ReadMe file for “Abraha\_2019\_ERL\_CarbonDebt.xlsx” which contains data presented in:

Michael Abraha, Ilya Gelfand, Stephen K. Hamilton, Jiquan Chen and G. Philip Robertson. 2019. Carbon debt of field-scale Conservation Reserve Program grasslands converted to annual and perennial bioenergy crops. Environmental Research Letters <https://doi.org/10.1088/1748-9326/aafc10>

This file describes the spreadsheets contained within “Abraha\_2019\_ERL\_CarbonDebt.xlsx” for the above publication. The study was conducted at the KBS GLBRC Scale-up fields (see methods). Additional data for soil chemical and physical properties and weather are available at: http://lter.kbs.msu.edu/datatables.

For further inquiries please contact Michael Abraha (abraha@msu.edu), Ilya Gelfand (igelfand@bgu.ac.il), Jiquan Chen (jqchen@msu.edu), or Phil Robertson (robert30@msu.edu).

Treatment names and description (See https://data.sustainability.glbrc.org/pages/1):

AGR-C: No-till continuous corn (-C) planted on lands previously managed as conventionally tilled corn-soybean rotation agricultural (AGR) land.

AGR-Sw: Switchgrass (-Sw) established on lands previously managed as conventionally tilled corn-soybean rotation agricultural (AGR) land.

AGR-Pr: Mixed prairie (-Pr) established on lands previously managed as conventionally tilled corn-soybean rotation agricultural (AGR) land.

CRP-C: No-till continuous corn (-C) planted on lands previously managed as Conservation Reserve Program (CRP) grasslands planted to smooth brome grass.

CRP-Pr: Mixed prairie (-Pr) established on lands previously managed as CRP grasslands planted to smooth brome grass.

CRP-Sw: Switchgrass (-Sw) established on lands previously managed as CRP grasslands planted to smooth brome grass.

CRP-Ref: Unconverted CRP grassland. Dominant vegetation is smooth brome grass.

The AGR lands were managed as corn-soybean rotation for 50+ years before conversion. The CRP grasslands were managed as CRP for 22 years before conversion with smooth brome grass as the dominant vegetation. All treatments, except for CRP-Ref, were planted to soybean in 2009 prior to crop establishment in 2010. Corn stover was left in place except in 2015 and 2016 when ~35% was harvested; the perennials were harvested from 2011 onwards while the CRP-Ref was not harvested at any time. The CRP-Ref received no management practice during the experiment.

Spreadsheets in “Abraha\_2019\_ERL\_CarbonDebt.xlsx”:

1) Fluxes&Yield\_CO2eq

2) AgInputs

3) Offset

4) GWI

5) Emission reduction

Each spreadsheet is described below along with variates explained.

1) Spreadsheet: Fluxes&Yield\_CO2eq

Description: CO2-equivalents of net ecosystem C exchange (NEE), Harvested biomass, NEE adjusted for harvest (NEEadj), soil N2O-N flux and soil CH4-C flux for all treatments from 2009 through 2016. Negative values indicate uptake and positive emission. Uncertainties and standard errors are described in supplementary material. Data presented in Figs. 1 and 3, Figs. S2 and S3, and Tables S7, S9, S10 and S11.

Variate Description

year the year activities were performed

treatment experimental treatment (see treatment description above)

harvest fraction fraction of harvest; ‘grain; stover; whole plant or none’, depending on harvested biomass

NEE net ecosystem C exchange, measured using EC, in gram CO2-eq per square meter per year

uncertainty NEE uncertainty for net ecosystem C exchange in gram CO2-eq per square meter per year

Harvest harvested biomass in gram CO2-eq per square meter per year

se Harvest standard error for harvested biomass in gram CO2-eq per square meter per year

NEEadj NEEadj in gram CO2-eq per square meter per year

uncertainty NEEadj uncertainty for NEEadj in gram CO2-eq per square meter per year

soil N2O-N flux Soil N2O-N flux (n = 4 chambers) in gram CO2-eq per square meter per year

se soil N2O-N flux standard error for N2O-N flux (n = 4 chambers) in gram CO2-eq per square meter per year

soil CH4-C flux soil CH4-C flux (n = 4 chambers) in gram CO2-eq per square meter per year

se soil CH4-C flux standard error for soil CH4-C flux (n = 4 chambers) in gram CO2 per square meter per year

2) Spreadsheet: AgInputs

Description: CO2-equivalents arising from farming inputs (seed, fertilizer, liming and pesticide productions, and field operations) for all treatments from 2009 through 2016. No standard errors provided. Data presented in Fig 3, and Table S7.

Variate Description

year the year activities were performed

treatment experimental treatment (see treatment description above)

harvest fraction fraction of harvest; ‘grain; stover; whole plant or none’, depending on harvested biomass

Ag Inputs farming inputs cost in gram CO2-eq per square meter per year

3) Spreadsheet: Offset

Description: Fossil fuel offset credit provided by ethanol produced from biomass for all treatments from 2009 through 2016. Data presented in Fig 3, and Tables S7 and S9.

Variate Description

year the year activities were performed

treatment experimental treatment (see treatment description above)

harvest fraction fraction of harvest; ‘grain; stover; whole plant or none’, depending on harvested biomass

Yield harvested biomass of a system in gram per square meter per year

se Yield standard error for harvested biomass of a system in gram per square meter per year

Fossil fuel offset credit fossil fuel offset credit due by ethanol biomass production in gram CO2-eq per square meter per year

se Fossil fuel offset credit standard error for fossil fuel offset credit provided by ethanol biomass production in gram CO2-eq per square meter per year

4) Spreadsheet: GWI

Description: Global warming impact (GWI) for all treatments from 2009 through 2016. Data presented in Figs. 1, 2 and 3, and Table S7.

Variate Description

year the year activities were performed

treatment experimental treatment (see treatment description above)

harvest fraction fraction of harvest; ‘grain; stover; whole plant or none’, depending on harvested biomass

GWI global warming impact in gram CO2-eq per square meter per year

se GWI standard error for global warming impact in gram CO2-eq per square meter per year

5) Spreadsheet: Emission reduction

Description: Emission reduction compared to fossil fuel (gasoline) lifecycle emission for all treatments from 2009 through 2016. Data presented in Fig. 4.

Variate Description

year the year activities were performed

treatment experimental treatment (see treatment description above)

harvest fraction fraction of harvest; ‘grain; stover; whole plant or none’, depending on harvested biomass

Emission reduction emission reduction compared to fossil fuel lifecycle emission in %

se Emission reduction standard error for emission reduction compared to fossil fuel lifecycle emission in %