



NECN-H Testing Results

FALL 2016

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Process Parameter Testing

Methods

This testing set was used to determine the impact of process parameters on the NECN-H extension of the LANDIS-II model. Process Parameters were tested at 10%, 50%,100%,150%,200% and 1000% of initial values for single cells. Original values were derived from previous runs on the Lake Tahoe Basin Region. Landscapes were tested at 10%, 50%,100% and 200% initial values. All other values in a test were left at original values. Single cell tests were run for 500 years, while landscape tests were run over 100 years. These tests were conducted using the NECN-H extension to the LANDIS-II Model, using specifications for the Lake Tahoe Basin Region.

Major Results

Atmospheric nitrogen values for both intercept and slope had the highest impact on the NEEC (net ecosystem exchange of carbon), SOMTC (soil organic material: total carbon) AGB (above ground biomass) and AGNPPC (above ground: net primary productivity of carbon) output values. As these values are lowered nitrogen becomes limiting in the system and total growth declines. Values do not however decline in single cell testing of the atmospheric nitrogen intercept until set low enough to limit nitrogen in the system.

Decay Rate of Soil Organic matter of the surface also correlated positively with NEEC but had a negative impact on AGB and SOMTC. This same pattern can be seen with the decay rate of SOM 2(Soil organic matter pool two). These positive correlations with NEEC in the decay rate of SOM 2 equalized after the first 60-80 years after which NEEC levels were roughly equal to one another.

Probability of establishment had a direct positive correlation to NEEC, AGB, SOMTC, and AGNPPC, which is to be expected. As more trees establish these values all increase. Decay rate of Soil organic matter 3 may have some negative impact on SOMTC when set at higher levels, though for the most part no change occurs. Decay rate of SOM 1 was the most interesting with values closer to the mean showed increased SOMTC, AGB and AGNPPC values, while the values further from the mean showed decreased values.

Process Parameter	Original Values
Probability Establishment	1.0
Initial Mineral Nitrogen	3.0
Atmospheric Nitrogen Slope	.08
Atmospheric Nitrogen Intercept	.005
Latitude	39.02
Denitrification Rate	.5
Decay Rate Surface	.4
Decay Rate Soil Organic Material Pool 1	1.0
Decay Rate Soil Organic Material Pool 2	.02
Decay Rate Soil Organic Material Pool 3	.002

Process Parameter Testing Summary

Single Cell	Atm. N Intercept	Atm. N Slope	Denitrification Rate	DR. Surf	DR. SOM 1	DR. SOM 2	DR. SOM 3	Initial Min N	Prob. Est
NEEC	TC(+)	DC(+)	NC	PC(-)	NC	NC	NC	NC	
SOMTC	TC(+)	DC(+)	NC	DC (-)	PC (+/-)	DC(-)	DC(-)	NC	
AGB	TC(+)	DC(+)	NC	NC	DC (-)	NC	NC	NC	
AG NPPC	TC(+)	DC(+)	NC	NC	NC	NC	NC	NC	
BG NPPC	TC(+)	DC(+)	NC	NC	NC	NC	NC	NC	
Landscape									
NEEC	NC	DC(+)	NC	NC	NC	IC(+)	NC	NC	DC(+)
SOMTC	DC(+)	DC(+)	NC	DC (-)	TC(-)	TC(-)	NC	NC	DC(+)
AGB	DC(+)	DC(+)	NC	DC (-)	DC(-)	DC(-)	NC	NC	DC(+)
AGNPPC	TC(+)	TC(+)	NC	NC	NC	NC	NC	NC	DC(+)

Summary table for testing results:

DC: Direct correlation

NC: No correlation

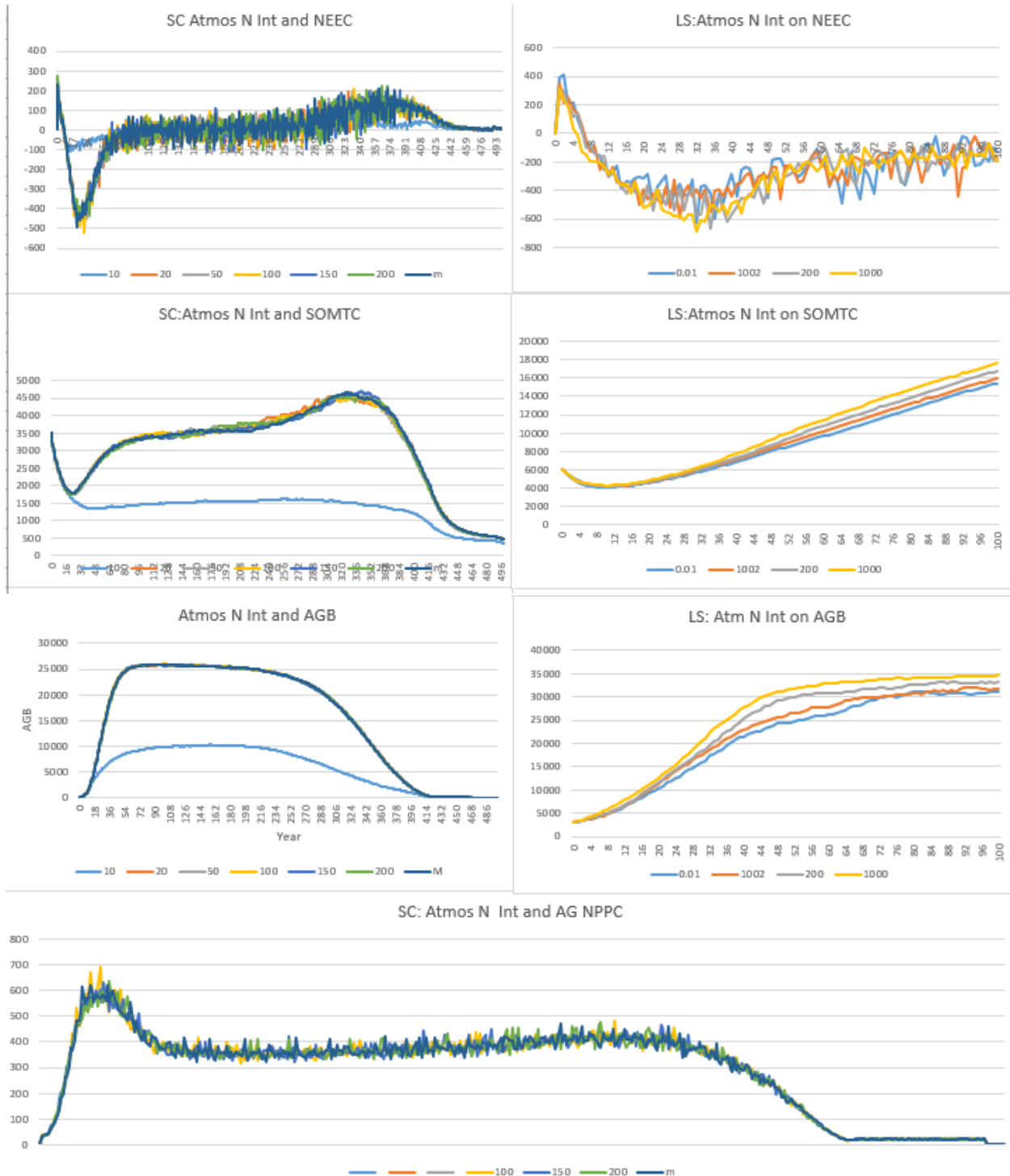
IC: Initial correlation: The observed metric rises in the beginning but has no long term observable impact

TC: Threshold correlation: The observed metric has no observable impact up into a point and then alters the output

(+)-Positive Correlation

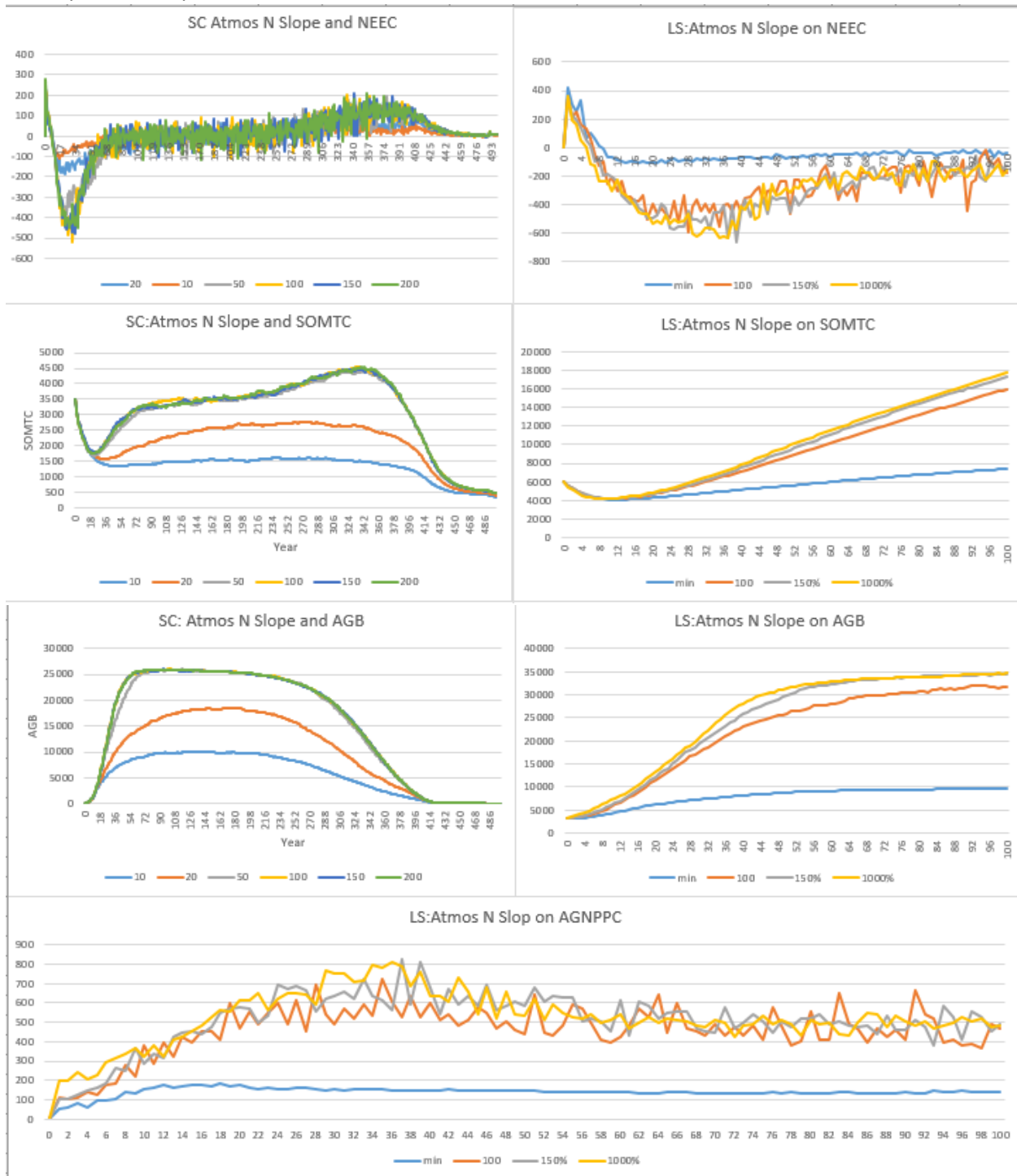
(-)-Negative correlation

Atmosphere N Intercept



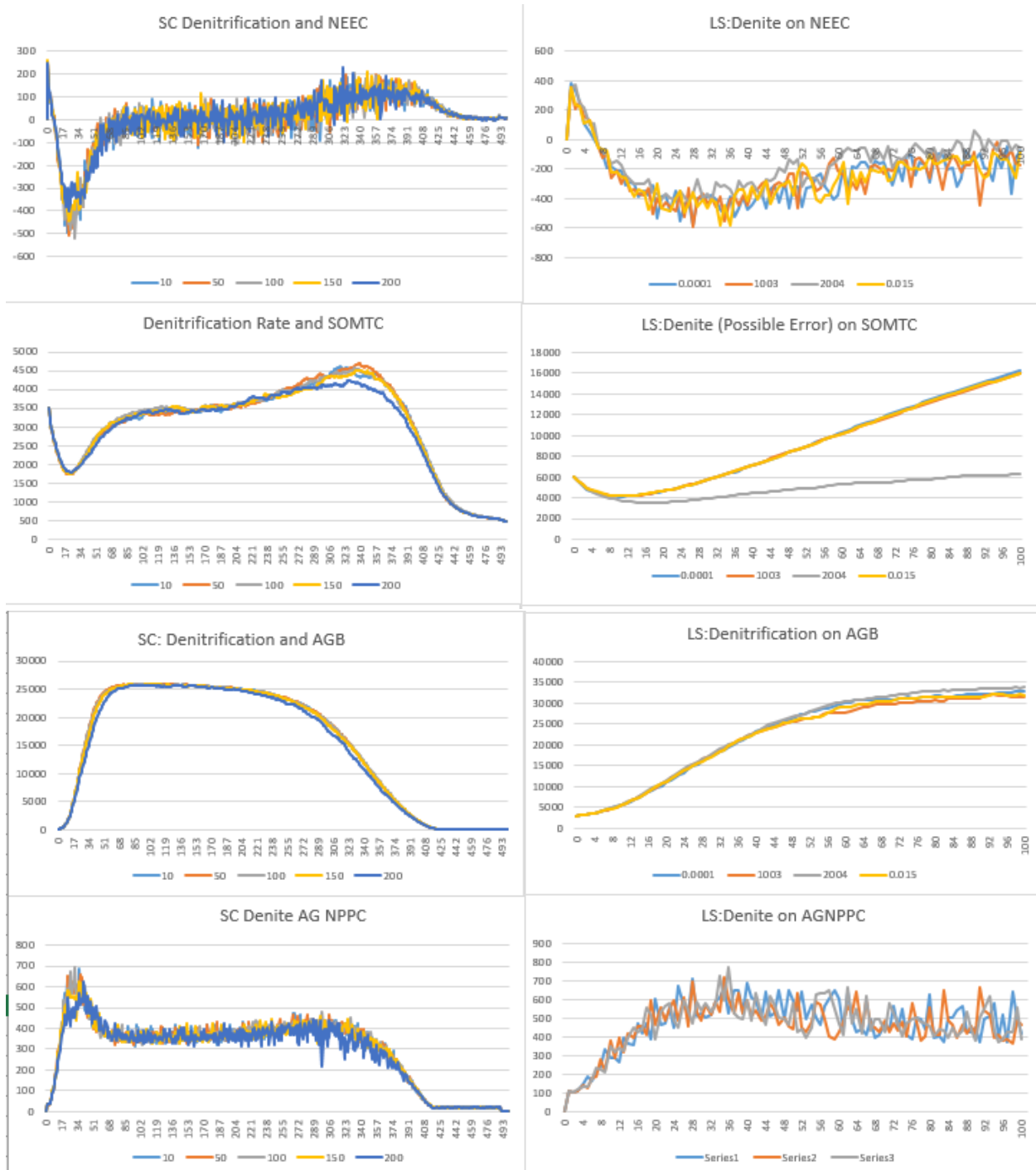
Atmosphere N intercept primarily impacts NEEC, SOMTC, and AGB, when set low enough to cause a lack of nitrogen availability. On the landscape scale, it does correlate to lower SOMTC and AGB

Atmosphere N Slope



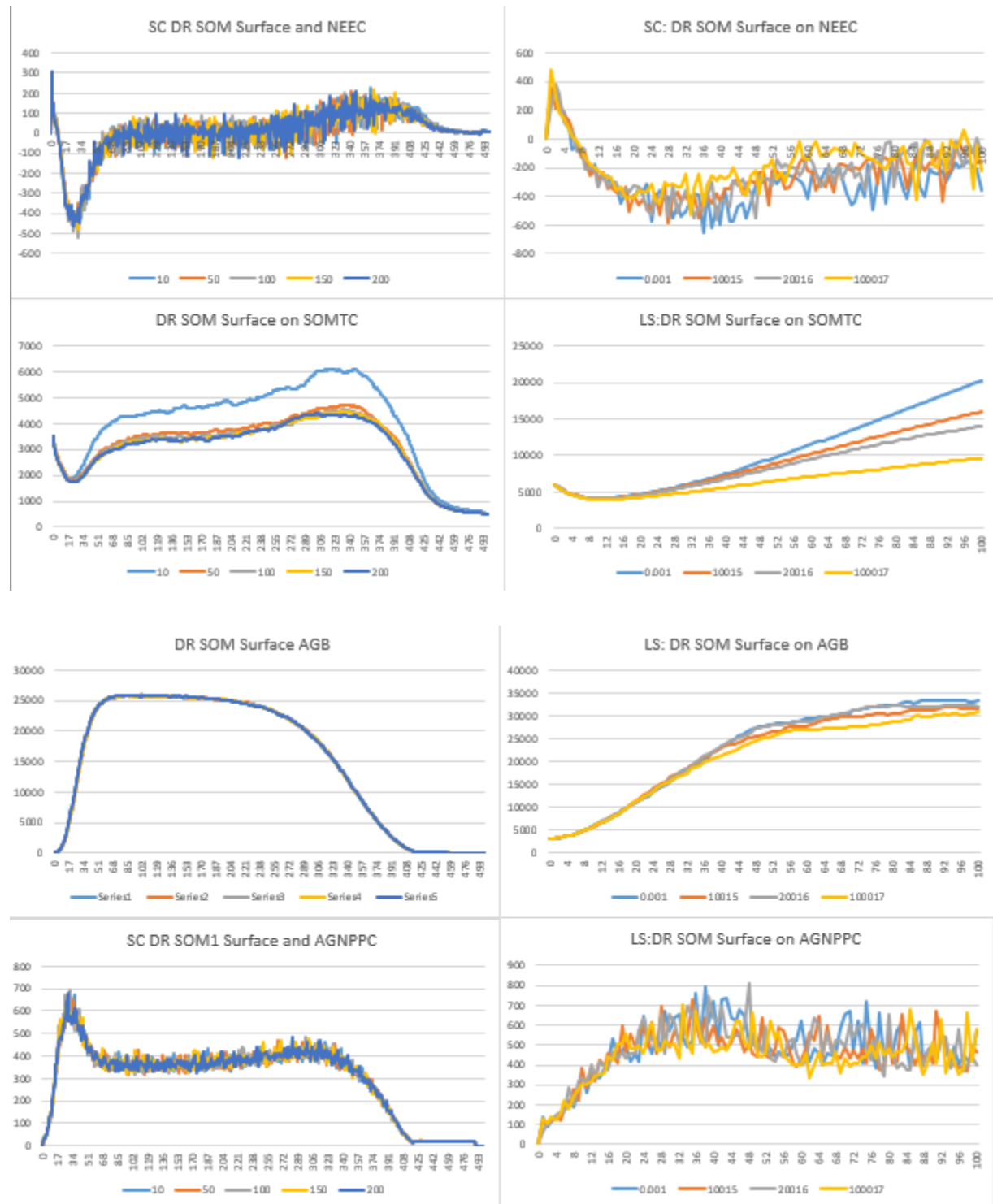
Denitrification

Atmosphere N slope: Impacts all four outputs, though NEEC is impacted less in the long run.



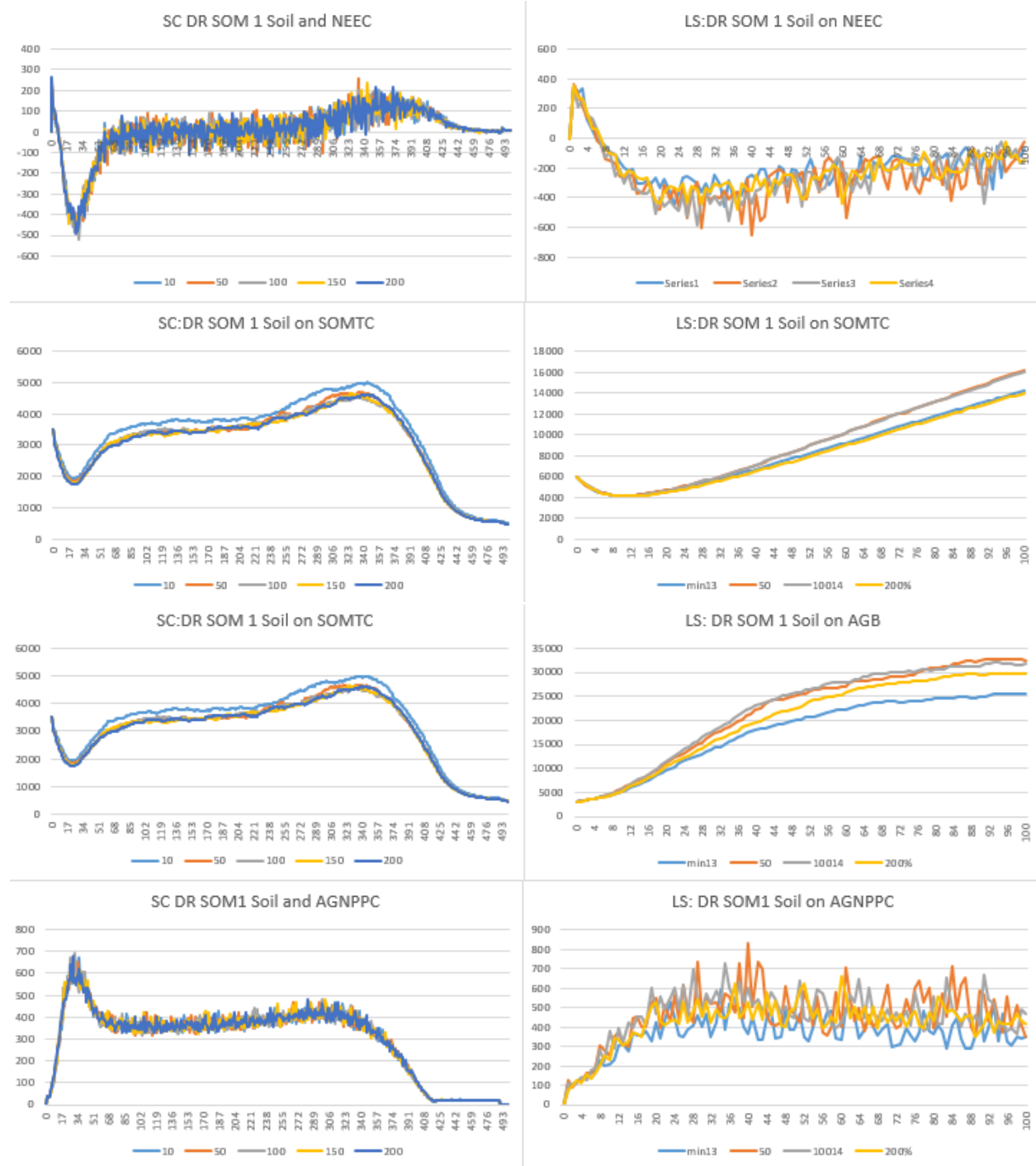
Denitrification has an impact on initial single cell NEEC level though it does not persist in the long run.

Decay Rate Surface



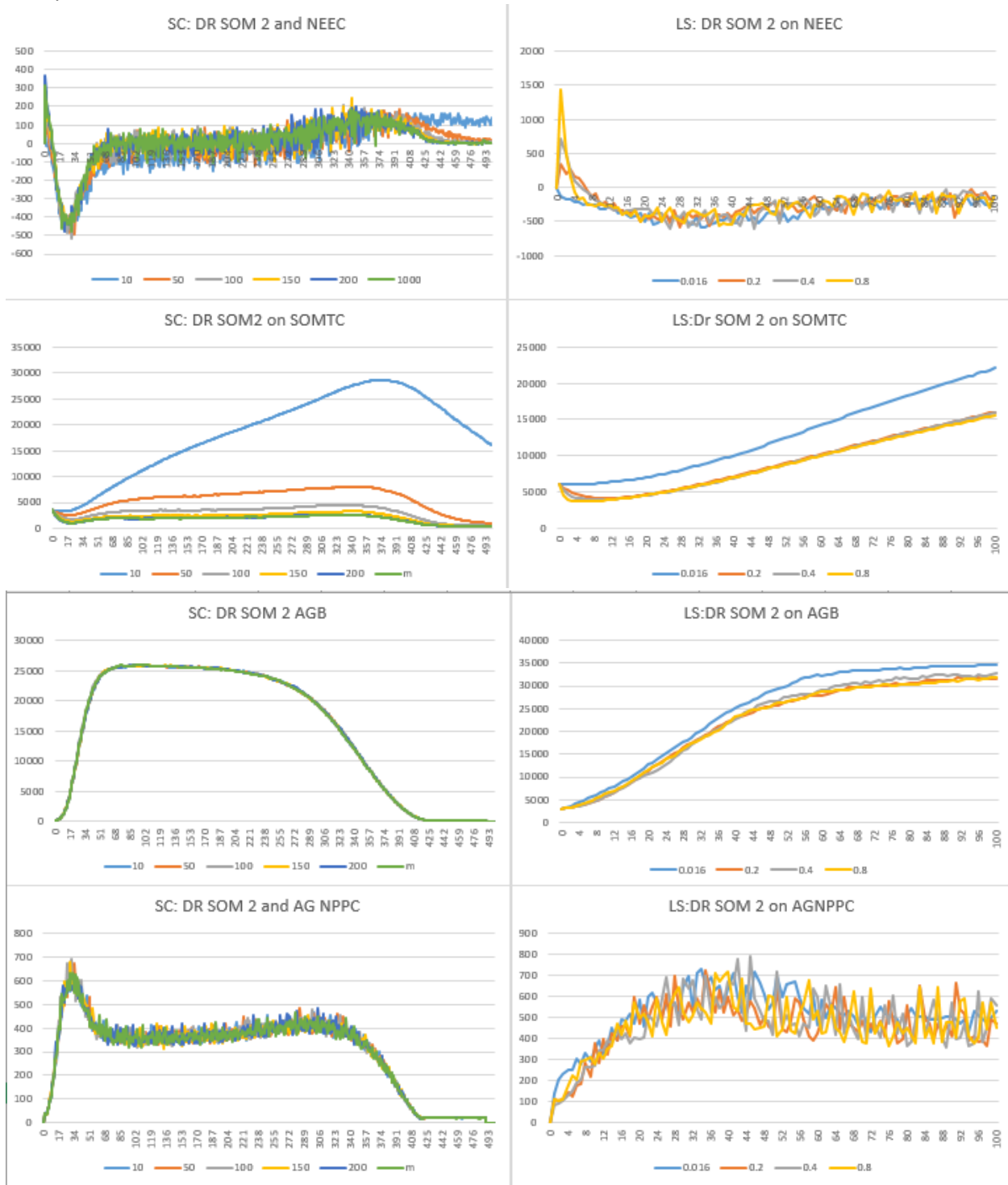
Decay Rate SOM surface impacts NEEC positively and had a negative impact on SOMTC and AGB on the landscape level.

Decay Rate SOM 1 Soil



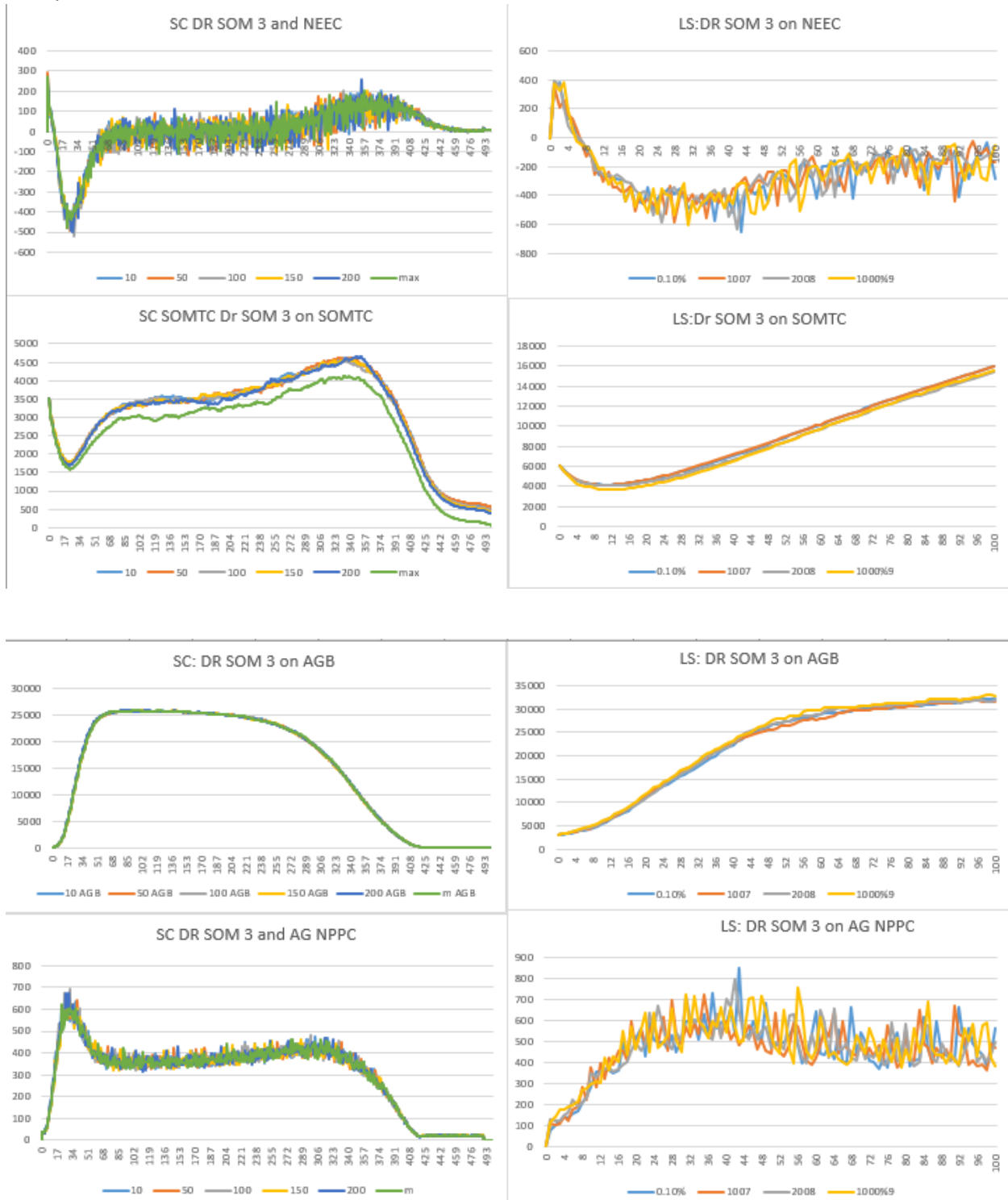
DR SOM 1 will impact AGB and AG-NPPC on the landscape level. It will also impact SOMTC inversely and initial NEEC

Decay Rate SOM 2



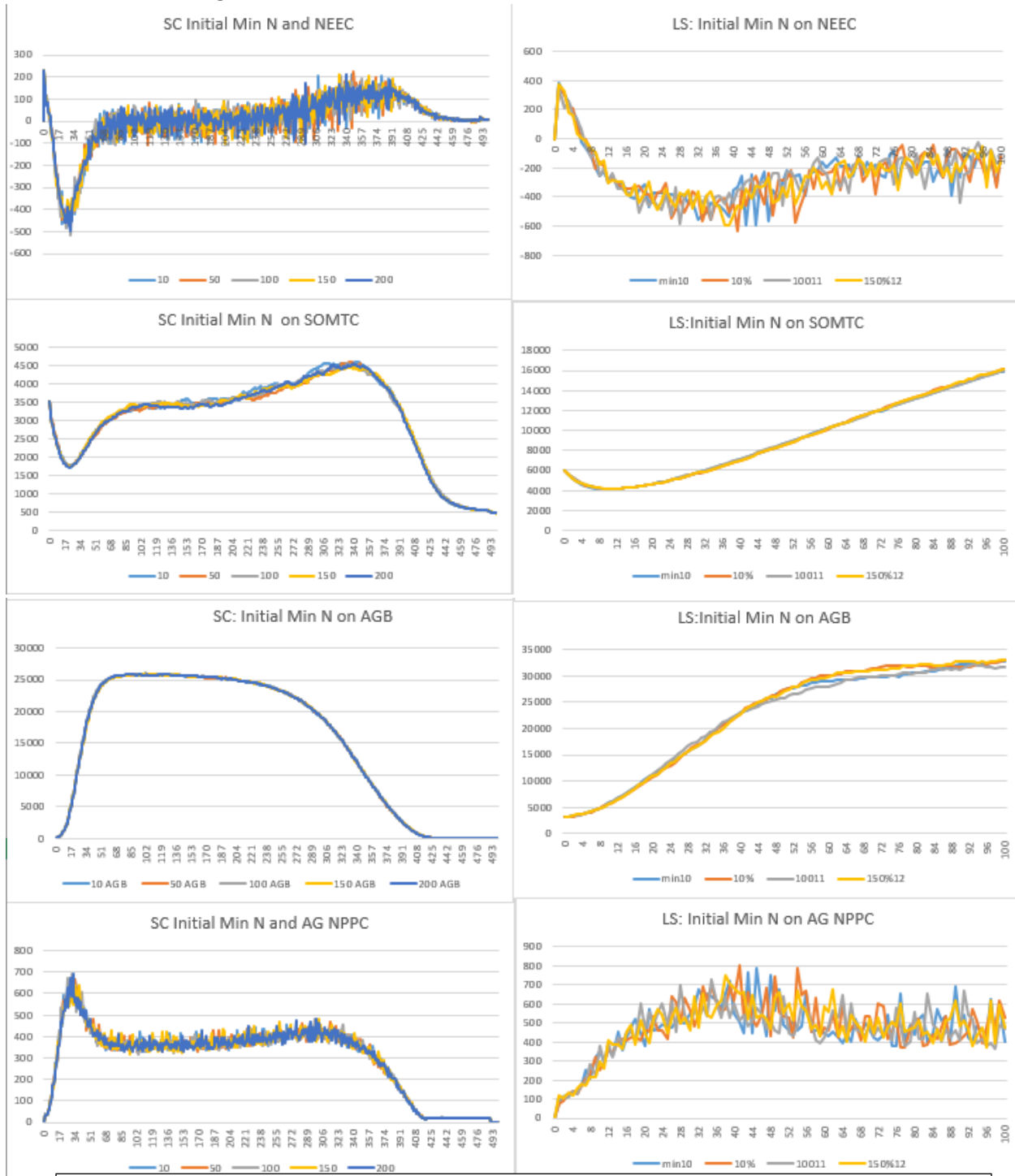
Decay Rate of SOM 2 has a strong impact on early stage NEEC levels, which are then lost later. It does have an inverse relationship to SOMTC, and may impact AGB

Decay Rate SOM 3



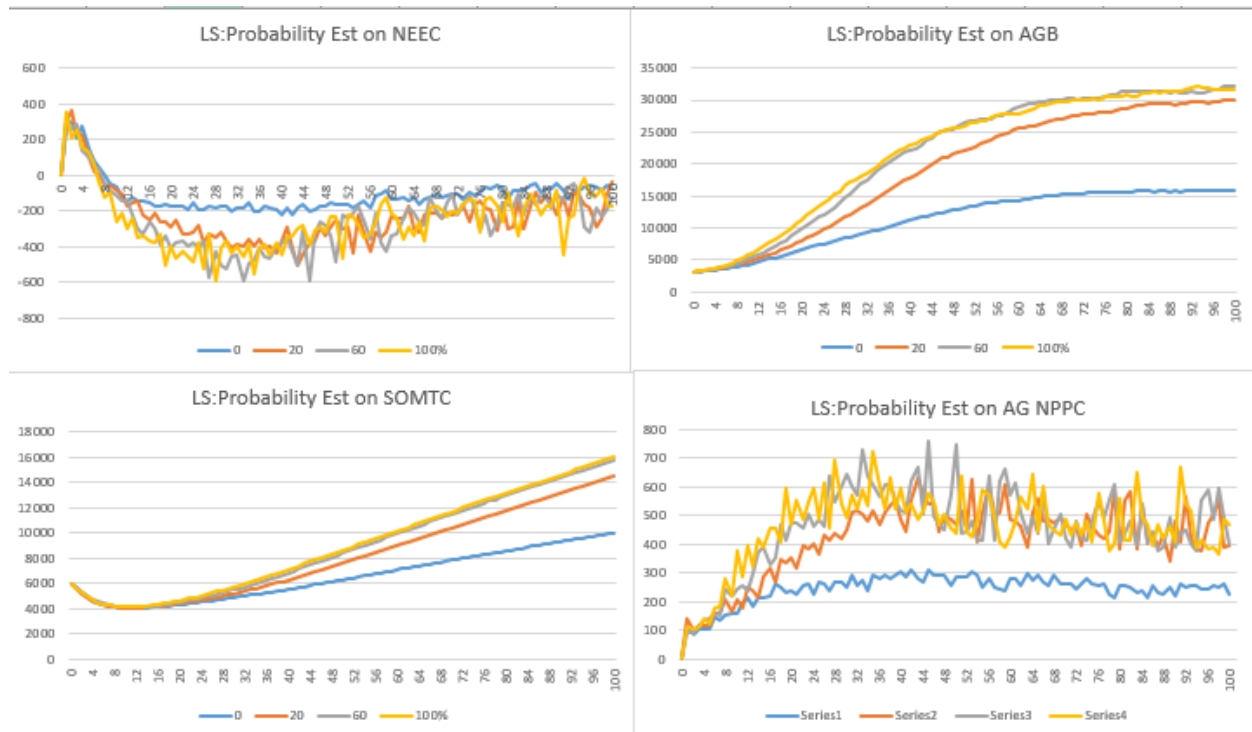
DR SOM 3 may have some initial impact on NEEC but otherwise has little impact

Initial Minimum Nitrogen



Initial minimum Nitrogen has some initial impact on NEEC in single cells, but otherwise has no impact.

Probability Establishment Coefficient



Probability of Establishment has a direct linear relationship to all 4 outputs on the landscape level.

Soil and Hydrology Maps

Methods

This testing set was to determine the impact of individual soil and hydrology maps of the NECN-H extension to the LANDIS-II model. All soil and hydrology maps were tested at 10%, 50%,100%,150%,200% of original values for single cells for landscape tests. The exception to this was Percent Sand and Percent Clay maps which were tested in intervals .01,.6,.5,.9. These tests were conducted using the NECN-H extension to the LANDIS-II Model, using specifications for the Lake Tahoe Basin Region.

Major Results

The results show that SOM (soil organic matter) 2 had a strong positive relationship with NEEC (net ecosystem exchange of carbon) and SOMTC (soil organic matter total carbon). This however, resulted in decreased AGB (above ground biomass) and AGNPPC (above ground net primary productivity).

The third carbon pool (SOM 3 C baseflow levels, soil depth, soil drainage and soil organic matter pool 3 nitrogen(SOM 3 N) negatively correlated to SOMTC and AGB. In the case soil drainage and baseflow levels this seems likely as more carbon is being removed from the system. SOM 1 C surface had a positive correlation to increased SOMTC and possibly an impact on above ground biomass

The wilting point did not regularly correlate to any outputs unless it was set close enough to the field capacity to minimize the possibility of growth (.05% of initial values).

Values for % sand, soil drain, baseflow, soil depth all exhibited a unique phenomena in single cell testing. The input levels did not seem to impact SOMTC for the 80-120 years at which point the different input values began to drastically diverge. The time-frame roughly aligns to with the leveling off of AGB and NEEC. The opposite can be said of SOM 2 C which is divergent from the beginning and shows less variance after the first 130 years.

The newly added deadwood values (surface and soil) did not seem to have a consistent observable impact on any of the metrics measured. The same can be said of the most of the nitrogen pools, though nitrogen limitation would at some stage inhibit growth. Perhaps at the levels of atmospheric nitrogen(slope/intercept) values in this tester make deposition the major factor in maintaining the levels above nitrogen limitation. Percent clay Storm flow SOM 1 C Soil all had no impact on the four outputs measured.

<u>Soil or Hydrology Map</u>	<u>Original Value</u>
Soil Depth	110
Soil drain	.75
Base Flow	0.4
Storm Flow	0.4
Field Capacity	.1-.2
Wilting Capacity	.05-.099
Percent Sand	.01-.5
Percent Clay	.01-.5
Initial soil organic matter pool 1 surface carbon	110

Initial soil organic matter pool 1 surface nitrogen	6
Initial soil organic matter pool 1 soil carbon	110
Initial soil organic matter pool 1 soil nitrogen	9
Initial soil organic matter pool 2 soil carbon	4500
Initial soil organic matter pool 2 soil nitrogen	50
Initial soil organic matter pool 3 soil carbon	1294
Initial soil organic matter pool 3 soil nitrogen	50
Dead wood Surface	110
Dead wood Soil	50

Single Cell	Base flow	Wilting point	Storm Flow	Soil Drain	Soil Depth	% sand	% Clay	SOM 1 C Surf
NEEC	NC	TC(-)	NC	NC	NC	NC	NC	NC
SOMTC	DC(+)	TC(-)	NC	DC(+)	NC	DC(-)	NC	NC
AGB	DC(-)	TC(-)	NC	NC	PC(+)	NC	NC	NC
Landscape								
NEEC	NC	NC	NC	PC(+)	PC(-)	NC	NC	NC
SOMTC	NC	NC	NC	PC(-)	PC(+)	DC(-)	NC	DC(+)
AGB	PC(-)	NC	NC	NC	DC(+)	DC(+)	NC	NC
AGNPPC	NC	NC	NC	NC	DC(+)	NC	NC	NC

Single Cell	SOM 1 N Surf	SOM 1 C Soil	SOM 1 N Soil	SOM 2 C	SOM 2 N	SOM 3 C	SOM 3 N	Deadwood Soil	Deadwood Surface
NEEC	NC	NC	NC	NC	NC	PC(+)	NC	NC	NC
SOMTC	NC	NC	NC	IC(-)	NC	OC(+)	NC	NC	NC
AGB	NC	NC	NC	PC(+)	NC	NC	NC	NC	NC
Landscape									
NEEC	NC	NC	NC	IC(+)	NC	PC(+)	NC	NC	NC
SOMTC	NC	NC	NC	DC(+)	PC(+)	DC(+)	PC(-)	NC	NC
AGB	PC(+)	NC	NC	DC(-)	NC	DC(-)	NC	NC	PC(+)
AG NPPC	NC	NC	NC	DC(-)	NC	NC	NC	NC	NC

Figure () Summary table for testing results:

DC: Direct correlation

NC: No correlation

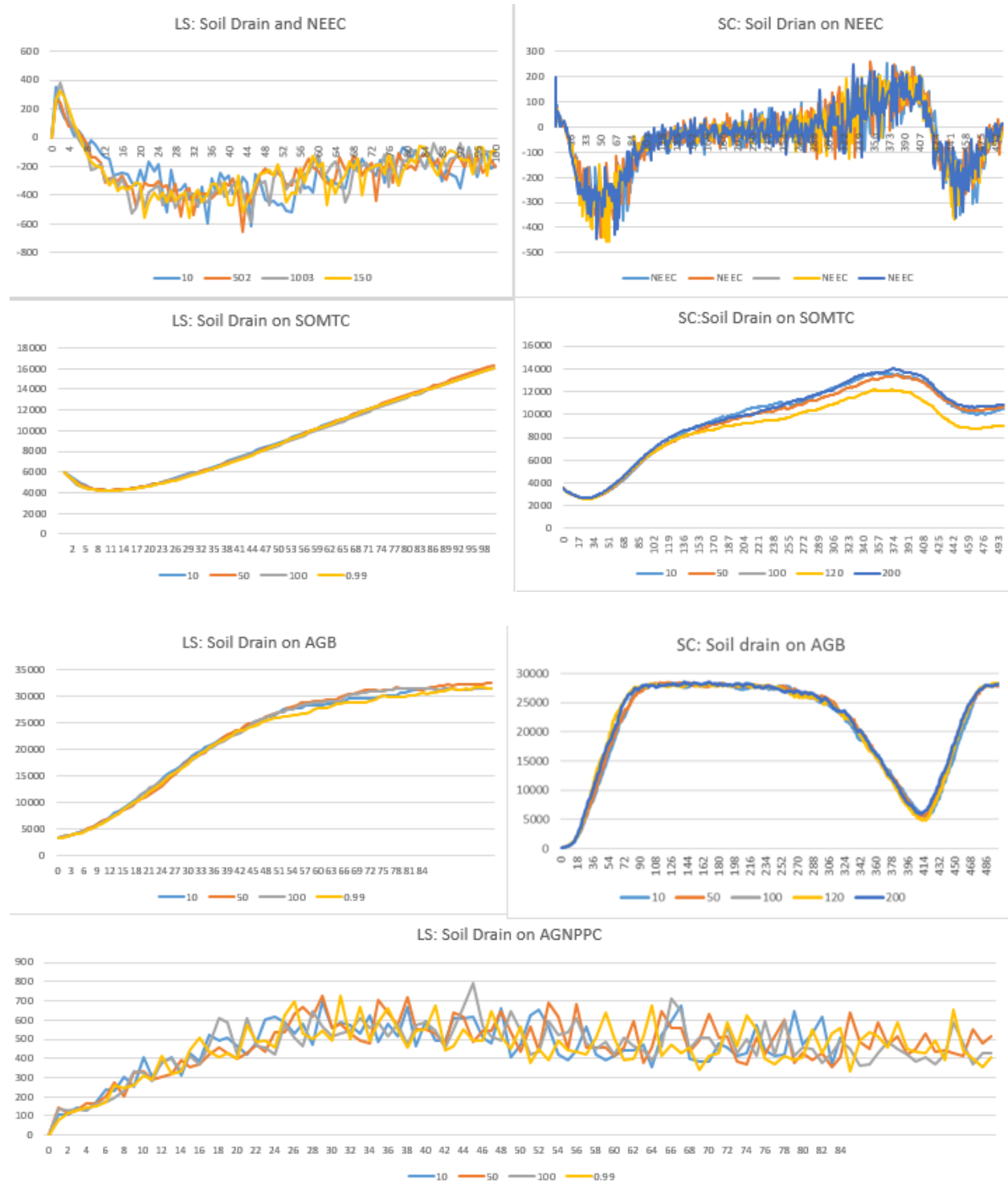
IC: Initial correlation: The observed metric rises in the beginning but has no long term observable impact

TC: Threshold correlation: The observed metric has no observable impact up into a point and then alters the output

(+)-Positive Correlation

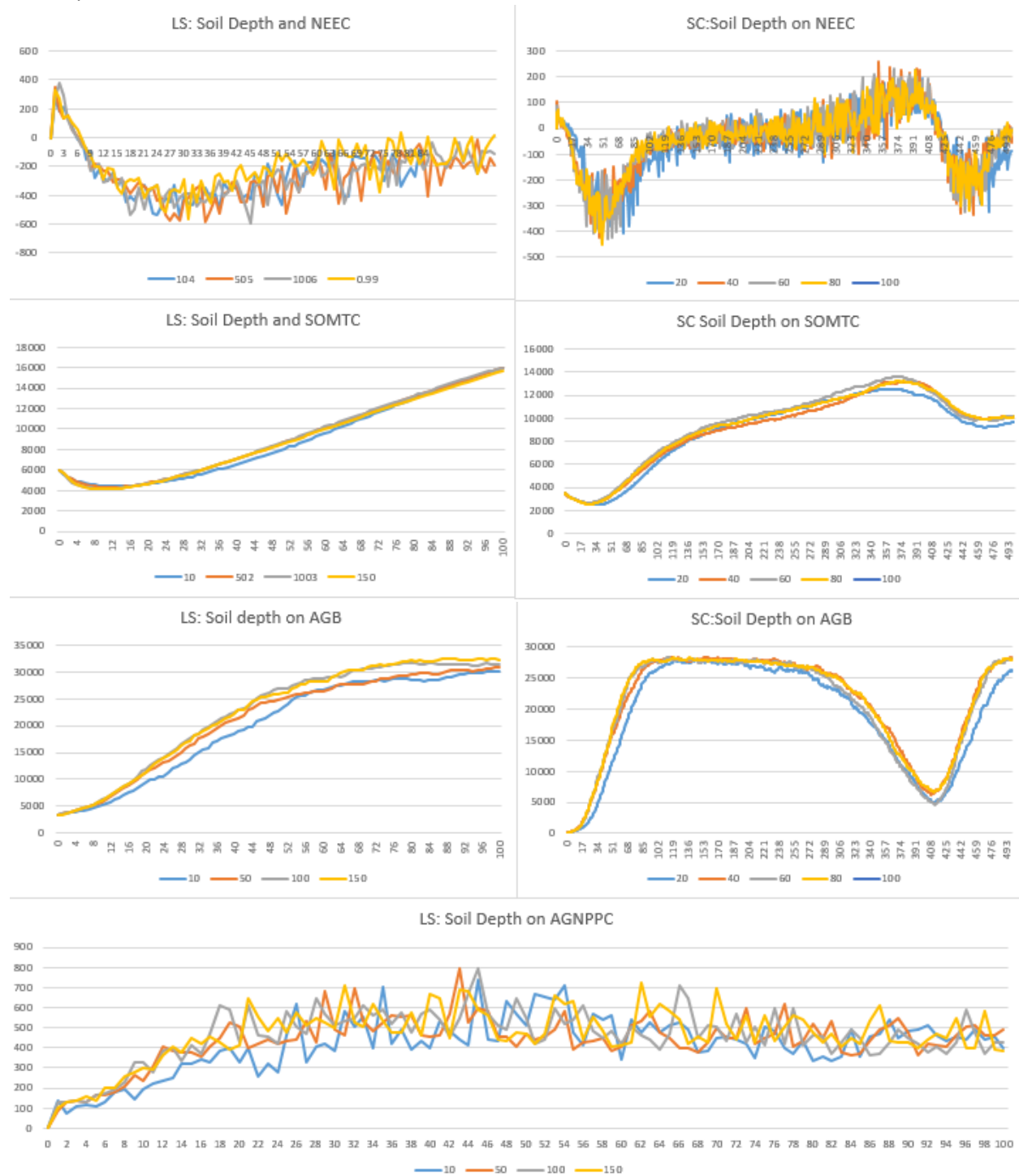
(-)-Negative correlation

Soil Drain



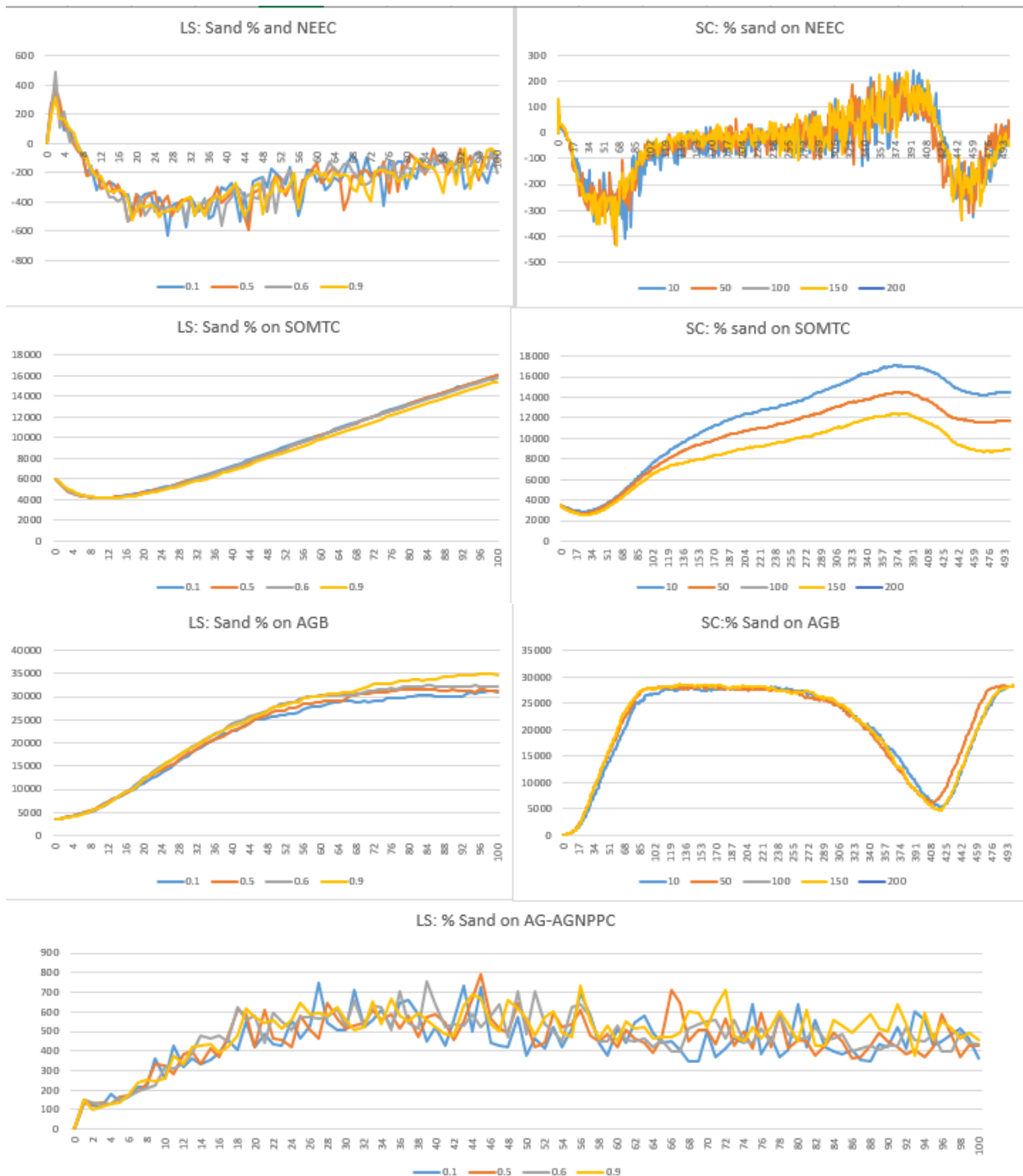
Soil Drain will impact the SOMTC over the longer time periods of the single cell test but this primarily occurred after the first hundred years.

Soil Depth



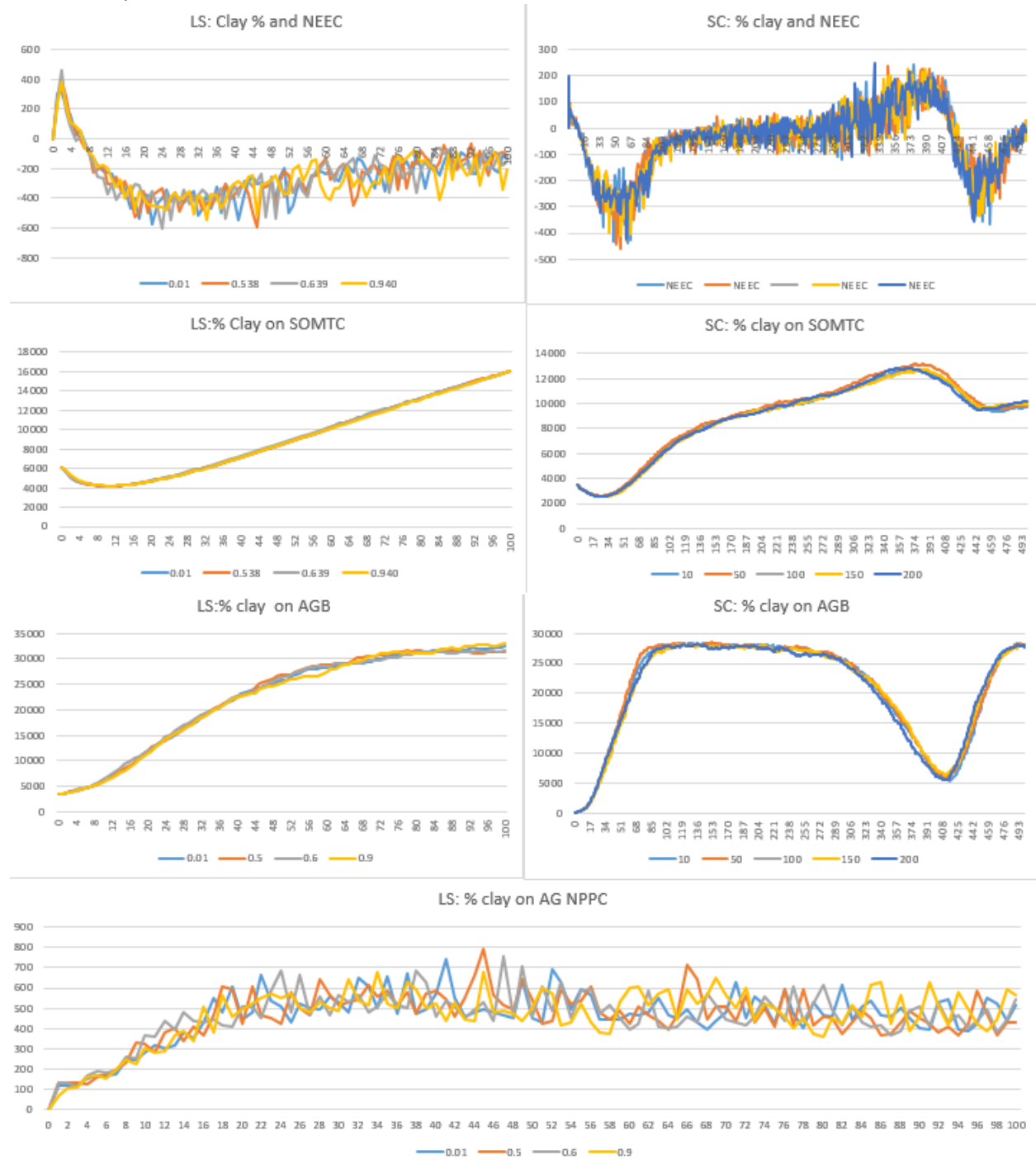
Soil Depth affected AGB on both single cell and landscape testing and had some impact on AGNPPC and SOMTC

Percent sand



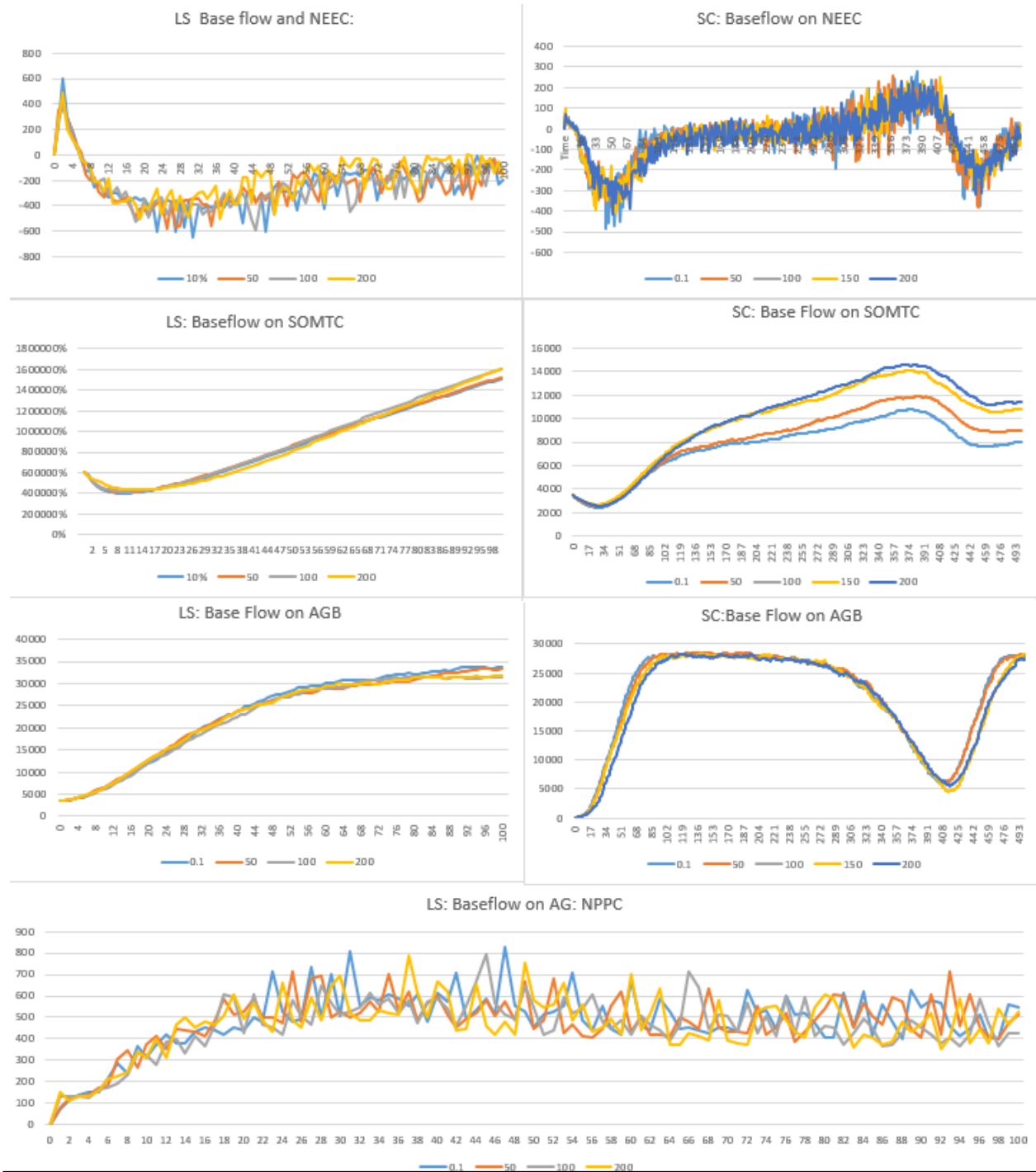
Percent sand primarily inversely impacted SOMTC in the longer single cell testing. It positively correlated to AGB on the landscape scale.

Percent Clay



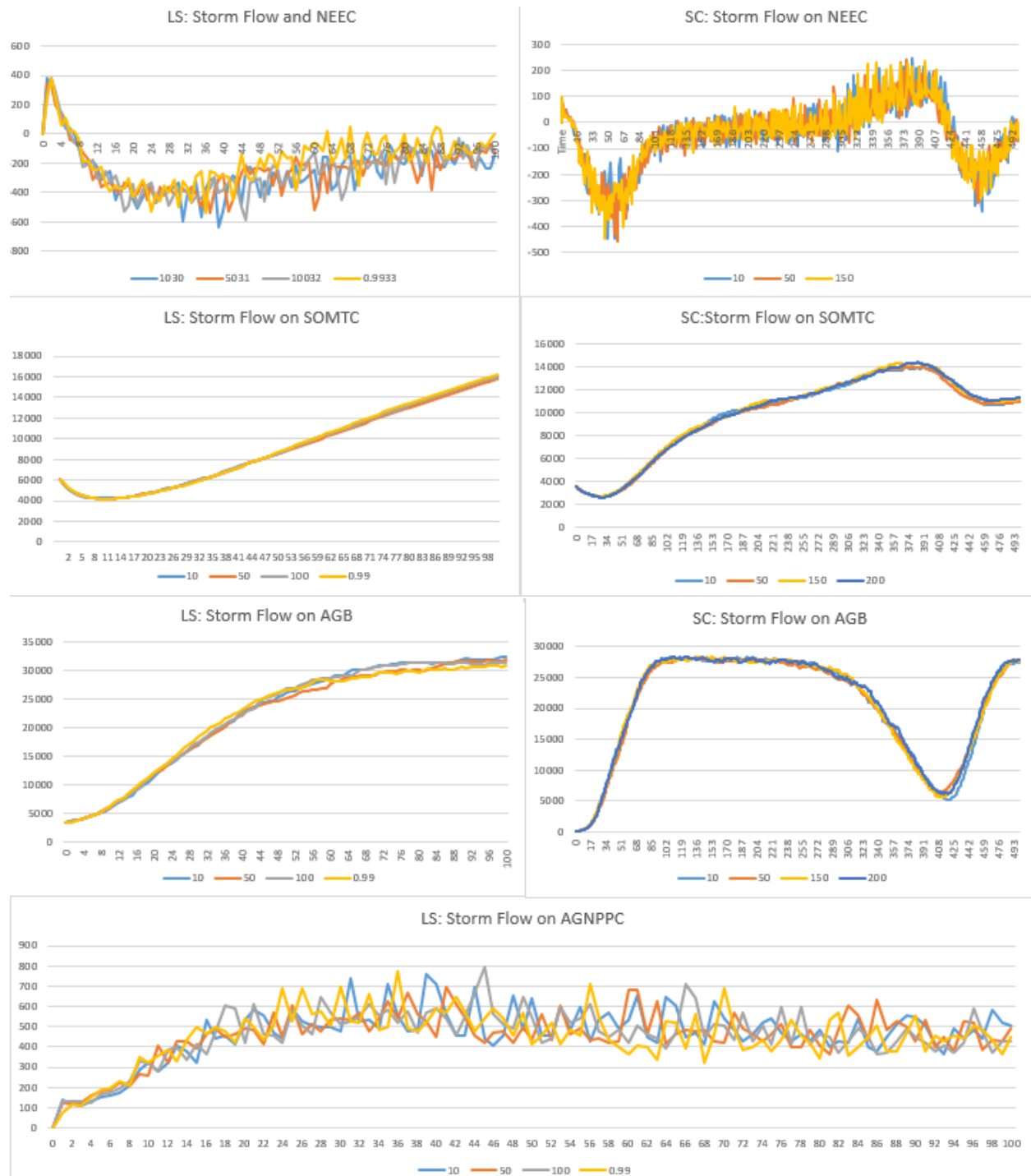
% clay had no impact on the four outputs that could be measured.

Base flow



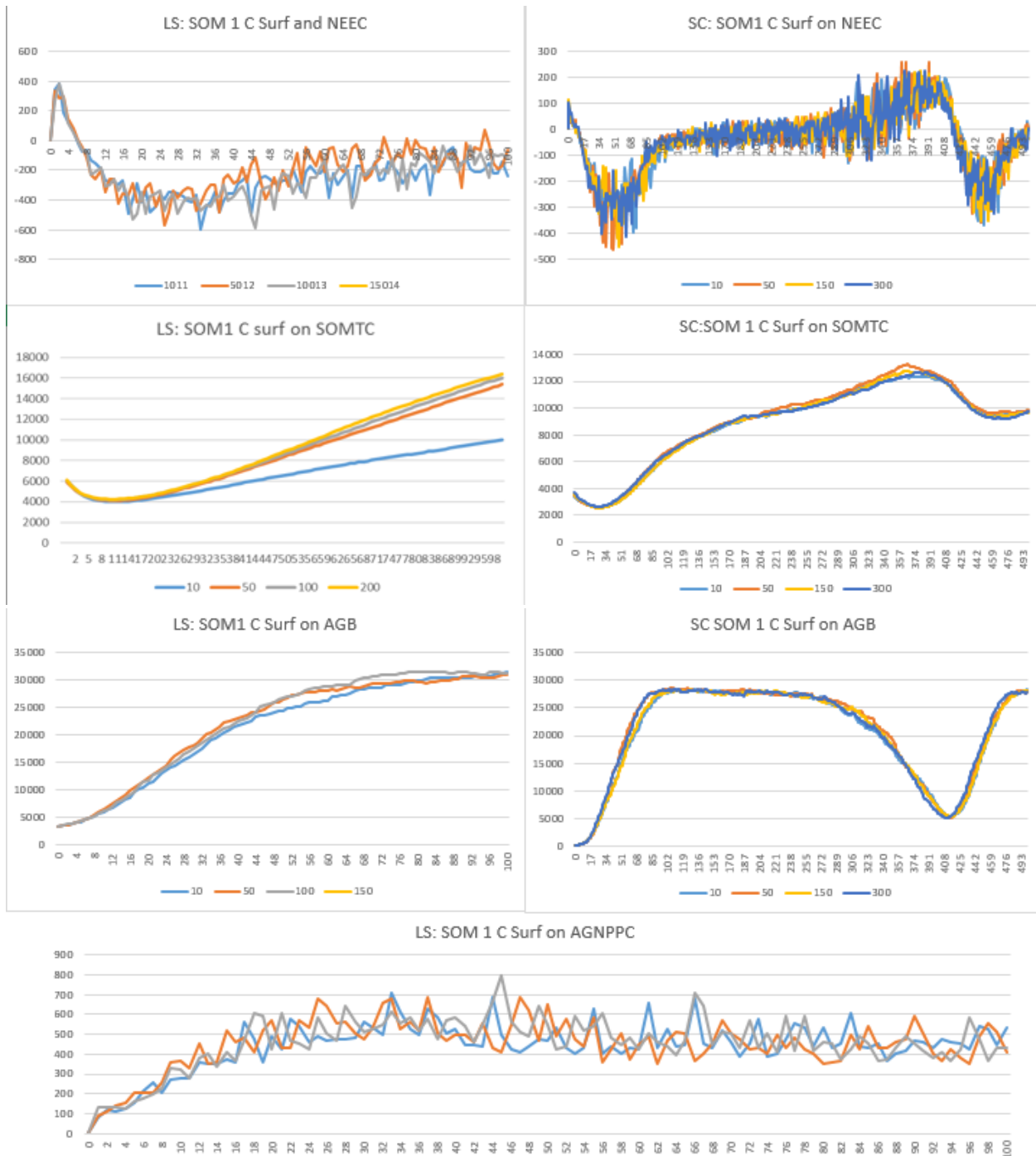
Baseflow impacted single cell SOMTC primarily after the first hungered years. This impact can be seen as well in the landscape testing though only toward the end. It had a slight inverse relationship with AGB

Storm flow



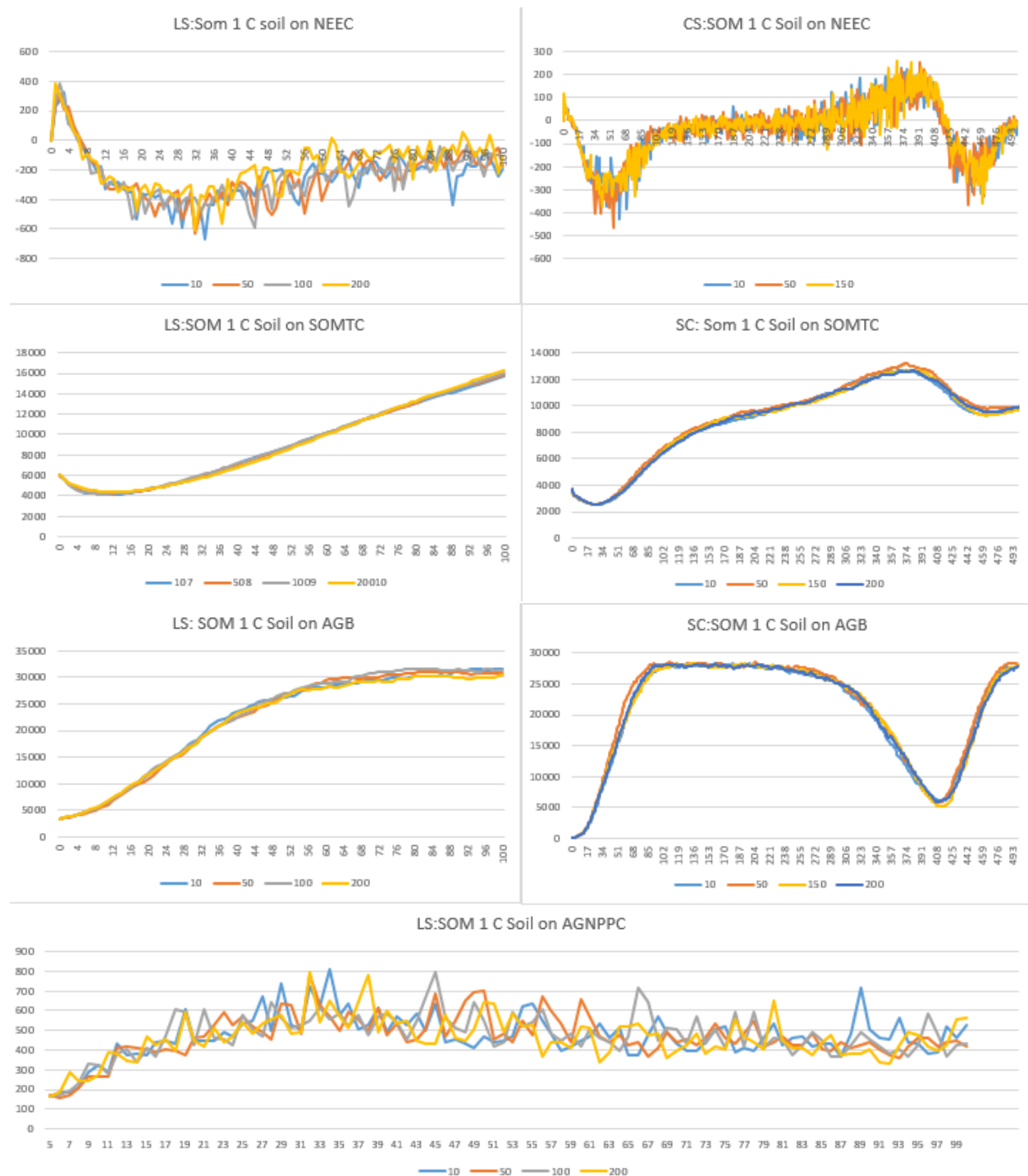
Stormflow had no correlation to the outputs measured.

Soil Organic Matter 1 Surface: Carbon



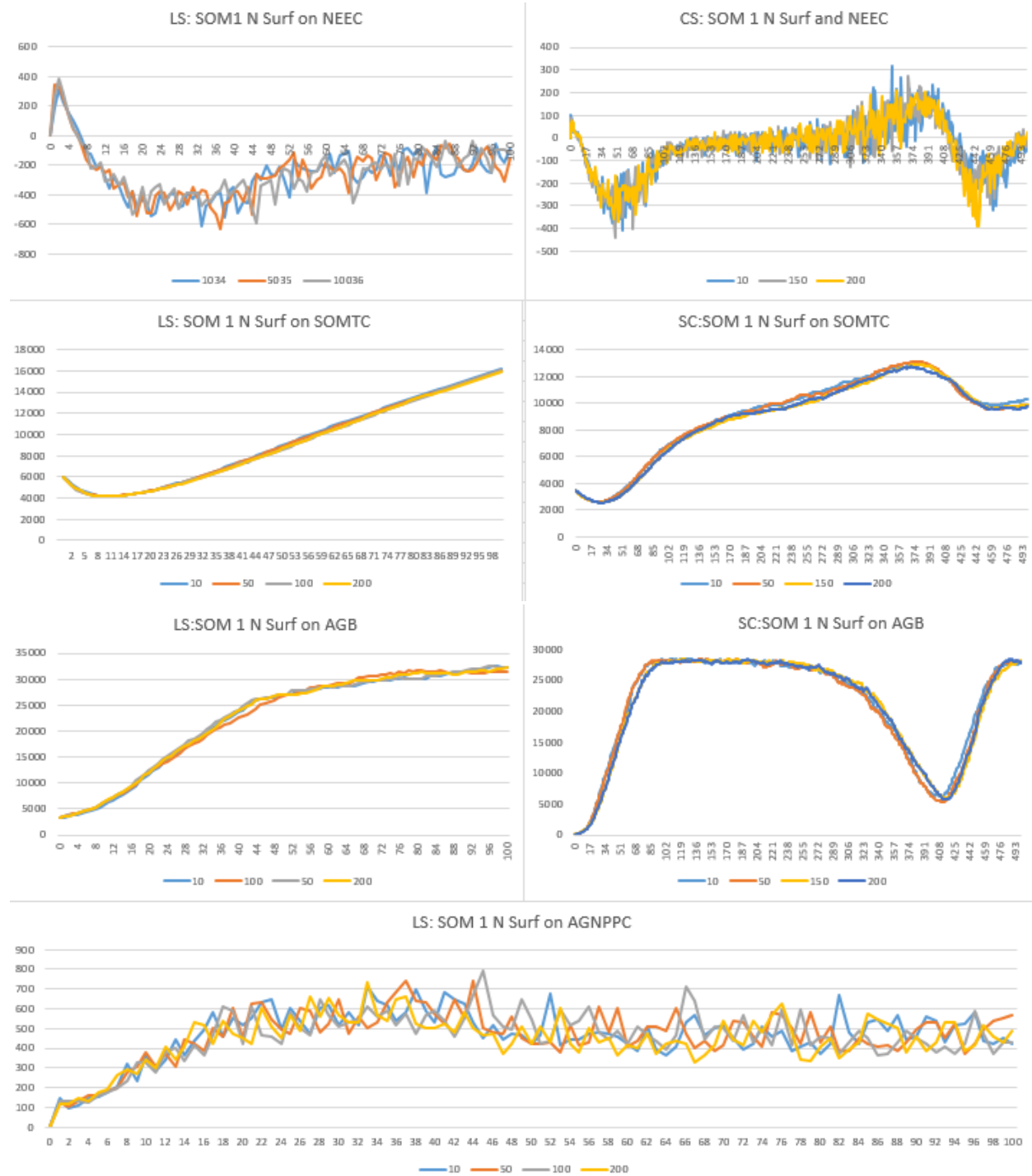
SOM 1 carbon surface positively correlated with SOMTC on the landscape scale.

Soil Organic Matter 1 Soil :Carbon



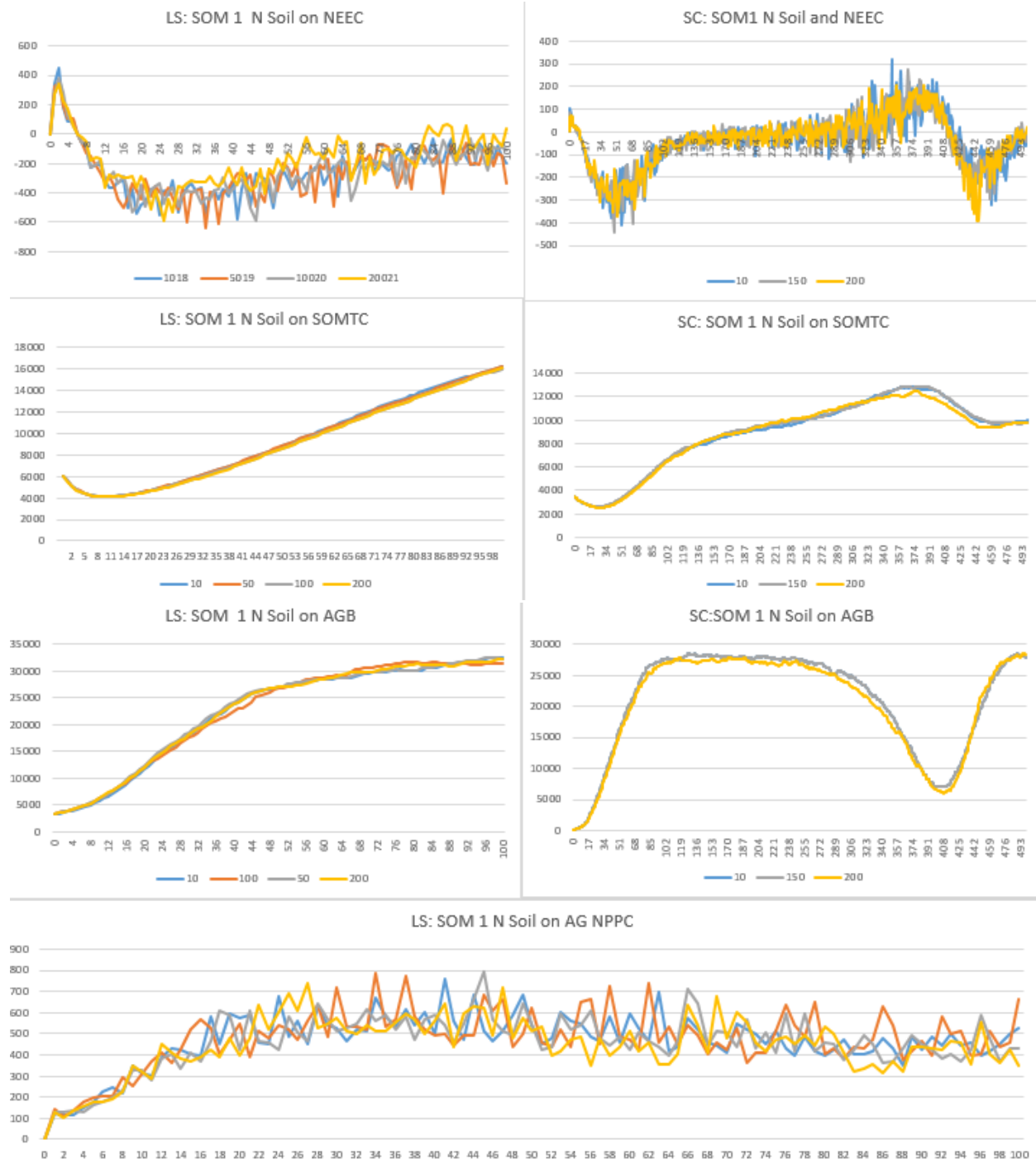
SOM 1 soil did not impact any of the four outputs at the levels tested.

Soil Organic Matter 1 Surface: Nitrogen



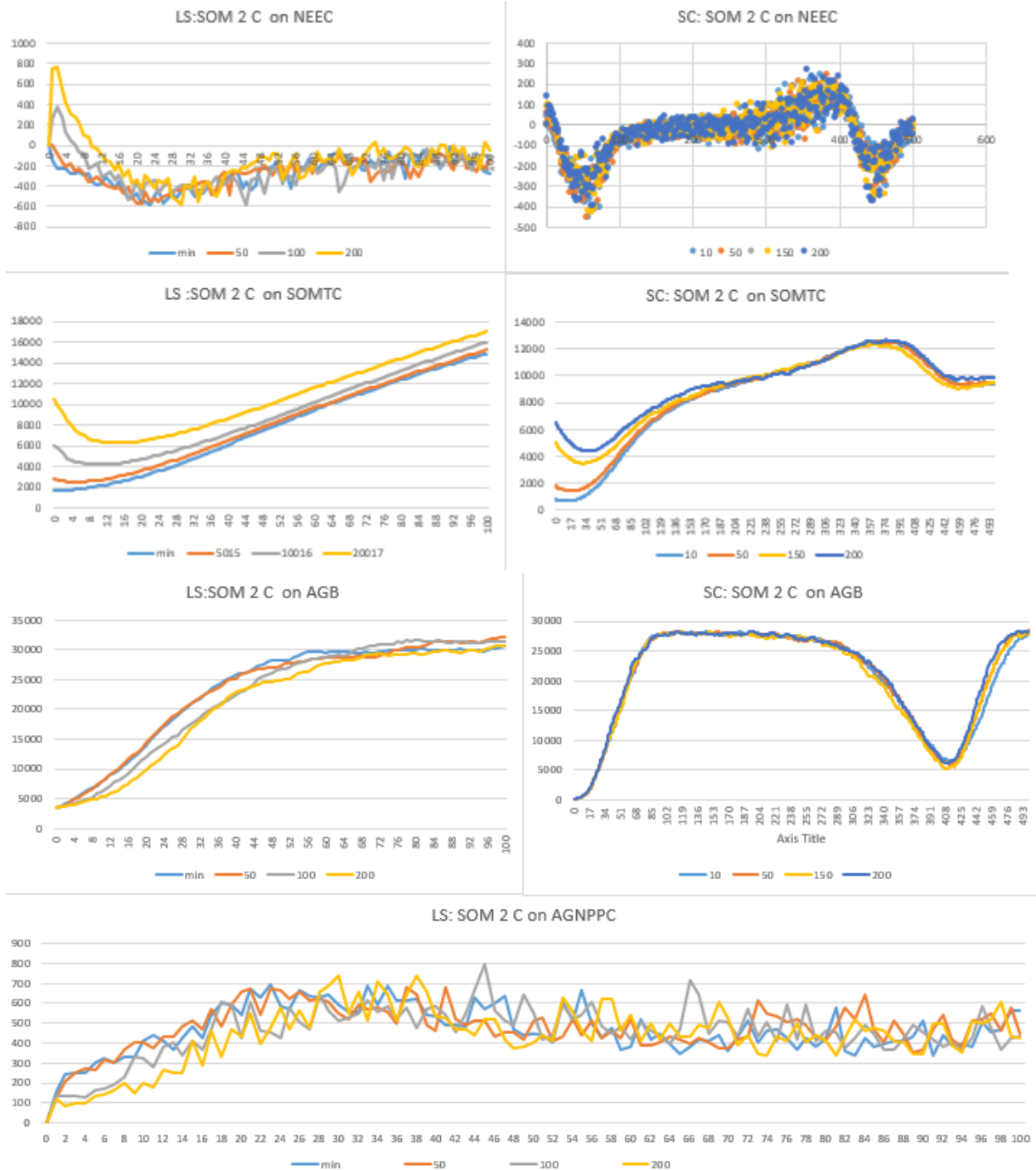
SOM 1 N surface did not impact any of the four outputs at the levels tested.

Soil Organic Matter 1 Soil: Nitrogen



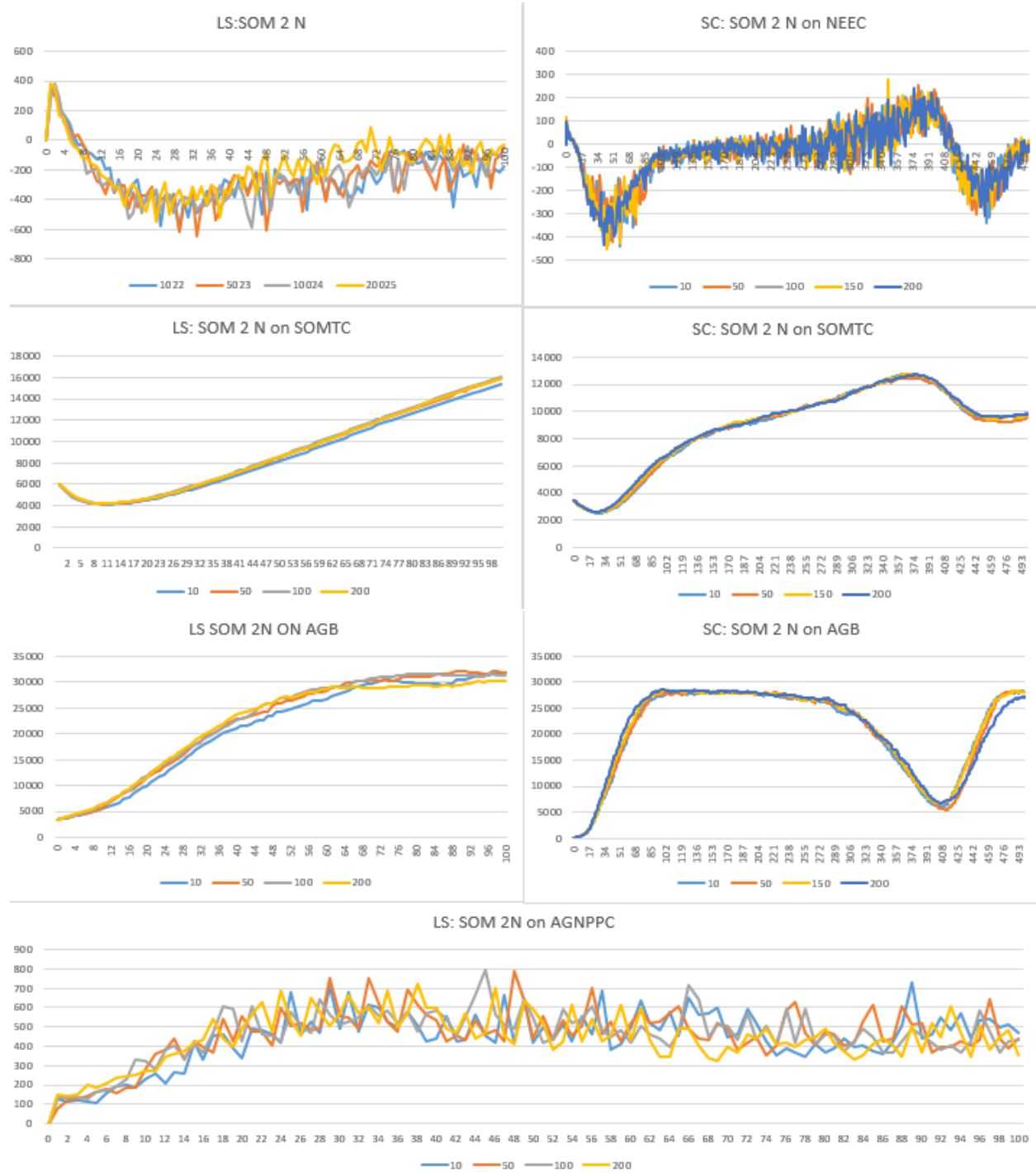
SOM 1 N soil did not impact any of the four outputs at the levels tested.

Soil Organic Matter 2: Carbon



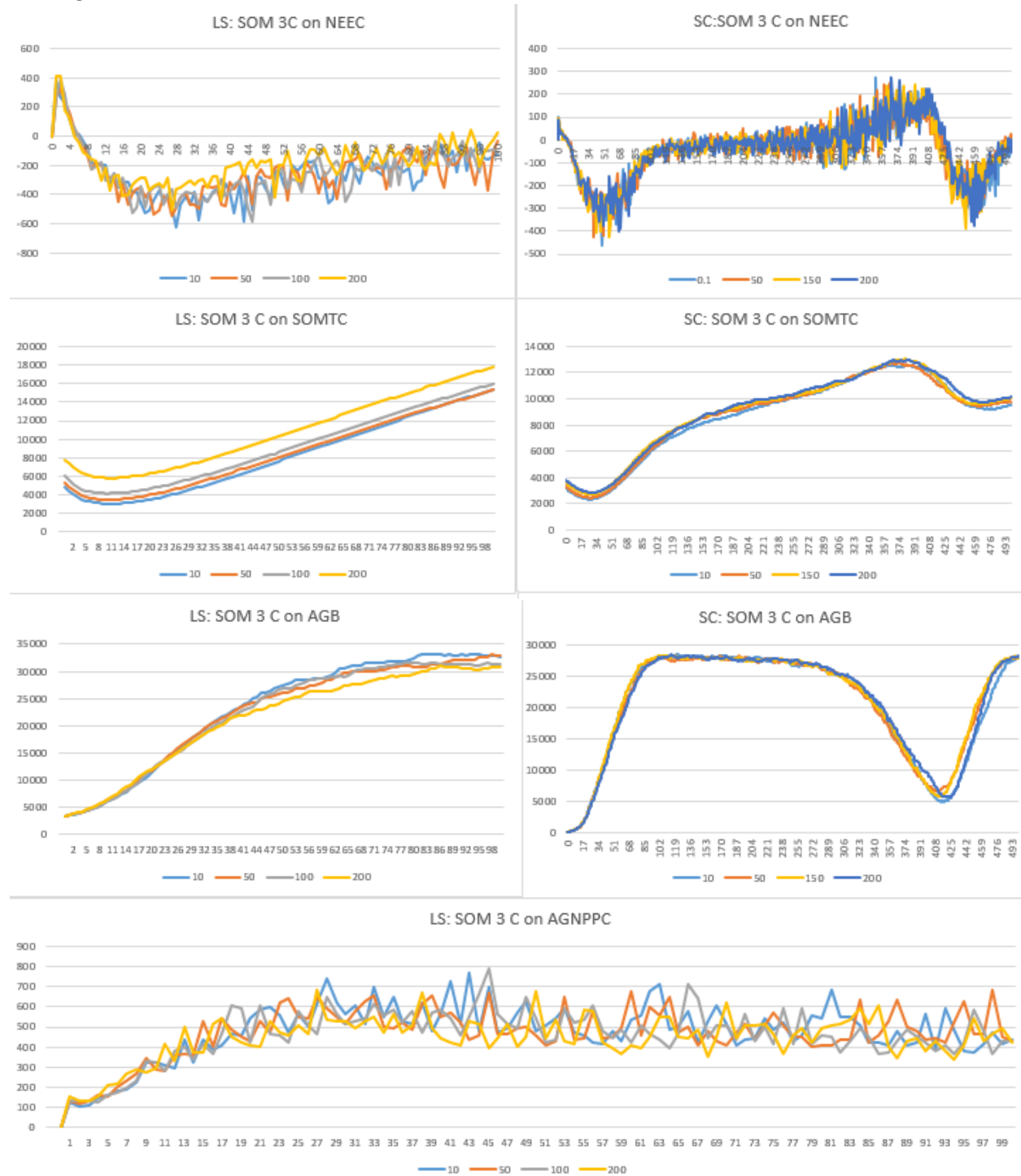
SOM 2 C impacted NEEC and SOMTC positively on the landscape scale though this impact diminished over time in the single cell. AGNPPC was also inversely correlated to increased SOM 2 C.

Soil Organic Matter 2: Nitrogen



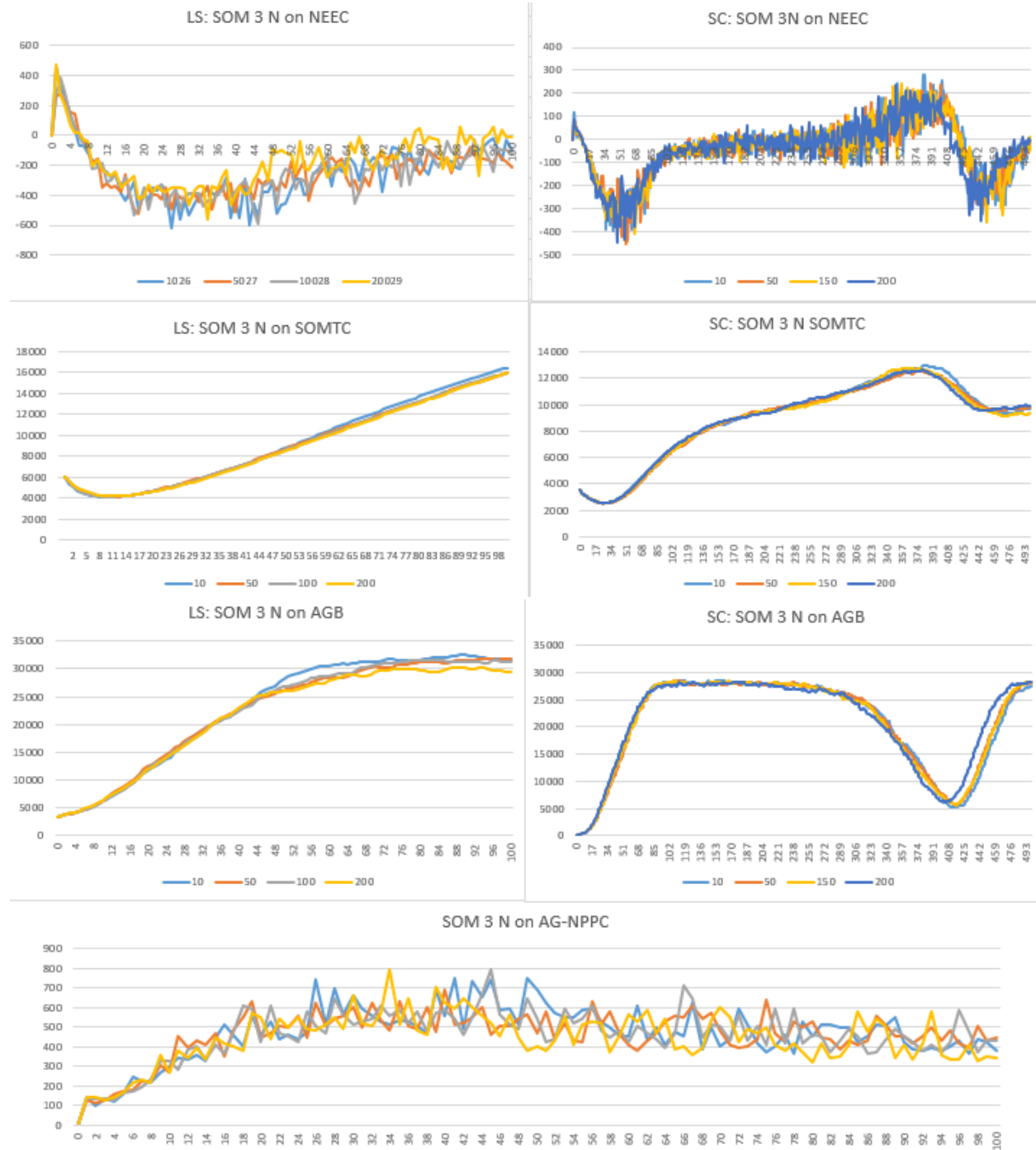
SOM 2 N did not impact any of the four outputs at the levels tested.

Soil Organic Matter 3: Carbon



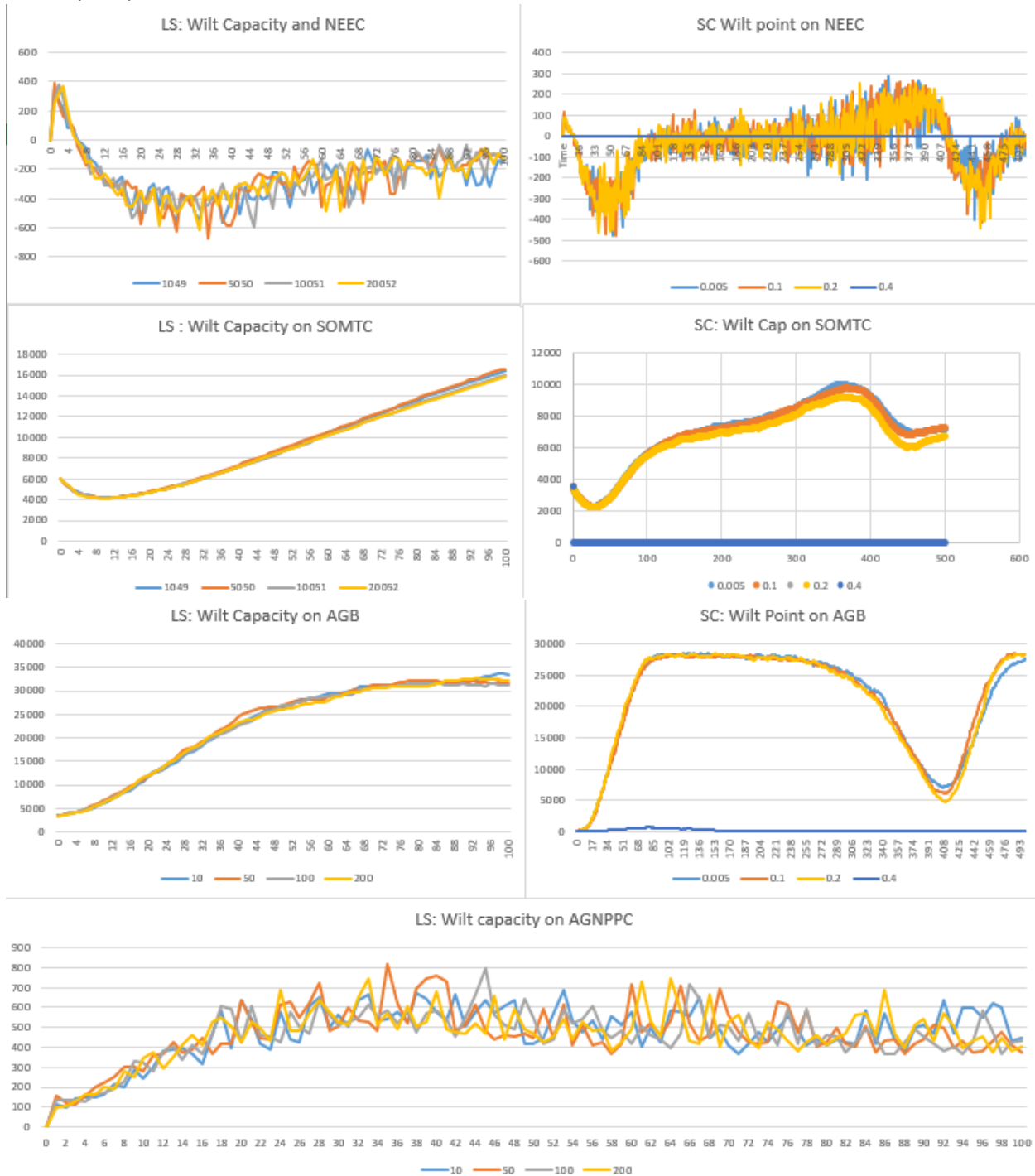
SOM 3 C had an inverse relationship with both SOMTC and AGB on the landscape scale.

Soil Organic Matter 3: Nitrogen



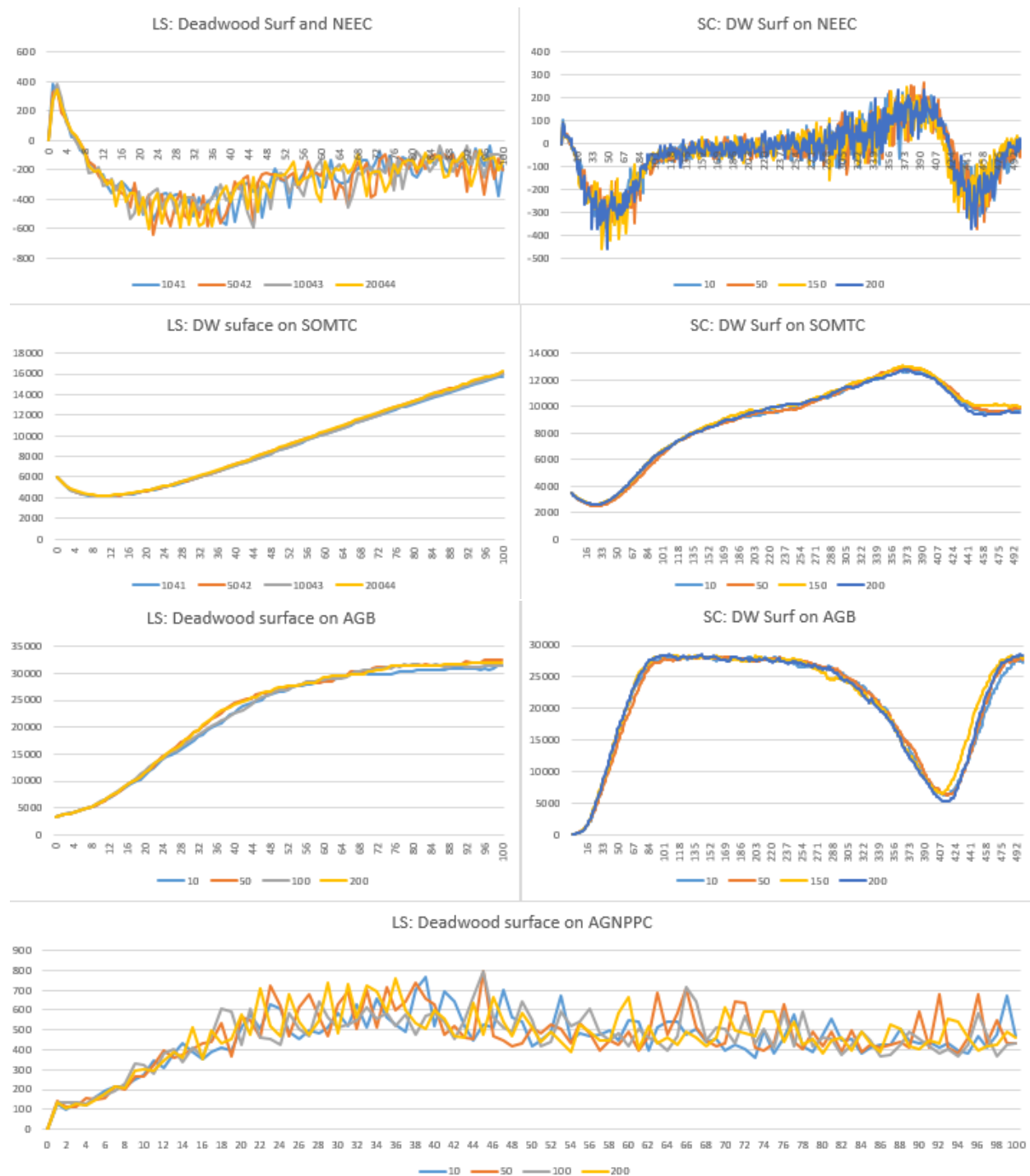
SOM 3 N pools inversely correlated to AGB on the landscape scale. At the longer time scale of the single cell testing however it did increase the regrowth of secondary cohorts.

Wilt Capacity



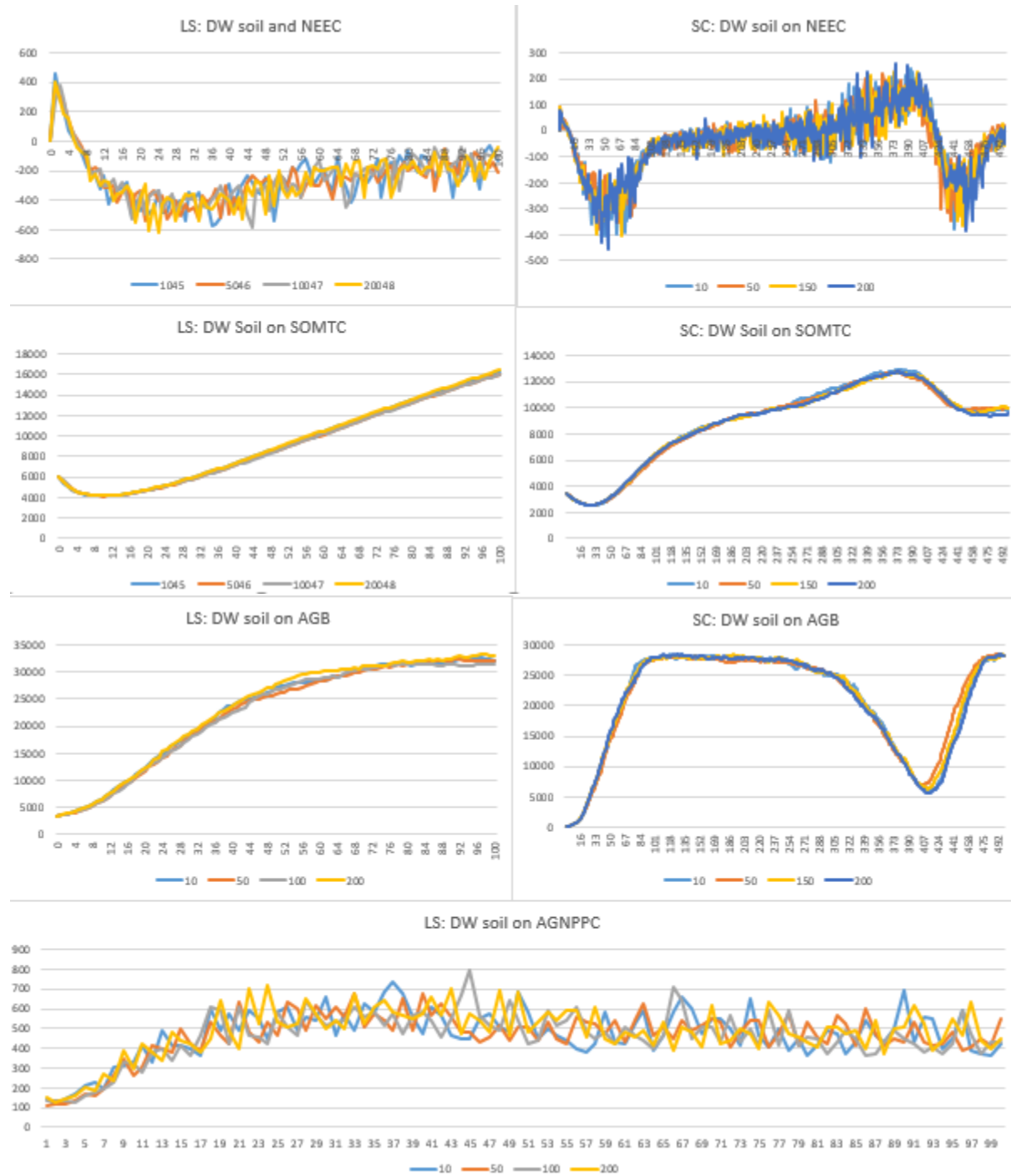
Wilt capacity impacted the single cell values when it was set close enough to the field capacity that it inhibits growth. Otherwise no impact was seen on the outputs.

Dead Wood Surface



Surface Deadwood levels may have impacted total AGB slightly. No other impacts were observed.

Dead Wood Soil

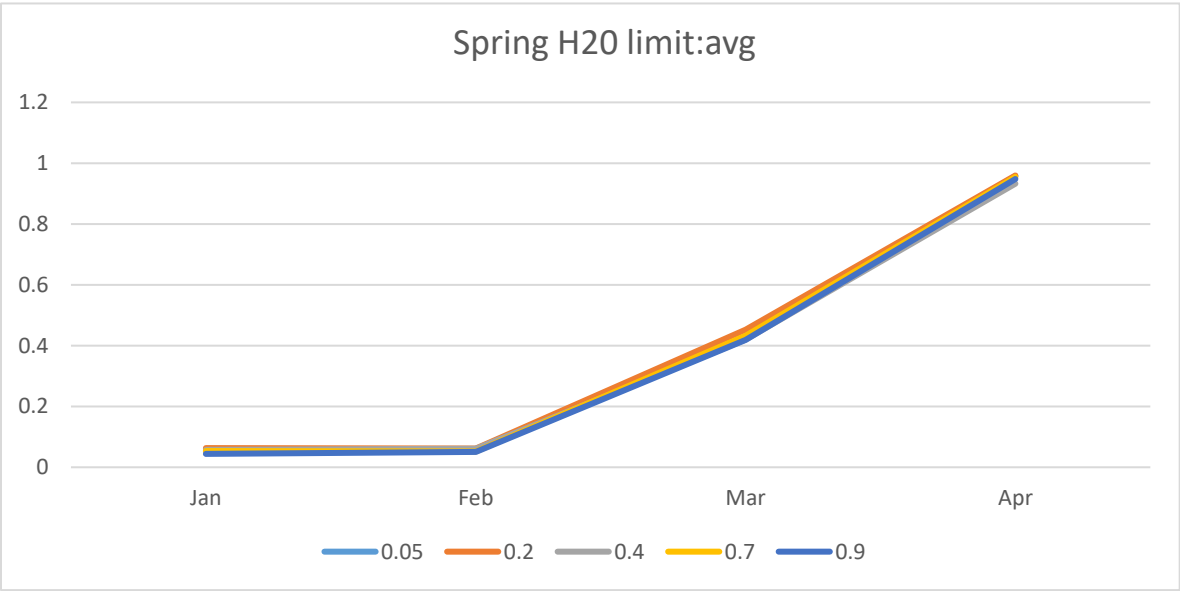
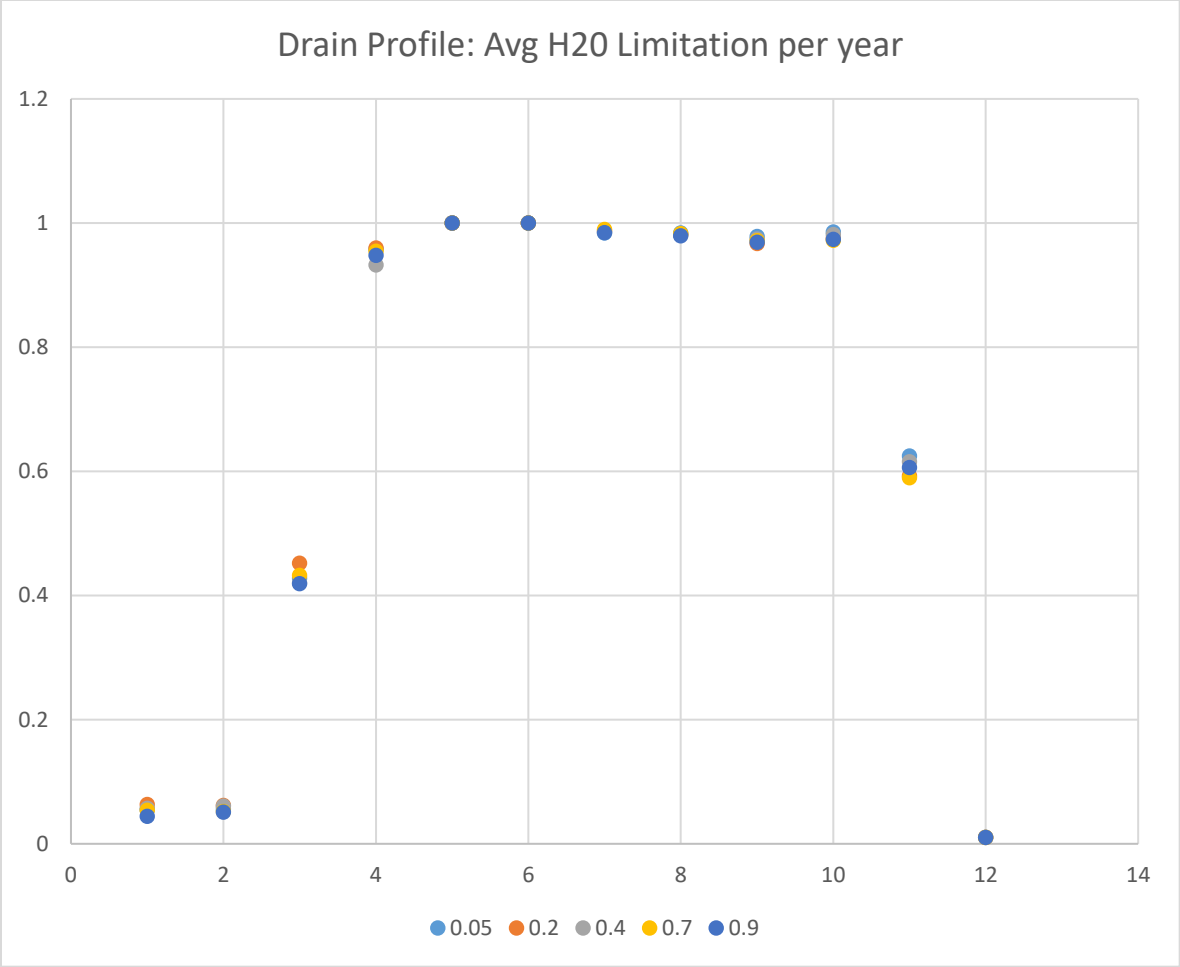


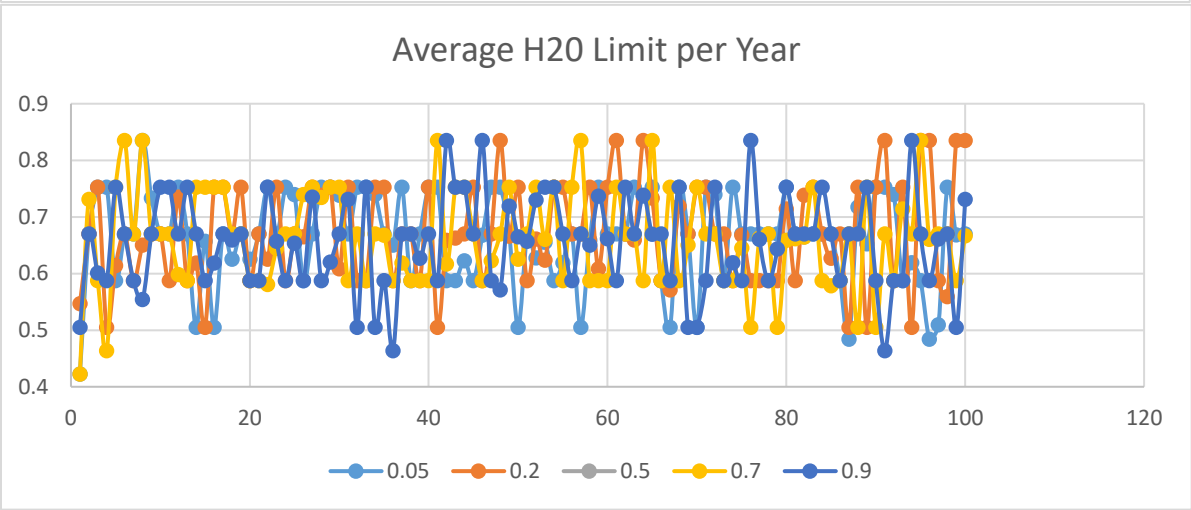
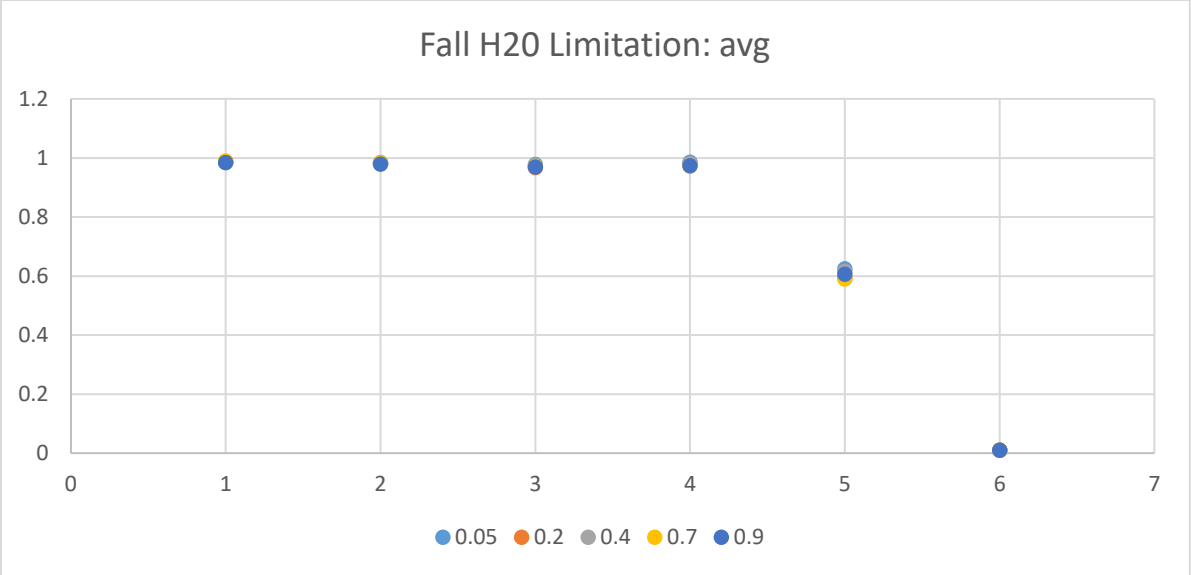
Deadwood Soil did not impact any of the four outputs at the levels tested.

Soil Drain Maps-H2O Limitation Report

This test was conducted using the differing soil drain map values on single cell test run for 500 years. The soil drain maps modified values ranged between .05 -.9. The outputs on H2O Limitation were plotted to see how Soil drain affected H2O limitation. No consistent pattern was found between H2O limitation and soil drain map input. Further none of the alterations drastically changed AGB or AGNPPC output.

Month	0.05	0.2	0.4	0.7	0.9
Jan	0.054	0.063	0.057	0.054	0.044
Feb	0.056	0.061	0.061	0.051	0.050
Mar	0.427	0.452	0.419	0.432	0.418
Apr	0.957	0.959	0.932	0.954	0.948
May	1	1	1	1	1
Jun	1	1	1	1	1
July	0.984	0.987	0.985	0.989	0.984
Aug	0.983	0.981	0.980	0.982	0.979
Sept	0.978	0.966	0.974	0.971	0.968
Oct	0.985	0.975	0.981	0.972	0.973
Nov	0.624	0.592	0.615	0.589	0.606
Dec	0.01	0.01	0.01	0.01	0.01
Average H2O Limitations by month					





Run-time testing

These tests were conducted using the same original Parameters as run in the process parameter and soil and hydrology maps testing done above. The number of time steps and climate regions was modified to determine how this impacted the time needed to complete a 100-year model run. Further, time-step was plotted to see if AGB was impacted. The time-step testing decreased the test duration as the time step became larger. Further total AGB was significantly decreased as time-step increased. The number of climate regions did not seem to impact the test duration time.

Change	Test duration
Time-step =1	2hrs
Time=step= 5	57 mins
Time=step=10	45 mins
Climate region=1	2hrs 16 mins
Climate regions=2	2 hrs 31 mins
Climate regions=3	2 hrs 27 mins
Climate regions=4	2 hrs 27 mins
Climate regions=5	2 hrs 43 mins

