Title: Data from: Multiple constraints cause positive and negative feedbacks limiting grassland soil CO2 efflux under CO2 enrichment

PI: Philip Fay, USDA-ARS Grassland, Soil, and Water Research Laboratory, Temple, TX 76502 USA.

Data collected: Data are from an 8-year (2007-2014) CO2 enrichment experiment of constructed communities of tallgrass prairie plants in central Texas, USA using the Lysimeter CO2 Enrichment Gradient Facility

Location of data collection: 31.04520, -97.34880

Date of file creation: 03 December 2020

Licenses or restrictions: none

Missing value designation: ‘- -‘

Figure 1

Columns A-H: Yearly data values for each soil type.

A: year

B: soil, soil texture classification

C: section, location along the carbon dioxide (CO2) gradient

D: CO2, CO2 concentration, units µL L-1

E: JCO2, soil CO2 efflux, µmol m-2 s-1

F: Aboveground net primary productivity (ANPP), g m-2

G: Soil water potential (Ψsoil), MPa

H: Photosynthetic photon flux density (PPFD), µmol m-2 s-1

Columns K-V: Mean data values by soil type and section.

K: soil, soil texture classification

L: section, location along the CO2 gradient

M: CO2, CO2 concentration, units µL L-1

N: CO2\_SE, standard error of CO2 concentration

O: JCO2, soil CO2 efflux, µmol m-2 s-1

P: JCO2\_SE, standard error of JCO2

Q: Aboveground net primary productivity (ANPP), g m-2

R: ANPP\_SE, standard error of ANPP

S: Soil water potential (Ψsoil), MPa

T:SWP\_SE, standard error of Ψsoil

U: Photosynthetic photon flux density (PPFD), µmol m,2 s,1

V: PPFD\_SE, standard error of PPFD.

Columns X-AF: Mean data values by soil type.

X: soil, soil texture classification

Y: JCO2, soil CO2 efflux, µmol m-2 s-1

Z: JCO2\_SE, standard error of JCO2

AA: Aboveground net primary productivity (ANPP), g m,2

AB: ANPP\_SE, standard error of ANPP

AC: Soil water potential (Ψsoil), MPa

AD:SWP\_SE, standard error of Ψsoil

AE: Photosynthetic photon flux density (PPFD), µmol m,2 s,1

AF: PPFD\_SE, standard error of PPFD.

Figure 2.

Columns A-E: Yearly data values for each soil type.

A: year

B: soil, soil texture classification

C: section, location along the CO2 gradient

D: CO2, CO2 concentration, units µL L-1

E: Effective species richness, exp(H).

Columns H-M: Mean data values by soil type and section.

H: soil, soil texture classification

I: section, location along the CO2 gradient

J: CO2, CO2 concentration, units µL L-1

K: CO2\_SE, standard error of CO2 concentration.

L: Effective species richness, exp(H).

M: expH\_SE, standard error of exp(H).

Columns P-S: Mean data values by soil type and section.

P: soil, soil texture classification

Q: lag, the distance between pairs of sections within a soil over which change in CO2 and species turnover are calculated. 1 = one section apart, 2=two sections apart, and so on.

R: Change in CO2, the difference in CO2 concentration (µmol m,2 s,1) between pairs of sections ‘lag’ sections apart within a soil, averaged over all years.

S: Turnover, the Bray-Curtis distance between pairs of sections ‘lag’ sections apart within a soil.

Columns V-AW: Bray-Curtis (BC) dissimilarity matrices and corresponding changes in CO2 concentration for all pairwise combinations of sections within soil types, by year.

V: year

W: soil, soil texture classification

X: section, location along the CO2 gradient

Y: CO2, CO2 concentration in the section, units µL L-1

Z: CO21 – the change in CO2 concentration between pairs of sections 1 section apart within a soil (e.g., within the silty clay soil from section 1 to 3, section 3 to 5, and so on).

AA: dBC1 – the Bray-Curtis distance between pairs of sections 1 section apart within a soil. Pairs with column Z.

AB: CO22 – the change in CO2 concentration between pairs of sections 2 sections apart within a soil (e.g., within the silty clay soil from section 1 to 5, section 3 to 7, and so on).

AC: dBC2 – the Bray-Curtis distance between pairs of sections 2 sections apart within a soil. Pairs with column AB.

And so on through:

AV: CO212 – the change in CO2 concentration between pairs of sections 12 sections apart within a soil (e.g., within the silty clay soil from section 1 to 20).

AW: dBC12 – the Bray-Curtis distance between pairs of sections 12 sections apart within a soil. Pairs with column AV.

Figure 3.

Columns A-E: Rates of change with respect to CO2 concentration in species turnover, dominant grass species abundance, and effective species richness.

A: year

B: soil – soil texture classification

C: Species turnover, Change in Bray-Curtis distance per unit change in CO2 concentration

D: Dominant grass species, change in dominant grass species abundance per unit change in CO2 concentration

E: exp(H) – change in effective species richness per unit change in CO2 concentration.

Figure 4

Columns A-G: Dataset used in structural equation models. Variables describe change in the indicated variable per unit change in CO2 concentration.

A: year

B: soil, soil texture classification

C: exp(H), change in effective species richness per unit change in CO2 concentration

D: species turnover, change in Bray-Curtis distance per unit change in CO2 concentration

E: ANPP, change in aboveground net primary production (ANPP) per unit change in CO2 concentration

F: Soil water potential, change in soil water potential (Ψsoil) per unit change in CO2 concentration

G: JCO2, change in soil CO2 efflux (JCO2) per unit change in CO2 concentration