.553	0.580	-0.461	0.824
species[T.ERIKAR]	-0.792	0.309	-2.563	0.010	-1.398	-0.186
species[T.HETARB]	-0.957	0.519	-1.842	0.065	-1.974	0.061
species[T.MALLAU]	0.195	0.330	0.590	0.555	-0.453	0.842
species[T.SALAPI]	0.146	0.311	0.470	0.638	-0.463	0.755
species[T.SALLEU]	-0.032	0.304	-0.107	0.915	-0.629	0.564
sample_wt	0.465	0.070	6.621	0.000	0.328	0.603
branching	0.120	0.058	2.064	0.039	0.006	0.234
sample_wt:branching	-0.010	0.057	-0.172	0.864	-0.121	0.102
mpa	0.083	0.063	1.315	0.189	-0.041	0.206
start_temp	0.172	0.062	2.788	0.005	0.051	0.293
Group Var	0.000					
species:plant_id Var	0.102	0.098				



Mixed Linear Model Regression Results

```

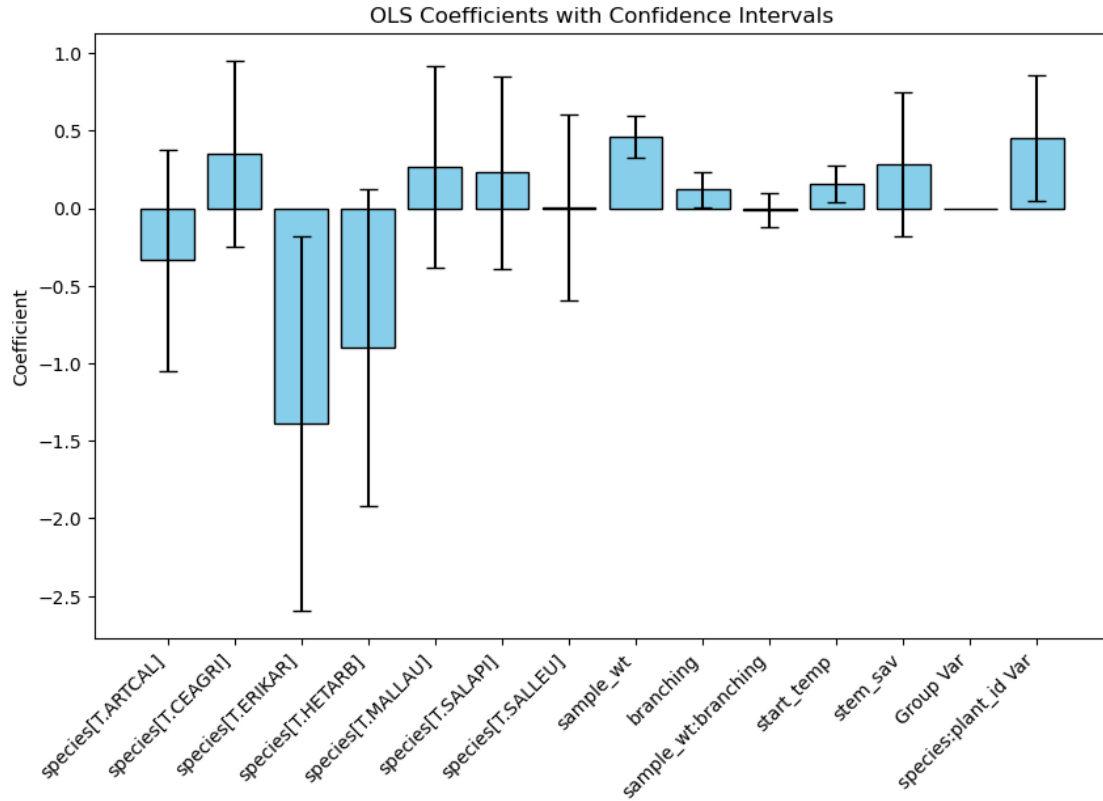
=====
Model:                MixedLM    Dependent Variable:   fh
No. Observations:     162        Method:              ML
No. Groups:           8          Scale:             0.2287
Min. group size:       2          Log-Likelihood:    -131.7285
Max. group size:       37        Converged:         No
Mean group size:       20.2

```

```

-----
              Coef.  Std.Err.   z    P>|z|  [0.025  0.975]
-----
Intercept                0.232    0.283  0.822  0.411  -0.322   0.787
species[T.ARTCAL]        -0.337    0.366 -0.921  0.357  -1.054   0.380
species[T.CEAGRI]         0.353    0.305  1.158  0.247  -0.244   0.950
species[T.ERIKAR]        -1.389    0.615 -2.258  0.024  -2.595  -0.183
species[T.HETARB]        -0.898    0.522 -1.721  0.085  -1.922   0.125
species[T.MALLAU]         0.264    0.333  0.795  0.427  -0.387   0.916
species[T.SALAPI]         0.230    0.318  0.721  0.471  -0.394   0.853
species[T.SALLEU]         0.003    0.305  0.010  0.992  -0.596   0.602
sample_wt                 0.459    0.070  6.581  0.000   0.323   0.596
branching                 0.120    0.058  2.069  0.039   0.006   0.235
sample_wt:branching      -0.010    0.057 -0.169  0.866  -0.121   0.101
start_temp                0.159    0.061  2.619  0.009   0.040   0.278
stem_sav                  0.286    0.236  1.211  0.226  -0.177   0.749
Group Var                 0.000
species:plant_id Var     0.103    0.099

```

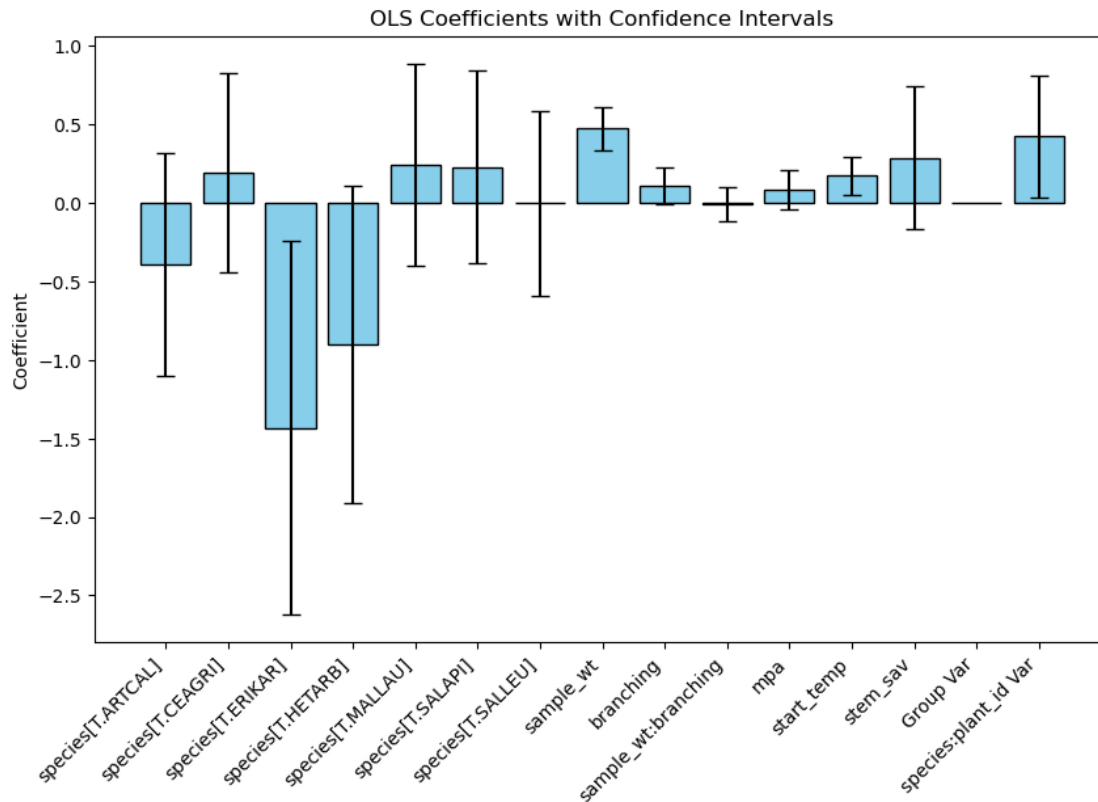
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM    Dependent Variable:   fh
No. Observations:     162        Method:                ML
No. Groups:            8          Scale:                0.2287
Min. group size:      2          Log-Likelihood:       -130.8309
Max. group size:      37        Converged:            Yes
Mean group size:      20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          0.277    0.281  0.987  0.324 -0.273  0.828
species[T.ARTCAL]  -0.389    0.363 -1.073  0.283 -1.101  0.322
species[T.CEAGRI]   0.191    0.324  0.592  0.554 -0.443  0.826
species[T.ERIKAR]  -1.433    0.607 -2.362  0.018 -2.622 -0.244
species[T.HETARB]  -0.901    0.517 -1.744  0.081 -1.914  0.112
species[T.MALLAU]   0.242    0.329  0.738  0.461 -0.402  0.887
species[T.SALAPI]   0.230    0.314  0.734  0.463 -0.384  0.845
species[T.SALLEU]  -0.001    0.300 -0.003  0.997 -0.590  0.588
sample_wt           0.474    0.070  6.742  0.000  0.337  0.612
branching           0.111    0.058  1.898  0.058 -0.004  0.225
sample_wt:branching -0.008    0.057 -0.140  0.888 -0.119  0.103
-----
```

mpa	0.084	0.062	1.339	0.180	-0.039	0.206
start_temp	0.173	0.061	2.828	0.005	0.053	0.294
stem_sav	0.287	0.232	1.236	0.216	-0.168	0.742
Group Var	0.000					
species:plant_id Var	0.097	0.095				

=====



Mixed Linear Model Regression Results

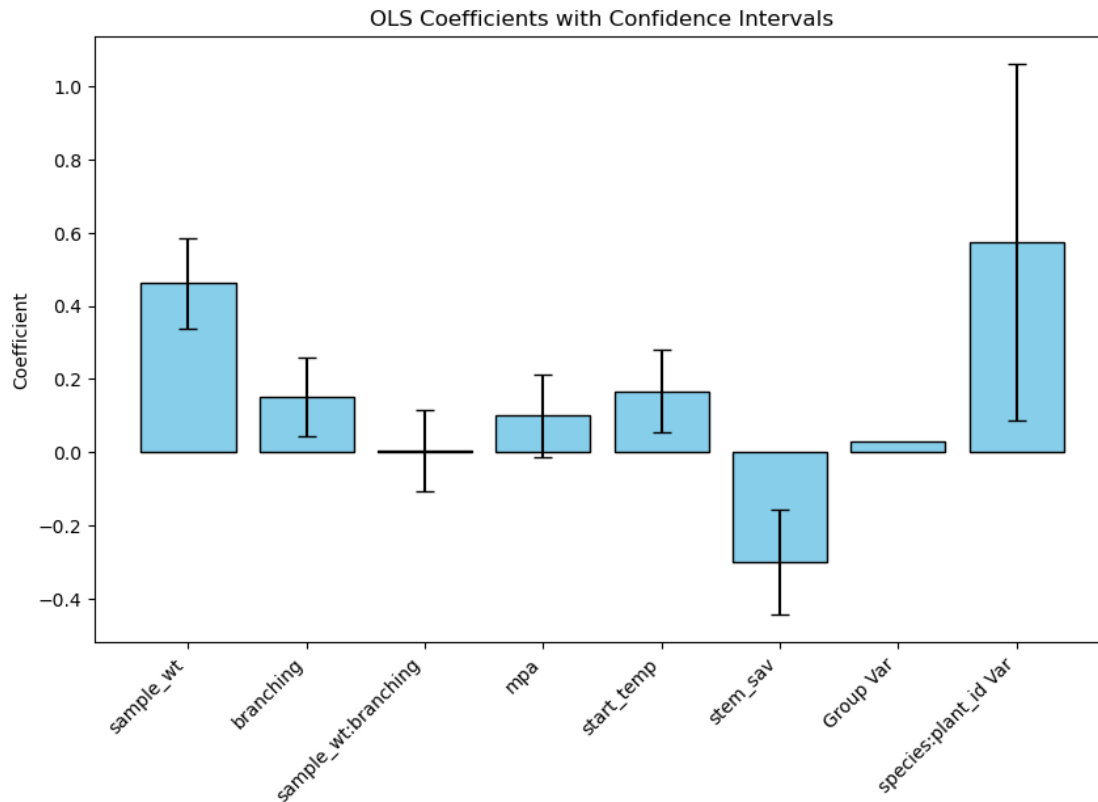
=====

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2350
Min. group size:	2	Log-Likelihood:	-138.1951
Max. group size:	37	Converged:	No
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.011	0.074	0.152	0.879	-0.133	0.155
sample_wt	0.462	0.063	7.352	0.000	0.339	0.585
branching	0.151	0.055	2.756	0.006	0.044	0.259

sample_wt:branching	0.006	0.057	0.099	0.921	-0.106	0.117
mpa	0.101	0.058	1.755	0.079	-0.012	0.214
start_temp	0.168	0.058	2.894	0.004	0.054	0.281
stem_sav	-0.299	0.073	-4.096	0.000	-0.443	-0.156
Group Var	0.007					
species:plant_id Var	0.135	0.120				

=====



Mixed Linear Model Regression Results

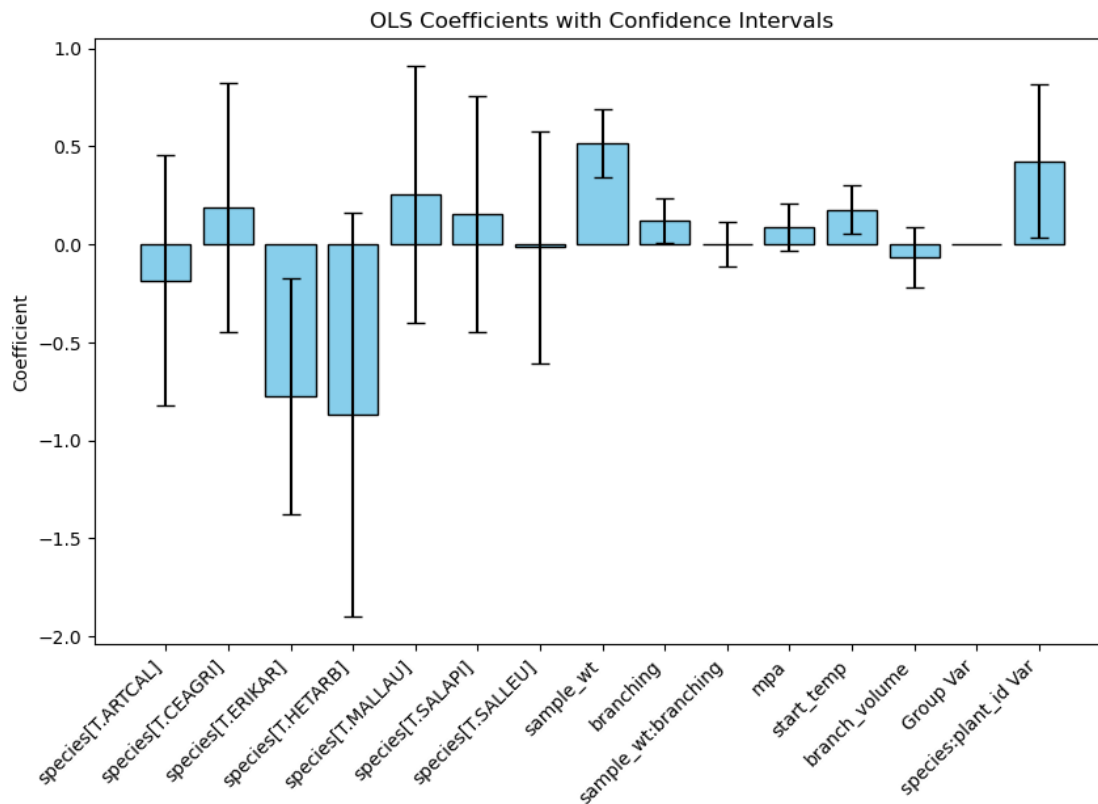
=====

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2297
Min. group size:	2	Log-Likelihood:	-131.2137
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.124	0.260	0.478	0.633	-0.386	0.634
species[T.ARTCAL]	-0.184	0.325	-0.566	0.571	-0.822	0.454

species[T.CEAGRI]	0.190	0.325	0.586	0.558	-0.446	0.827
species[T.ERIKAR]	-0.775	0.307	-2.529	0.011	-1.376	-0.174
species[T.HETARB]	-0.870	0.525	-1.657	0.098	-1.900	0.159
species[T.MALLAU]	0.255	0.335	0.762	0.446	-0.401	0.911
species[T.SALAPI]	0.156	0.308	0.508	0.611	-0.447	0.760
species[T.SALLEU]	-0.015	0.301	-0.051	0.959	-0.606	0.575
sample_wt	0.515	0.090	5.721	0.000	0.339	0.692
branching	0.123	0.058	2.112	0.035	0.009	0.237
sample_wt:branching	0.001	0.058	0.012	0.991	-0.114	0.115
mpa	0.088	0.063	1.396	0.163	-0.035	0.211
start_temp	0.178	0.062	2.877	0.004	0.057	0.299
branch_volume	-0.068	0.078	-0.873	0.383	-0.221	0.085
Group Var	0.000					
species:plant_id Var	0.097	0.096				

=====



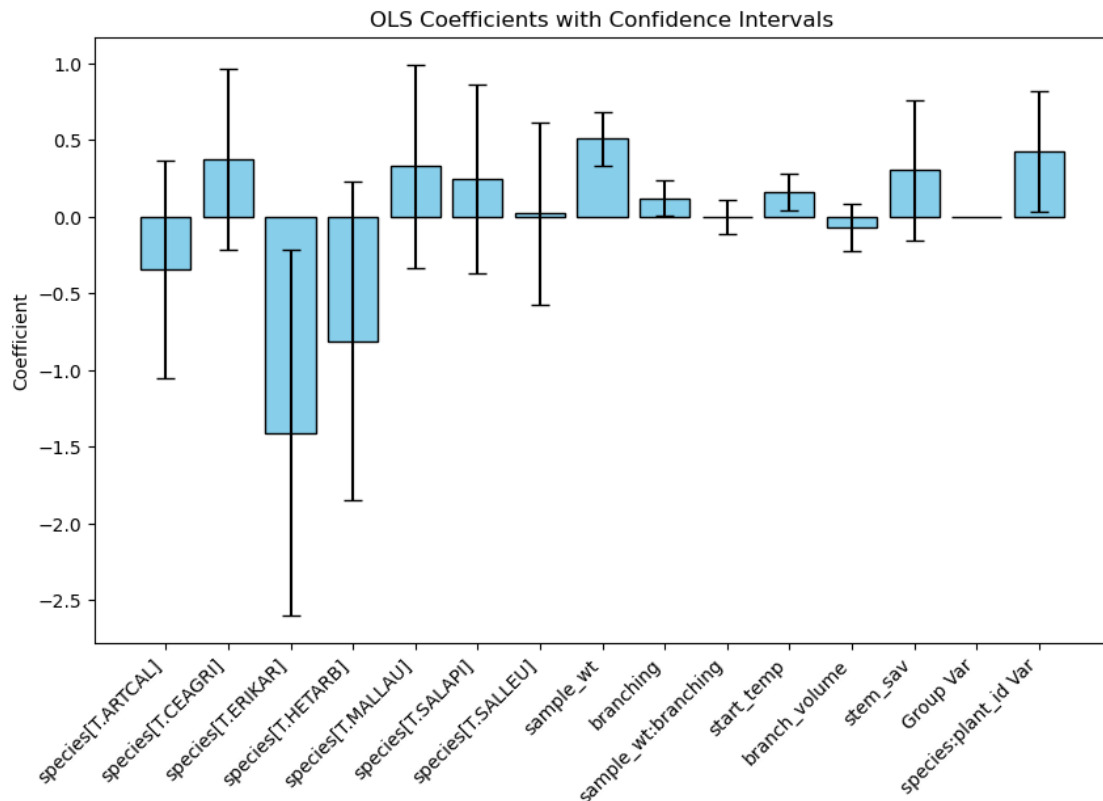
Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2300

Min. group size: 2 Log-Likelihood: -131.3432
 Max. group size: 37 Converged: No
 Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.216	0.280	0.769	0.442	-0.334	0.765
species[T.ARTCAL]	-0.339	0.362	-0.936	0.349	-1.049	0.371
species[T.CEAGRI]	0.374	0.302	1.238	0.216	-0.218	0.965
species[T.ERIKAR]	-1.409	0.608	-2.319	0.020	-2.600	-0.218
species[T.HETARB]	-0.809	0.529	-1.529	0.126	-1.845	0.228
species[T.MALLAU]	0.329	0.338	0.975	0.329	-0.333	0.991
species[T.SALAPI]	0.246	0.315	0.780	0.436	-0.372	0.864
species[T.SALLEU]	0.024	0.303	0.078	0.938	-0.569	0.617
sample_wt	0.510	0.090	5.664	0.000	0.333	0.686
branching	0.123	0.058	2.115	0.034	0.009	0.237
sample_wt:branching	0.001	0.058	0.014	0.989	-0.113	0.115
start_temp	0.164	0.061	2.702	0.007	0.045	0.284
branch_volume	-0.068	0.078	-0.873	0.383	-0.222	0.085
stem_sav	0.304	0.234	1.301	0.193	-0.154	0.762
Group Var	0.000					
species:plant_id Var	0.098	0.097				



Mixed Linear Model Regression Results

```

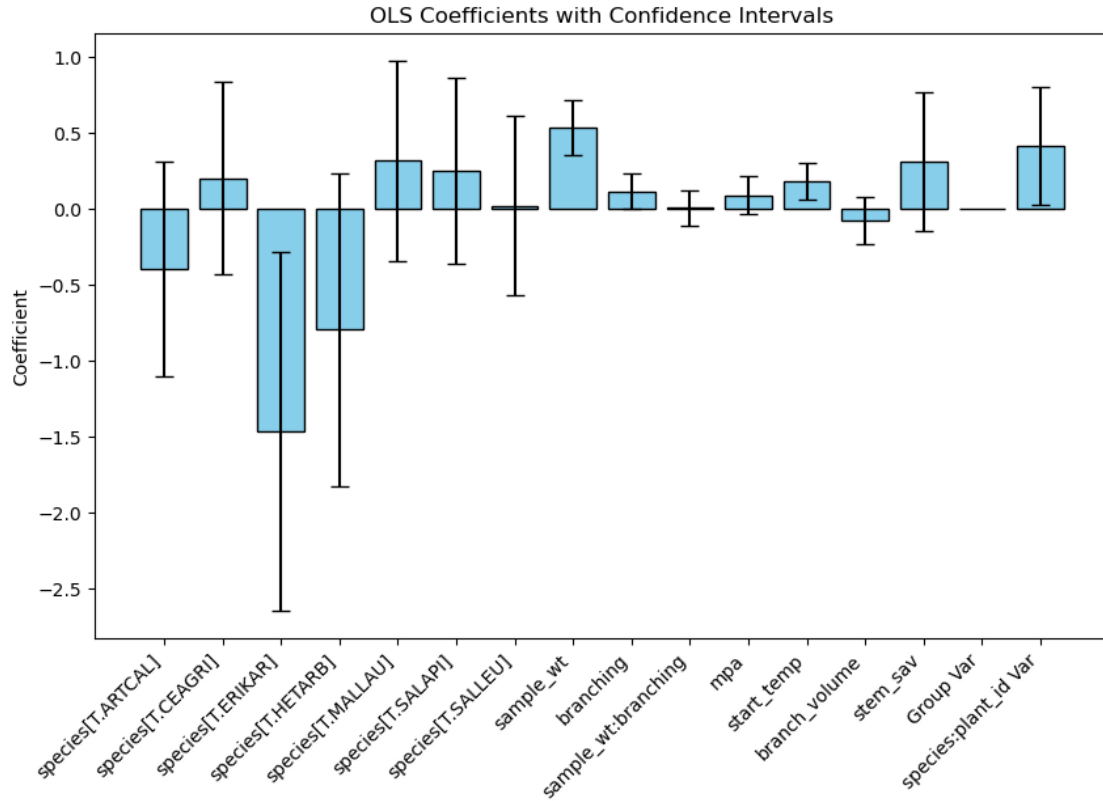
=====
Model:                MixedLM    Dependent Variable:   fh
No. Observations:    162        Method:              ML
No. Groups:          8          Scale:              0.2285
Min. group size:     2          Log-Likelihood:     -130.3624
Max. group size:     37        Converged:           Yes
Mean group size:     20.2

```

```

-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept                0.264    0.280  0.944 0.345 -0.284  0.813
species[T.ARTCAL]        -0.398    0.361 -1.103 0.270 -1.106  0.310
species[T.CEAGRI]         0.202    0.322  0.625 0.532 -0.430  0.833
species[T.ERIKAR]        -1.465    0.602 -2.433 0.015 -2.645 -0.285
species[T.HETARB]        -0.797    0.525 -1.518 0.129 -1.825  0.232
species[T.MALLAU]         0.315    0.335  0.941 0.347 -0.342  0.973
species[T.SALAPI]         0.248    0.313  0.793 0.428 -0.365  0.861
species[T.SALLEU]         0.020    0.300  0.065 0.948 -0.568  0.607
sample_wt                 0.532    0.091  5.868 0.000  0.355  0.710
branching                 0.113    0.058  1.945 0.052 -0.001  0.228
sample_wt:branching       0.005    0.058  0.082 0.934 -0.109  0.118
mpa                       0.090    0.063  1.432 0.152 -0.033  0.212
start_temp                0.180    0.061  2.933 0.003  0.060  0.301
branch_volume             -0.079    0.078 -1.010 0.313 -0.232  0.074
stem_sav                  0.309    0.231  1.340 0.180 -0.143  0.762
Group Var                 0.000
species:plant_id Var      0.094    0.094

```



Mixed Linear Model Regression Results

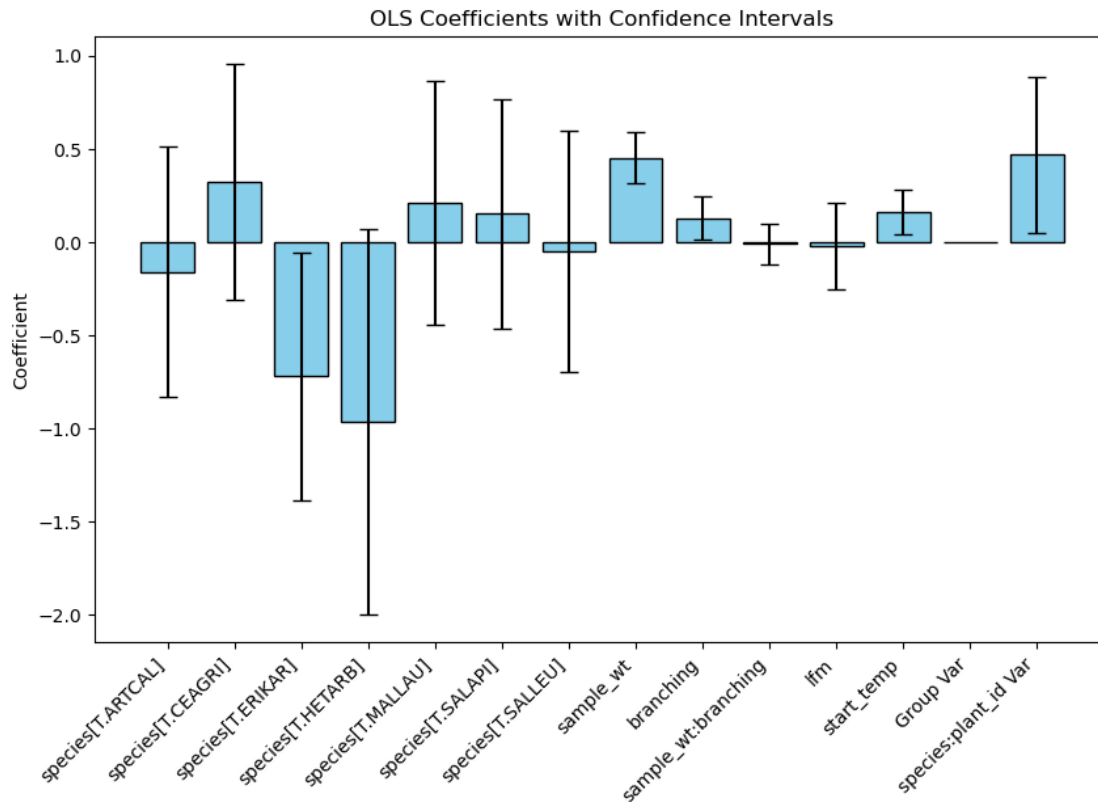
```
=====
Model:                MixedLM    Dependent Variable:   fh
No. Observations:     162        Method:                ML
No. Groups:           8          Scale:                0.2294
Min. group size:      2          Log-Likelihood:       -132.4330
Max. group size:      37        Converged:            Yes
Mean group size:      20.2
=====
```

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.104	0.263	0.397	0.691	-0.410	0.619
species[T.ARTCAL]	-0.160	0.344	-0.465	0.642	-0.834	0.514
species[T.CEAGRI]	0.322	0.323	0.996	0.319	-0.311	0.955
species[T.ERIKAR]	-0.720	0.339	-2.124	0.034	-1.385	-0.056
species[T.HETARB]	-0.967	0.527	-1.835	0.066	-2.000	0.066
species[T.MALLAU]	0.211	0.334	0.630	0.529	-0.444	0.866
species[T.SALAPI]	0.151	0.314	0.480	0.631	-0.465	0.767
species[T.SALLEU]	-0.051	0.330	-0.155	0.877	-0.697	0.595
sample_wt	0.450	0.070	6.426	0.000	0.313	0.587
branching	0.127	0.059	2.154	0.031	0.011	0.243
sample_wt:branching	-0.012	0.057	-0.209	0.834	-0.123	0.100

```

lfm                -0.024    0.118 -0.207 0.836 -0.255  0.206
start_temp         0.159    0.061  2.594 0.009  0.039  0.279
Group Var          0.000
species:plant_id Var 0.107    0.102
=====

```



Mixed Linear Model Regression Results

```

=====
Model:                MixedLM   Dependent Variable:   fh
No. Observations:    162       Method:              ML
No. Groups:          8         Scale:              0.2317
Min. group size:     2         Log-Likelihood:    -132.4338
Max. group size:     37       Converged:         Yes
Mean group size:     20.2

```

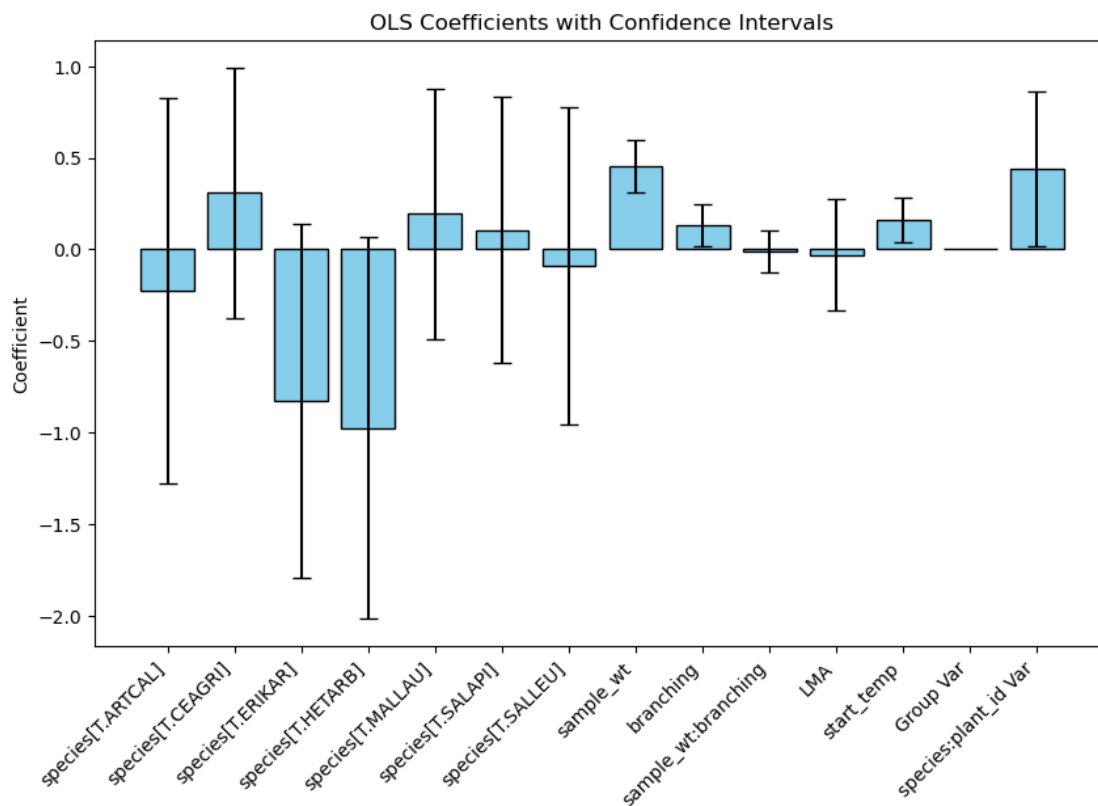
```

-----
                Coef.  Std.Err.   z    P>|z|  [0.025  0.975]
-----
Intercept          0.150    0.357   0.421  0.674  -0.549   0.850
species[T.ARTCAL]  -0.226    0.536  -0.423  0.673  -1.277   0.824
species[T.CEAGRI]   0.308    0.349   0.884  0.377  -0.375   0.991
species[T.ERIKAR]  -0.827    0.493  -1.677  0.093  -1.794   0.139

```


species[T.HETARB]	-0.975	0.531	-1.837	0.066	-2.016	0.065
species[T.MALLAU]	0.194	0.350	0.554	0.580	-0.492	0.879
species[T.SALAPI]	0.105	0.370	0.285	0.776	-0.620	0.830
species[T.SALLEU]	-0.092	0.443	-0.208	0.836	-0.960	0.776
sample_wt	0.455	0.072	6.306	0.000	0.314	0.597
branching	0.131	0.058	2.237	0.025	0.016	0.245
sample_wt:branching	-0.011	0.057	-0.194	0.847	-0.123	0.101
LMA	-0.032	0.155	-0.206	0.837	-0.337	0.273
start_temp	0.160	0.062	2.596	0.009	0.039	0.281
Group Var	0.000					
species:plant_id Var	0.102	0.103				

=====

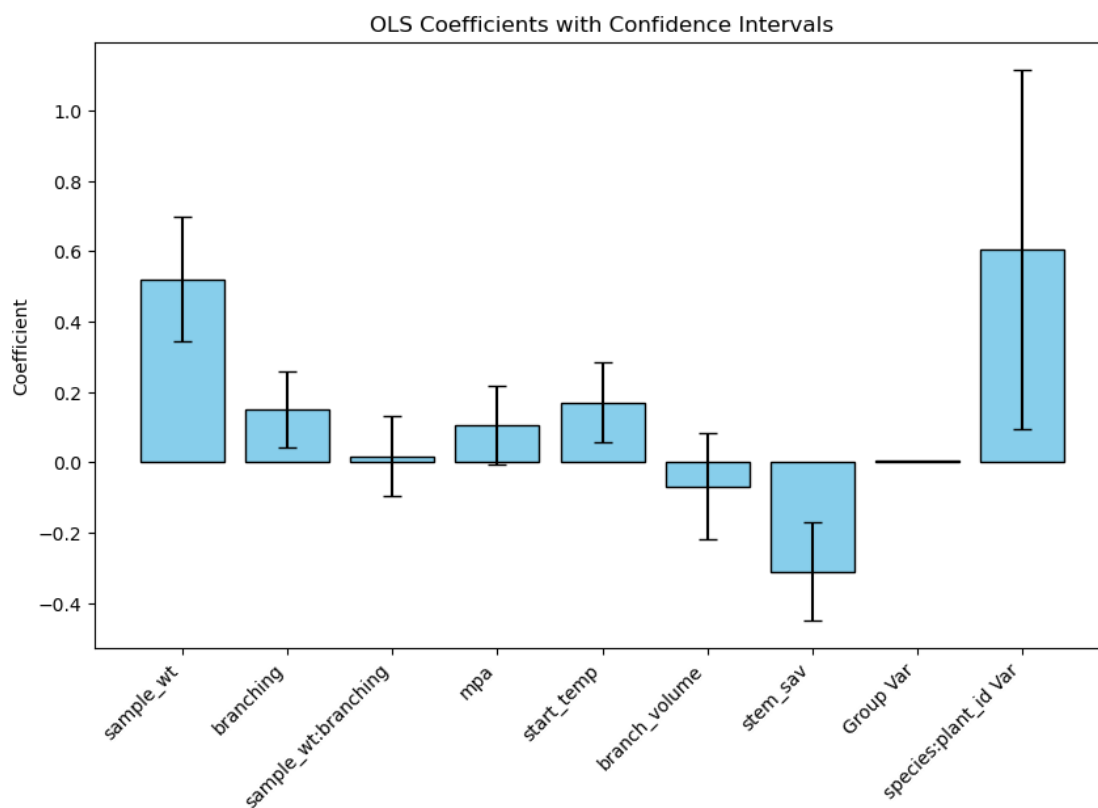


Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2323
Min. group size:	2	Log-Likelihood:	-137.4511
Max. group size:	37	Converged:	No
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.014	0.068	0.203	0.839	-0.120	0.147
sample_wt	0.521	0.091	5.752	0.000	0.343	0.698
branching	0.151	0.054	2.775	0.006	0.044	0.257
sample_wt:branching	0.018	0.058	0.305	0.760	-0.096	0.131
mpa	0.106	0.057	1.867	0.062	-0.005	0.218
start_temp	0.170	0.057	2.969	0.003	0.058	0.283
branch_volume	-0.068	0.077	-0.883	0.377	-0.219	0.083
stem_sav	-0.310	0.071	-4.368	0.000	-0.450	-0.171
Group Var	0.001					
species:plant_id Var	0.140	0.126				



Mixed Linear Model Regression Results

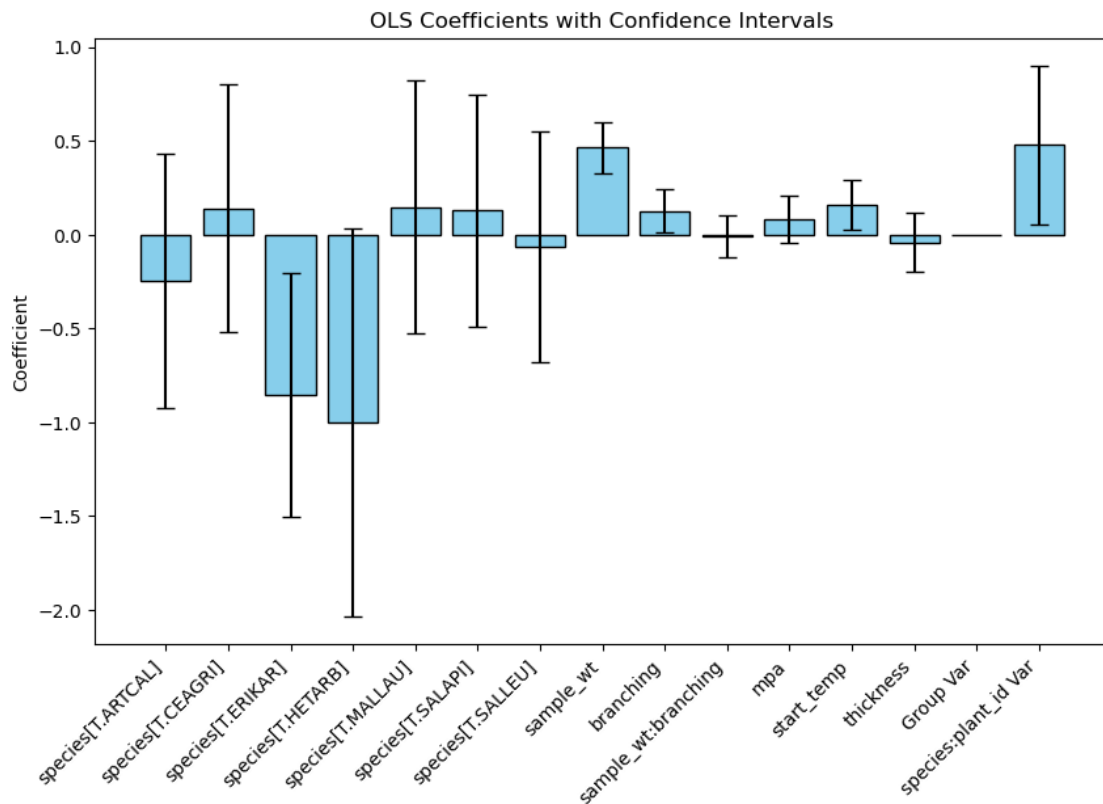
```

=====
Model:                MixedLM    Dependent Variable:   fh
No. Observations:    162         Method:                ML
No. Groups:          8           Scale:                 0.2258
Min. group size:     2           Log-Likelihood:       -131.4849
=====

```

Max. group size: 37 Converged: Yes
Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.184	0.272	0.676	0.499	-0.349	0.717
species[T.ARTCAL]	-0.245	0.345	-0.712	0.477	-0.921	0.430
species[T.CEAGRI]	0.141	0.338	0.417	0.677	-0.522	0.804
species[T.ERIKAR]	-0.857	0.332	-2.584	0.010	-1.507	-0.207
species[T.HETARB]	-1.000	0.528	-1.893	0.058	-2.035	0.035
species[T.MALLAU]	0.146	0.344	0.425	0.671	-0.529	0.821
species[T.SALAPI]	0.129	0.314	0.409	0.683	-0.488	0.745
species[T.SALLEU]	-0.065	0.312	-0.208	0.835	-0.677	0.547
sample_wt	0.464	0.070	6.621	0.000	0.326	0.601
branching	0.125	0.059	2.129	0.033	0.010	0.240
sample_wt:branching	-0.007	0.057	-0.115	0.909	-0.118	0.105
mpa	0.082	0.063	1.312	0.189	-0.041	0.205
start_temp	0.158	0.066	2.384	0.017	0.028	0.289
thickness	-0.042	0.080	-0.528	0.597	-0.198	0.114
Group Var	0.000					
species:plant_id Var	0.108	0.102				

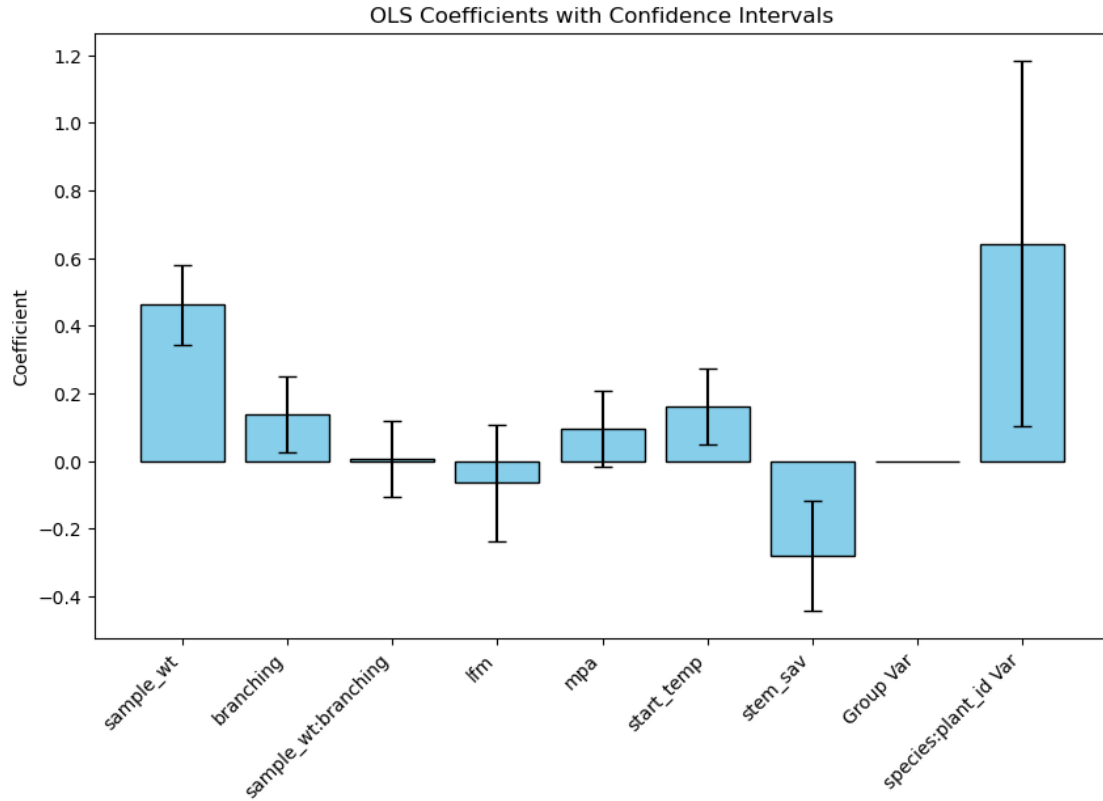


Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fh			
No. Observations:	162	Method:	ML			
No. Groups:	8	Scale:	0.2300			
Min. group size:	2	Log-Likelihood:	-137.5220			
Max. group size:	37	Converged:	Yes			
Mean group size:	20.2					

	Coef.	Std.Err.	z	P> z	[0.025	0.975]

Intercept	0.017	0.068	0.257	0.797	-0.116	0.150
sample_wt	0.462	0.061	7.614	0.000	0.343	0.582
branching	0.138	0.057	2.418	0.016	0.026	0.250
sample_wt:branching	0.007	0.056	0.121	0.904	-0.104	0.117
lfm	-0.064	0.088	-0.728	0.467	-0.236	0.108
mpa	0.096	0.057	1.680	0.093	-0.016	0.208
start_temp	0.162	0.058	2.785	0.005	0.048	0.275
stem_sav	-0.280	0.083	-3.369	0.001	-0.442	-0.117
Group Var	0.000					
species:plant_id Var	0.148	0.132				
=====						



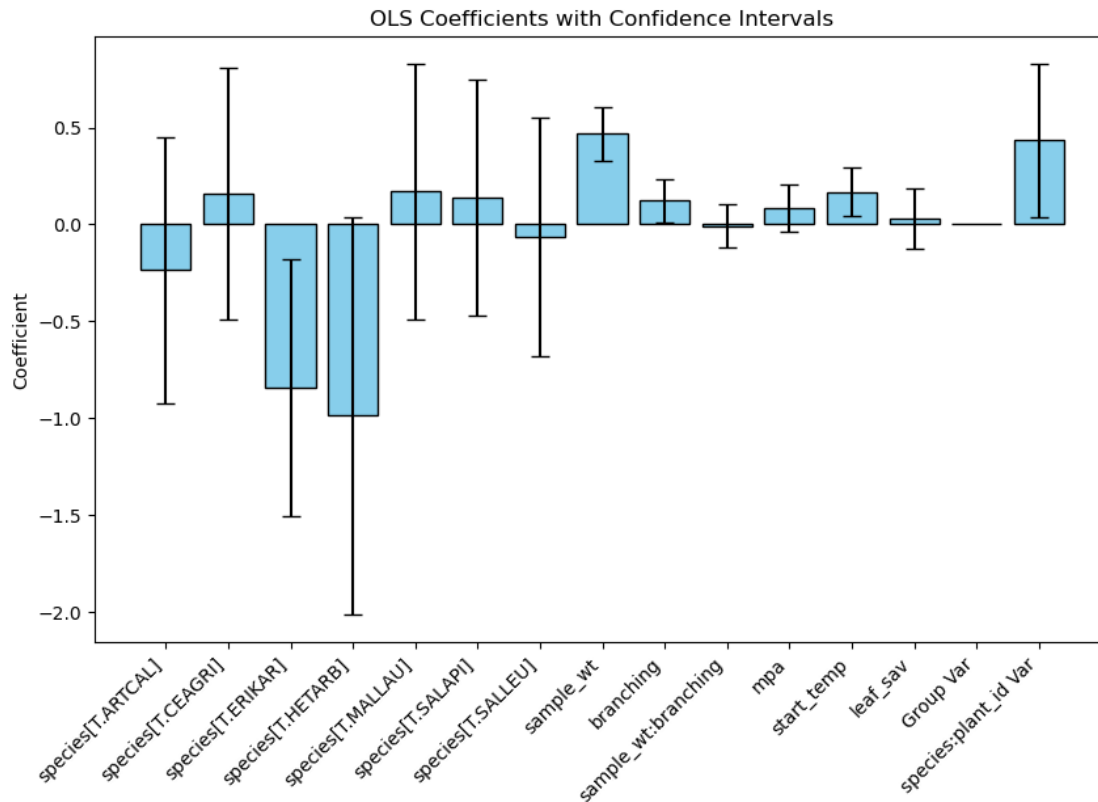
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM   Dependent Variable:   fh
No. Observations:    162       Method:                ML
No. Groups:          8         Scale:                0.2298
Min. group size:     2         Log-Likelihood:      -131.5239
Max. group size:     37        Converged:            Yes
Mean group size:     20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z|  [0.025  0.975]
-----
Intercept                0.173    0.271   0.638  0.524  -0.359   0.705
species[T.ARTCAL]        -0.237    0.350  -0.677  0.499  -0.922   0.449
species[T.CEAGRI]         0.160    0.331   0.483  0.629  -0.489   0.810
species[T.ERIKAR]        -0.843    0.338  -2.494  0.013  -1.505  -0.180
species[T.HETARB]        -0.986    0.524  -1.884  0.060  -2.013   0.040
species[T.MALLAU]         0.169    0.336   0.502  0.616  -0.490   0.828
species[T.SALAPI]         0.138    0.310   0.447  0.655  -0.469   0.745
species[T.SALLEU]        -0.064    0.315  -0.203  0.839  -0.681   0.553
sample_wt                 0.468    0.071   6.635  0.000   0.330   0.606
branching                 0.122    0.058   2.084  0.037   0.007   0.236
sample_wt:branching      -0.009    0.057  -0.159  0.874  -0.121   0.103
-----
```

mpa	0.083	0.063	1.316	0.188	-0.040	0.206
start_temp	0.166	0.064	2.612	0.009	0.041	0.291
leaf_sav	0.030	0.080	0.373	0.709	-0.127	0.187
Group Var	0.000					
species:plant_id Var	0.099	0.096				

=====



Mixed Linear Model Regression Results

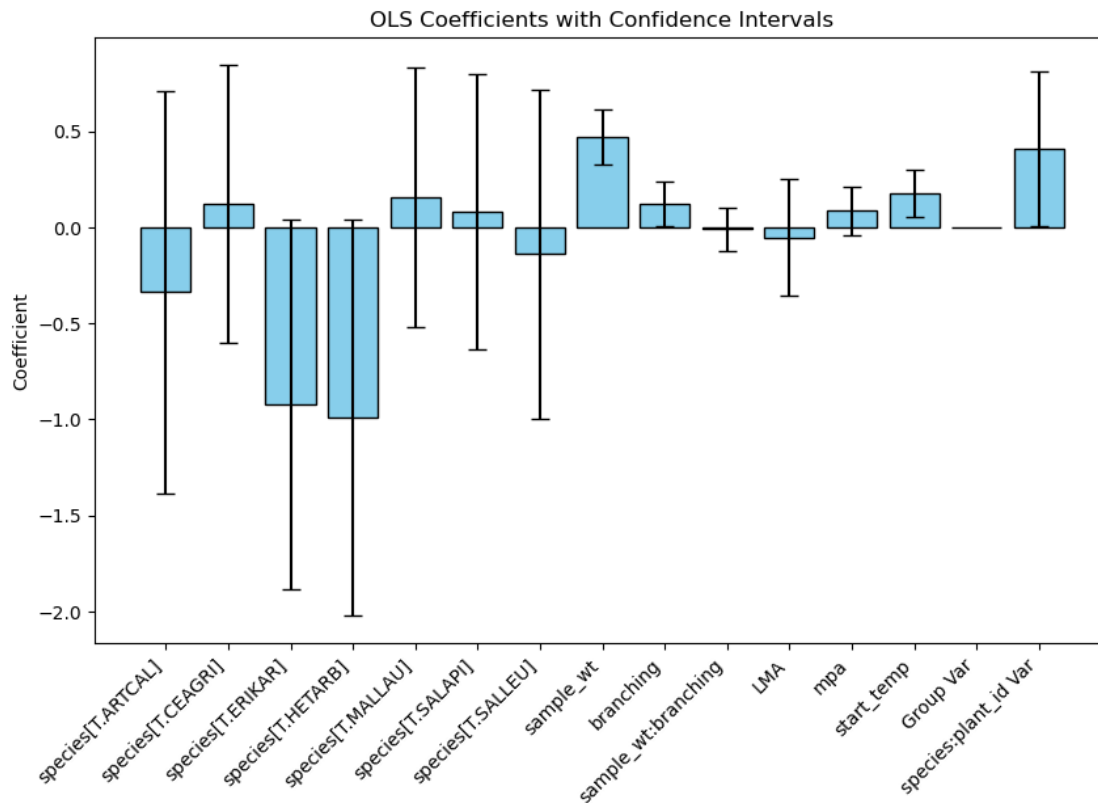
=====

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2321
Min. group size:	2	Log-Likelihood:	-131.5356
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.229	0.357	0.642	0.521	-0.470	0.928
species[T.ARTCAL]	-0.337	0.535	-0.629	0.529	-1.385	0.712
species[T.CEAGRI]	0.121	0.370	0.326	0.744	-0.604	0.846

species[T.ERIKAR]	-0.923	0.492	-1.877	0.061	-1.886	0.041
species[T.HETARB]	-0.992	0.525	-1.888	0.059	-2.022	0.038
species[T.MALLAU]	0.156	0.346	0.450	0.652	-0.523	0.835
species[T.SALAPI]	0.078	0.366	0.214	0.830	-0.638	0.795
species[T.SALLEU]	-0.141	0.438	-0.321	0.748	-0.999	0.718
sample_wt	0.473	0.073	6.475	0.000	0.330	0.616
branching	0.122	0.059	2.085	0.037	0.007	0.237
sample_wt:branching	-0.009	0.057	-0.154	0.878	-0.121	0.103
LMA	-0.053	0.154	-0.346	0.729	-0.355	0.249
mpa	0.085	0.063	1.346	0.178	-0.039	0.208
start_temp	0.176	0.062	2.817	0.005	0.053	0.298
Group Var	0.000					
species:plant_id Var	0.095	0.098				

=====

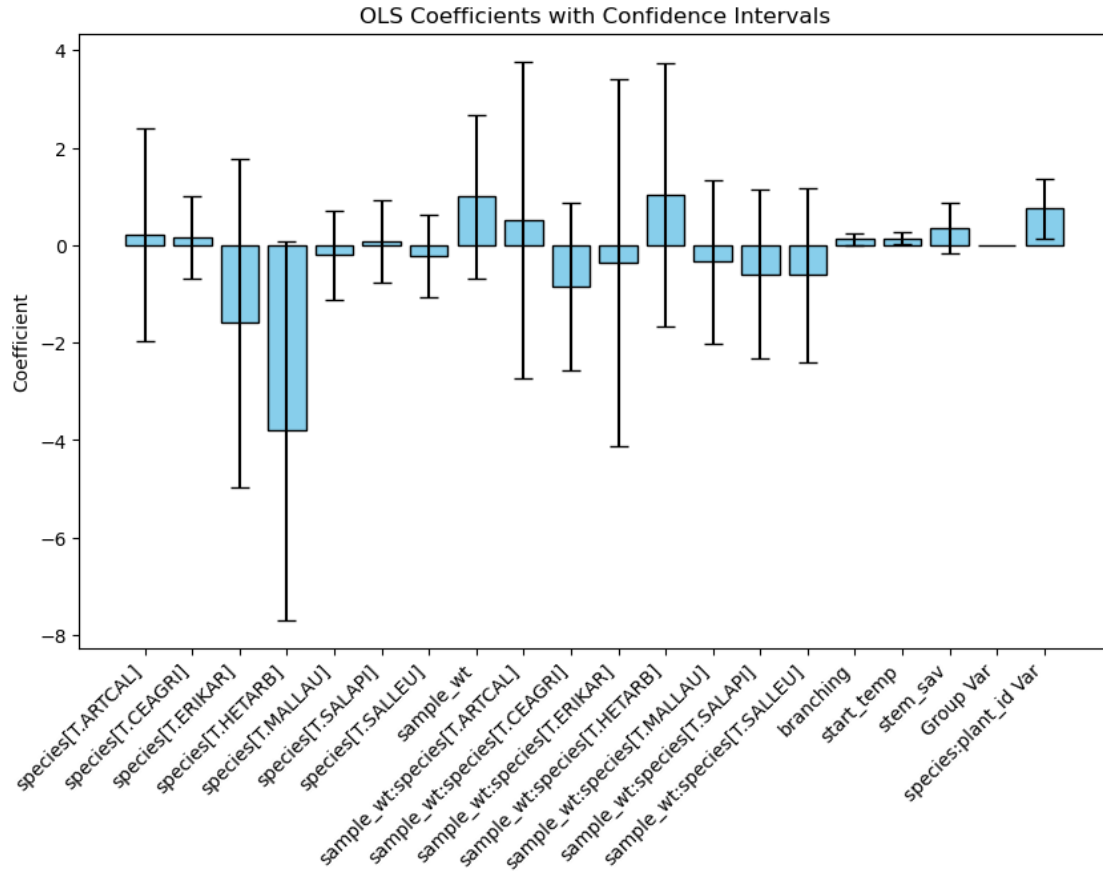


Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1945
Min. group size:	2	Log-Likelihood:	-126.5441

Max. group size: 37 Converged: Yes
Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.469	0.412	1.137	0.256	-0.340	1.277
species[T.ARTCAL]	0.206	1.112	0.186	0.853	-1.973	2.386
species[T.CEAGRI]	0.171	0.431	0.397	0.691	-0.673	1.015
species[T.ERIKAR]	-1.596	1.715	-0.931	0.352	-4.957	1.765
species[T.HETARB]	-3.810	1.980	-1.924	0.054	-7.690	0.070
species[T.MALLAU]	-0.206	0.462	-0.445	0.656	-1.111	0.700
species[T.SALAPI]	0.072	0.428	0.169	0.866	-0.767	0.912
species[T.SALLEU]	-0.223	0.436	-0.512	0.609	-1.078	0.632
sample_wt	0.996	0.859	1.159	0.247	-0.689	2.680
sample_wt:species[T.ARTCAL]	0.516	1.660	0.311	0.756	-2.737	3.769
sample_wt:species[T.CEAGRI]	-0.853	0.874	-0.976	0.329	-2.567	0.860
sample_wt:species[T.ERIKAR]	-0.360	1.916	-0.188	0.851	-4.116	3.396
sample_wt:species[T.HETARB]	1.029	1.379	0.746	0.455	-1.674	3.733
sample_wt:species[T.MALLAU]	-0.337	0.859	-0.392	0.695	-2.021	1.346
sample_wt:species[T.SALAPI]	-0.594	0.879	-0.675	0.499	-2.317	1.129
sample_wt:species[T.SALLEU]	-0.617	0.912	-0.676	0.499	-2.405	1.171
branching	0.120	0.063	1.898	0.058	-0.004	0.244
start_temp	0.143	0.061	2.347	0.019	0.024	0.262
stem_sav	0.355	0.261	1.360	0.174	-0.157	0.867
Group Var	0.000					
species:plant_id Var	0.146	0.138				



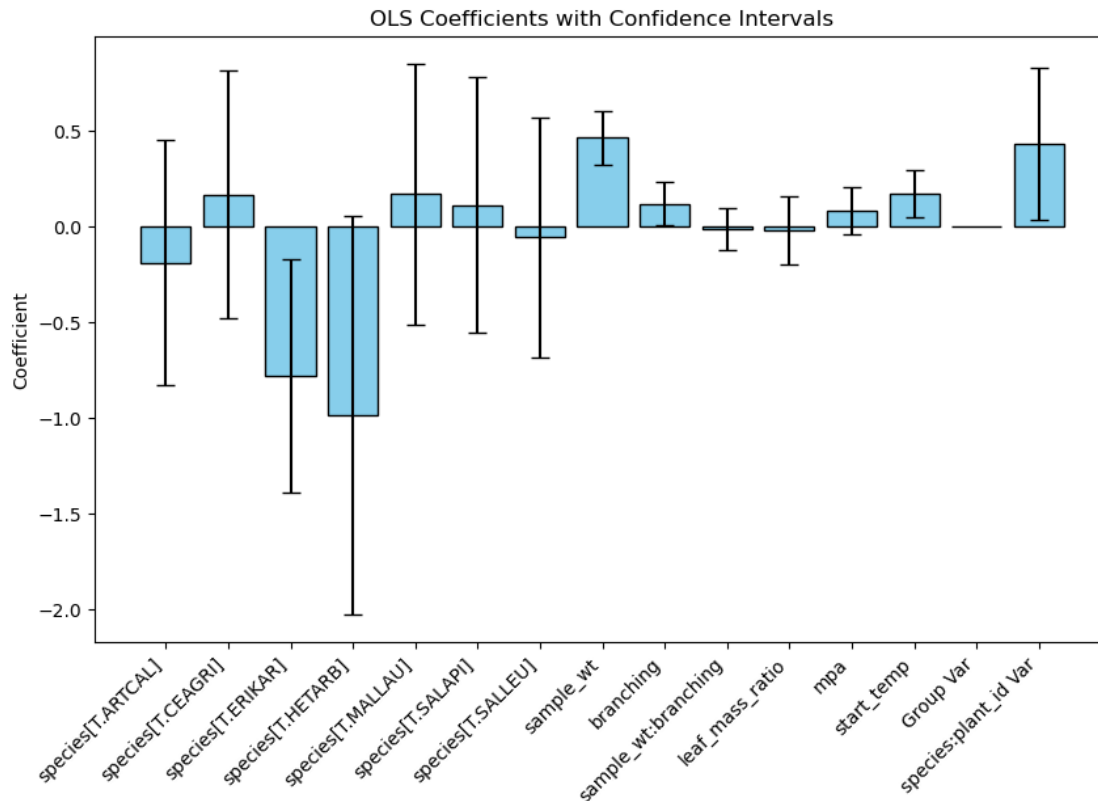
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM    Dependent Variable:    fh
No. Observations:     162        Method:                ML
No. Groups:           8          Scale:                0.2300
Min. group size:      2          Log-Likelihood:       -131.5764
Max. group size:      37        Converged:            No
Mean group size:      20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          0.157    0.266  0.589 0.556 -0.364  0.678
species[T.ARTCAL]  -0.188    0.327 -0.575 0.565 -0.829  0.453
species[T.CEAGRI]   0.169    0.331  0.510 0.610 -0.481  0.818
species[T.ERIKAR]  -0.778    0.312 -2.493 0.013 -1.390 -0.166
species[T.HETARB]  -0.984    0.532 -1.850 0.064 -2.026  0.059
species[T.MALLAU]   0.170    0.347  0.490 0.624 -0.511  0.851
species[T.SALAPI]   0.114    0.341  0.335 0.737 -0.554  0.783
species[T.SALLEU]  -0.055    0.320 -0.171 0.864 -0.682  0.573
sample_wt           0.465    0.070  6.607 0.000  0.327  0.603
-----
```

branching	0.119	0.058	2.051	0.040	0.005	0.234
sample_wt:branching	-0.011	0.057	-0.191	0.849	-0.123	0.101
leaf_mass_ratio	-0.020	0.090	-0.223	0.824	-0.197	0.157
mpa	0.083	0.063	1.324	0.185	-0.040	0.206
start_temp	0.173	0.062	2.801	0.005	0.052	0.294
Group Var	0.000					
species:plant_id Var	0.099	0.097				

=====



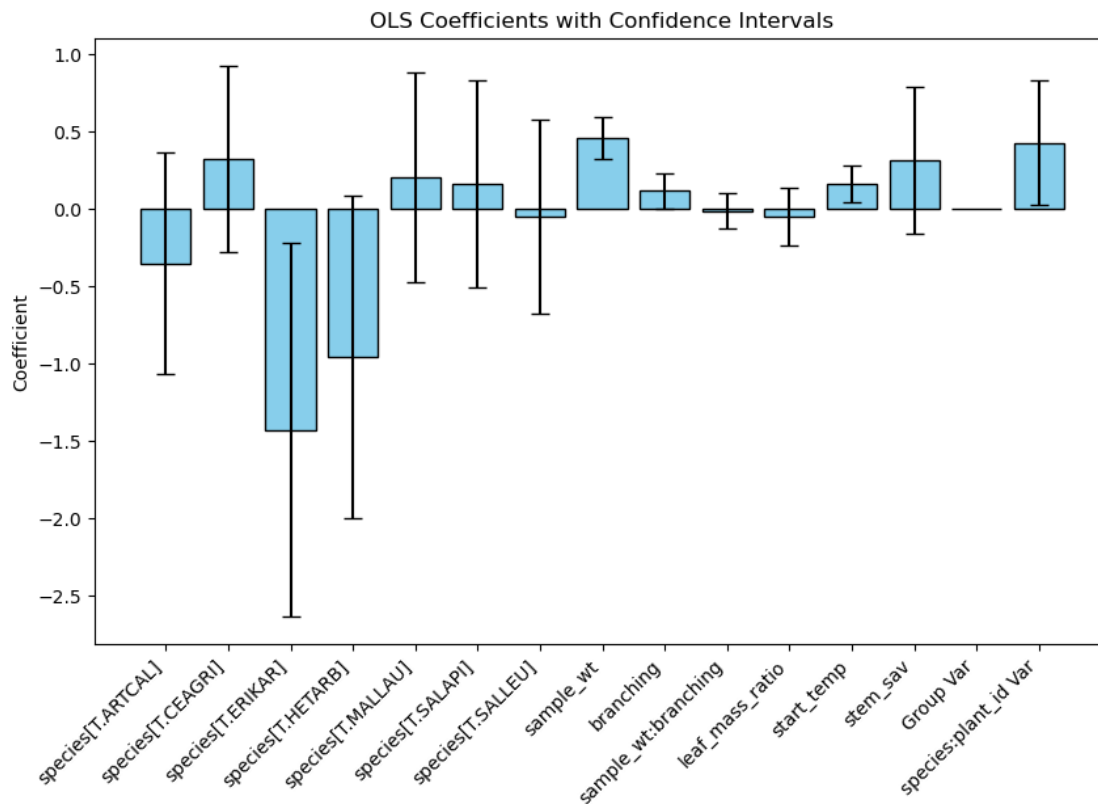
Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2302
Min. group size:	2	Log-Likelihood:	-131.5861
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.275	0.293	0.938	0.348	-0.300	0.849

species[T.ARTCAL]	-0.352	0.365	-0.965	0.334	-1.067	0.363
species[T.CEAGRI]	0.325	0.307	1.060	0.289	-0.276	0.927
species[T.ERIKAR]	-1.430	0.616	-2.321	0.020	-2.637	-0.222
species[T.HETARB]	-0.958	0.532	-1.802	0.072	-2.001	0.084
species[T.MALLAU]	0.209	0.347	0.604	0.546	-0.470	0.889
species[T.SALAPI]	0.161	0.342	0.471	0.638	-0.509	0.831
species[T.SALLEU]	-0.049	0.320	-0.154	0.877	-0.676	0.577
sample_wt	0.459	0.070	6.570	0.000	0.322	0.596
branching	0.118	0.058	2.022	0.043	0.004	0.233
sample_wt:branching	-0.012	0.057	-0.203	0.839	-0.123	0.100
leaf_mass_ratio	-0.049	0.093	-0.526	0.599	-0.232	0.134
start_temp	0.162	0.061	2.657	0.008	0.042	0.281
stem_sav	0.318	0.242	1.314	0.189	-0.156	0.793
Group Var	0.000					
species:plant_id Var	0.099	0.098				

=====



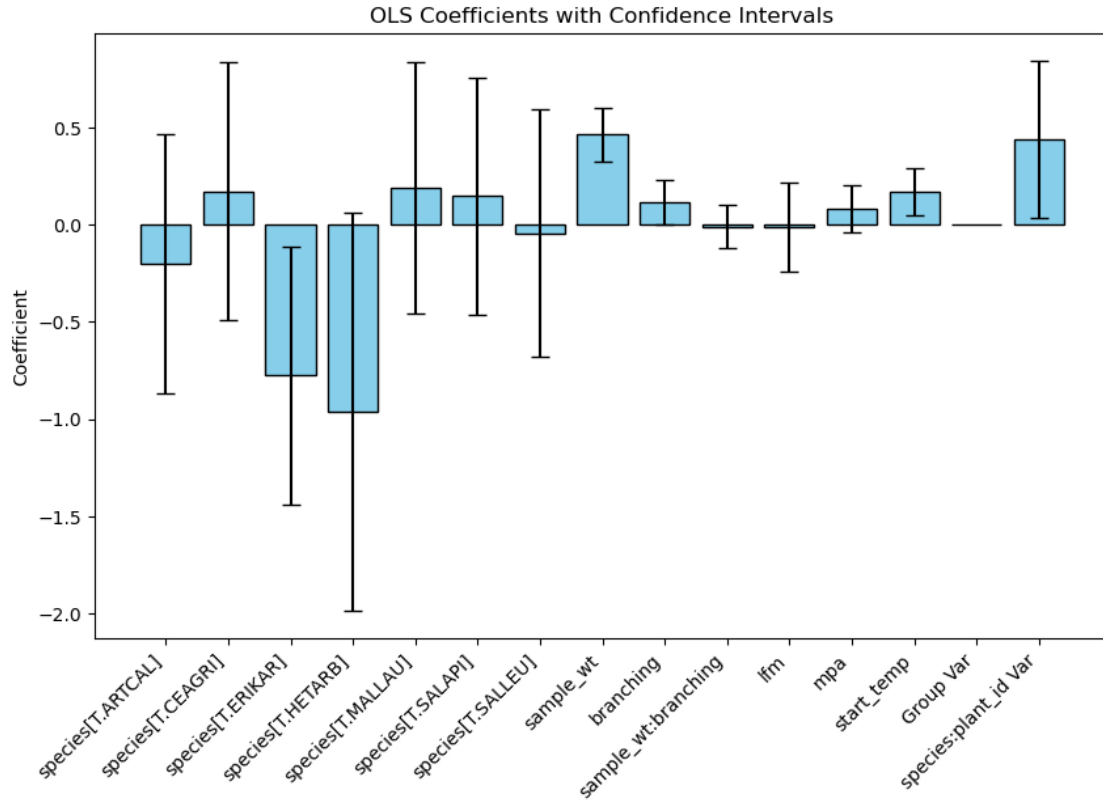
Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	fh
No. Observations:	162	Method:	ML

No. Groups:	8	Scale:	0.2292
Min. group size:	2	Log-Likelihood:	-131.5875
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.147	0.262	0.561	0.575	-0.366	0.659
species[T.ARTCAL]	-0.201	0.341	-0.589	0.556	-0.870	0.468
species[T.CEAGRI]	0.172	0.339	0.509	0.611	-0.492	0.837
species[T.ERIKAR]	-0.776	0.337	-2.300	0.021	-1.438	-0.115
species[T.HETARB]	-0.963	0.522	-1.845	0.065	-1.987	0.060
species[T.MALLAU]	0.192	0.331	0.580	0.562	-0.457	0.840
species[T.SALAPI]	0.149	0.310	0.479	0.632	-0.460	0.757
species[T.SALLEU]	-0.044	0.325	-0.136	0.892	-0.682	0.593
sample_wt	0.465	0.071	6.583	0.000	0.327	0.604
branching	0.119	0.059	2.012	0.044	0.003	0.235
sample_wt:branching	-0.010	0.057	-0.177	0.859	-0.121	0.101
lfm	-0.013	0.117	-0.107	0.914	-0.241	0.216
mpa	0.082	0.063	1.305	0.192	-0.041	0.206
start_temp	0.172	0.062	2.792	0.005	0.051	0.293
Group Var	0.000					
species:plant_id Var	0.101	0.099				



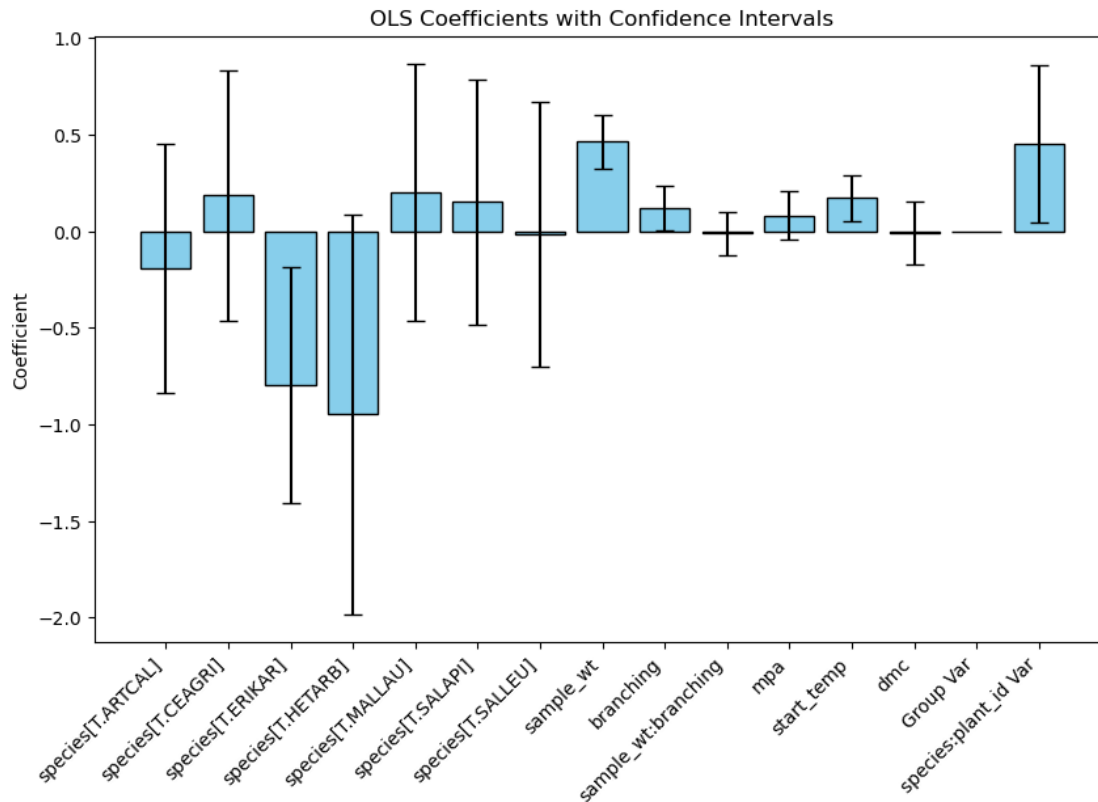
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM    Dependent Variable:   fh
No. Observations:    162        Method:                ML
No. Groups:           8         Scale:                0.2283
Min. group size:     2         Log-Likelihood:       -131.6094
Max. group size:     37        Converged:            No
Mean group size:     20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept                0.141    0.268  0.526  0.599 -0.385  0.667
species[T.ARTCAL]       -0.192    0.329 -0.584  0.560 -0.837  0.453
species[T.CEAGRI]        0.185    0.332  0.557  0.577 -0.466  0.836
species[T.ERIKAR]       -0.795    0.310 -2.563  0.010 -1.404 -0.187
species[T.HETARB]       -0.947    0.529 -1.791  0.073 -1.984  0.090
species[T.MALLAU]        0.202    0.339  0.594  0.552 -0.464  0.867
species[T.SALAPI]        0.154    0.324  0.475  0.635 -0.481  0.789
species[T.SALLEU]       -0.017    0.350 -0.050  0.960 -0.704  0.669
sample_wt                 0.466    0.071  6.594  0.000  0.327  0.604
branching                 0.120    0.058  2.064  0.039  0.006  0.234
sample_wt:branching     -0.009    0.057 -0.165  0.869 -0.121  0.102
-----
```

mpa	0.083	0.063	1.316	0.188	-0.041	0.207
start_temp	0.171	0.062	2.769	0.006	0.050	0.293
dmc	-0.008	0.084	-0.094	0.926	-0.172	0.156
Group Var	0.000					
species:plant_id Var	0.103	0.099				

=====



5 Flame Duration

```
[9]: yvar='fd'
     cols=cols_use
     df=flam
     compare_predictors_mixedeff(df, cols, yvar)
```

	cols	aics	pvals	coefs	top_mod
0	species	451.016860	-0.382953	5.361410e-01	True
1	mpa	446.750330	-0.045917	6.229635e-01	False
2	start_temp	446.445675	-0.046927	5.914359e-01	False
3	thickness	445.980840	0.065724	4.658912e-01	False
4	branching	445.895056	0.145043	1.196389e-01	False

5	leaf_sav	445.496714	-0.092000	3.336763e-01	False
6	LMA	444.851697	0.305154	1.408714e-02	False
7	lfm	444.134673	-0.255362	5.476824e-02	False
8	leaf_mass_ratio	443.949117	-0.241753	2.874643e-02	False
9	stem_sav	442.180284	-0.349600	9.230438e-03	False
10	branch_volume	435.619538	0.317514	4.464033e-04	False
11	dmc	435.194484	0.409251	2.901647e-04	False
12	sample_wt	420.165104	0.484080	4.249122e-08	False

```
[10]: AIC_iterator(flam, cols_use, Y_VAR='fd',
                minnumsingle=mns, maxnumsingle=mxs, minnumint=mni, maxnumint=mxi)
```

ERROR: Formula model error: fd ~ leaf_sav*thickness

Columns present in sig. interaction terms: {'dmc', 'sample_wt'}

Total Num. Cols : Num. Sig. Int. Cols; 13 : 2

Significant Interactions:

('sample_wt', 'dmc')

Number of formulas: 2048

ERROR: Formula model error: fd ~ sample_wt*dmc + lfm + LMA + mpa + leaf_sav + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + LMA + branching + mpa + leaf_sav + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + lfm + LMA + mpa + start_temp + leaf_sav + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + lfm + branching + mpa + start_temp + branch_volume + leaf_sav + species

ERROR: Formula model error: fd ~ sample_wt*dmc + lfm + branching + mpa + start_temp + branch_volume + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + LMA + branching + mpa + stem_sav + leaf_sav + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + lfm + LMA + branching + mpa + start_temp + stem_sav + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + lfm + branching + mpa + start_temp + branch_volume + leaf_sav + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + LMA + branching + mpa + start_temp + stem_sav + leaf_sav + thickness + species

ERROR: Formula model error: fd ~ sample_wt*dmc + lfm + LMA + branching + mpa + start_temp + stem_sav + leaf_sav + thickness + species

fd ~ sample_wt*dmc + leaf_mass_ratio + mpa + species

fd ~ sample_wt*dmc + leaf_mass_ratio

fd ~ sample_wt*dmc + leaf_mass_ratio + mpa + branch_volume + species

fd ~ sample_wt*dmc + LMA + leaf_mass_ratio + species

```

fd ~ sample_wt*dmc + mpa + species
fd ~ sample_wt*dmc + LMA + species
fd ~ sample_wt*dmc + LMA + leaf_mass_ratio + branch_volume + species
fd ~ sample_wt*dmc + leaf_mass_ratio + mpa + thickness + species
fd ~ sample_wt*dmc
fd ~ sample_wt*dmc + leaf_mass_ratio + mpa + branch_volume + thickness + species
fd ~ sample_wt*dmc + LMA + leaf_mass_ratio + mpa + stem_sav + species
fd ~ sample_wt*dmc + branching
fd ~ sample_wt*dmc + LMA + leaf_mass_ratio + mpa + leaf_sav + species
fd ~ sample_wt*dmc + leaf_mass_ratio + mpa
fd ~ sample_wt*dmc + LMA + leaf_mass_ratio + mpa + start_temp + species
fd ~ sample_wt*dmc + lfm + species
fd ~ sample_wt*dmc + leaf_mass_ratio + stem_sav
fd ~ sample_wt*dmc + branch_volume + species
fd ~ sample_wt*dmc + thickness + species
fd ~ sample_wt*dmc + LMA + leaf_mass_ratio + branching + mpa + species
fd ~ sample_wt*dmc + LMA + leaf_mass_ratio + mpa + thickness + species
fd ~ sample_wt*dmc + leaf_mass_ratio + mpa + stem_sav + species
fd ~ sample_wt*dmc + lfm
fd ~ sample_wt*dmc + lfm + leaf_mass_ratio
fd ~ sample_wt*dmc + leaf_mass_ratio + branching + branch_volume + species
fd ~ sample_wt*dmc + leaf_mass_ratio + branching
fd ~ sample_wt*dmc + leaf_mass_ratio + start_temp + branch_volume + species

```

Mixed Linear Model Regression Results

```

=====
Model:                MixedLM   Dependent Variable:   fd
No. Observations:    162       Method:                ML
No. Groups:          8         Scale:                0.5566
Min. group size:     2         Log-Likelihood:      -187.3370
Max. group size:     37        Converged:            No
Mean group size:     20.2

```

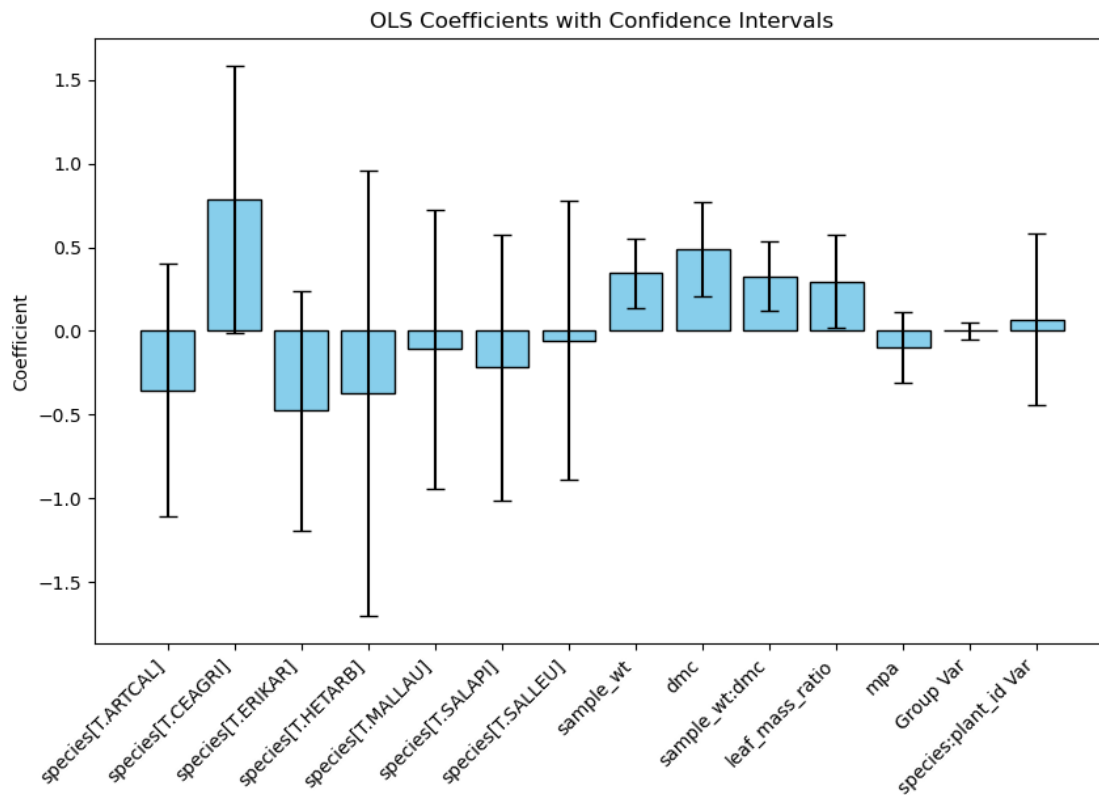
```

-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.045    0.315 -0.143 0.887 -0.663  0.573
species[T.ARTCAL]   -0.354    0.385 -0.919 0.358 -1.108  0.401
species[T.CEAGRI]    0.785    0.407  1.930 0.054 -0.012  1.581
species[T.ERIKAR]   -0.475    0.365 -1.301 0.193 -1.190  0.240
species[T.HETARB]   -0.373    0.678 -0.551 0.582 -1.702  0.955
species[T.MALLAU]   -0.106    0.425 -0.249 0.803 -0.938  0.727
species[T.SALAPI]   -0.216    0.405 -0.534 0.593 -1.009  0.577
species[T.SALLEU]   -0.055    0.424 -0.130 0.896 -0.887  0.776
sample_wt           0.344    0.106  3.235 0.001  0.136  0.553
dmc                 0.486    0.144  3.382 0.001  0.204  0.767
sample_wt:dmc       0.327    0.107  3.055 0.002  0.117  0.537
leaf_mass_ratio     0.294    0.142  2.071 0.038  0.016  0.573

```


mpa	-0.097	0.108	-0.894	0.371	-0.309	0.116
Group Var	0.002	0.020				
species:plant_id Var	0.037	0.195				

=====



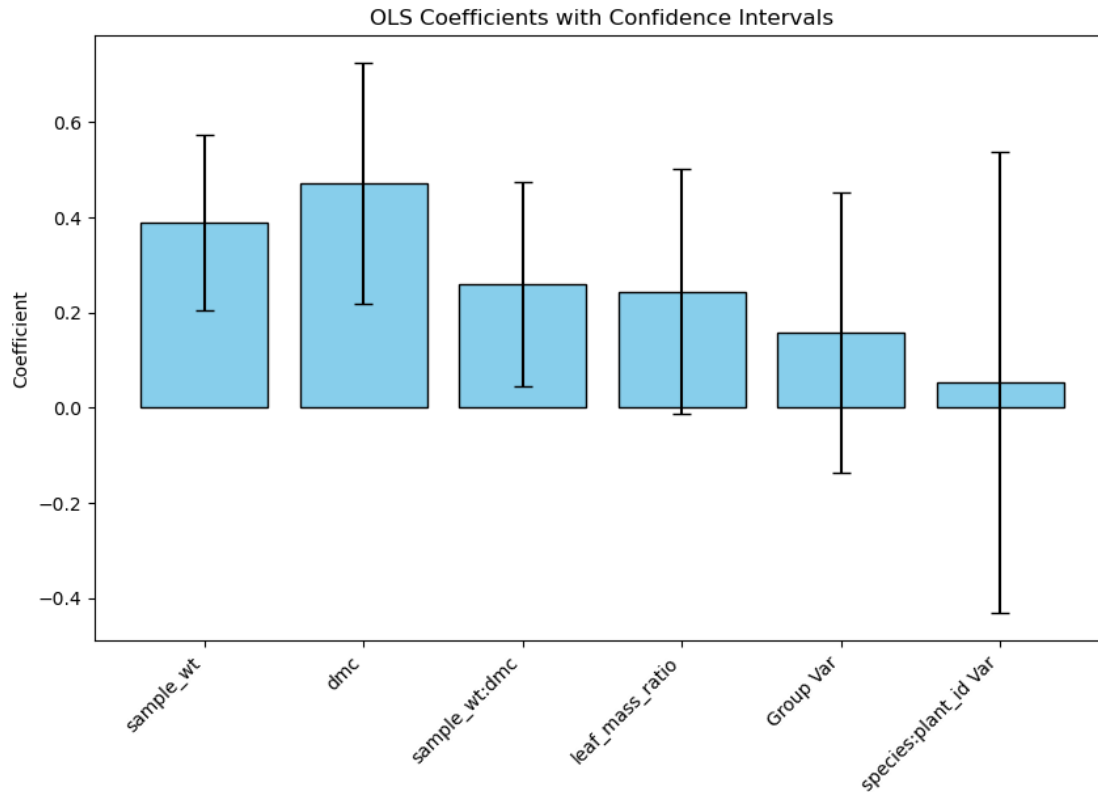
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM    Dependent Variable:   fd
No. Observations:     162        Method:                ML
No. Groups:            8          Scale:                0.5873
Min. group size:       2          Log-Likelihood:       -195.4017
Max. group size:       37         Converged:            Yes
Mean group size:       20.2
=====
```

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.088	0.142	-0.621	0.535	-0.366	0.190
sample_wt	0.389	0.094	4.125	0.000	0.204	0.573
dmc	0.471	0.129	3.637	0.000	0.217	0.724
sample_wt:dmc	0.259	0.109	2.371	0.018	0.045	0.474
leaf_mass_ratio	0.244	0.131	1.865	0.062	-0.012	0.501

Group Var	0.093	0.115
species:plant_id Var	0.031	0.189

=====



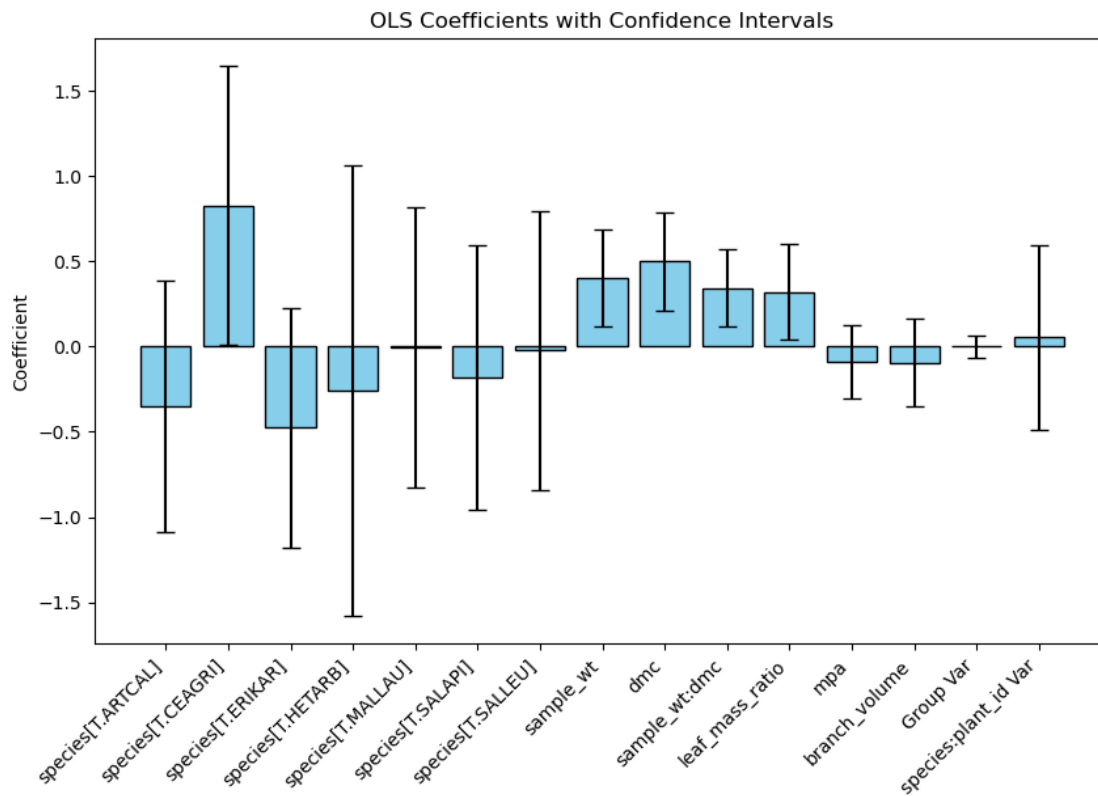
Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5586
Min. group size:	2	Log-Likelihood:	-186.6338
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.083	0.317	-0.261	0.794	-0.704	0.539
species[T.ARTCAL]	-0.351	0.377	-0.931	0.352	-1.090	0.388
species[T.CEAGRI]	0.827	0.417	1.984	0.047	0.010	1.644
species[T.ERIKAR]	-0.476	0.358	-1.332	0.183	-1.177	0.224
species[T.HETARB]	-0.258	0.675	-0.382	0.702	-1.580	1.064
species[T.MALLAU]	-0.004	0.419	-0.010	0.992	-0.825	0.817

species[T.SALAPI]	-0.181	0.395	-0.459	0.647	-0.954	0.592
species[T.SALLEU]	-0.023	0.416	-0.055	0.956	-0.838	0.792
sample_wt	0.403	0.145	2.784	0.005	0.119	0.687
dmc	0.498	0.146	3.424	0.001	0.213	0.784
sample_wt:dmc	0.341	0.115	2.965	0.003	0.116	0.567
leaf_mass_ratio	0.319	0.143	2.227	0.026	0.038	0.600
mpa	-0.093	0.110	-0.843	0.399	-0.308	0.123
branch_volume	-0.095	0.132	-0.725	0.469	-0.354	0.163
Group Var	0.000	0.024				
species:plant_id Var	0.030	0.206				

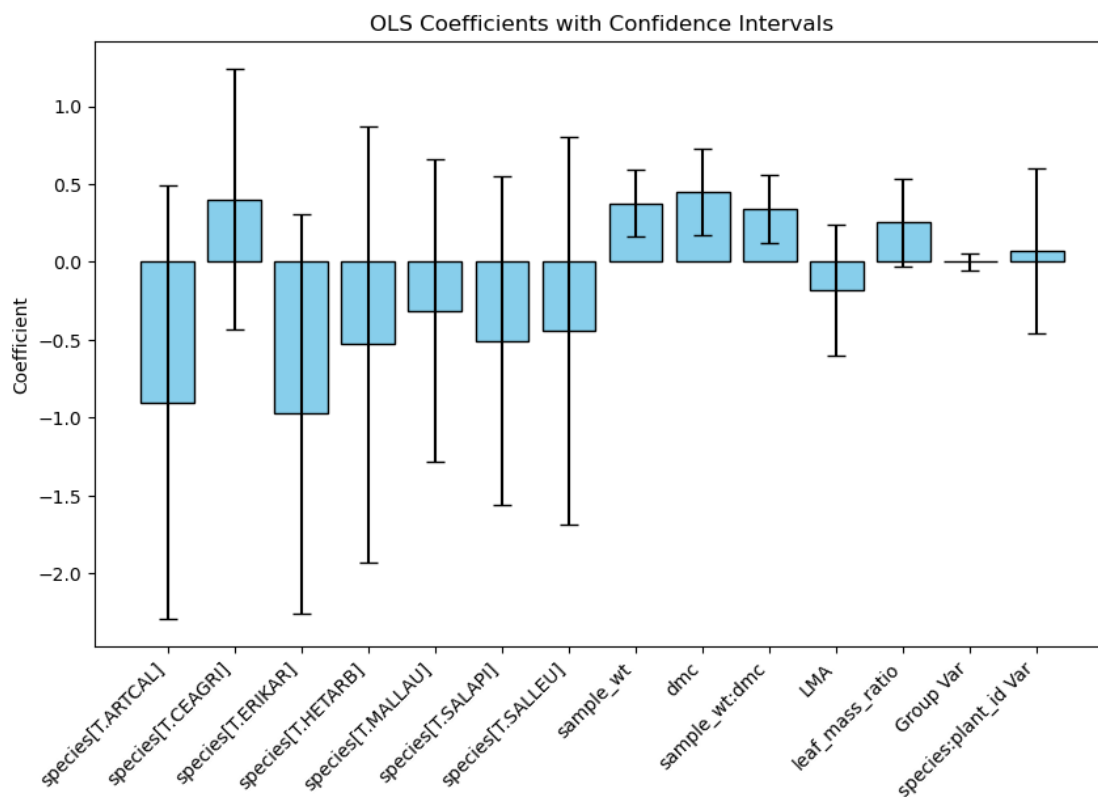
=====



Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5561
Min. group size:	2	Log-Likelihood:	-187.6392
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.307	0.478	0.643	0.520	-0.629	1.244
species[T.ARTCAL]	-0.902	0.709	-1.273	0.203	-2.292	0.488
species[T.CEAGRI]	0.401	0.427	0.940	0.347	-0.436	1.238
species[T.ERIKAR]	-0.974	0.655	-1.487	0.137	-2.257	0.309
species[T.HETARB]	-0.528	0.715	-0.739	0.460	-1.930	0.874
species[T.MALLAU]	-0.312	0.496	-0.628	0.530	-1.284	0.661
species[T.SALAPI]	-0.506	0.539	-0.938	0.348	-1.563	0.551
species[T.SALLEU]	-0.441	0.636	-0.694	0.488	-1.687	0.805
sample_wt	0.377	0.110	3.419	0.001	0.161	0.593
dmc	0.448	0.141	3.170	0.002	0.171	0.725
sample_wt:dmc	0.339	0.110	3.077	0.002	0.123	0.555
LMA	-0.182	0.215	-0.848	0.396	-0.603	0.239
leaf_mass_ratio	0.252	0.145	1.740	0.082	-0.032	0.537
Group Var	0.001	0.021				
species:plant_id Var	0.041	0.202				



Mixed Linear Model Regression Results

```

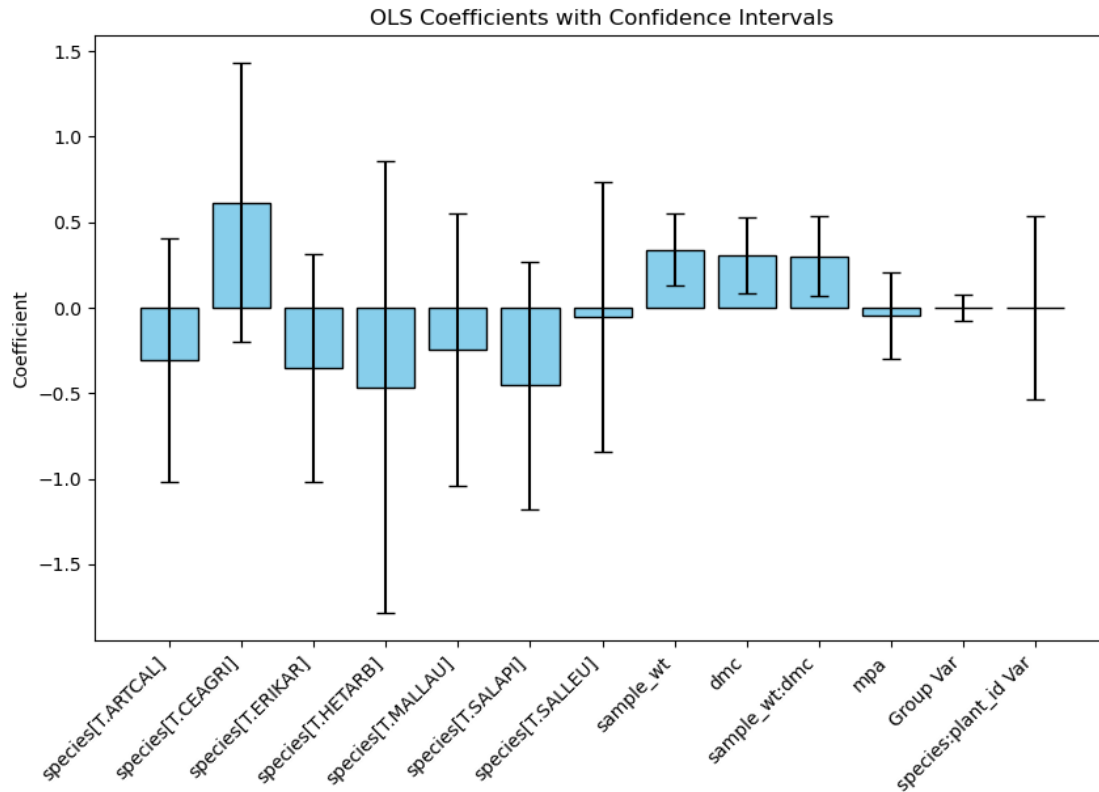
Model:                MixedLM   Dependent Variable:   fd
No. Observations:     162       Method:              ML
No. Groups:           8         Scale:              0.6002
Min. group size:      2         Log-Likelihood:     -188.6947
Max. group size:      37       Converged:          Yes
Mean group size:      20.2

```

```

-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept                0.017    0.300  0.058 0.954 -0.570  0.605
species[T.ARTCAL]       -0.306    0.362 -0.845 0.398 -1.017  0.404
species[T.CEAGRI]        0.615    0.416  1.476 0.140 -0.201  1.431
species[T.ERIKAR]       -0.356    0.340 -1.047 0.295 -1.021  0.310
species[T.HETARB]       -0.465    0.674 -0.690 0.490 -1.786  0.856
species[T.MALLAU]       -0.249    0.407 -0.611 0.541 -1.045  0.548
species[T.SALAPI]       -0.455    0.369 -1.233 0.218 -1.178  0.268
species[T.SALLEU]       -0.054    0.402 -0.135 0.893 -0.842  0.733
sample_wt                0.340    0.108  3.132 0.002  0.127  0.552
dmc                     0.303    0.114  2.669 0.008  0.081  0.526
sample_wt:dmc           0.299    0.119  2.508 0.012  0.065  0.533
mpa                    -0.046    0.129 -0.360 0.719 -0.299  0.207
Group Var                0.000    0.031
species:plant_id Var    0.001    0.212
=====

```



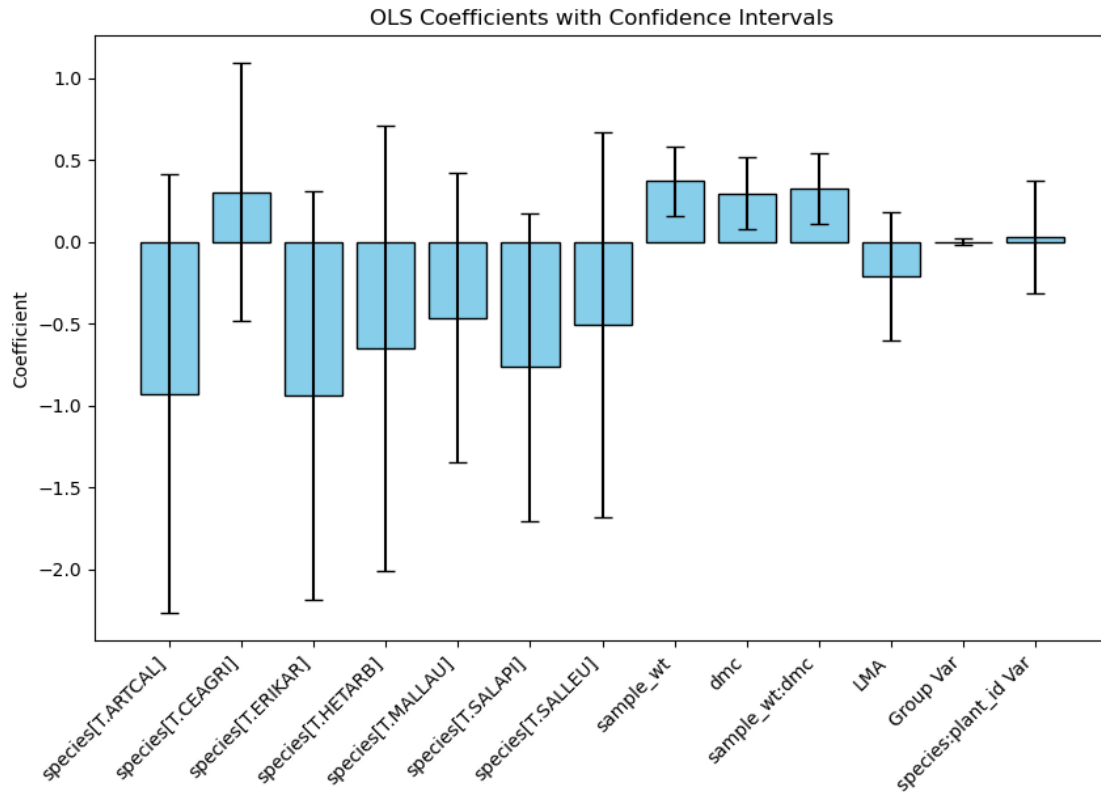
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM   Dependent Variable:   fd
No. Observations:    162       Method:                ML
No. Groups:           8        Scale:                0.5850
Min. group size:     2        Log-Likelihood:      -188.7017
Max. group size:     37       Converged:           Yes
Mean group size:     20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          0.391    0.453  0.862 0.389 -0.498  1.279
species[T.ARTCAL]  -0.928    0.684 -1.357 0.175 -2.268  0.412
species[T.CEAGRI]   0.303    0.403  0.753 0.451 -0.486  1.092
species[T.ERIKAR]  -0.935    0.637 -1.468 0.142 -2.184  0.314
species[T.HETARB]  -0.653    0.694 -0.941 0.347 -2.014  0.707
species[T.MALLAU]  -0.463    0.450 -1.029 0.303 -1.344  0.419
species[T.SALAPI]  -0.765    0.479 -1.595 0.111 -1.704  0.175
species[T.SALLEU]  -0.504    0.599 -0.842 0.400 -1.679  0.670
sample_wt           0.371    0.108  3.423 0.001  0.158  0.583
dmc                 0.297    0.114  2.611 0.009  0.074  0.519
sample_wt:dmc       0.325    0.110  2.941 0.003  0.108  0.541
-----
```

LMA	-0.210	0.201	-1.043	0.297	-0.605	0.185
Group Var	0.001	0.009				
species:plant_id Var	0.016	0.134				

=====



Mixed Linear Model Regression Results

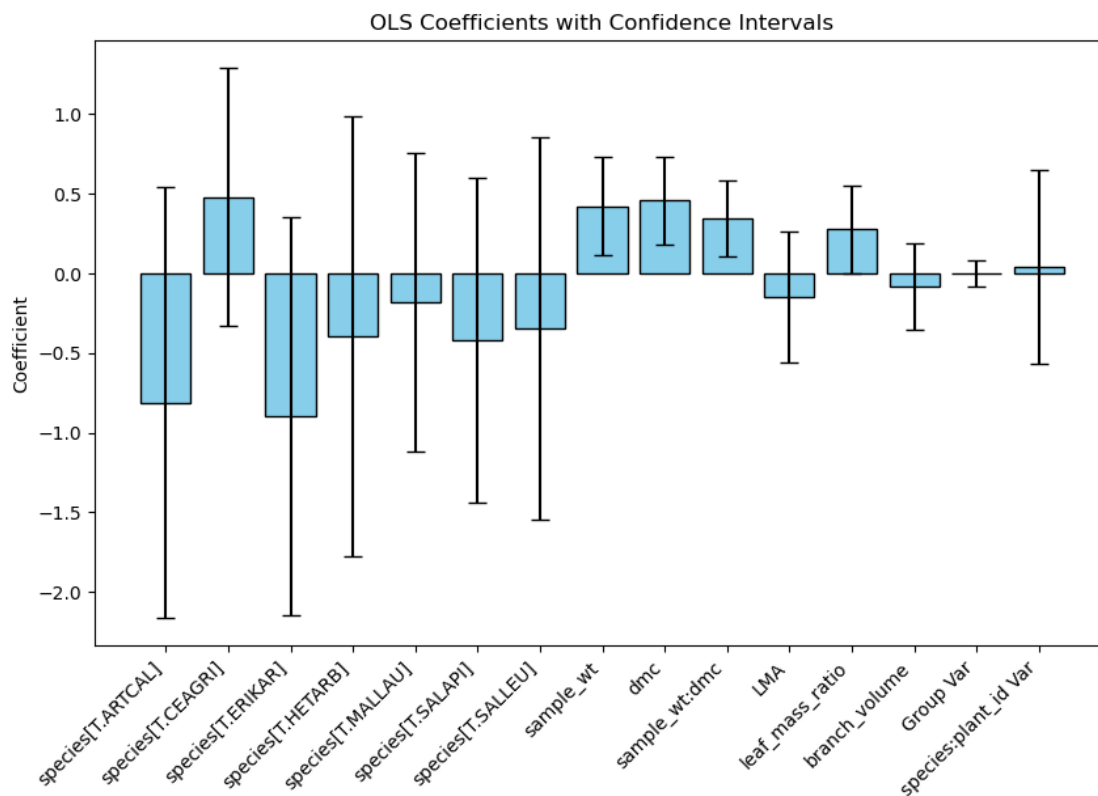
=====

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5668
Min. group size:	2	Log-Likelihood:	-186.7264
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.222	0.463	0.478	0.632	-0.686	1.130
species[T.ARTCAL]	-0.813	0.690	-1.179	0.238	-2.165	0.538
species[T.CEAGRI]	0.478	0.414	1.156	0.248	-0.333	1.289
species[T.ERIKAR]	-0.898	0.638	-1.407	0.160	-2.148	0.353
species[T.HETARB]	-0.394	0.706	-0.559	0.576	-1.777	0.989

species[T.MALLAU]	-0.184	0.479	-0.384	0.701	-1.123	0.755
species[T.SALAPI]	-0.422	0.521	-0.811	0.418	-1.442	0.598
species[T.SALLEU]	-0.346	0.613	-0.564	0.573	-1.547	0.856
sample_wt	0.420	0.158	2.669	0.008	0.112	0.729
dmc	0.460	0.141	3.271	0.001	0.184	0.736
sample_wt:dmc	0.345	0.121	2.856	0.004	0.108	0.582
LMA	-0.151	0.210	-0.718	0.473	-0.562	0.260
leaf_mass_ratio	0.278	0.141	1.981	0.048	0.003	0.554
branch_volume	-0.080	0.139	-0.576	0.565	-0.353	0.193
Group Var	0.000	0.031				
species:plant_id Var	0.021	0.233				

=====

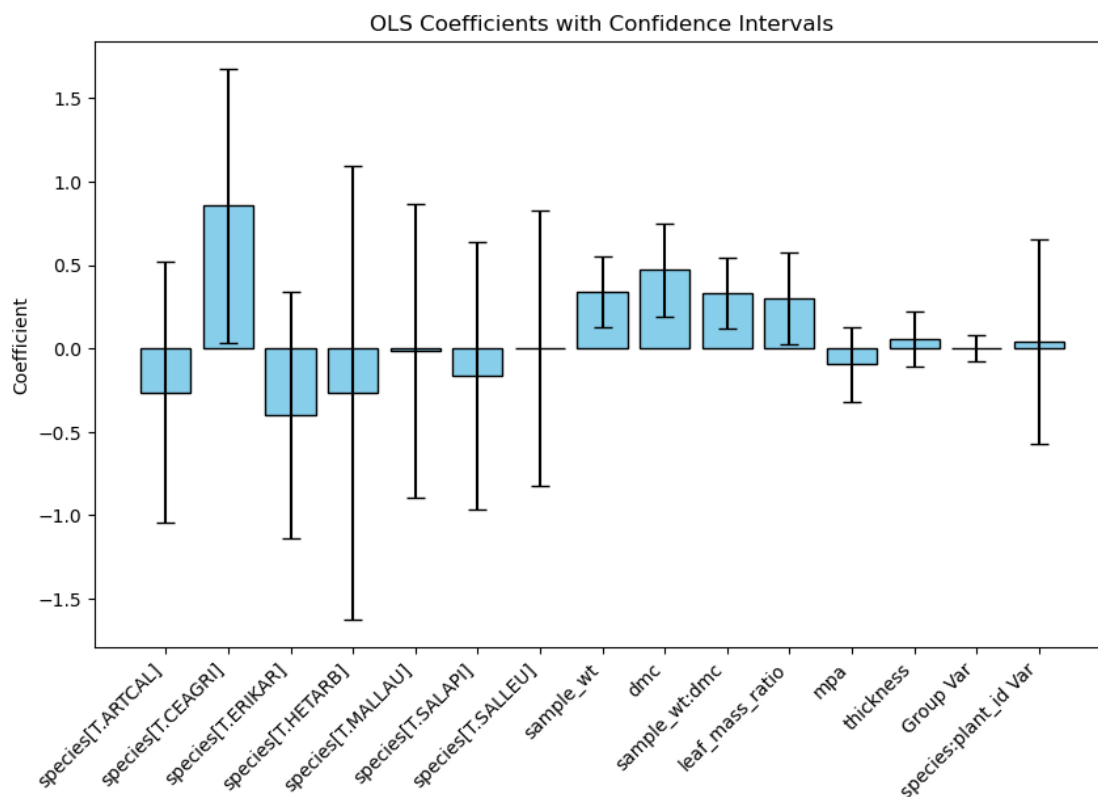


Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5647
Min. group size:	2	Log-Likelihood:	-186.7325
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.111	0.324	-0.343	0.731	-0.745	0.523
species[T.ARTCAL]	-0.264	0.399	-0.661	0.509	-1.047	0.519
species[T.CEAGRI]	0.856	0.418	2.047	0.041	0.037	1.675
species[T.ERIKAR]	-0.400	0.377	-1.061	0.289	-1.139	0.339
species[T.HETARB]	-0.267	0.694	-0.385	0.700	-1.626	1.093
species[T.MALLAU]	-0.012	0.449	-0.026	0.979	-0.892	0.869
species[T.SALAPI]	-0.161	0.408	-0.394	0.693	-0.961	0.640
species[T.SALLEU]	0.001	0.421	0.002	0.998	-0.823	0.825
sample_wt	0.342	0.107	3.181	0.001	0.131	0.552
dmc	0.472	0.142	3.324	0.001	0.194	0.750
sample_wt:dmc	0.329	0.109	3.026	0.002	0.116	0.542
leaf_mass_ratio	0.301	0.141	2.138	0.033	0.025	0.577
mpa	-0.096	0.115	-0.833	0.405	-0.321	0.130
thickness	0.055	0.084	0.651	0.515	-0.110	0.220
Group Var	0.001	0.031				
species:plant_id Var	0.023	0.236				

=====



Mixed Linear Model Regression Results

```

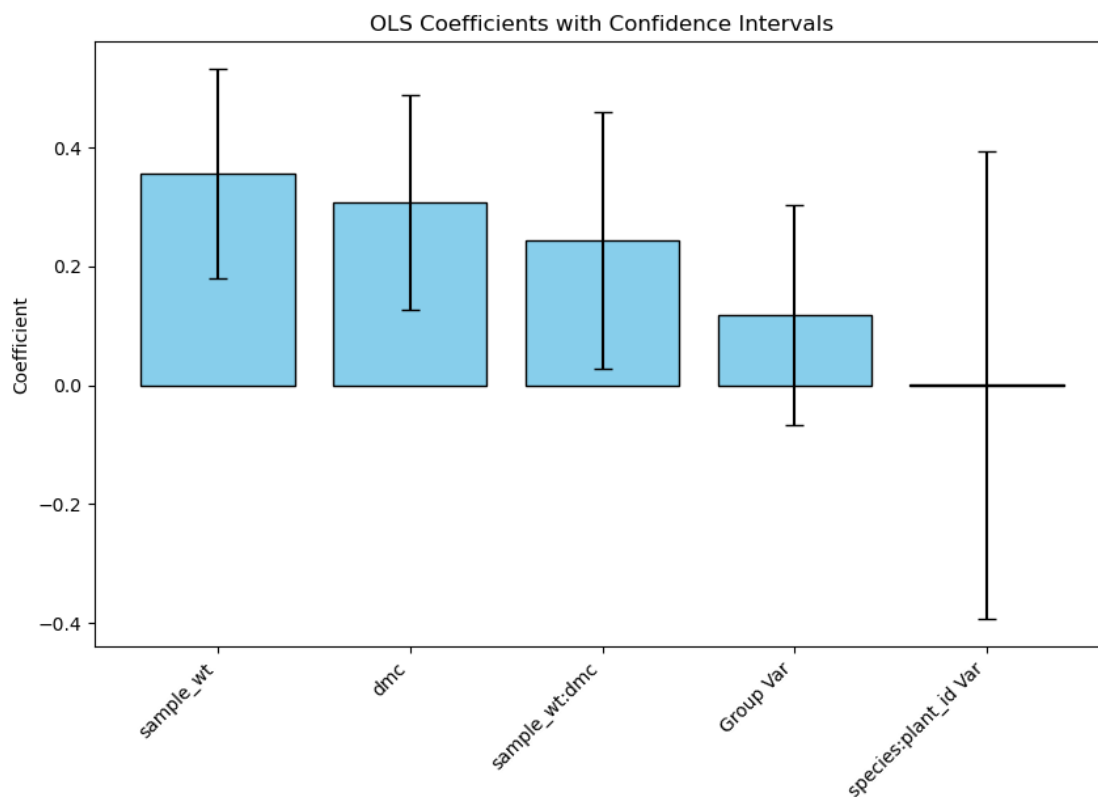
=====
Model:                MixedLM   Dependent Variable:   fd
No. Observations:     162       Method:              ML
No. Groups:           8         Scale:              0.6285
Min. group size:      2         Log-Likelihood:     -196.7721
Max. group size:      37       Converged:          No
Mean group size:      20.2
=====

```

```

-----
              Coef.  Std.Err.   z    P>|z|  [0.025  0.975]
-----
Intercept          -0.086    0.130  -0.659  0.510   -0.342   0.170
sample_wt           0.356    0.090   3.963  0.000    0.180   0.531
dmc                 0.308    0.092   3.345  0.001    0.127   0.488
sample_wt:dmc       0.244    0.110   2.218  0.027    0.028   0.460
Group Var           0.074    0.075
species:plant_id Var 0.000    0.159
=====

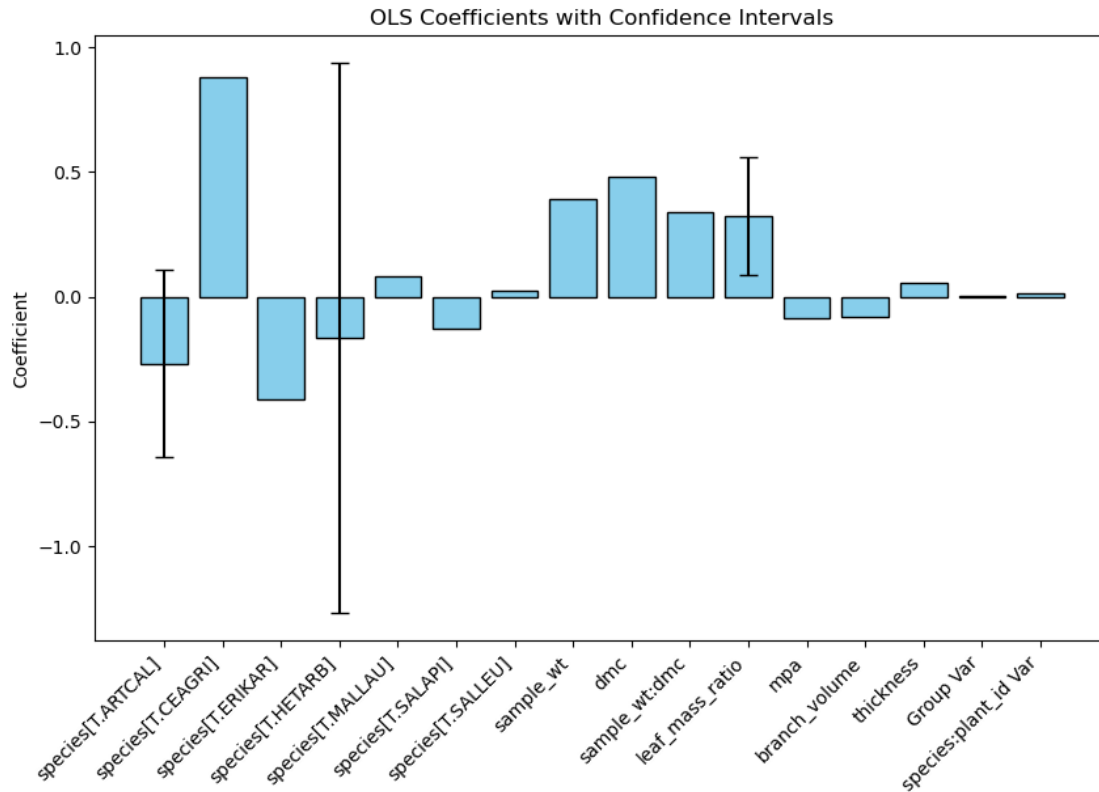
```



Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5744
Min. group size:	2	Log-Likelihood:	-185.9190
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.137					
species[T.ARTCAL]	-0.268	0.192	-1.394	0.163	-0.645	0.109
species[T.CEAGRI]	0.879					
species[T.ERIKAR]	-0.410					
species[T.HETARB]	-0.166	0.562	-0.295	0.768	-1.269	0.936
species[T.MALLAU]	0.079					
species[T.SALAPI]	-0.128					
species[T.SALLEU]	0.021					
sample_wt	0.389					
dmc	0.483					
sample_wt:dmc	0.338					
leaf_mass_ratio	0.323	0.122	2.651	0.008	0.084	0.562
mpa	-0.088					
branch_volume	-0.080					
thickness	0.053					
Group Var	0.000					
species:plant_id Var	0.007					



Mixed Linear Model Regression Results

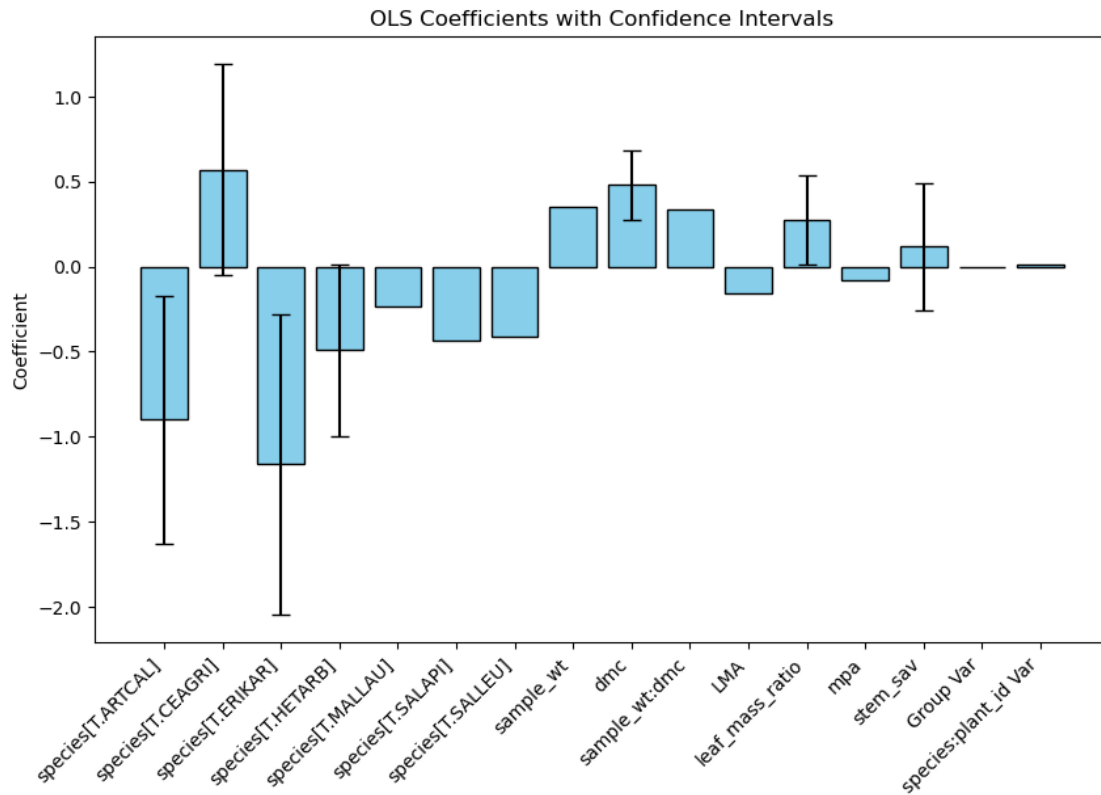
```
=====
Model:                MixedLM   Dependent Variable:   fd
No. Observations:    162       Method:                ML
No. Groups:           8        Scale:                0.5730
Min. group size:     2        Log-Likelihood:      -186.0285
Max. group size:     37       Converged:           Yes
Mean group size:     20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z|  [0.025  0.975]
-----
Intercept          0.296    0.328   0.904  0.366  -0.346   0.939
species[T.ARTCAL]  -0.900    0.371  -2.424  0.015  -1.628  -0.172
species[T.CEAGRI]   0.569    0.317   1.797  0.072  -0.052   1.190
species[T.ERIKAR]  -1.162    0.451  -2.575  0.010  -2.047  -0.277
species[T.HETARB]  -0.491    0.258  -1.905  0.057  -0.996   0.014
species[T.MALLAU]  -0.231             0.000  0.000  0.000   0.000   0.000
species[T.SALAPI]  -0.433             0.000  0.000  0.000   0.000   0.000
species[T.SALLEU]  -0.412             0.000  0.000  0.000   0.000   0.000
sample_wt           0.355             0.000  0.000  0.000   0.000   0.000
dmc                 0.482    0.104   4.631  0.000   0.278   0.685
sample_wt:dmc       0.334             0.000  0.000  0.000   0.000   0.000
-----
```

```

LMA                                -0.159
leaf_mass_ratio                    0.273    0.133    2.059 0.039    0.013    0.534
mpa                                -0.082
stem_sav                          0.116    0.192    0.607 0.544   -0.260    0.493
Group Var                          0.000
species:plant_id Var              0.009
=====

```



Mixed Linear Model Regression Results

```

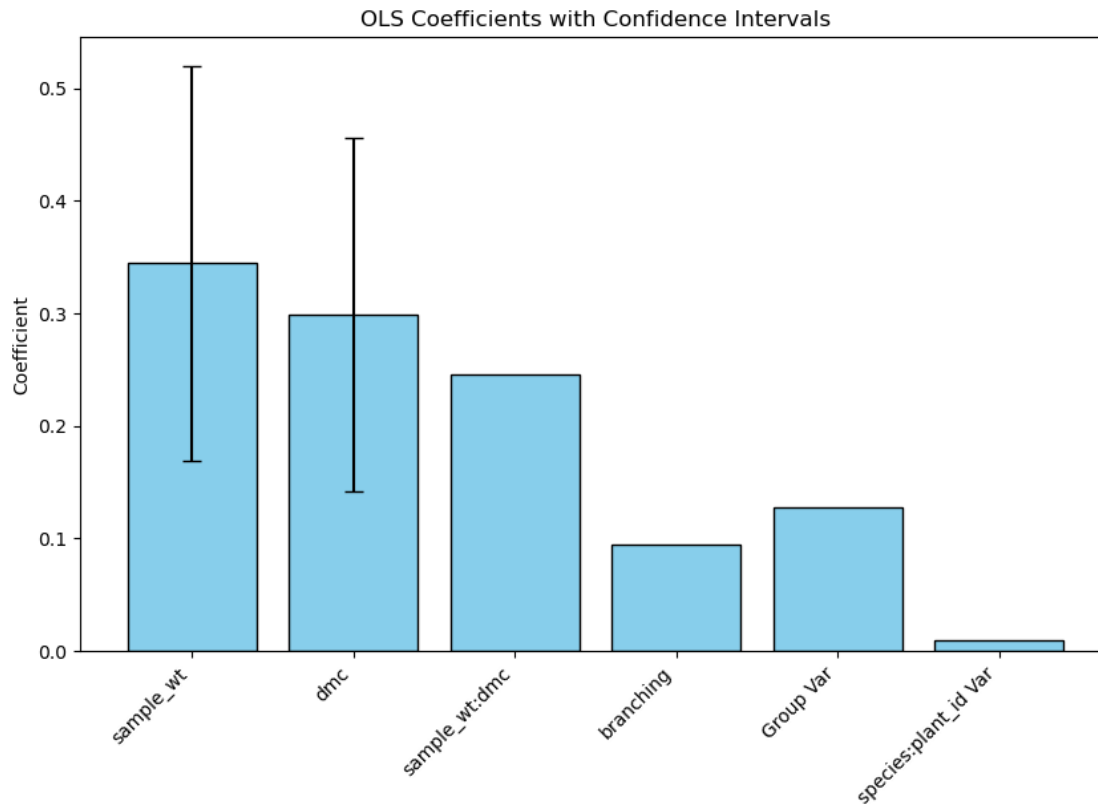
=====
Model:                MixedLM    Dependent Variable:    fd
No. Observations:    162        Method:                ML
No. Groups:          8          Scale:                0.6165
Min. group size:     2          Log-Likelihood:      -196.0384
Max. group size:     37        Converged:           Yes
Mean group size:     20.2
=====

```

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.091					
sample_wt	0.344	0.089	3.859	0.000	0.170	0.519

dmc	0.298	0.080	3.731	0.000	0.142	0.455
sample_wt:dmc	0.246					
branching	0.095					
Group Var	0.079					
species:plant_id Var	0.006					

=====



Mixed Linear Model Regression Results

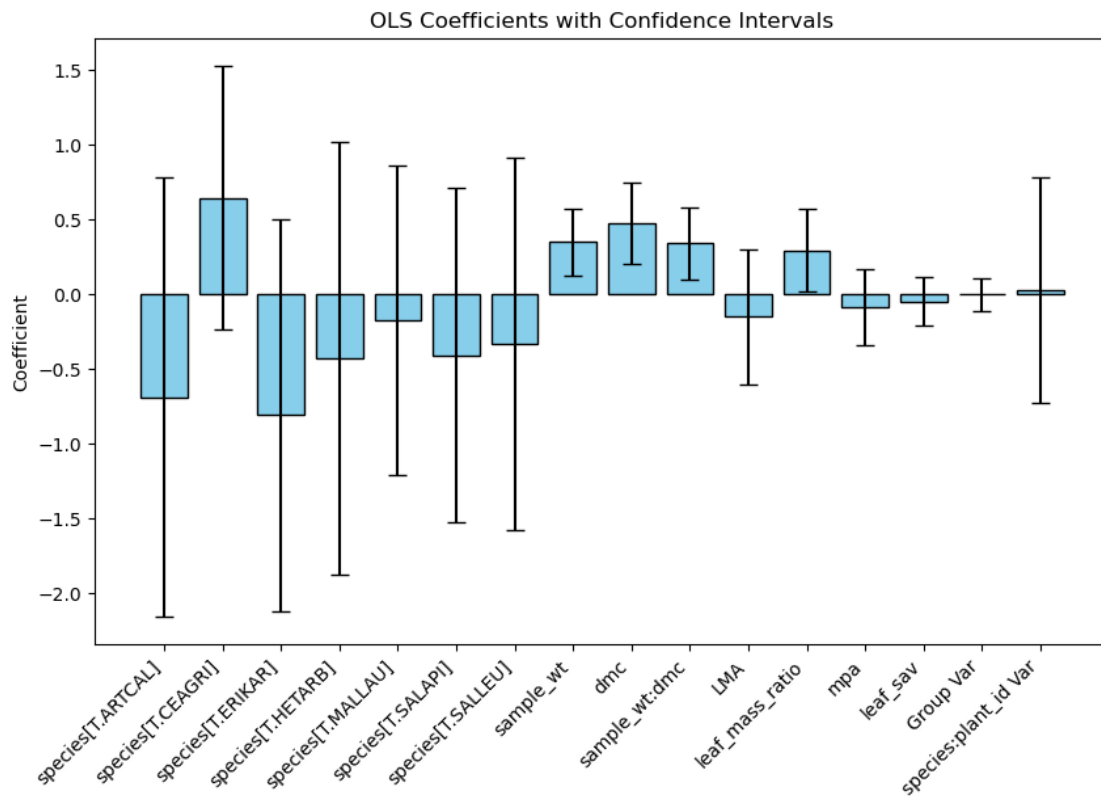
=====

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5678
Min. group size:	2	Log-Likelihood:	-186.1024
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.160	0.482	0.332	0.740	-0.785	1.105
species[T.ARTCAL]	-0.689	0.750	-0.918	0.359	-2.160	0.782
species[T.CEAGRI]	0.645	0.450	1.432	0.152	-0.238	1.528

species[T.ERIKAR]	-0.809	0.669	-1.209	0.227	-2.121	0.502
species[T.HETARB]	-0.428	0.738	-0.579	0.562	-1.875	1.020
species[T.MALLAU]	-0.177	0.528	-0.335	0.737	-1.212	0.858
species[T.SALAPI]	-0.407	0.569	-0.715	0.475	-1.522	0.709
species[T.SALLEU]	-0.331	0.637	-0.520	0.603	-1.579	0.917
sample_wt	0.349	0.114	3.075	0.002	0.127	0.572
dmc	0.478	0.140	3.421	0.001	0.204	0.751
sample_wt:dmc	0.341	0.121	2.803	0.005	0.102	0.579
LMA	-0.151	0.230	-0.655	0.512	-0.603	0.301
leaf_mass_ratio	0.294	0.142	2.065	0.039	0.015	0.573
mpa	-0.086	0.132	-0.653	0.514	-0.345	0.173
leaf_sav	-0.050	0.083	-0.600	0.549	-0.214	0.113
Group Var	0.000	0.042				
species:plant_id Var	0.015	0.289				

=====



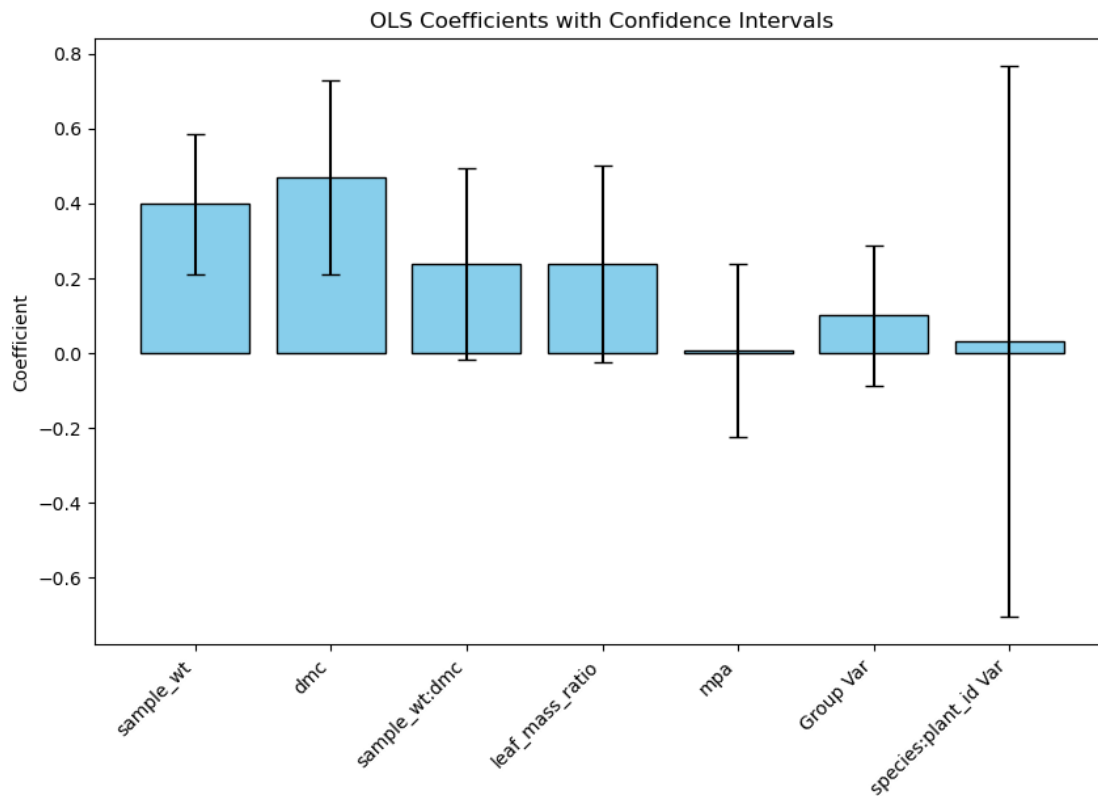
Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.6035

Min. group size: 2 Log-Likelihood: -195.1395
 Max. group size: 37 Converged: Yes
 Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.077	0.138	-0.555	0.579	-0.347	0.194
sample_wt	0.398	0.095	4.189	0.000	0.212	0.584
dmc	0.469	0.132	3.550	0.000	0.210	0.728
sample_wt:dmc	0.239	0.131	1.826	0.068	-0.018	0.495
leaf_mass_ratio	0.238	0.133	1.786	0.074	-0.023	0.499
mpa	0.007	0.118	0.057	0.955	-0.224	0.238
Group Var	0.061	0.074				
species:plant_id Var	0.019	0.292				

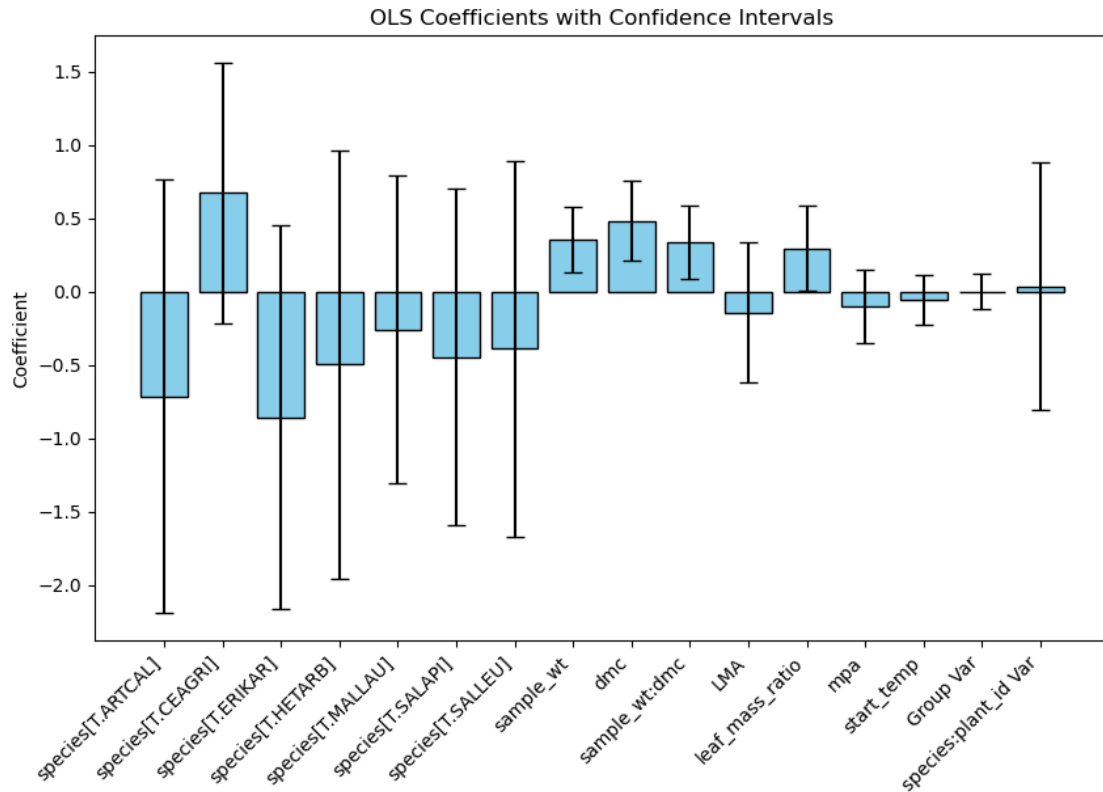


Mixed Linear Model Regression Results

Model: MixedLM Dependent Variable: fd
 No. Observations: 162 Method: ML
 No. Groups: 8 Scale: 0.5643

Min. group size:	2	Log-Likelihood:	-186.1557
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.198	0.484	0.409	0.682	-0.750	1.146
species[T.ARTCAL]	-0.715	0.754	-0.949	0.343	-2.192	0.762
species[T.CEAGRI]	0.672	0.452	1.487	0.137	-0.214	1.557
species[T.ERIKAR]	-0.858	0.668	-1.285	0.199	-2.167	0.451
species[T.HETARB]	-0.497	0.746	-0.666	0.505	-1.958	0.965
species[T.MALLAU]	-0.258	0.534	-0.483	0.629	-1.306	0.789
species[T.SALAPI]	-0.446	0.587	-0.760	0.447	-1.596	0.704
species[T.SALLEU]	-0.389	0.654	-0.595	0.552	-1.671	0.893
sample_wt	0.353	0.115	3.071	0.002	0.128	0.578
dmc	0.482	0.141	3.427	0.001	0.206	0.758
sample_wt:dmc	0.339	0.128	2.657	0.008	0.089	0.589
LMA	-0.143	0.243	-0.589	0.556	-0.620	0.334
leaf_mass_ratio	0.294	0.147	2.000	0.045	0.006	0.582
mpa	-0.102	0.129	-0.787	0.431	-0.355	0.151
start_temp	-0.055	0.087	-0.633	0.527	-0.225	0.115
Group Var	0.000	0.047				
species:plant_id Var	0.020	0.323				



Mixed Linear Model Regression Results

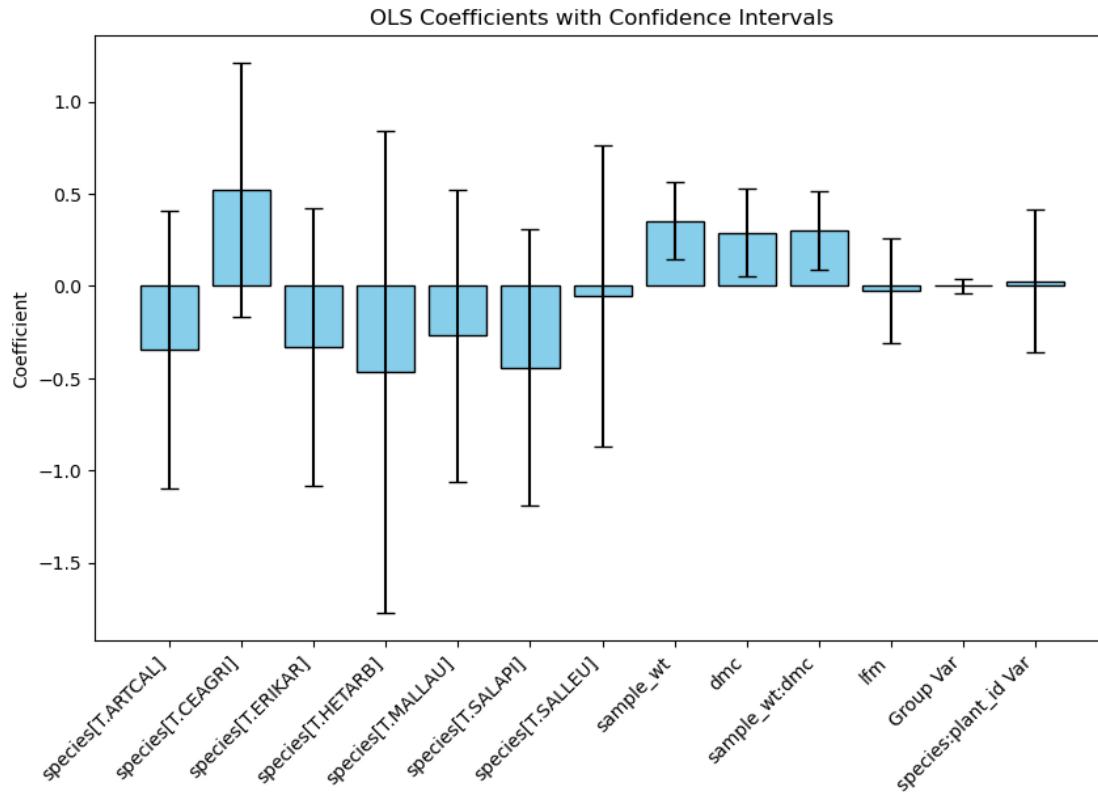
```
=====
Model:                MixedLM   Dependent Variable:   fd
No. Observations:    162       Method:                ML
No. Groups:          8         Scale:                0.5891
Min. group size:     2         Log-Likelihood:       -189.1722
Max. group size:     37       Converged:            No
Mean group size:     20.2
=====
```

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.033	0.302	0.109	0.913	-0.559	0.624
species[T.ARTCAL]	-0.345	0.384	-0.897	0.370	-1.098	0.409
species[T.CEAGRI]	0.520	0.352	1.477	0.140	-0.170	1.211
species[T.ERIKAR]	-0.331	0.384	-0.864	0.388	-1.083	0.421
species[T.HETARB]	-0.465	0.668	-0.696	0.486	-1.775	0.845
species[T.MALLAU]	-0.270	0.404	-0.667	0.505	-1.062	0.523
species[T.SALAPI]	-0.441	0.383	-1.152	0.249	-1.191	0.309
species[T.SALLEU]	-0.053	0.417	-0.127	0.899	-0.871	0.765
sample_wt	0.354	0.108	3.279	0.001	0.142	0.565
dmc	0.289	0.121	2.382	0.017	0.051	0.527
sample_wt:dmc	0.301	0.109	2.753	0.006	0.087	0.515

```

lfm                -0.024    0.146 -0.164 0.870 -0.310  0.263
Group Var          0.000    0.015
species:plant_id Var 0.017    0.151
=====

```



Mixed Linear Model Regression Results

```

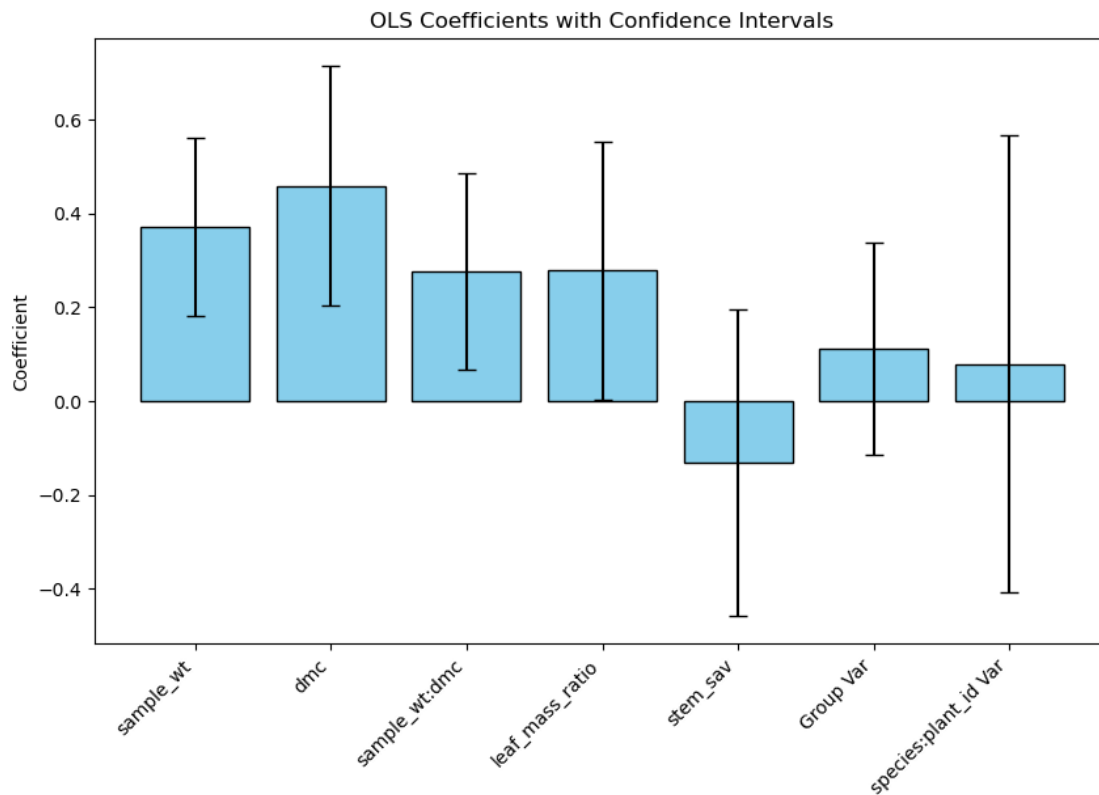
=====
Model:                MixedLM    Dependent Variable:  fd
No. Observations:    162        Method:                ML
No. Groups:           8         Scale:                0.5812
Min. group size:      2         Log-Likelihood:       -195.1888
Max. group size:      37        Converged:            No
Mean group size:      20.2
=====

```

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.107	0.130	-0.819	0.413	-0.362	0.148
sample_wt	0.371	0.096	3.848	0.000	0.182	0.559
dmc	0.458	0.130	3.519	0.000	0.203	0.713
sample_wt:dmc	0.276	0.107	2.584	0.010	0.067	0.485
leaf_mass_ratio	0.278	0.140	1.985	0.047	0.003	0.553

stem_sav	-0.131	0.167	-0.785	0.432	-0.458	0.196
Group Var	0.065	0.087				
species:plant_id Var	0.046	0.190				

=====



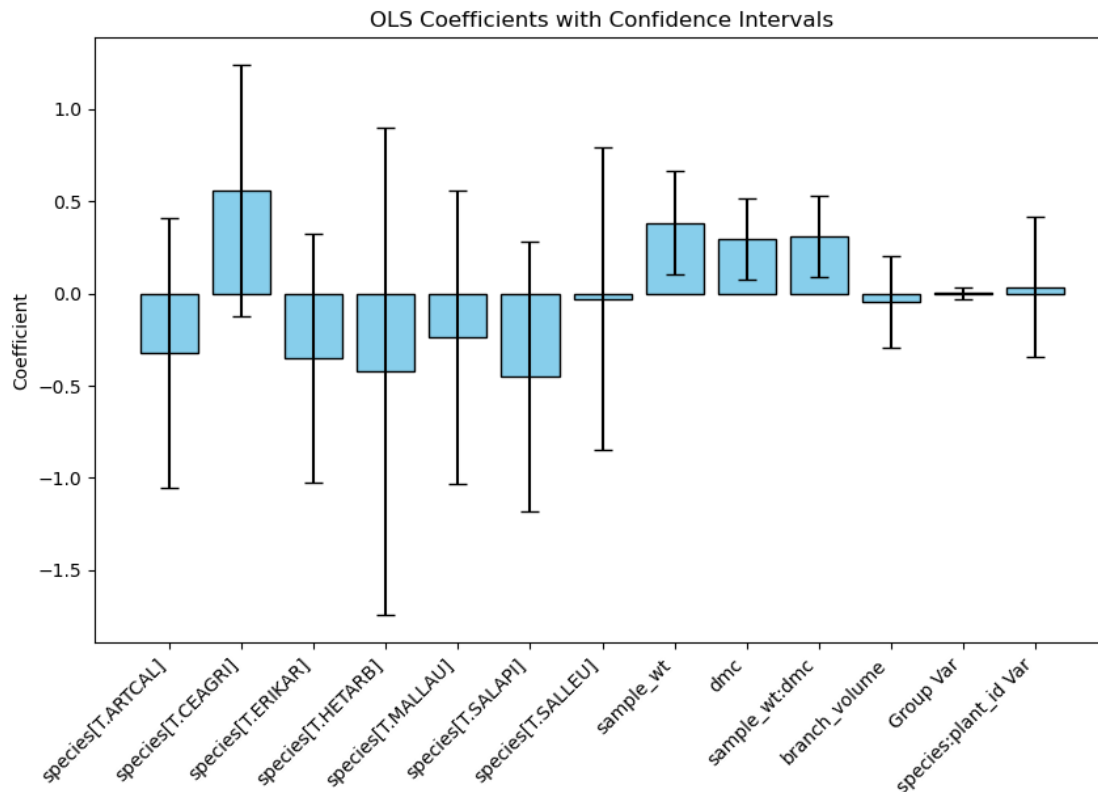
Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5854
Min. group size:	2	Log-Likelihood:	-189.2348
Max. group size:	37	Converged:	No
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.018	0.309	0.059	0.953	-0.587	0.623
species[T.ARTCAL]	-0.322	0.373	-0.864	0.387	-1.054	0.409
species[T.CEAGRI]	0.557	0.348	1.600	0.109	-0.125	1.239
species[T.ERIKAR]	-0.354	0.344	-1.029	0.303	-1.029	0.320
species[T.HETARB]	-0.421	0.675	-0.623	0.533	-1.744	0.902

species[T.MALLAU]	-0.237	0.407	-0.581	0.561	-1.035	0.562
species[T.SALAPI]	-0.452	0.372	-1.214	0.225	-1.182	0.278
species[T.SALLEU]	-0.029	0.419	-0.069	0.945	-0.851	0.793
sample_wt	0.381	0.143	2.671	0.008	0.102	0.661
dmc	0.296	0.114	2.595	0.009	0.072	0.519
sample_wt:dmc	0.310	0.114	2.725	0.006	0.087	0.532
branch_volume	-0.044	0.128	-0.343	0.731	-0.294	0.207
Group Var	0.000	0.012				
species:plant_id Var	0.021	0.148				



Mixed Linear Model Regression Results

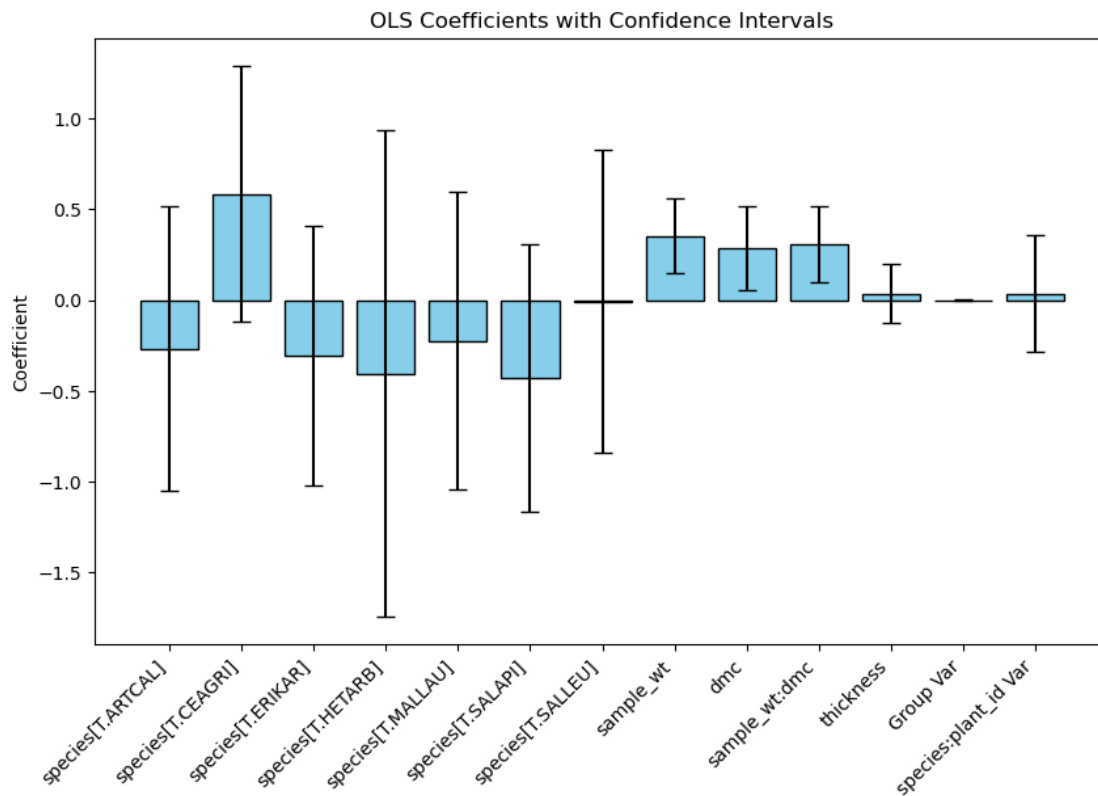
Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5852
Min. group size:	2	Log-Likelihood:	-189.2358
Max. group size:	37	Converged:	No
Mean group size:	20.2		

Coef.	Std.Err.	z	P> z	[0.025 0.975]
-------	----------	---	------	---------------

```

-----
Intercept                -0.009    0.321 -0.028 0.978 -0.638 0.620
species[T.ARTCAL]        -0.266    0.399 -0.667 0.505 -1.048 0.516
species[T.CEAGRI]         0.584    0.359  1.626 0.104 -0.120 1.289
species[T.ERIKAR]        -0.305    0.366 -0.833 0.405 -1.023 0.413
species[T.HETARB]        -0.405    0.683 -0.593 0.553 -1.743 0.933
species[T.MALLAU]        -0.223    0.418 -0.535 0.593 -1.042 0.595
species[T.SALAPI]        -0.428    0.377 -1.136 0.256 -1.167 0.310
species[T.SALLEU]        -0.007    0.426 -0.017 0.986 -0.843 0.828
sample_wt                 0.355    0.107  3.331 0.001  0.146 0.564
dmc                       0.285    0.117  2.442 0.015  0.056 0.514
sample_wt:dmc             0.306    0.107  2.872 0.004  0.097 0.515
thickness                 0.036    0.083  0.434 0.664 -0.127 0.200
Group Var                 0.001    0.000
species:plant_id Var     0.021    0.126
=====

```



Mixed Linear Model Regression Results

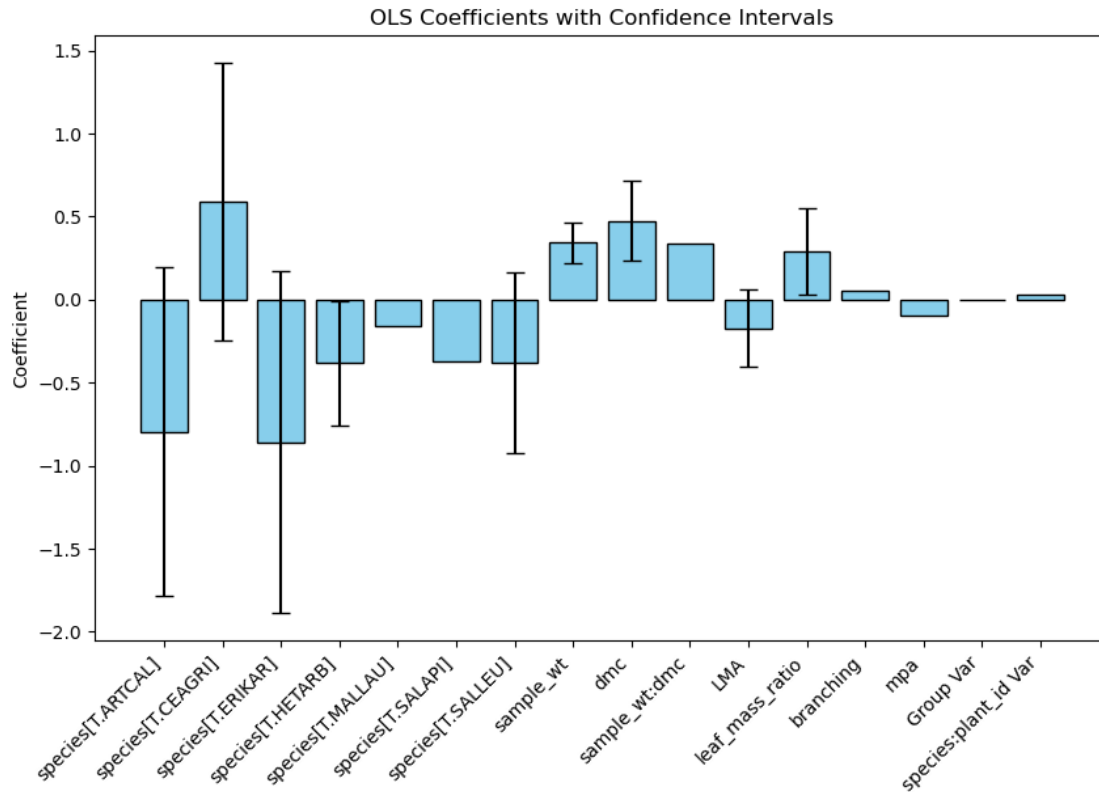
```

=====
Model:                MixedLM    Dependent Variable:  fd
No. Observations:    162        Method:                ML

```

No. Groups:	8	Scale:	0.5650
Min. group size:	2	Log-Likelihood:	-186.2367
Max. group size:	37	Converged:	No
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.190	0.332	0.571	0.568	-0.461	0.841
species[T.ARTCAL]	-0.796	0.506	-1.574	0.115	-1.788	0.195
species[T.CEAGRI]	0.591	0.425	1.389	0.165	-0.243	1.424
species[T.ERIKAR]	-0.858	0.525	-1.635	0.102	-1.887	0.171
species[T.HETARB]	-0.382	0.192	-1.993	0.046	-0.758	-0.006
species[T.MALLAU]	-0.158					
species[T.SALAPI]	-0.372					
species[T.SALLEU]	-0.382	0.278	-1.375	0.169	-0.927	0.163
sample_wt	0.344	0.062	5.562	0.000	0.223	0.465
dmc	0.475	0.121	3.935	0.000	0.238	0.712
sample_wt:dmc	0.335					
LMA	-0.171	0.119	-1.439	0.150	-0.405	0.062
leaf_mass_ratio	0.288	0.133	2.169	0.030	0.028	0.548
branching	0.053					
mpa	-0.094					
Group Var	0.001					
species:plant_id Var	0.019					



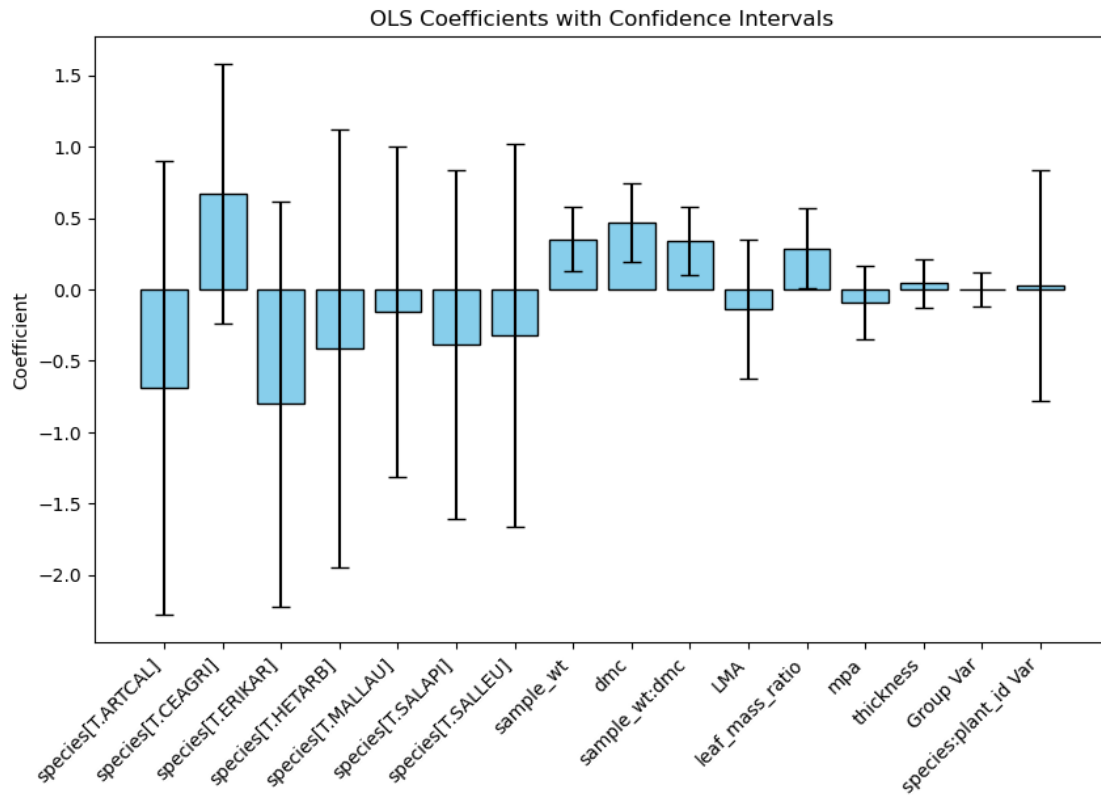
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM   Dependent Variable:   fd
No. Observations:    162       Method:                ML
No. Groups:           8        Scale:                0.5679
Min. group size:     2        Log-Likelihood:      -186.2446
Max. group size:     37       Converged:           Yes
Mean group size:     20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z|  [0.025 0.975]
-----
Intercept          0.147    0.526  0.280  0.779  -0.884  1.179
species[T.ARTCAL]  -0.689    0.812 -0.848  0.396  -2.280  0.903
species[T.CEAGRI]   0.668    0.464  1.440  0.150  -0.241  1.578
species[T.ERIKAR]  -0.802    0.723 -1.110  0.267  -2.219  0.615
species[T.HETARB]  -0.415    0.784 -0.529  0.597  -1.951  1.121
species[T.MALLAU]  -0.160    0.590 -0.271  0.786  -1.317  0.997
species[T.SALAPI]  -0.386    0.624 -0.619  0.536  -1.609  0.836
species[T.SALLEU]  -0.322    0.682 -0.471  0.637  -1.659  1.016
sample_wt           0.352    0.115  3.077  0.002   0.128  0.577
dmc                 0.467    0.141  3.317  0.001   0.191  0.744
sample_wt:dmc       0.341    0.123  2.765  0.006   0.099  0.583
-----
```


LMA	-0.141	0.249	-0.569	0.569	-0.629	0.346
leaf_mass_ratio	0.289	0.144	2.002	0.045	0.006	0.572
mpa	-0.090	0.132	-0.679	0.497	-0.348	0.169
thickness	0.043	0.086	0.499	0.618	-0.126	0.212
Group Var	0.001	0.045				
species:plant_id Var	0.016	0.311				

=====



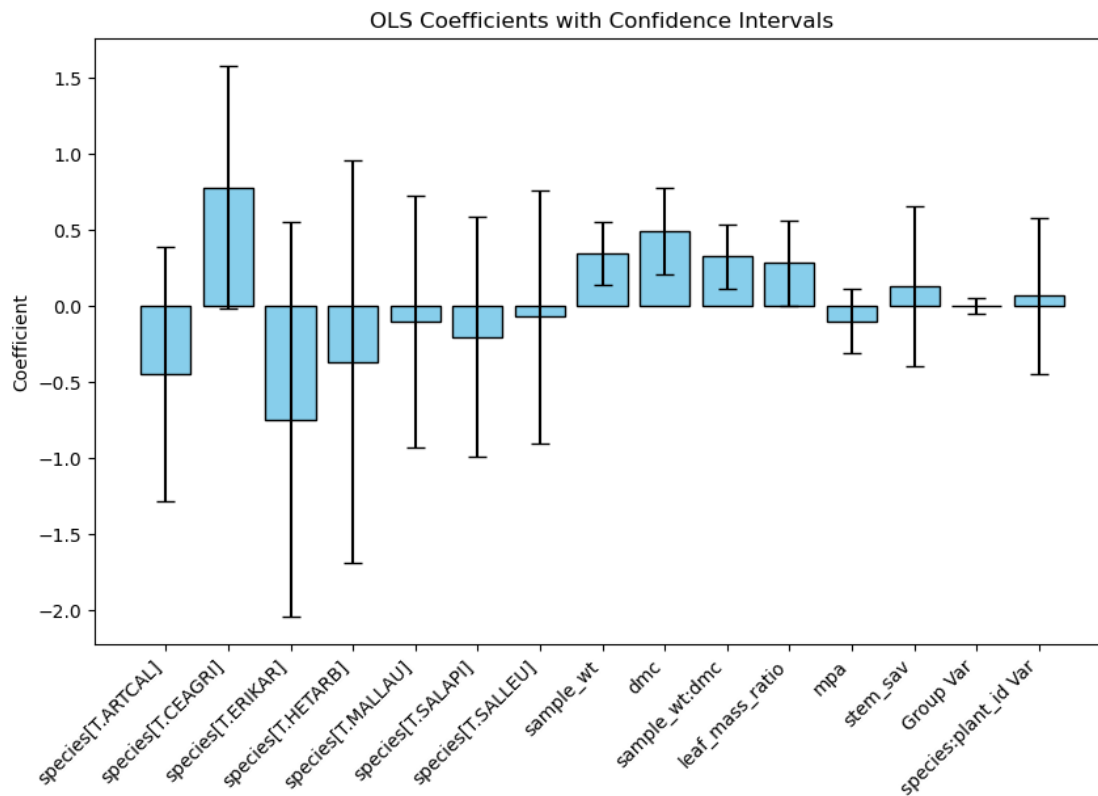
Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5548
Min. group size:	2	Log-Likelihood:	-187.2503
Max. group size:	37	Converged:	No
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	0.023	0.344	0.068	0.946	-0.652	0.698
species[T.ARTCAL]	-0.446	0.428	-1.041	0.298	-1.285	0.394

species[T.CEAGRI]	0.780	0.407	1.915	0.055	-0.018	1.578
species[T.ERIKAR]	-0.745	0.662	-1.125	0.261	-2.042	0.553
species[T.HETARB]	-0.365	0.677	-0.539	0.590	-1.691	0.962
species[T.MALLAU]	-0.101	0.424	-0.238	0.812	-0.931	0.730
species[T.SALAPI]	-0.201	0.404	-0.496	0.620	-0.993	0.592
species[T.SALLEU]	-0.070	0.426	-0.164	0.870	-0.905	0.765
sample_wt	0.347	0.106	3.258	0.001	0.138	0.555
dmc	0.494	0.145	3.407	0.001	0.210	0.778
sample_wt:dmc	0.326	0.108	3.028	0.002	0.115	0.536
leaf_mass_ratio	0.285	0.144	1.982	0.047	0.003	0.566
mpa	-0.099	0.109	-0.912	0.362	-0.312	0.114
stem_sav	0.129	0.269	0.479	0.632	-0.398	0.655
Group Var	0.001	0.020				
species:plant_id Var	0.039	0.195				

=====



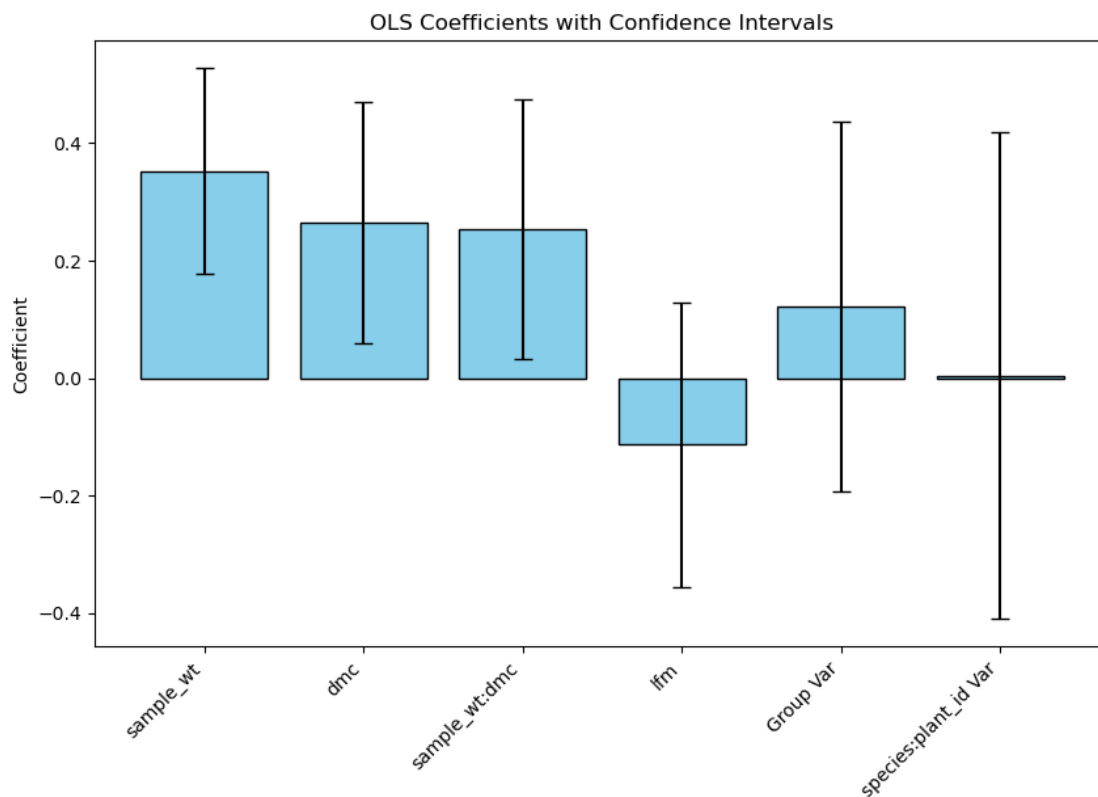
Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.6218

Min. group size:	2	Log-Likelihood:	-196.2606
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.097	0.133	-0.727	0.467	-0.358	0.164
sample_wt	0.352	0.089	3.942	0.000	0.177	0.528
dmc	0.265	0.105	2.538	0.011	0.060	0.470
sample_wt:dmc	0.254	0.113	2.252	0.024	0.033	0.476
lfm	-0.113	0.124	-0.915	0.360	-0.356	0.130
Group Var	0.075	0.127				
species:plant_id Var	0.003	0.167				

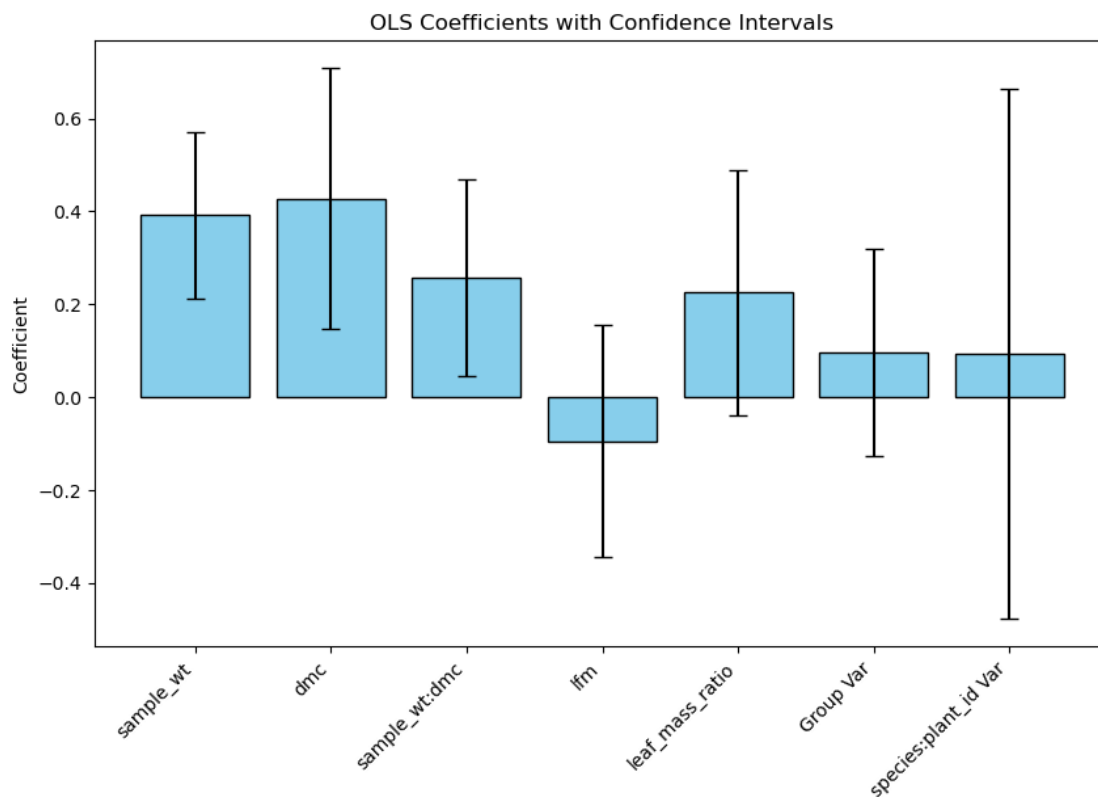


Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5789
Min. group size:	2	Log-Likelihood:	-195.3070

Max. group size: 37 Converged: Yes
Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.094	0.125	-0.747	0.455	-0.339	0.152
sample_wt	0.392	0.092	4.277	0.000	0.212	0.572
dmc	0.428	0.143	2.985	0.003	0.147	0.709
sample_wt:dmc	0.257	0.108	2.369	0.018	0.044	0.469
lfm	-0.095	0.128	-0.745	0.456	-0.346	0.155
leaf_mass_ratio	0.225	0.134	1.678	0.093	-0.038	0.488
Group Var	0.056	0.086				
species:plant_id Var	0.054	0.221				

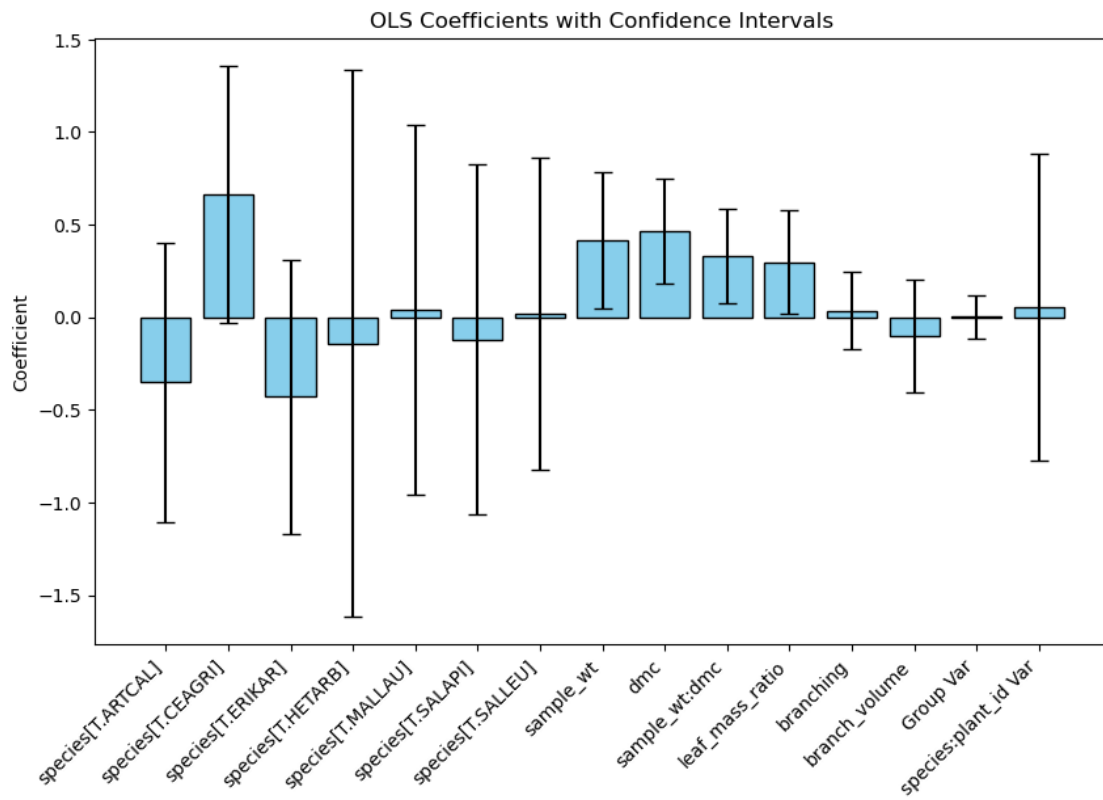


Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	fd
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.5621
Min. group size:	2	Log-Likelihood:	-187.3075

Max. group size: 37 Converged: No
Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.084	0.327	-0.256	0.798	-0.725	0.557
species[T.ARTCAL]	-0.351	0.386	-0.910	0.363	-1.107	0.405
species[T.CEAGRI]	0.662	0.354	1.867	0.062	-0.033	1.356
species[T.ERIKAR]	-0.430	0.376	-1.142	0.253	-1.167	0.308
species[T.HETARB]	-0.142	0.753	-0.188	0.851	-1.618	1.334
species[T.MALLAU]	0.039	0.510	0.076	0.939	-0.960	1.037
species[T.SALAPI]	-0.119	0.482	-0.248	0.804	-1.064	0.825
species[T.SALLEU]	0.021	0.430	0.050	0.960	-0.822	0.865
sample_wt	0.416	0.188	2.210	0.027	0.047	0.786
dmc	0.468	0.145	3.234	0.001	0.184	0.752
sample_wt:dmc	0.331	0.130	2.534	0.011	0.075	0.586
leaf_mass_ratio	0.298	0.142	2.105	0.035	0.021	0.576
branching	0.037	0.107	0.344	0.731	-0.173	0.246
branch_volume	-0.101	0.156	-0.645	0.519	-0.406	0.205
Group Var	0.001	0.044				
species:plant_id Var	0.030	0.318				



Mixed Linear Model Regression Results

```

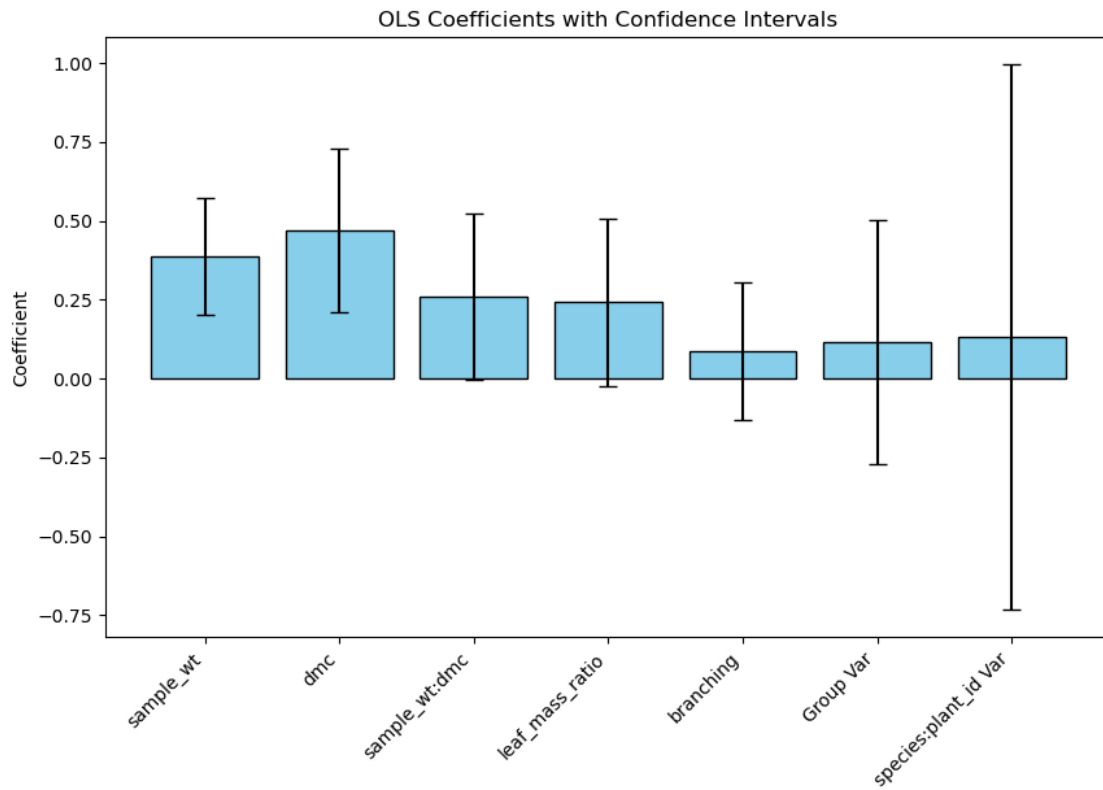
=====
Model:                MixedLM   Dependent Variable:   fd
No. Observations:     162       Method:              ML
No. Groups:           8         Scale:             0.5629
Min. group size:      2         Log-Likelihood:    -195.3271
Max. group size:      37       Converged:         Yes
Mean group size:      20.2
=====

```

```

-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.093    0.138 -0.670 0.503  -0.363  0.178
sample_wt           0.387    0.094  4.119 0.000   0.203  0.571
dmc                 0.470    0.133  3.535 0.000   0.209  0.730
sample_wt:dmc       0.258    0.134  1.920 0.055  -0.005  0.522
leaf_mass_ratio     0.241    0.136  1.767 0.077  -0.026  0.508
branching           0.088    0.111  0.790 0.430  -0.130  0.305
Group Var           0.065    0.148
species:plant_id Var 0.074    0.331
=====

```



Mixed Linear Model Regression Results

```

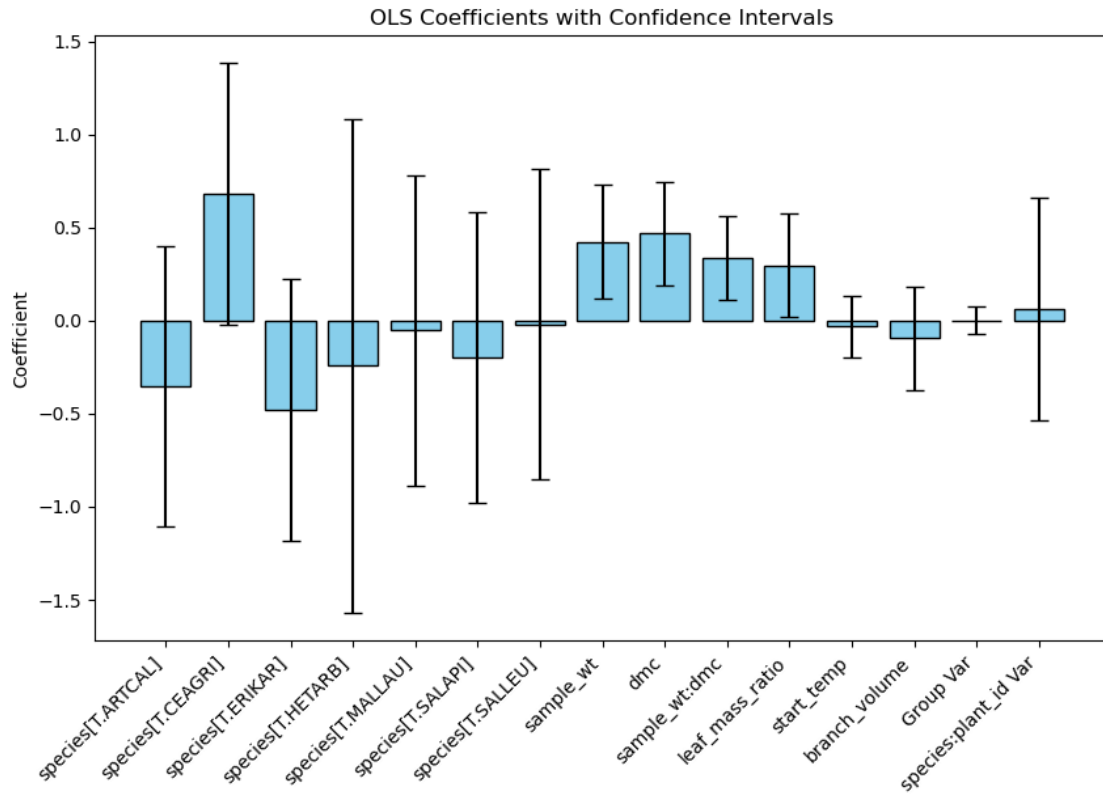
=====
Model:                MixedLM    Dependent Variable:    fd
No. Observations:     162        Method:                ML
No. Groups:            8          Scale:                0.5590
Min. group size:       2          Log-Likelihood:       -187.3342
Max. group size:       37        Converged:            No
Mean group size:       20.2
=====

```

```

-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.042    0.315 -0.133 0.894 -0.660  0.576
species[T.ARTCAL]   -0.355    0.384 -0.924 0.356 -1.107  0.398
species[T.CEAGRI]    0.681    0.358  1.900 0.057 -0.021  1.383
species[T.ERIKAR]   -0.481    0.359 -1.341 0.180 -1.185  0.222
species[T.HETARB]   -0.244    0.678 -0.361 0.718 -1.572  1.084
species[T.MALLAU]   -0.054    0.425 -0.128 0.898 -0.887  0.778
species[T.SALAPI]   -0.202    0.399 -0.506 0.613 -0.983  0.579
species[T.SALLEU]   -0.021    0.425 -0.050 0.960 -0.854  0.811
sample_wt           0.423    0.155  2.737 0.006  0.120  0.727
dmc                 0.469    0.142  3.307 0.001  0.191  0.746
sample_wt:dmc       0.336    0.116  2.899 0.004  0.109  0.562
leaf_mass_ratio      0.297    0.143  2.078 0.038  0.017  0.576
start_temp          -0.032    0.085 -0.382 0.703 -0.198  0.133
branch_volume        -0.097    0.140 -0.689 0.491 -0.372  0.178
Group Var            0.000    0.028
species:plant_id Var 0.035    0.228
=====

```



6 Temp Change

```
[11]: yvar='temp_change'
      cols=cols_use
      df=flam
      compare_predictors_mixedeff(df, cols, yvar)
```

	cols	aics	pvals	coefs	top_mod
0	LMA	304.534939	0.097680	4.176065e-01	True
1	dmc	303.949995	0.089897	2.708376e-01	True
2	branch_volume	303.464900	0.077979	1.971672e-01	True
3	leaf_mass_ratio	302.284645	-0.167626	7.418627e-02	False
4	thickness	302.081699	0.138460	7.364841e-02	False
5	leaf_sav	302.043892	-0.150075	7.109881e-02	False
6	species	301.769198	-0.477024	1.651199e-01	False
7	lfm	301.232764	-0.197459	4.315243e-02	False
8	stem_sav	300.585701	-0.254306	2.181084e-03	False
9	mpa	300.174135	0.140693	2.528577e-02	False
10	sample_wt	296.458956	0.210282	3.440285e-03	False
11	branching	296.043031	0.171873	2.301602e-03	False
12	start_temp	272.278944	-0.350094	5.298375e-10	False


```
[12]: AIC_iterator(flam, cols_use, Y_VAR='temp_change',
                 minnumsingle=mns, maxnumsingle=mxs, minnumint=mni, maxnumint=mxi)
```

ERROR: Formula model error: temp_change ~ leaf_sav*thickness

Columns present in sig. interaction terms: {'sample_wt', 'start_temp'}

Total Num. Cols : Num. Sig. Int. Cols; 13 : 2

Significant Interactions:
('sample_wt', 'start_temp')

Number of formulas: 2048

ERROR: Formula model error: temp_change ~ sample_wt*start_temp + leaf_mass_ratio + branching + stem_sav + leaf_sav + thickness

ERROR: Formula model error: temp_change ~ sample_wt*start_temp + lfm + LMA + leaf_mass_ratio + dmc + thickness + species

ERROR: Formula model error: temp_change ~ sample_wt*start_temp + lfm + LMA + leaf_mass_ratio + mpa + dmc + branch_volume + stem_sav + species

```
temp_change ~ sample_wt*start_temp + branching + stem_sav
temp_change ~ sample_wt*start_temp + branching + branch_volume + stem_sav
temp_change ~ sample_wt*start_temp + branching + mpa + stem_sav
temp_change ~ sample_wt*start_temp + lfm + branching + mpa
temp_change ~ sample_wt*start_temp + lfm + leaf_mass_ratio + branching
temp_change ~ sample_wt*start_temp + LMA + branching + stem_sav
temp_change ~ sample_wt*start_temp + LMA + branching + branch_volume + stem_sav
temp_change ~ sample_wt*start_temp + lfm + branching
temp_change ~ sample_wt*start_temp + branching + stem_sav + thickness
temp_change ~ sample_wt*start_temp + lfm + branching + dmc
temp_change ~ sample_wt*start_temp + branching + mpa + branch_volume + stem_sav
temp_change ~ sample_wt*start_temp + branching
temp_change ~ sample_wt*start_temp + leaf_mass_ratio + branching
```

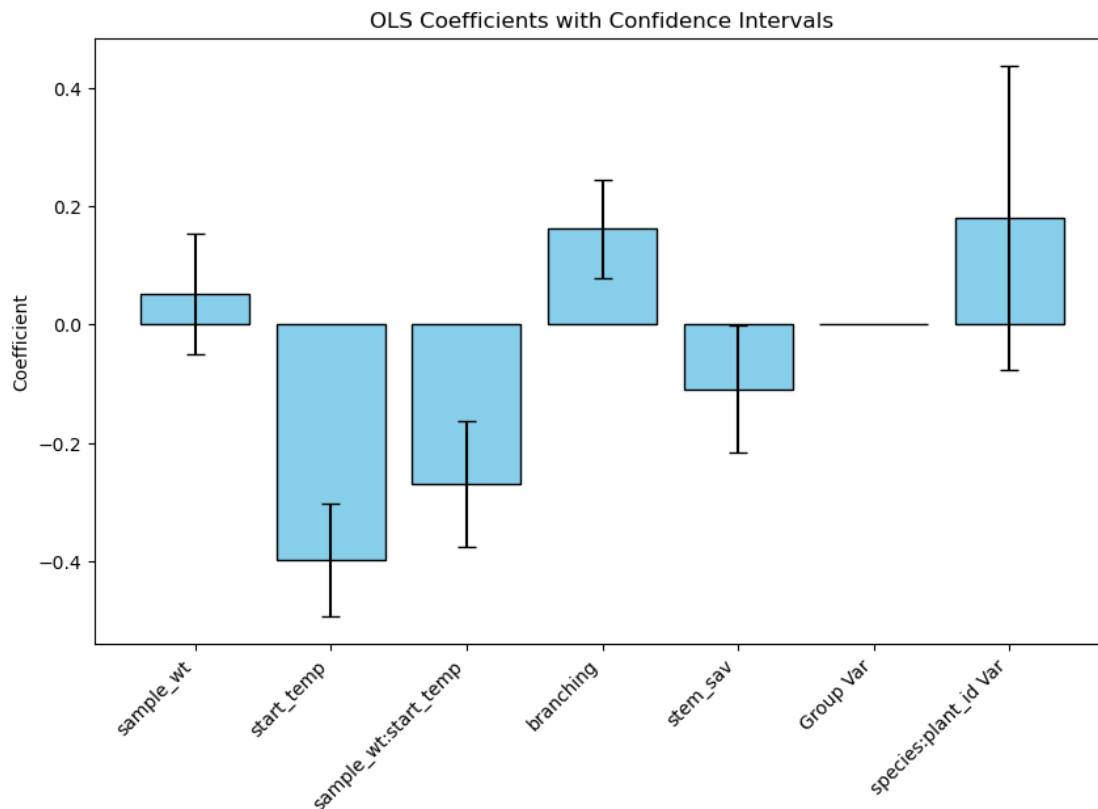
Mixed Linear Model Regression Results

```
=====
Model:                MixedLM   Dependent Variable:  temp_change
No. Observations:    162        Method:                ML
No. Groups:          8          Scale:                0.1971
Min. group size:     2          Log-Likelihood:     -109.3537
Max. group size:     37        Converged:           Yes
Mean group size:     20.2
```

```
-----
                Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
```

Intercept	-0.101	0.048	-2.127	0.033	-0.194	-0.008
sample_wt	0.051	0.052	0.975	0.330	-0.051	0.152
start_temp	-0.398	0.048	-8.212	0.000	-0.492	-0.303
sample_wt:start_temp	-0.269	0.054	-4.937	0.000	-0.376	-0.162
branching	0.161	0.042	3.841	0.000	0.079	0.244
stem_sav	-0.109	0.055	-1.991	0.046	-0.217	-0.002
Group Var	0.000					
species:plant_id Var	0.036	0.058				

=====



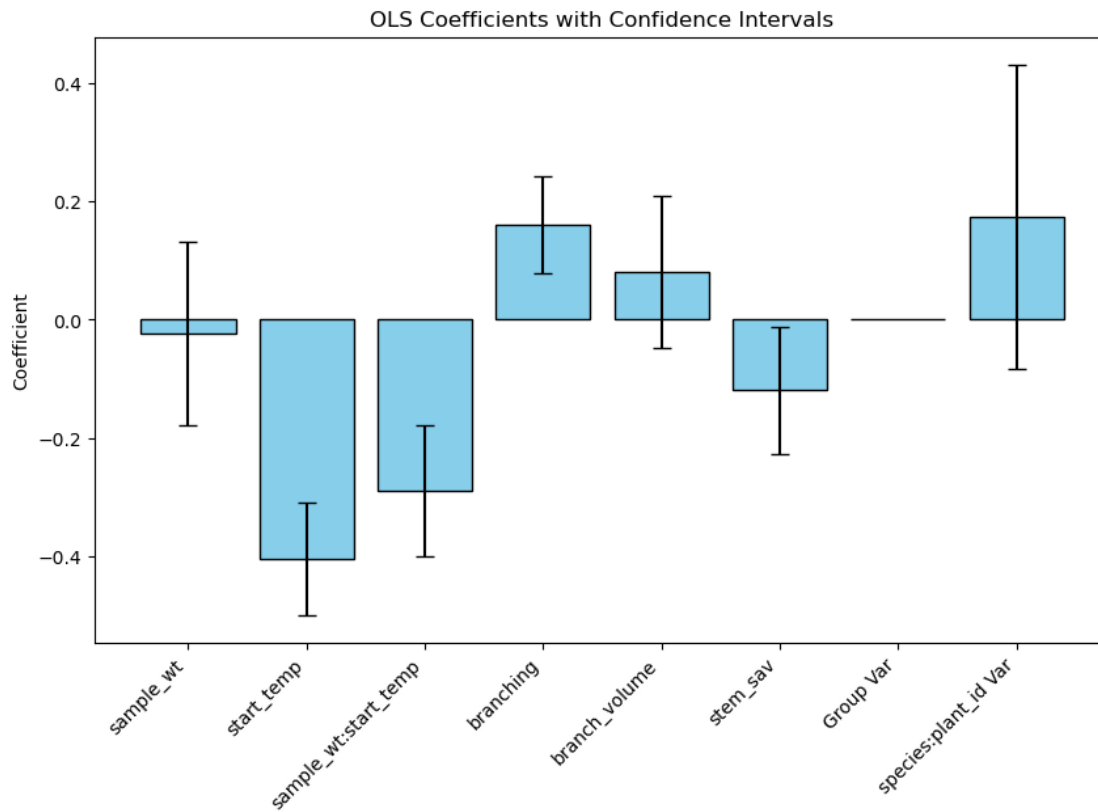
Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	temp_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1960
Min. group size:	2	Log-Likelihood:	-108.5869
Max. group size:	37	Converged:	No
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025 0.975]
sample_wt	0.051	0.052	0.975	0.330	-0.051 0.152
start_temp	-0.398	0.048	-8.212	0.000	-0.492 -0.303
sample_wt:start_temp	-0.269	0.054	-4.937	0.000	-0.376 -0.162
branching	0.161	0.042	3.841	0.000	0.079 0.244
stem_sav	-0.109	0.055	-1.991	0.046	-0.217 -0.002
Group Var	0.000				
species:plant_id Var	0.036	0.058			

Intercept	-0.106	0.047	-2.249	0.025	-0.198	-0.014
sample_wt	-0.024	0.079	-0.302	0.763	-0.179	0.131
start_temp	-0.404	0.049	-8.338	0.000	-0.500	-0.309
sample_wt:start_temp	-0.289	0.057	-5.117	0.000	-0.400	-0.179
branching	0.160	0.042	3.834	0.000	0.078	0.242
branch_volume	0.081	0.066	1.242	0.214	-0.047	0.210
stem_sav	-0.119	0.055	-2.179	0.029	-0.227	-0.012
Group Var	0.000					
species:plant_id Var	0.034	0.058				

=====



Mixed Linear Model Regression Results

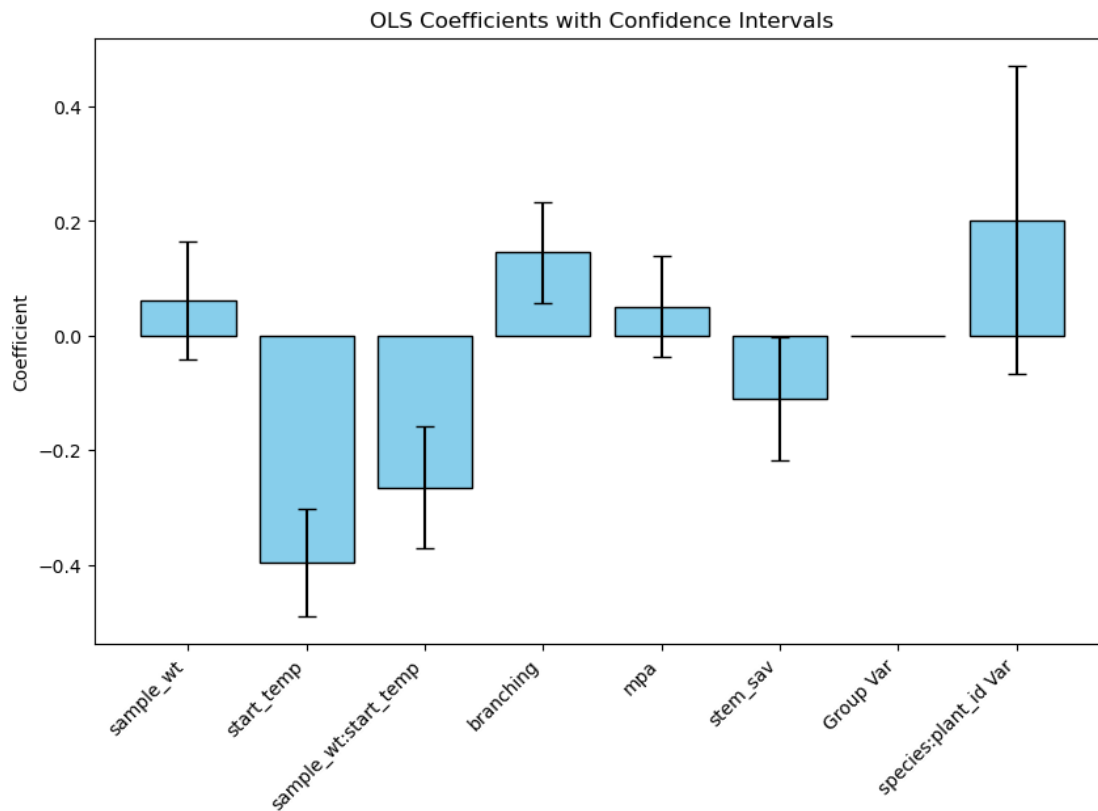
Model:	MixedLM	Dependent Variable:	temp_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1932
Min. group size:	2	Log-Likelihood:	-108.7121
Max. group size:	37	Converged:	No
Mean group size:	20.2		

Coef.	Std.Err.	z	P> z	[0.025	0.975]
-------	----------	---	------	--------	--------

```

-----
Intercept          -0.098    0.048 -2.040 0.041 -0.193 -0.004
sample_wt           0.062    0.053  1.173 0.241 -0.042  0.165
start_temp        -0.396    0.048 -8.265 0.000 -0.489 -0.302
sample_wt:start_temp -0.265    0.054 -4.877 0.000 -0.372 -0.159
branching           0.145    0.044  3.264 0.001  0.058  0.232
mpa                 0.051    0.045  1.123 0.261 -0.038  0.139
stem_sav          -0.110    0.055 -1.994 0.046 -0.219 -0.002
Group Var           0.000
species:plant_id Var 0.039    0.060
=====

```



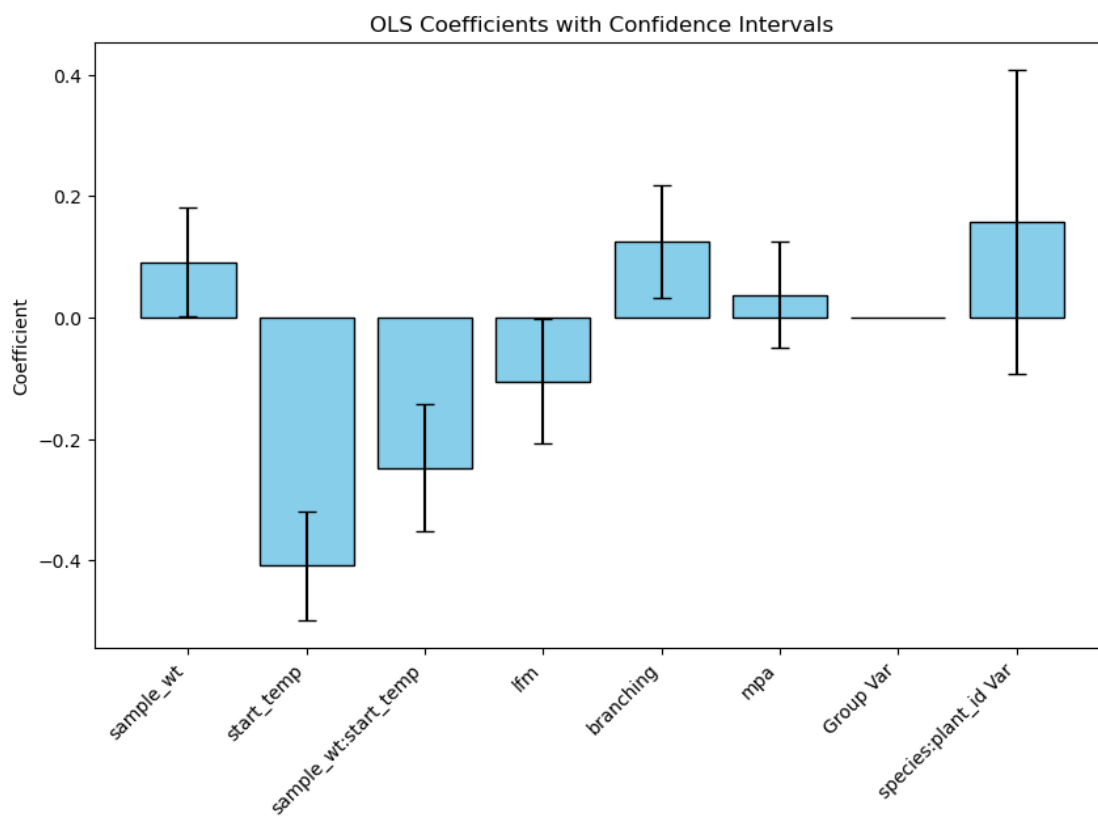
Mixed Linear Model Regression Results

```

=====
Model:              MixedLM    Dependent Variable:  temp_change
No. Observations:   162        Method:                ML
No. Groups:         8          Scale:              0.1985
Min. group size:    2          Log-Likelihood:     -108.8481
Max. group size:    37        Converged:          No
Mean group size:    20.2
=====

```

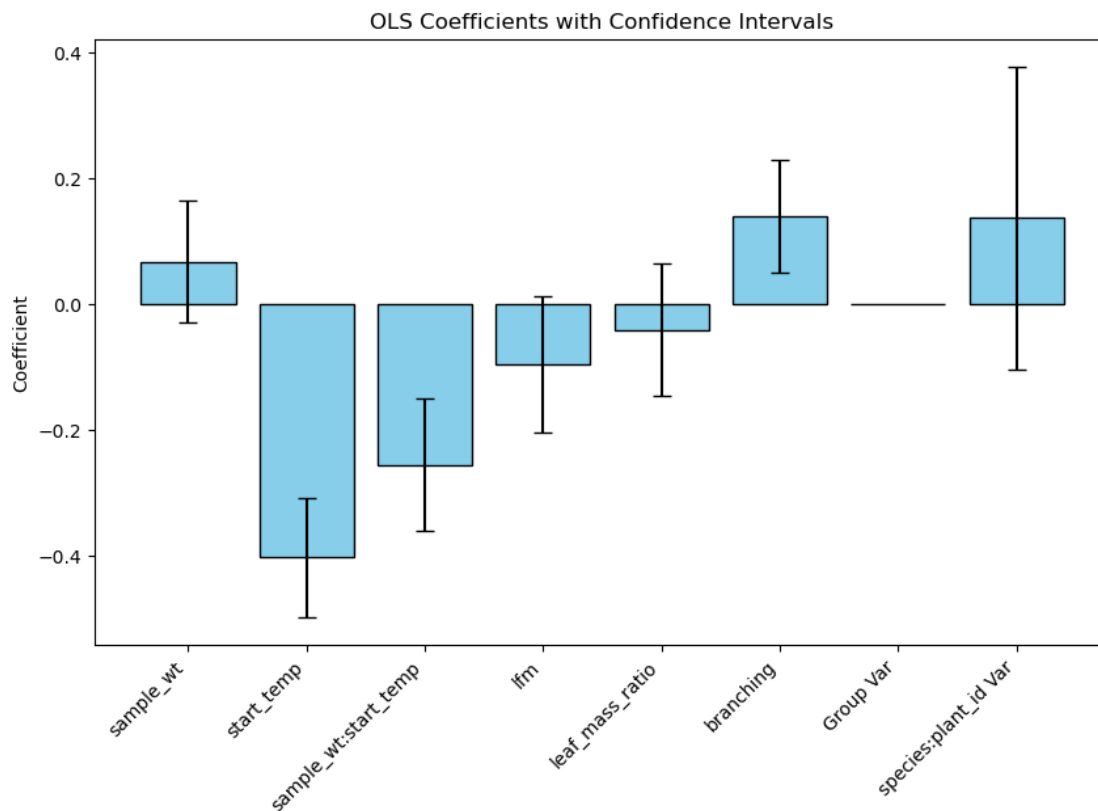
	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.090	0.047	-1.929	0.054	-0.182	0.001
sample_wt	0.092	0.046	1.985	0.047	0.001	0.182
start_temp	-0.409	0.046	-8.958	0.000	-0.499	-0.320
sample_wt:start_temp	-0.248	0.054	-4.637	0.000	-0.353	-0.143
lfm	-0.105	0.052	-2.012	0.044	-0.208	-0.003
branching	0.126	0.047	2.660	0.008	0.033	0.219
mpa	0.037	0.045	0.826	0.409	-0.051	0.125
Group Var	0.000					
species:plant_id Var	0.031	0.057				



Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	temp_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.2014
Min. group size:	2	Log-Likelihood:	-108.8672
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.095	0.046	-2.082	0.037	-0.185	-0.006
sample_wt	0.067	0.050	1.360	0.174	-0.030	0.164
start_temp	-0.402	0.048	-8.330	0.000	-0.497	-0.307
sample_wt:start_temp	-0.255	0.054	-4.762	0.000	-0.360	-0.150
lfm	-0.096	0.055	-1.737	0.082	-0.205	0.012
leaf_mass_ratio	-0.041	0.053	-0.767	0.443	-0.145	0.064
branching	0.139	0.046	3.028	0.002	0.049	0.229
Group Var	0.000					
species:plant_id Var	0.027	0.055				

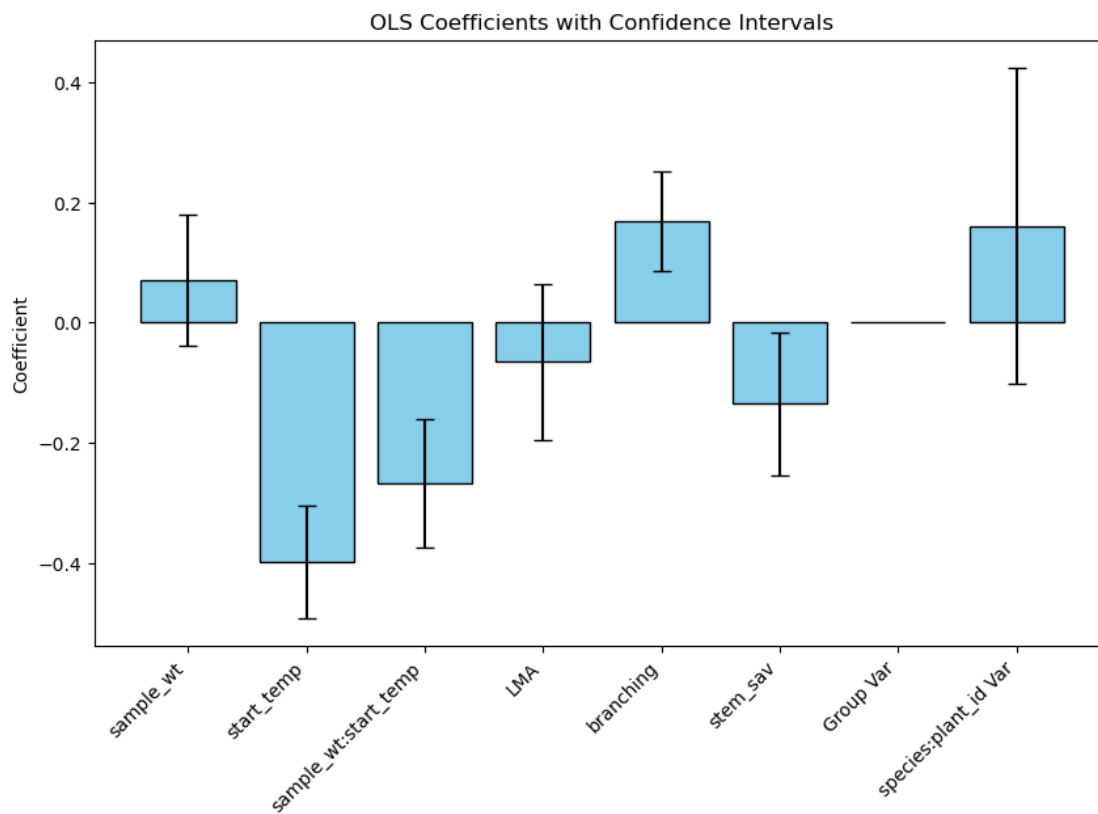


Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	temp_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1983
Min. group size:	2	Log-Likelihood:	-108.8724
Max. group size:	37	Converged:	Yes

Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.103	0.047	-2.201	0.028	-0.195	-0.011
sample_wt	0.071	0.055	1.276	0.202	-0.038	0.179
start_temp	-0.398	0.048	-8.310	0.000	-0.492	-0.304
sample_wt:start_temp	-0.268	0.054	-4.920	0.000	-0.374	-0.161
LMA	-0.066	0.066	-0.998	0.318	-0.195	0.063
branching	0.168	0.042	3.964	0.000	0.085	0.252
stem_sav	-0.135	0.060	-2.243	0.025	-0.254	-0.017
Group Var	0.000					
species:plant_id Var	0.032	0.060				

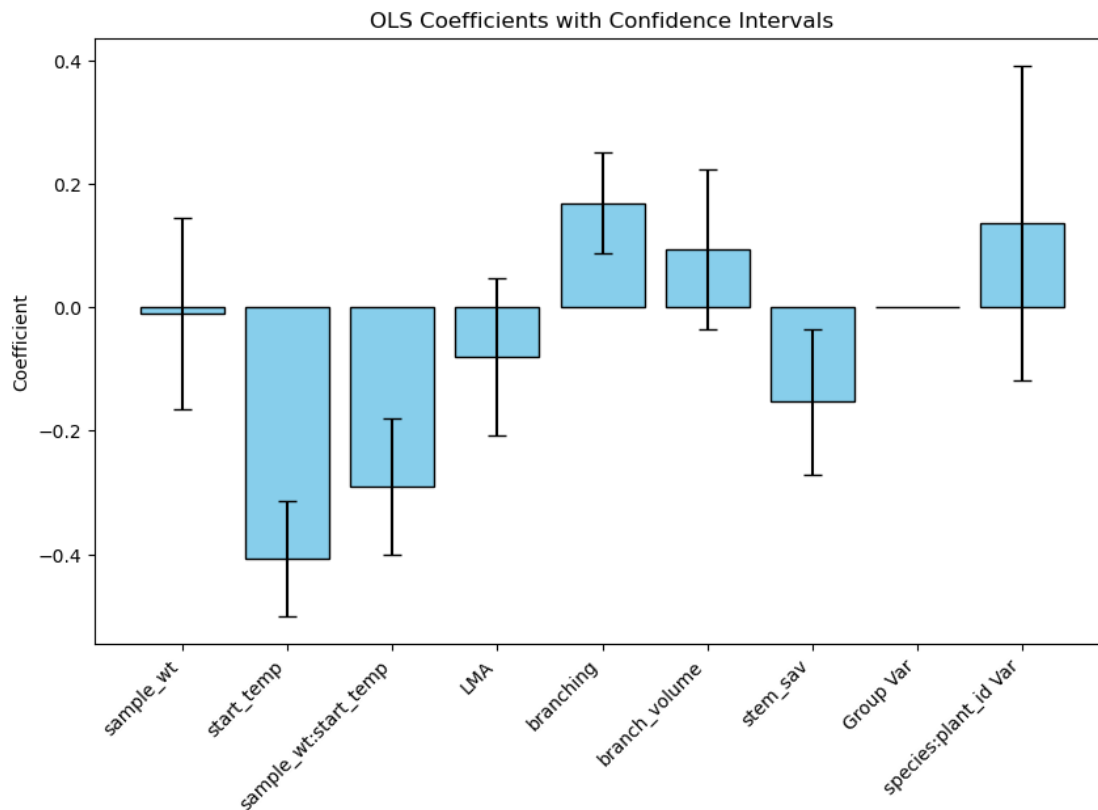


Mixed Linear Model Regression Results

Model:	MixedLM	Dependent Variable:	temp_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1989
Min. group size:	2	Log-Likelihood:	-107.8804

Max. group size: 37 Converged: Yes
Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.109	0.046	-2.388	0.017	-0.199	-0.020
sample_wt	-0.011	0.079	-0.137	0.891	-0.166	0.145
start_temp	-0.407	0.048	-8.559	0.000	-0.500	-0.314
sample_wt:start_temp	-0.291	0.056	-5.178	0.000	-0.401	-0.181
LMA	-0.081	0.065	-1.246	0.213	-0.207	0.046
branching	0.169	0.042	4.020	0.000	0.087	0.251
branch_volume	0.094	0.066	1.422	0.155	-0.035	0.223
stem_sav	-0.153	0.060	-2.541	0.011	-0.271	-0.035
Group Var	0.000					
species:plant_id Var	0.027	0.058				

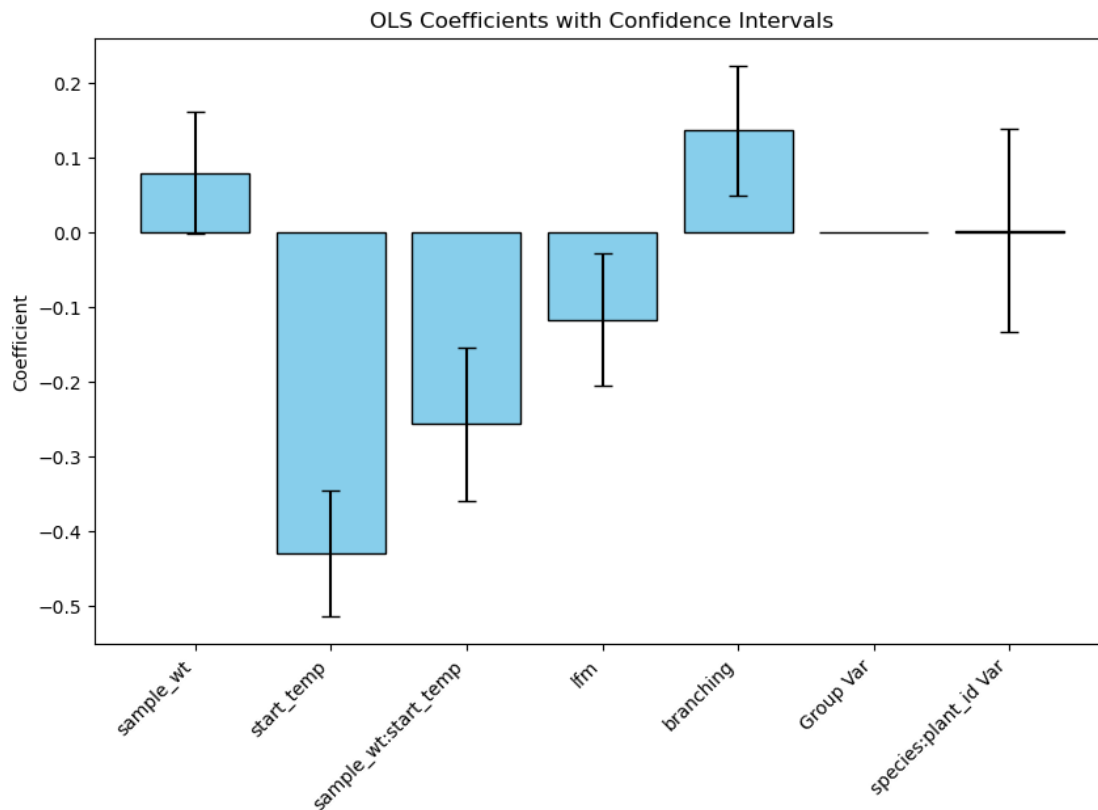


Mixed Linear Model Regression Results

Model: MixedLM Dependent Variable: temp_change
No. Observations: 162 Method: ML

No. Groups: 8 Scale: 0.2270
 Min. group size: 2 Log-Likelihood: -109.8950
 Max. group size: 37 Converged: Yes
 Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.102	0.040	-2.550	0.011	-0.180	-0.024
sample_wt	0.079	0.042	1.899	0.058	-0.003	0.161
start_temp	-0.430	0.043	-10.046	0.000	-0.514	-0.346
sample_wt:start_temp	-0.257	0.052	-4.913	0.000	-0.360	-0.155
lfm	-0.117	0.045	-2.585	0.010	-0.206	-0.028
branching	0.136	0.044	3.070	0.002	0.049	0.223
Group Var	0.000					
species:plant_id Var	0.000	0.033				

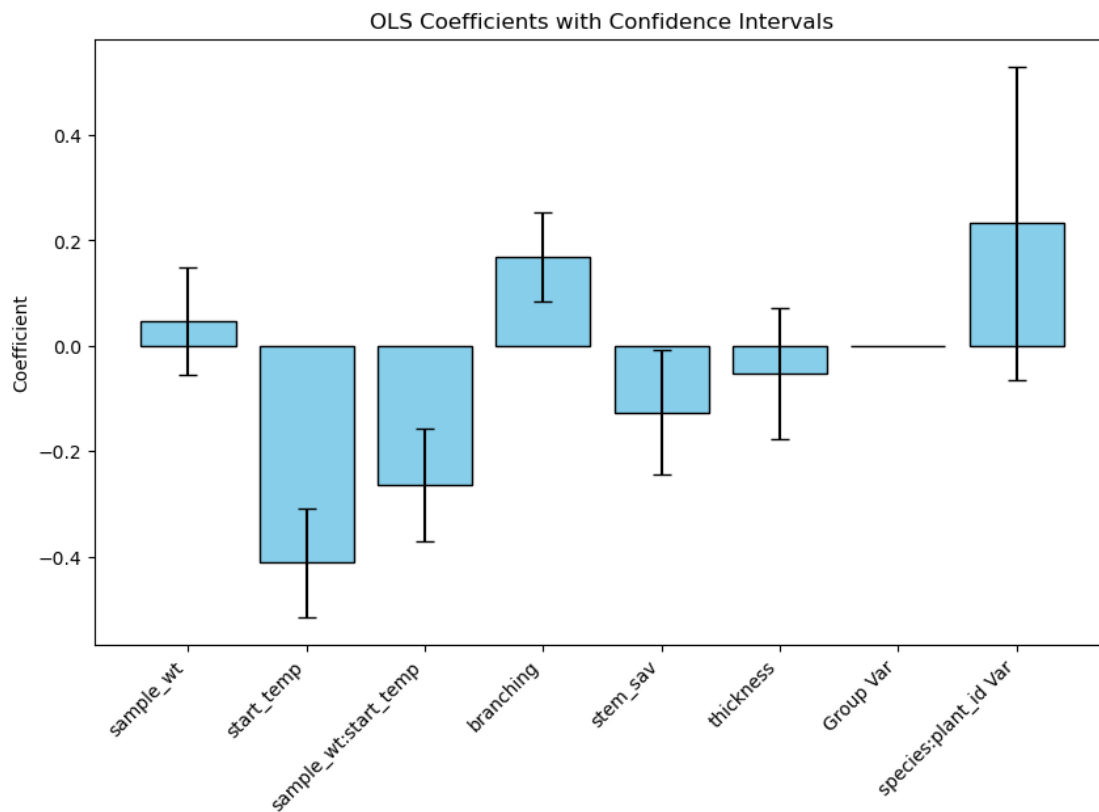


Mixed Linear Model Regression Results

Model: MixedLM Dependent Variable: temp_change
 No. Observations: 162 Method: ML

No. Groups: 8 Scale: 0.1906
 Min. group size: 2 Log-Likelihood: -109.0103
 Max. group size: 37 Converged: Yes
 Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.102	0.049	-2.080	0.037	-0.198	-0.006
sample_wt	0.047	0.052	0.901	0.368	-0.055	0.150
start_temp	-0.411	0.053	-7.817	0.000	-0.514	-0.308
sample_wt:start_temp	-0.264	0.055	-4.836	0.000	-0.371	-0.157
branching	0.168	0.043	3.882	0.000	0.083	0.253
stem_sav	-0.126	0.060	-2.089	0.037	-0.245	-0.008
thickness	-0.052	0.063	-0.817	0.414	-0.176	0.072
Group Var	0.000					
species:plant_id Var	0.044	0.066				

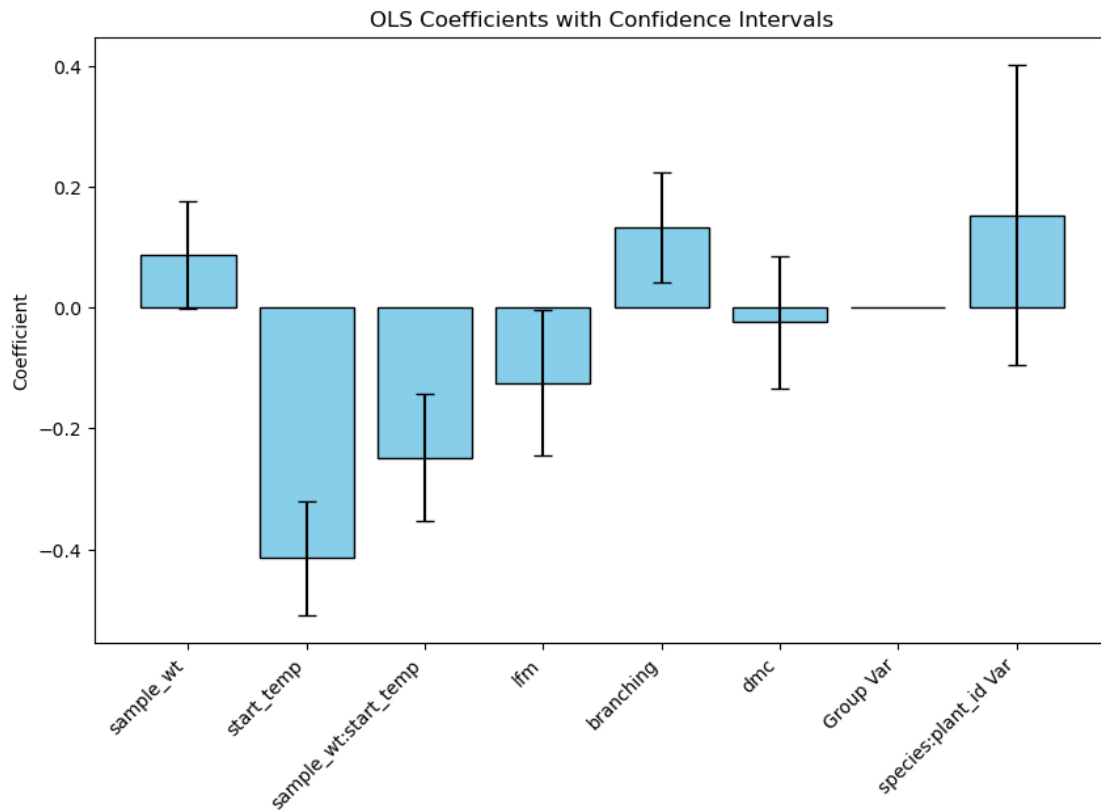


Mixed Linear Model Regression Results

Model: MixedLM Dependent Variable: temp_change

No. Observations: 162 Method: ML
 No. Groups: 8 Scale: 0.1997
 Min. group size: 2 Log-Likelihood: -109.0624
 Max. group size: 37 Converged: Yes
 Mean group size: 20.2

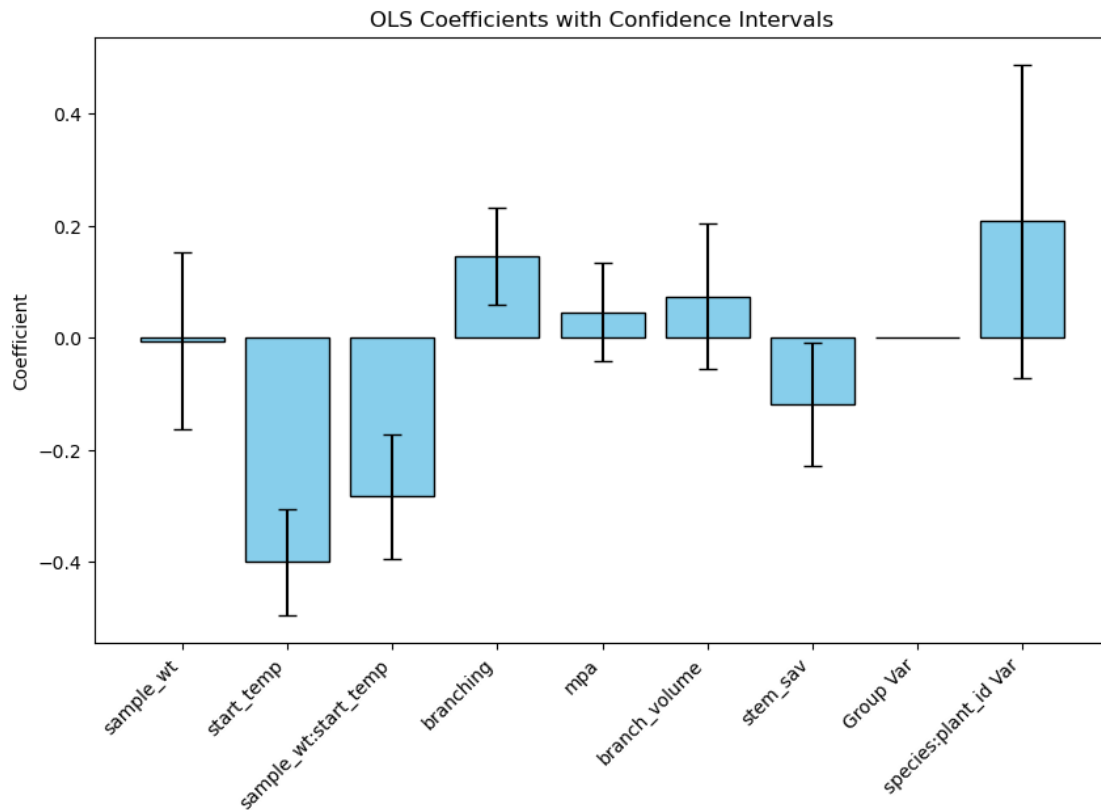
	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.091	0.046	-1.960	0.050	-0.182	-0.000
sample_wt	0.088	0.046	1.922	0.055	-0.002	0.177
start_temp	-0.415	0.048	-8.638	0.000	-0.509	-0.321
sample_wt:start_temp	-0.248	0.054	-4.627	0.000	-0.353	-0.143
lfm	-0.125	0.062	-2.024	0.043	-0.245	-0.004
branching	0.132	0.047	2.841	0.004	0.041	0.223
dmc	-0.024	0.056	-0.430	0.667	-0.133	0.085
Group Var	0.000					
species:plant_id Var	0.031	0.057				



Mixed Linear Model Regression Results

Model: MixedLM Dependent Variable: temp_change
 No. Observations: 162 Method: ML
 No. Groups: 8 Scale: 0.1911
 Min. group size: 2 Log-Likelihood: -108.0762
 Max. group size: 37 Converged: No
 Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.103	0.048	-2.129	0.033	-0.197	-0.008
sample_wt	-0.006	0.081	-0.075	0.940	-0.165	0.153
start_temp	-0.400	0.048	-8.292	0.000	-0.495	-0.306
sample_wt:start_temp	-0.284	0.057	-4.991	0.000	-0.395	-0.172
branching	0.145	0.044	3.279	0.001	0.058	0.232
mpa	0.046	0.045	1.010	0.312	-0.043	0.134
branch_volume	0.074	0.066	1.119	0.263	-0.056	0.203
stem_sav	-0.119	0.056	-2.145	0.032	-0.228	-0.010
Group Var	0.000					
species:plant_id Var	0.040	0.062				



Mixed Linear Model Regression Results

```

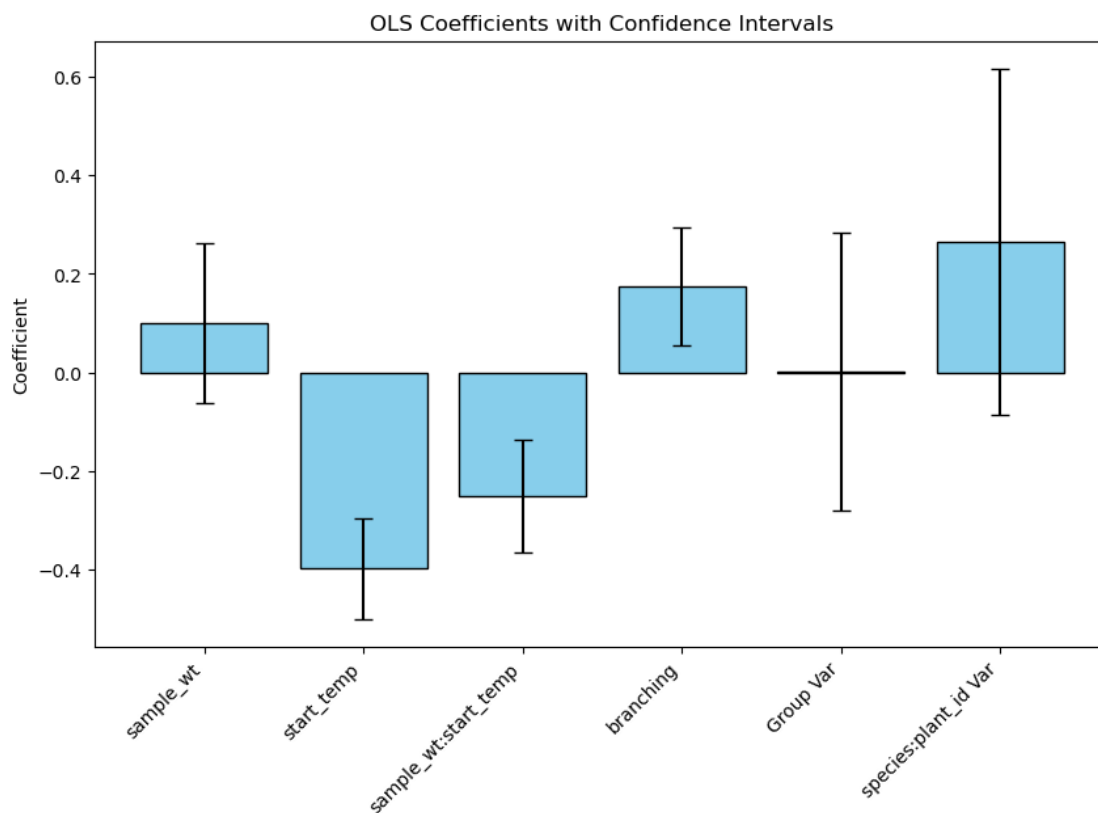
=====
Model:                MixedLM   Dependent Variable:  temp_change
No. Observations:    162       Method:              ML
No. Groups:          8         Scale:             0.1924
Min. group size:     2         Log-Likelihood:    -111.2144
Max. group size:     37       Converged:         No
Mean group size:     20.2
=====

```

```

-----
                Coef.  Std.Err.   z    P>|z|  [0.025  0.975]
-----
Intercept          -0.091    0.052  -1.758  0.079  -0.192   0.010
sample_wt           0.100    0.083   1.205  0.228  -0.063   0.262
start_temp         -0.398    0.052  -7.612  0.000  -0.501  -0.296
sample_wt:start_temp -0.251    0.059  -4.279  0.000  -0.366  -0.136
branching           0.175    0.061   2.870  0.004   0.055   0.294
Group Var           0.000    0.063
species:plant_id Var 0.051    0.079
=====

```



Mixed Linear Model Regression Results

```

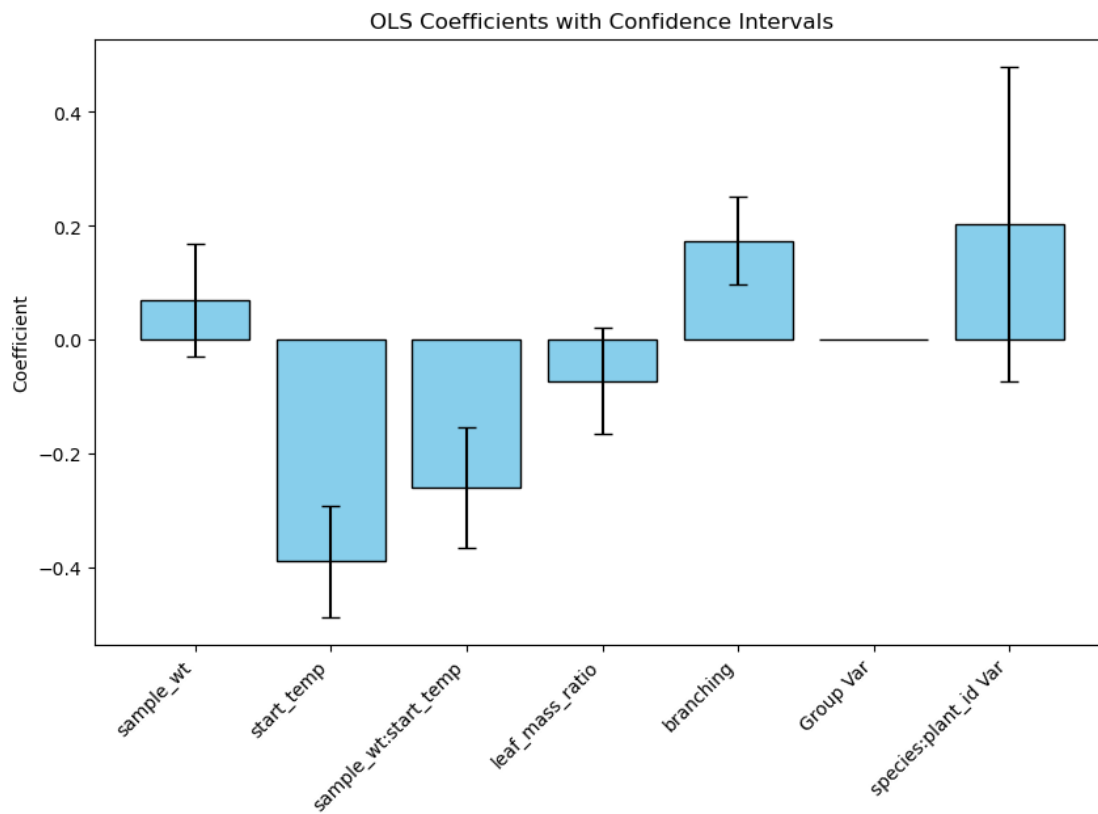
=====
Model:                MixedLM   Dependent Variable:  temp_change
No. Observations:    162       Method:                ML
No. Groups:          8         Scale:                0.1967
Min. group size:     2         Log-Likelihood:       -110.2737
Max. group size:     37        Converged:             Yes
Mean group size:     20.2
=====

```

```

-----
                Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.097    0.048 -2.012 0.044 -0.191 -0.002
sample_wt           0.070    0.050  1.393 0.164 -0.029  0.169
start_temp        -0.389    0.050 -7.825 0.000 -0.486 -0.291
sample_wt:start_temp -0.259    0.054 -4.765 0.000 -0.366 -0.153
leaf_mass_ratio    -0.072    0.048 -1.517 0.129 -0.166  0.021
branching           0.175    0.039  4.431 0.000  0.097  0.252
Group Var           0.000
species:plant_id Var 0.040    0.062
=====

```



7 Heat Flux Change

```
[13]: yvar='heat_flux_change'
      cols=cols_use
      df=flam
      compare_predictors_mixedeff(df, cols, yvar)
```

	cols	aics	pvals	coefs	top_mod
0	thickness	412.755489	0.018575	8.731548e-01	True
1	mpa	411.997205	-0.076142	3.758305e-01	True
2	dmc	410.897627	0.147214	1.630031e-01	True
3	species	410.286512	-1.035451	4.592281e-02	False
4	branching	410.177288	0.127608	1.048537e-01	False
5	leaf_mass_ratio	410.129840	-0.209494	8.185376e-02	False
6	leaf_sav	409.878494	-0.232572	8.228504e-02	False
7	start_temp	408.717362	0.185878	4.241968e-02	False
8	lfm	407.170292	-0.341791	1.955246e-02	False
9	stem_sav	405.824626	-0.375070	1.278106e-03	False
10	LMA	394.396642	0.515376	2.286915e-06	False
11	branch_volume	384.376755	0.397924	7.332081e-09	False
12	sample_wt	329.865131	0.683418	1.428780e-20	False

```
[14]: AIC_iterator(flam, cols_use, Y_VAR='heat_flux_change',
                  minnumsingle=mns, maxnumsingle=mxs, minnumint=mni, maxnumint=mxl)
```

ERROR: Formula model error: heat_flux_change ~ leaf_sav*thickness

Columns present in sig. interaction terms: {'sample_wt', 'start_temp'}

Total Num. Cols : Num. Sig. Int. Cols; 13 : 2

Significant Interactions:
('sample_wt', 'start_temp')

Number of formulas: 2048

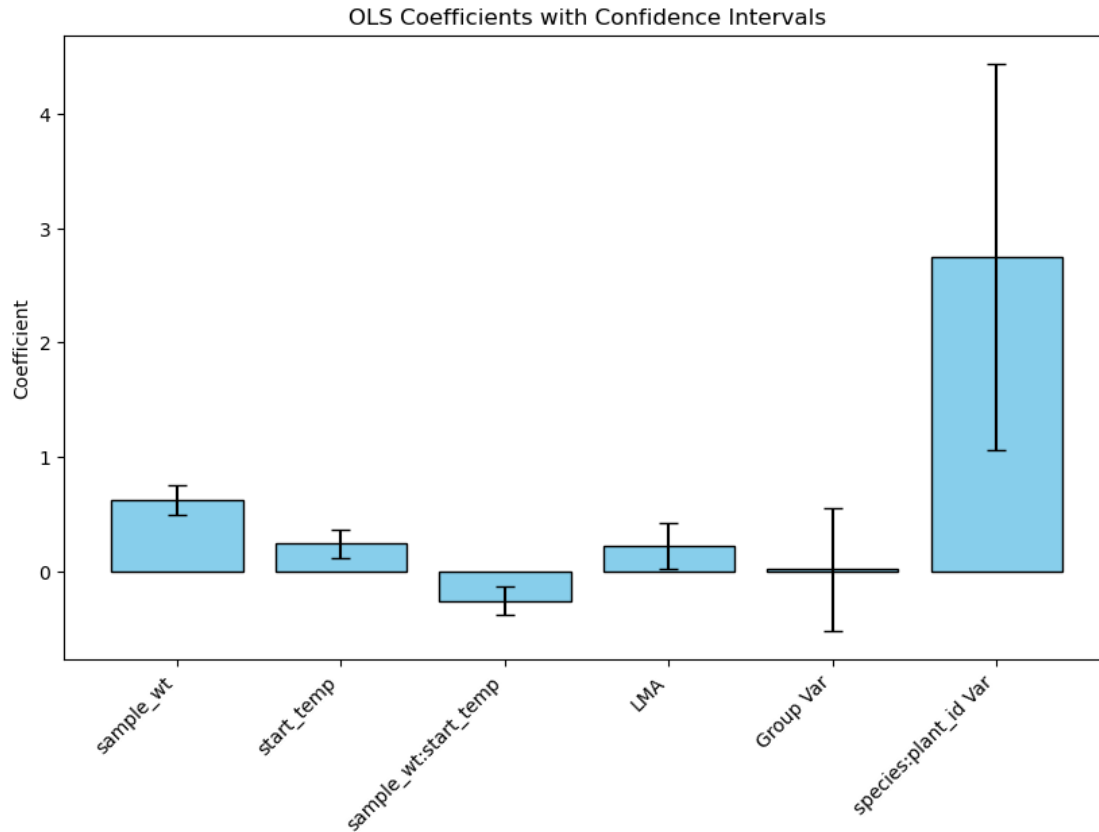
```
heat_flux_change ~ sample_wt*start_temp + LMA
heat_flux_change ~ sample_wt*start_temp + LMA + leaf_mass_ratio
heat_flux_change ~ sample_wt*start_temp + LMA + branching
heat_flux_change ~ sample_wt*start_temp + LMA + thickness
heat_flux_change ~ sample_wt*start_temp + lfm + LMA
heat_flux_change ~ sample_wt*start_temp + LMA + leaf_mass_ratio + dmc
heat_flux_change ~ sample_wt*start_temp + LMA + stem_sav
heat_flux_change ~ sample_wt*start_temp + LMA + leaf_sav
heat_flux_change ~ sample_wt*start_temp + LMA + leaf_mass_ratio + thickness
heat_flux_change ~ sample_wt*start_temp + LMA + mpa
heat_flux_change ~ sample_wt*start_temp + LMA + branch_volume
```

```
heat_flux_change ~ sample_wt*start_temp + lfm + LMA + leaf_mass_ratio
heat_flux_change ~ sample_wt*start_temp + LMA + dmc
```

Mixed Linear Model Regression Results

```
=====
Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:          8       Scale:                0.1730
Min. group size:     2       Log-Likelihood:      -143.5655
Max. group size:     37      Converged:           Yes
Mean group size:     20.2

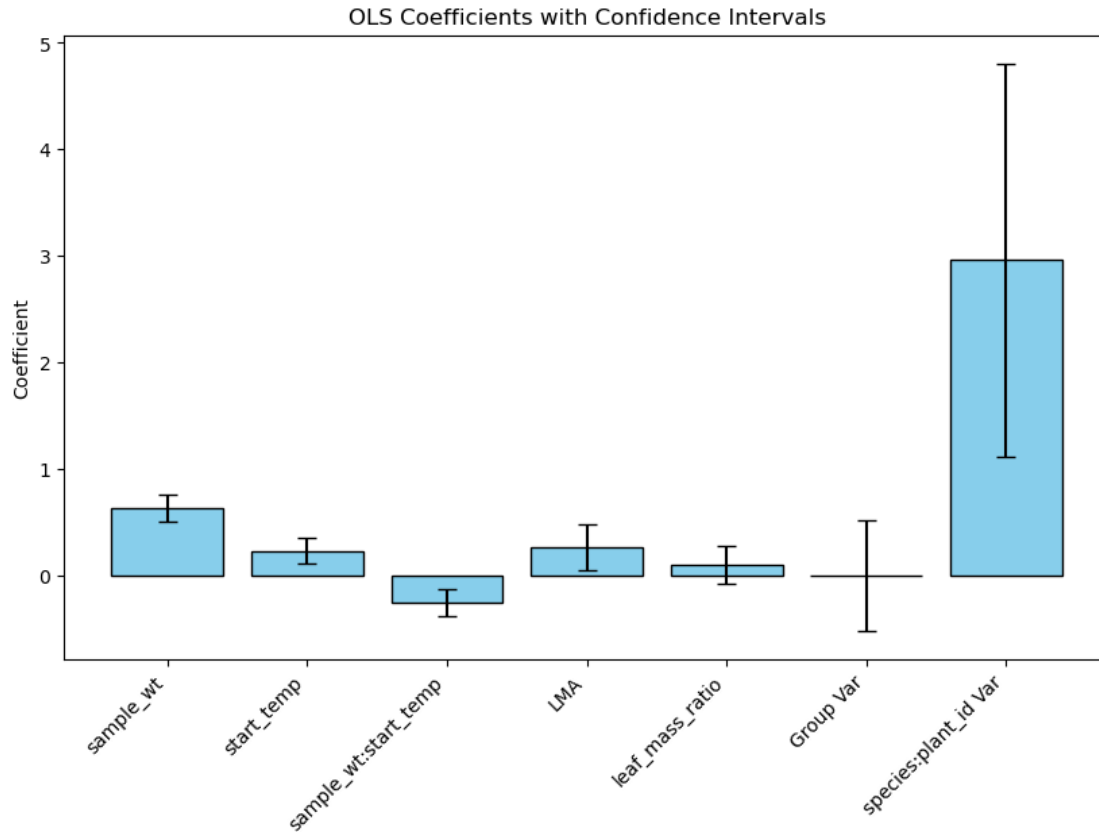
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.115    0.107 -1.070 0.285 -0.325  0.096
sample_wt           0.623    0.067  9.249 0.000  0.491  0.755
start_temp          0.241    0.063  3.856 0.000  0.119  0.364
sample_wt:start_temp -0.257    0.065 -3.938 0.000 -0.385 -0.129
LMA                 0.222    0.104  2.128 0.033  0.018  0.427
Group Var           0.003    0.114
species:plant_id Var 0.476    0.358
=====
```

Mixed Linear Model Regression Results

```
=====
Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:           8       Scale:              0.1683
Min. group size:      2       Log-Likelihood:   -142.9470
Max. group size:      37      Converged:         Yes
Mean group size:      20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.114    0.107 -1.064 0.287  -0.324  0.096
sample_wt           0.632    0.066  9.571 0.000   0.503  0.761
start_temp          0.232    0.062  3.730 0.000   0.110  0.355
sample_wt:start_temp -0.258    0.065 -3.989 0.000  -0.385 -0.131
LMA                 0.265    0.112  2.374 0.018   0.046  0.484
leaf_mass_ratio      0.101    0.091  1.109 0.267  -0.077  0.279
Group Var           0.000    0.109
species:plant_id Var 0.499    0.386
=====
```



Mixed Linear Model Regression Results

```

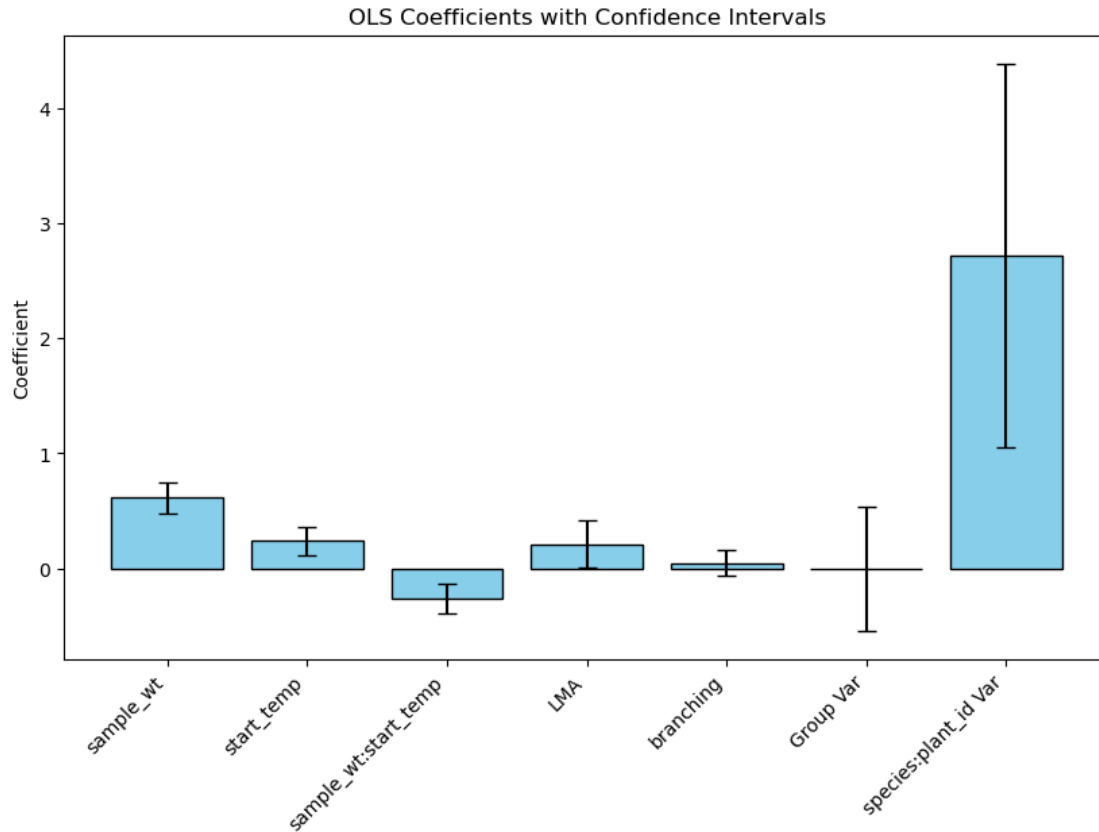
=====
Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:          8       Scale:              0.1729
Min. group size:     2       Log-Likelihood:   -143.1523
Max. group size:     37      Converged:        Yes
Mean group size:     20.2
=====

```

```

-----
                Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.110    0.105 -1.050 0.294 -0.315  0.095
sample_wt           0.616    0.068  9.078 0.000  0.483  0.749
start_temp          0.240    0.062  3.855 0.000  0.118  0.362
sample_wt:start_temp -0.258    0.065 -3.949 0.000 -0.387 -0.130
LMA                 0.211    0.104  2.025 0.043  0.007  0.416
branching           0.049    0.055  0.896 0.370 -0.058  0.156
Group Var           0.000    0.115
species:plant_id Var 0.471    0.354
=====

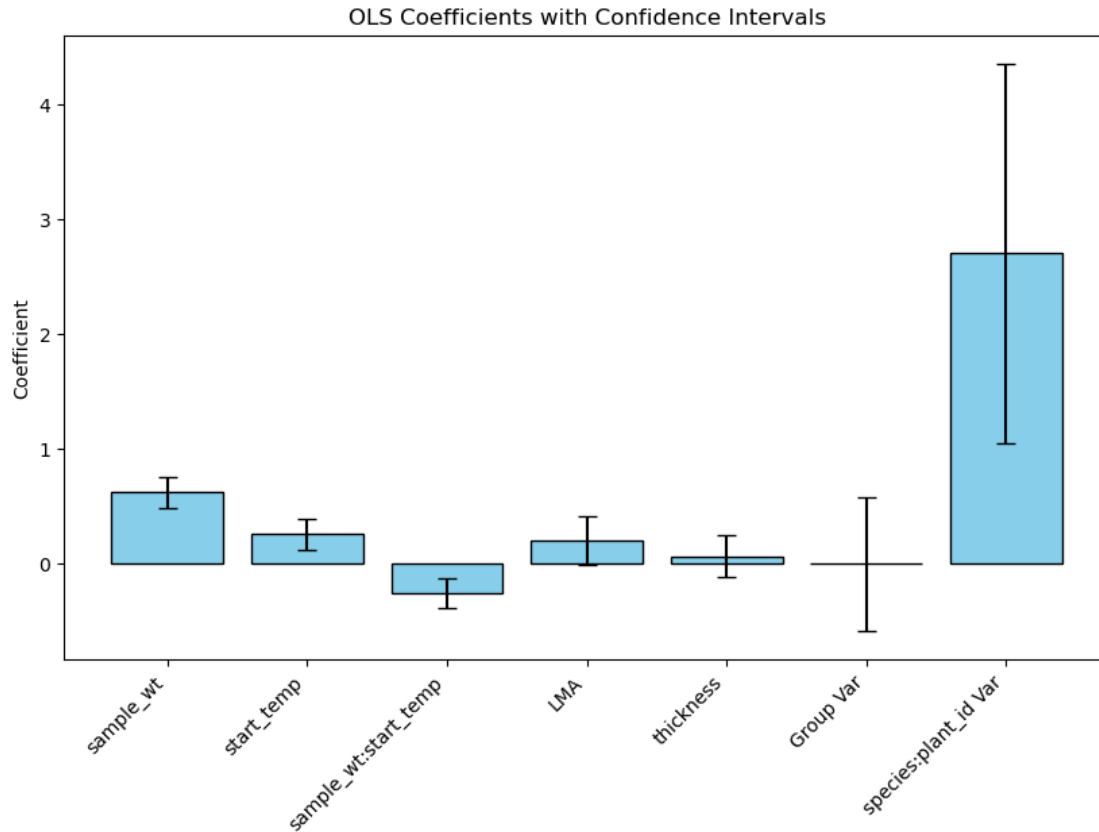
```



Mixed Linear Model Regression Results

```
=====
Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:          8       Scale:              0.1736
Min. group size:     2       Log-Likelihood:   -143.2780
Max. group size:     37      Converged:        Yes
Mean group size:     20.2
=====
```

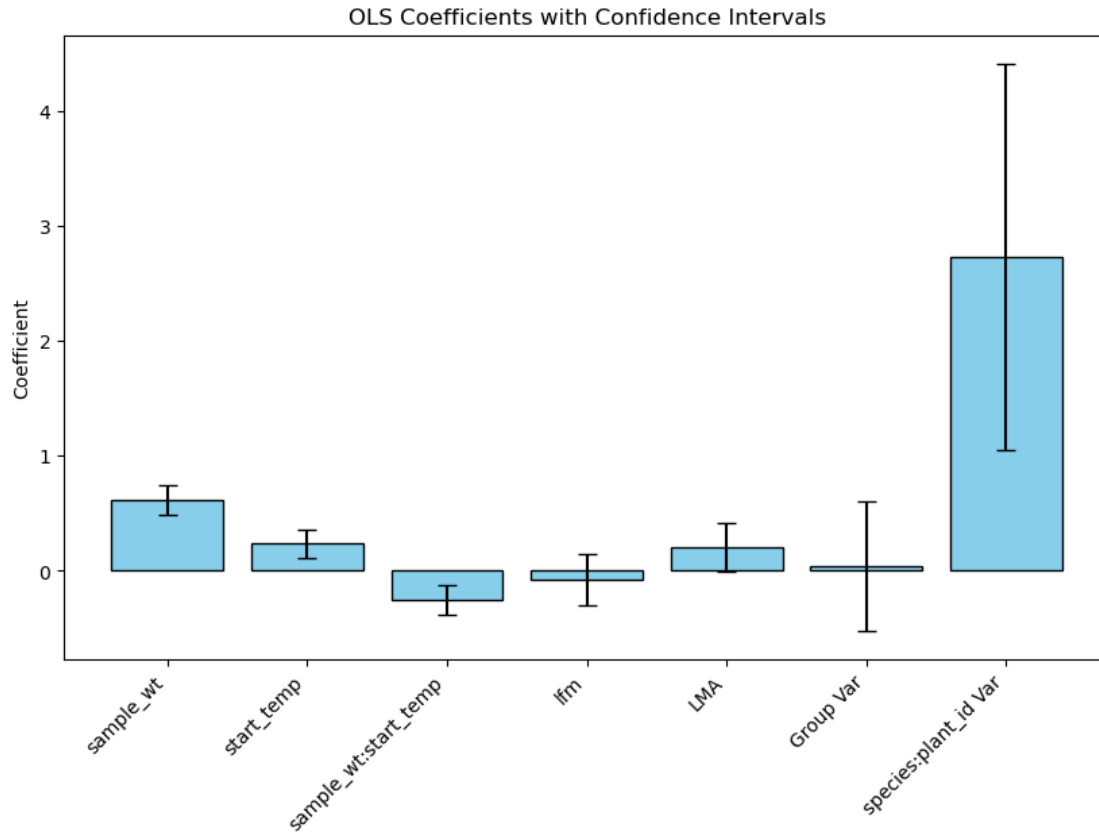
```
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.109    0.105 -1.038 0.299 -0.315  0.097
sample_wt           0.622    0.068  9.121 0.000  0.488  0.755
start_temp          0.260    0.068  3.801 0.000  0.126  0.394
sample_wt:start_temp -0.254    0.066 -3.845 0.000 -0.383 -0.124
LMA                 0.206    0.107  1.922 0.055 -0.004  0.416
thickness           0.067    0.092  0.730 0.466 -0.113  0.248
Group Var           0.000    0.123
species:plant_id Var 0.469    0.351
=====
```



Mixed Linear Model Regression Results

```
=====
Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:           8       Scale:              0.1724
Min. group size:      2       Log-Likelihood:    -143.3172
Max. group size:      37      Converged:         Yes
Mean group size:      20.2
=====
```

```
-----
              Coef.  Std.Err.   z    P>|z| [0.025 0.975]
-----
Intercept          -0.111    0.109 -1.018 0.309 -0.324  0.103
sample_wt           0.619    0.067  9.199 0.000  0.487  0.751
start_temp          0.237    0.063  3.784 0.000  0.114  0.360
sample_wt:start_temp -0.257    0.065 -3.958 0.000 -0.385 -0.130
lfm                 -0.077    0.111 -0.692 0.489 -0.295  0.141
LMA                 0.203    0.108  1.883 0.060 -0.008  0.415
Group Var           0.007    0.119
species:plant_id Var 0.471    0.357
=====
```

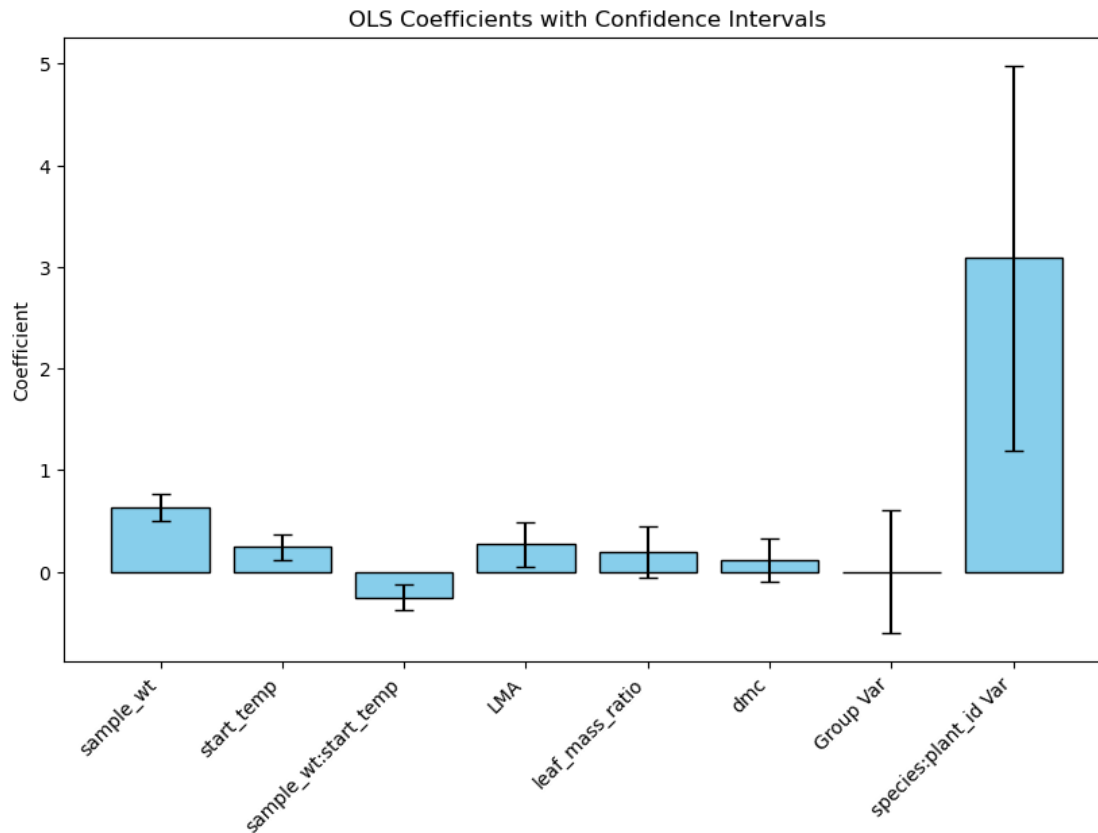


Mixed Linear Model Regression Results

```
=====
Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:          8       Scale:                0.1653
Min. group size:     2       Log-Likelihood:   -142.4004
Max. group size:     37      Converged:         Yes
Mean group size:     20.2
=====
```

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.108	0.108	-1.000	0.317	-0.318	0.103
sample_wt	0.631	0.066	9.576	0.000	0.502	0.760
start_temp	0.241	0.063	3.851	0.000	0.118	0.364
sample_wt:start_temp	-0.256	0.065	-3.962	0.000	-0.383	-0.129
LMA	0.270	0.111	2.434	0.015	0.053	0.488
leaf_mass_ratio	0.197	0.130	1.513	0.130	-0.058	0.452
dmc	0.111	0.109	1.022	0.307	-0.102	0.325
Group Var	0.000	0.125				
species:plant_id Var	0.510	0.393				

=====



Mixed Linear Model Regression Results

```

=====
Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:          8       Scale:              0.1726
Min. group size:     2       Log-Likelihood:   -143.4082
Max. group size:     37      Converged:        Yes
Mean group size:     20.2
=====

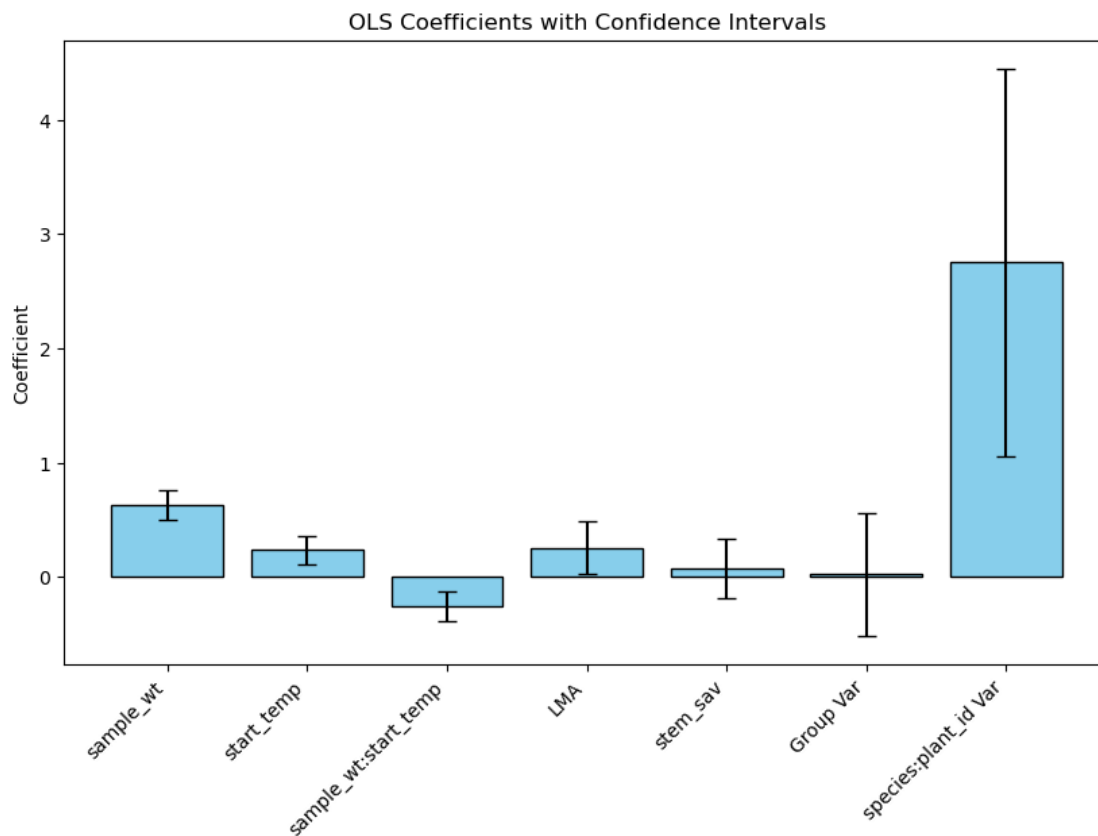
```

```

-----
              Coef.  Std.Err.   z    P>|z|  [0.025  0.975]
-----
Intercept          -0.109    0.109  -1.001  0.317  -0.322   0.104
sample_wt           0.628    0.067   9.303  0.000   0.496   0.760
start_temp          0.237    0.063   3.760  0.000   0.113   0.360
sample_wt:start_temp -0.258    0.065  -3.951  0.000  -0.386  -0.130
LMA                 0.253    0.118   2.143  0.032   0.022   0.485
stem_sav            0.074    0.134   0.554  0.580  -0.189   0.337
Group Var           0.004    0.114
species:plant_id Var 0.475    0.359
-----

```

=====



Mixed Linear Model Regression Results

=====

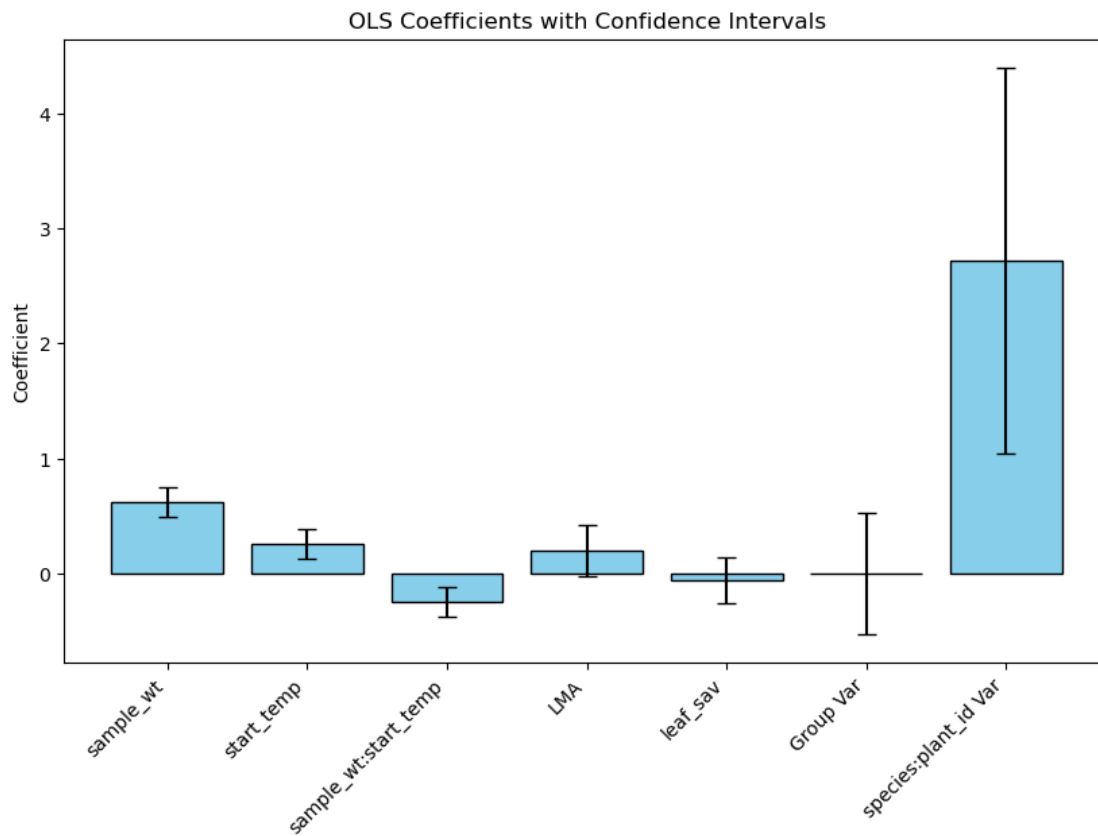
```

Model:                MixedLM Dependent Variable: heat_flux_change
No. Observations:    162      Method:                ML
No. Groups:          8       Scale:              0.1735
Min. group size:     2       Log-Likelihood:   -143.4101
Max. group size:     37      Converged:        Yes
Mean group size:     20.2
  
```

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.114	0.105	-1.082	0.279	-0.320	0.092
sample_wt	0.619	0.068	9.123	0.000	0.486	0.752
start_temp	0.253	0.066	3.823	0.000	0.123	0.383
sample_wt:start_temp	-0.254	0.066	-3.858	0.000	-0.382	-0.125
LMA	0.198	0.113	1.758	0.079	-0.023	0.419
leaf_sav	-0.057	0.102	-0.558	0.577	-0.257	0.143
Group Var	0.000	0.112				

species:plant_id Var 0.472 0.357

=====



Mixed Linear Model Regression Results

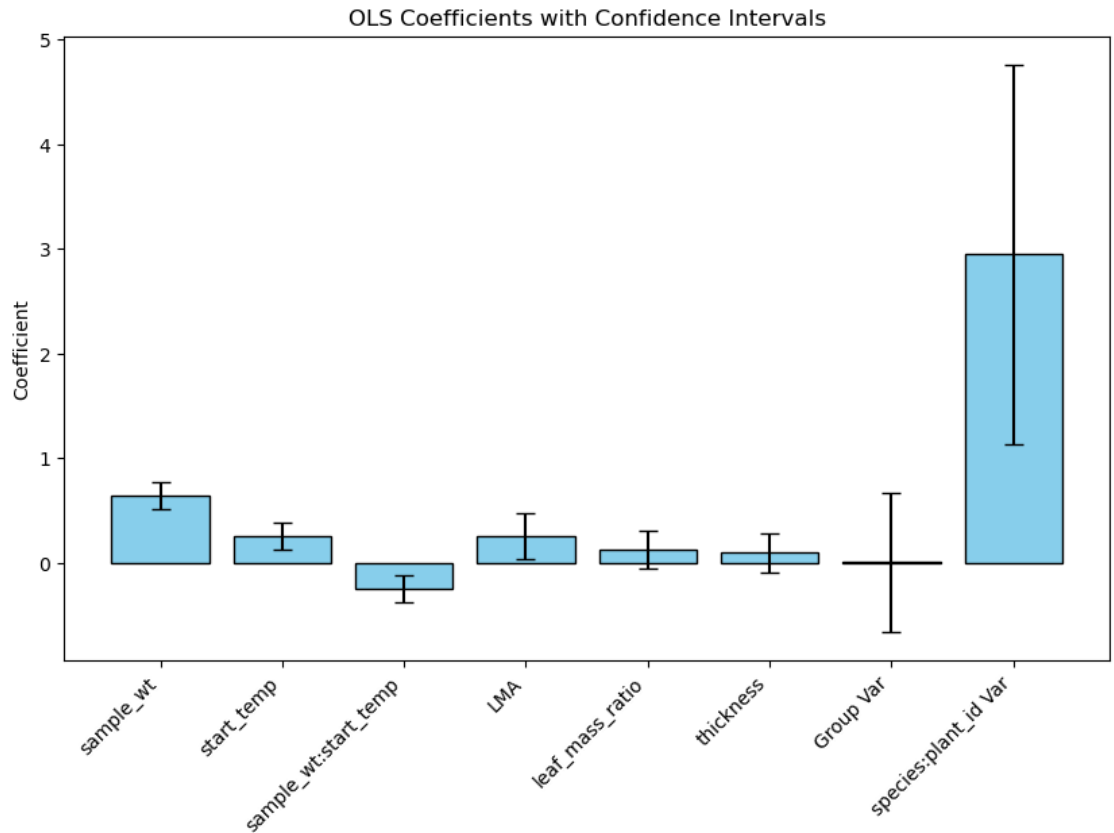
=====

Model: MixedLM Dependent Variable: heat_flux_change
 No. Observations: 162 Method: ML
 No. Groups: 8 Scale: 0.1676
 Min. group size: 2 Log-Likelihood: -142.4251
 Max. group size: 37 Converged: Yes
 Mean group size: 20.2

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.104	0.106	-0.976	0.329	-0.313	0.105
sample_wt	0.634	0.066	9.566	0.000	0.504	0.764
start_temp	0.255	0.067	3.802	0.000	0.124	0.387
sample_wt:start_temp	-0.255	0.066	-3.881	0.000	-0.384	-0.126
LMA	0.253	0.114	2.227	0.026	0.030	0.476
leaf_mass_ratio	0.121	0.093	1.305	0.192	-0.061	0.304

thickness	0.092	0.096	0.956	0.339	-0.097	0.281
Group Var	0.000	0.138				
species:plant_id Var	0.493	0.379				

=====



Mixed Linear Model Regression Results

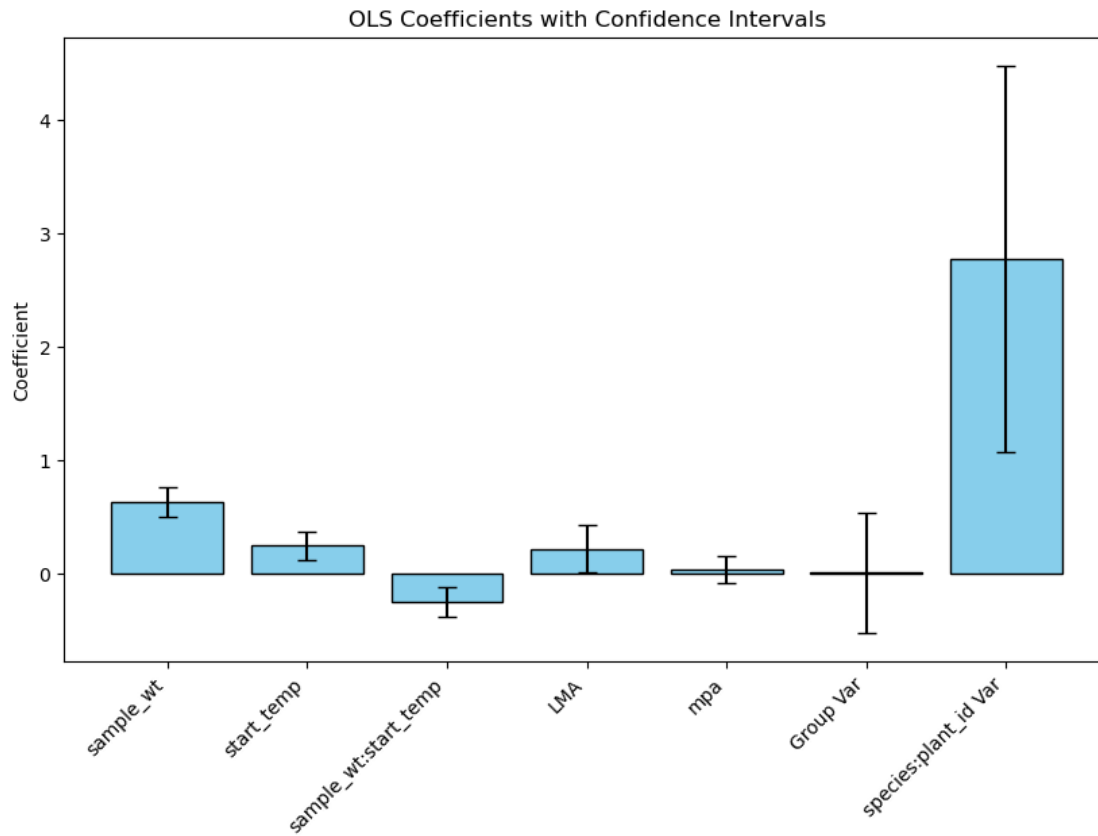
=====

Model:	MixedLM	Dependent Variable:	heat_flux_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1726
Min. group size:	2	Log-Likelihood:	-143.4378
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.111	0.106	-1.045	0.296	-0.319	0.097
sample_wt	0.629	0.068	9.201	0.000	0.495	0.763
start_temp	0.243	0.062	3.897	0.000	0.121	0.365
sample_wt:start_temp	-0.253	0.066	-3.840	0.000	-0.382	-0.124

LMA	0.217	0.104	2.073	0.038	0.012	0.421
mpa	0.030	0.059	0.506	0.613	-0.086	0.145
Group Var	0.001	0.112				
species:plant_id Var	0.478	0.361				

=====



Mixed Linear Model Regression Results

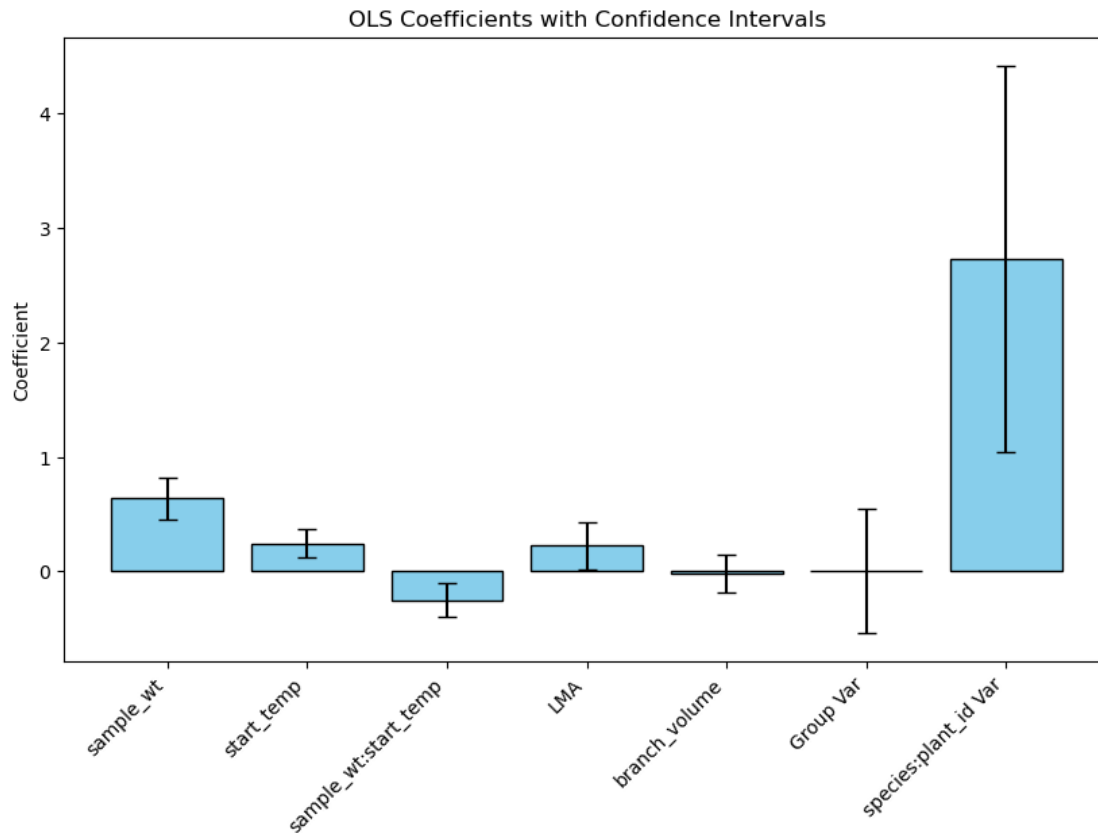
=====

Model:	MixedLM	Dependent Variable:	heat_flux_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1735
Min. group size:	2	Log-Likelihood:	-143.5438
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.114	0.106	-1.078	0.281	-0.321	0.093
sample_wt	0.636	0.092	6.887	0.000	0.455	0.817
start_temp	0.244	0.063	3.836	0.000	0.119	0.368

sample_wt:start_temp	-0.250	0.073	-3.440	0.001	-0.393	-0.108
LMA	0.224	0.104	2.149	0.032	0.020	0.428
branch_volume	-0.017	0.083	-0.208	0.835	-0.180	0.146
Group Var	0.001	0.115				
species:plant_id Var	0.474	0.358				

=====



Mixed Linear Model Regression Results

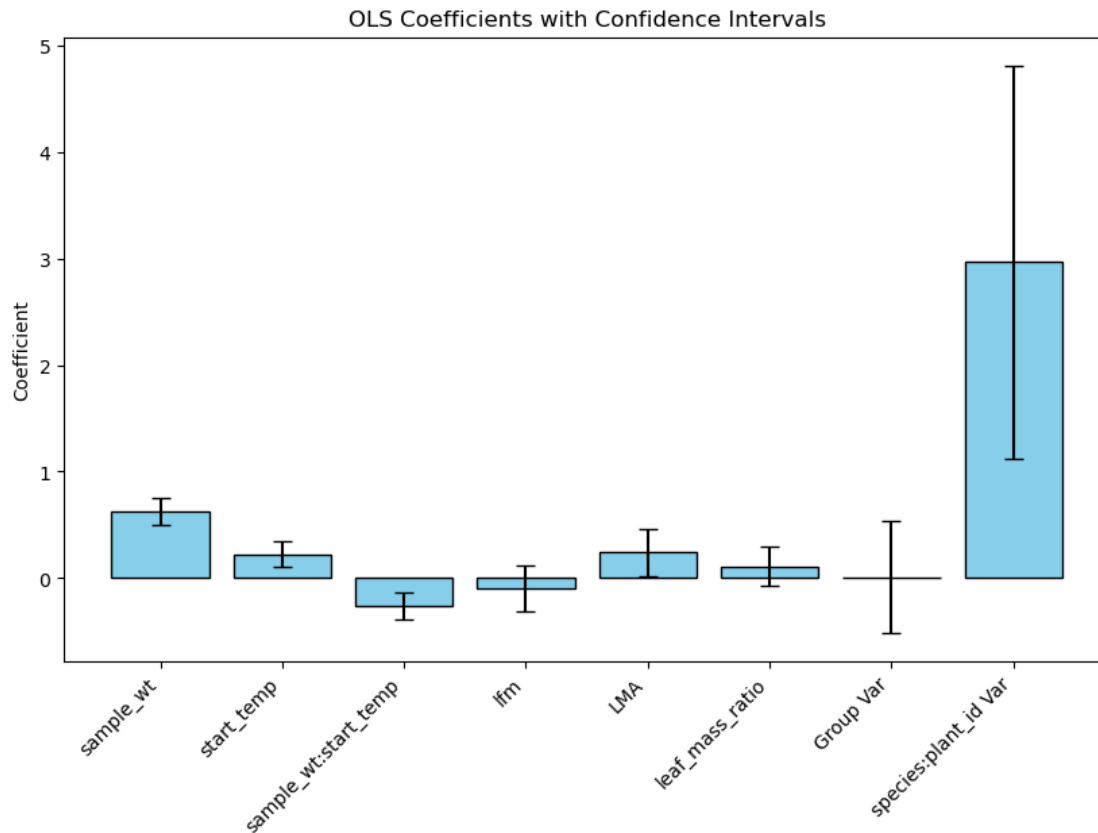
=====

Model:	MixedLM	Dependent Variable:	heat_flux_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1674
Min. group size:	2	Log-Likelihood:	-142.5567
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

	Coef.	Std.Err.	z	P> z	[0.025	0.975]
Intercept	-0.109	0.107	-1.015	0.310	-0.319	0.101
sample_wt	0.627	0.066	9.527	0.000	0.498	0.756

start_temp	0.226	0.062	3.620	0.000	0.104	0.348
sample_wt:start_temp	-0.258	0.064	-4.000	0.000	-0.384	-0.132
lfm	-0.097	0.111	-0.872	0.383	-0.315	0.121
LMA	0.245	0.113	2.164	0.030	0.023	0.467
leaf_mass_ratio	0.113	0.092	1.234	0.217	-0.067	0.293
Group Var	0.002	0.109				
species:plant_id Var	0.496	0.385				

=====



Mixed Linear Model Regression Results

=====

Model:	MixedLM	Dependent Variable:	heat_flux_change
No. Observations:	162	Method:	ML
No. Groups:	8	Scale:	0.1730
Min. group size:	2	Log-Likelihood:	-143.5633
Max. group size:	37	Converged:	Yes
Mean group size:	20.2		

Coef.	Std.Err.	z	P> z	[0.025 0.975]
-------	----------	---	------	---------------

Intercept	-0.115	0.108	-1.067	0.286	-0.326	0.096
sample_wt	0.623	0.068	9.171	0.000	0.490	0.756
start_temp	0.240	0.064	3.759	0.000	0.115	0.366
sample_wt:start_temp	-0.257	0.065	-3.934	0.000	-0.386	-0.129
LMA	0.224	0.108	2.081	0.037	0.013	0.435
dmc	-0.005	0.076	-0.068	0.946	-0.154	0.144
Group Var	0.003	0.115				
species:plant_id Var	0.476	0.359				

=====

