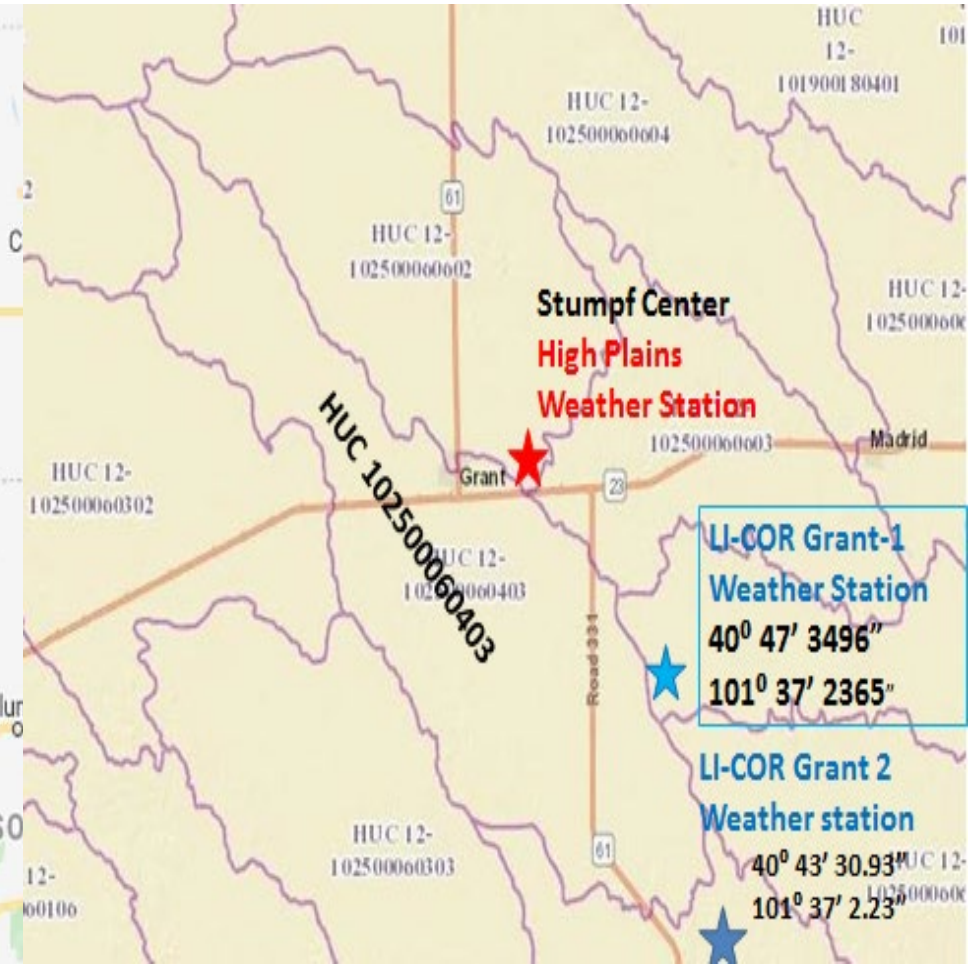
Parallel 41 & HUC 12 Project

Nov 15, 2022 Cambridge

Parallel 41

HUC 12



LI-COR Flux Tower
Grant NE-01

HUC 12 LI-COR Station

Comparing LI-COR Grant 01 to HUC 12 and Frericks Weather Station

LI-Cor Grant 01 compared to the Pessl weather station						10/19/2022
	Grant 01	Grant 01		Pessl	Grant 01 ETc	**Grant 01 ETr**
Month	ETc	ETr	Difference	Frericks ETr	Difference	**Difference**
June	0.137	0.249	0.112	0.000	0.000	**0.000**
July	0.207	0.235	0.029	0.210	0.009	**-0.027**
August	0.162	0.237	0.075	0.220	0.058	**-0.017**
Sepember	0.095	0.248	0.154	0.167	0.073	**-0.416**
Yearly average	**0.150**	**0.242**	**0.092**	**0.199**	**0.047**	**-0.153**

LI-COR HUC 12 compared to the Frericks weather station						10/11/2022
	HUC 12	HUC 12		Pessl	HUC 12 ETc	**HUC 12 ETr**
Month	ETc	ETr	Difference	Frericks ETr	Difference	**Difference**
June		0.000				
July	0.060	0.219	0.042	0.218	0.181	**0.025**
Aug	0.089	0.115	0.167	0.628	0.161	**-0.005**
Sep	0.056	0.245	0.189	0.176	0.120	**-0.069**
Yearly average	**0.069**	**0.193**	**0.133**	**0.341**	**0.154**	**-0.016**

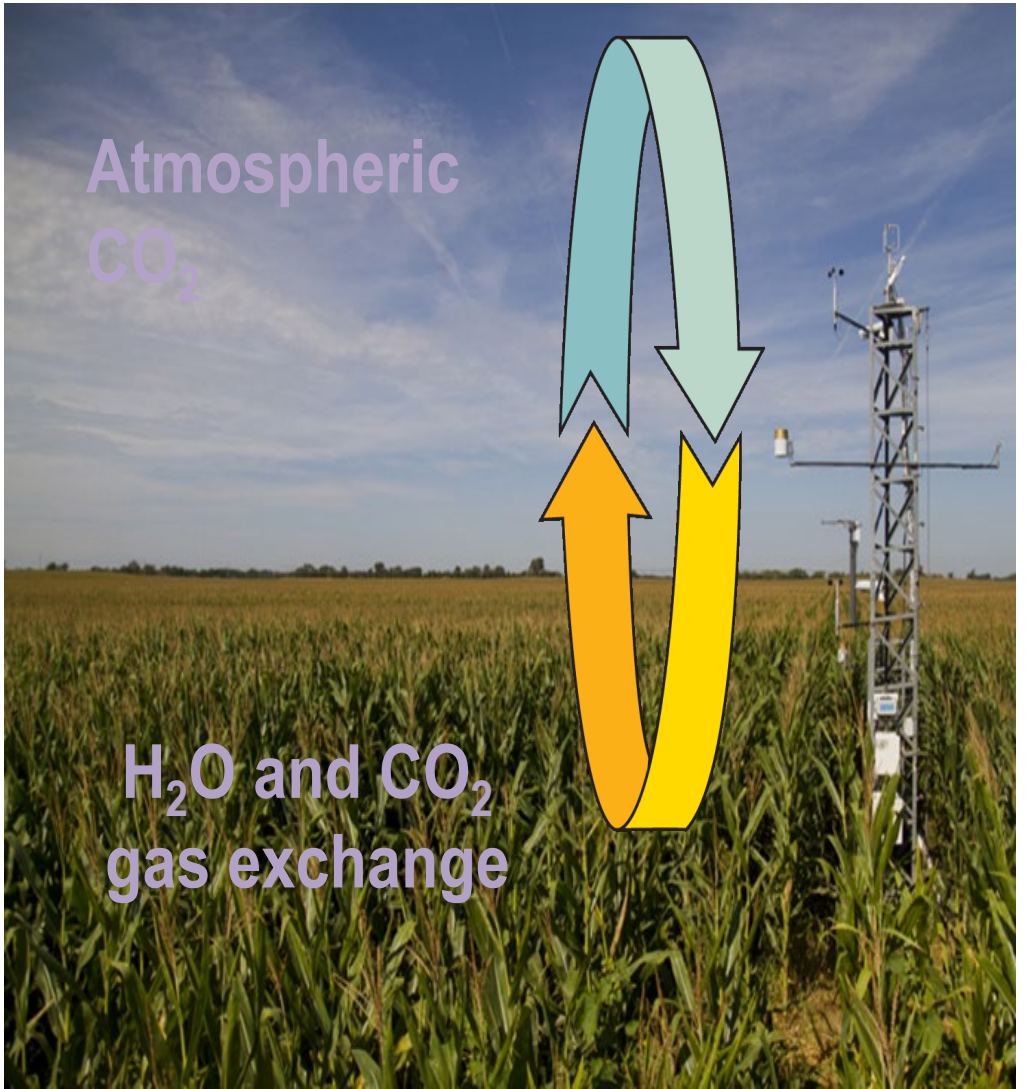
Eddy Covariance and Watershed Vegetative Consumptive Water Use

Eddy Covariance Systems

- An array of sensors that measures various data
  - Net radiation (Net radiometer)
  - Wind speed and direction (3D ultrasonic anemometer)
  - Water vapor and CO_2 (open path CO_2/H_2O analyzer)
  - Soil heat flux plates
  - Other various instrumentation
    - rain gauge, cup anemometer, RH%, pressure

Eddy Covariance Systems: H_20 and CO_2

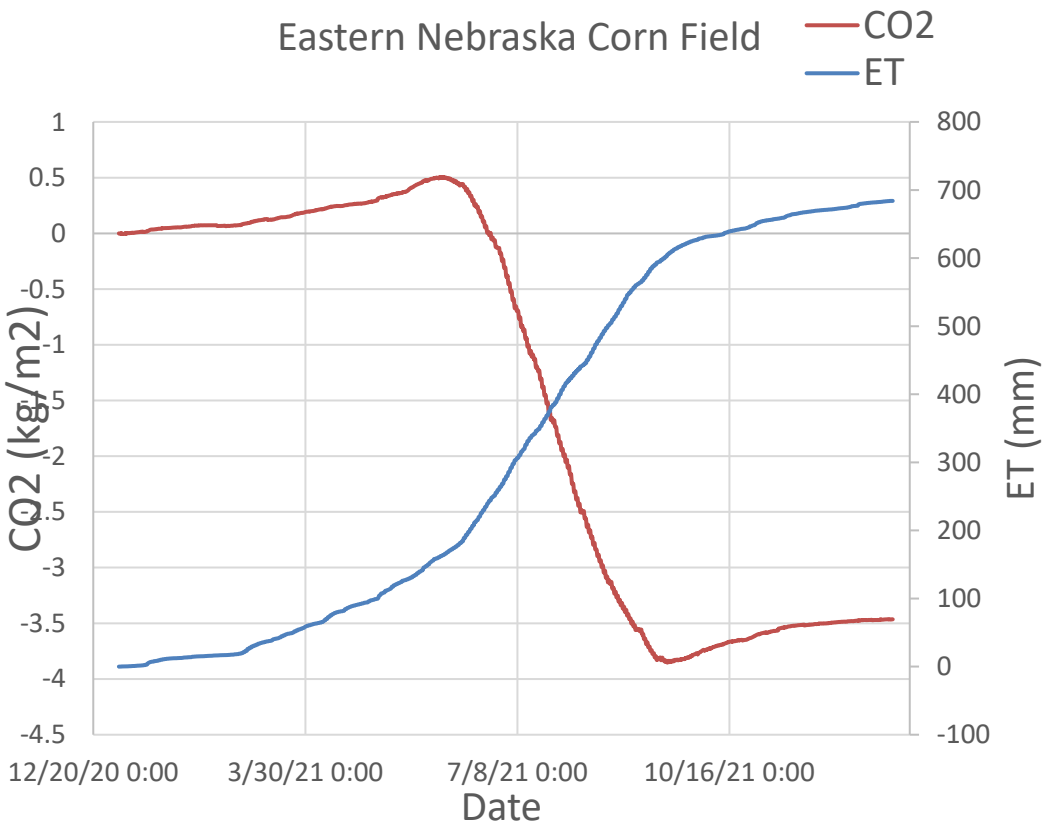
- H_2O and CO_2 measurements
  - Transpiring vegetation will uptake CO_2 and release H_2O
  - Eddy covariance measures the concentration of these gases and the vertical wind speed to determine how much H_2O and CO_2 is moving in/out of and area



Eddy Covariance Systems: H_20 and CO_2

- With eddy covariance systems, the movement of H_2O and CO_2 can be measured continuously, giving us an idea of how much H2O and CO2 is begin transferred to/from the land surface/atmosphere

- ET (evapotranspiration) – evaporation plus transpiration



Eddy Covariance and Watershed Vegetative Consumptive Water Use

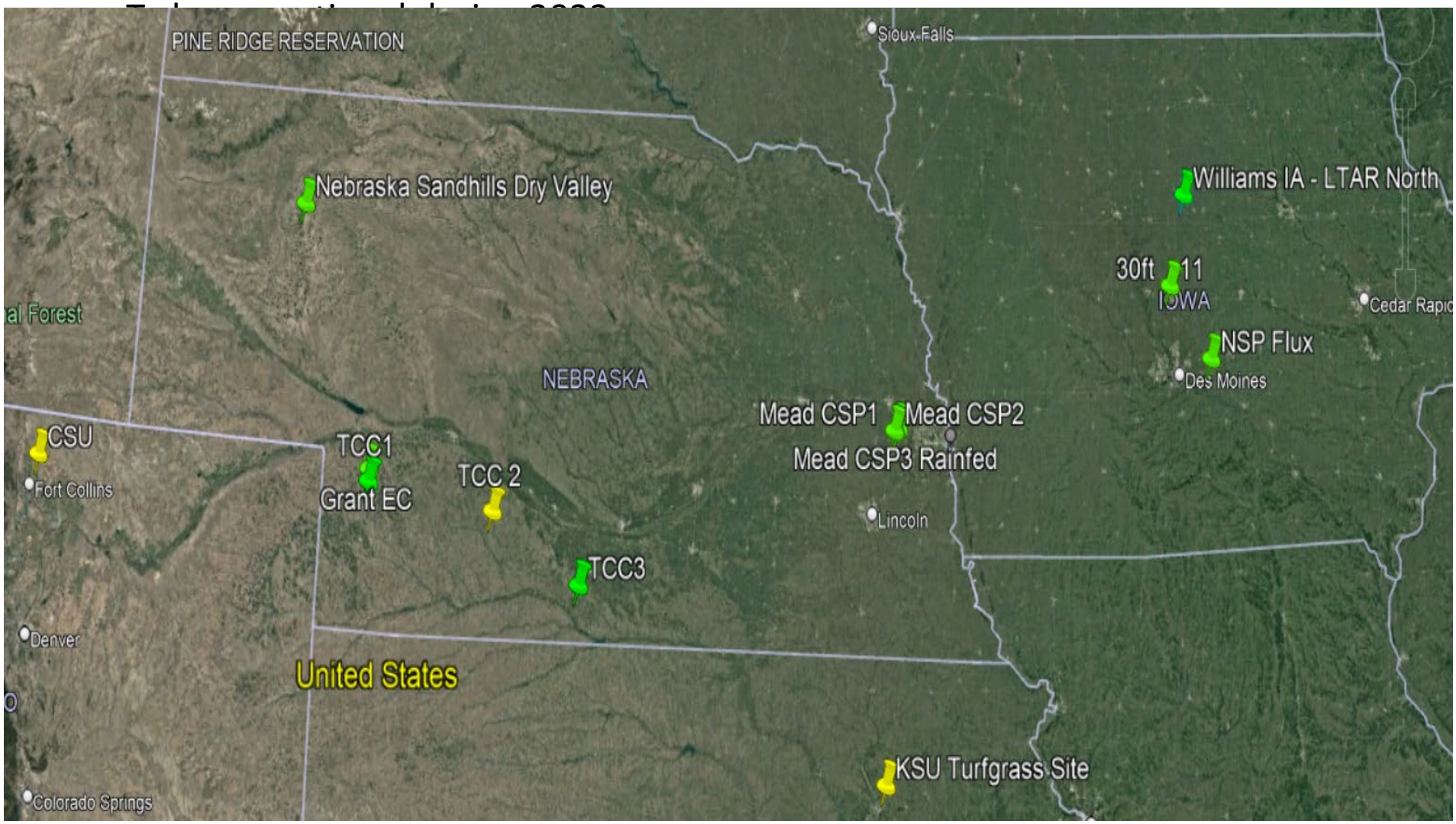
- Eddy covariance systems provide accurate measurement of H_2O and CO_2 exchange at a given location
- Modeling approaches (often utilizing satellite data) can be used to estimate H_2O and CO_2 exchange over large areas
- The measurements from eddy covariance systems can be used to improve accuracy of modeled estimates

Parallel 41 Flux Network Concept

- A network of Eddy Covariance systems to provide real-time energy balance fluxes and gas exchange of different crops and vegetated surfaces, to be used for water balance and crop water productivity estimates in different watersheds and agricultural systems.
- Provide real-time crop actual evapotranspiration for irrigation water management to farmers and water managers
- Use the data for improving the accuracy of spatially distributed satellite-based estimates of evapotranspiration

Parallel 41 Flux Network: Real Time Crop Evapotranspiration

- Installed Eddy Covariance Flux stations with **SmartFlux** and networked with **FluxSuite**: 7 in NE, 3 in IA

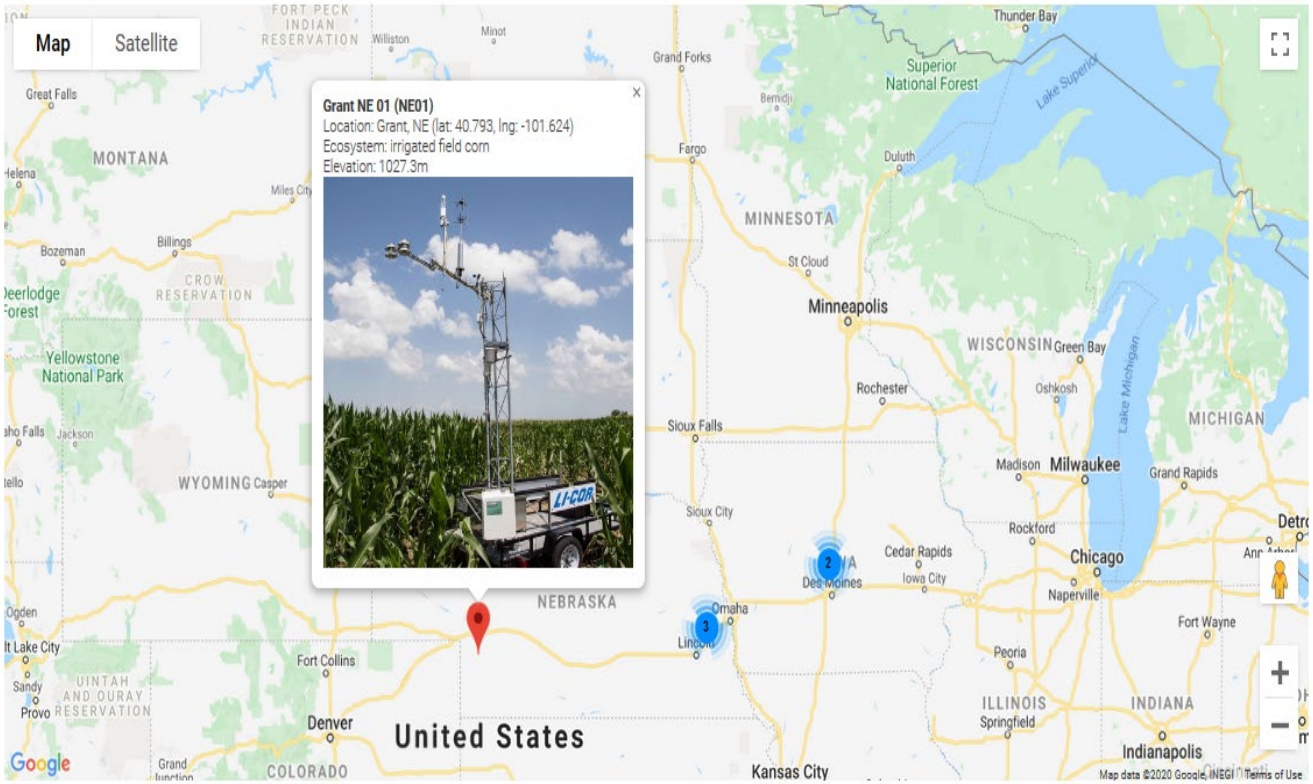


Parallel 41
Flux Network

Home | About | Flux Stations | Producer Dashboard | Resources

Get Started

Pins on the map represent flux station locations. Click a point to view data. Data and graphs will appear below the map.



Grant NE 01

Date	2019-07-31
ET Units	○ mm ◉ inches
Daily Measured ET (ETc) Value	0.16 inches

ETc of Previous 7 Days	2019-07-25	2019-07-26	2019-07-27	2019-07-28	2019-07-29	2019-07-30	2019-07-31
	0.22	0.23	0.21	0.24	0.24	0.21	0.16

https://parallel41.nebraska.edu/#/

Wind Rose (Grant,NE)
Legend
> 7
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
Grant
N40°47'42"
Grant
W101°37'30"
Road 333
Google Earth
N
2000 ft

Grant, NE

All Stations | Dashboard | Information | Manage Alerts

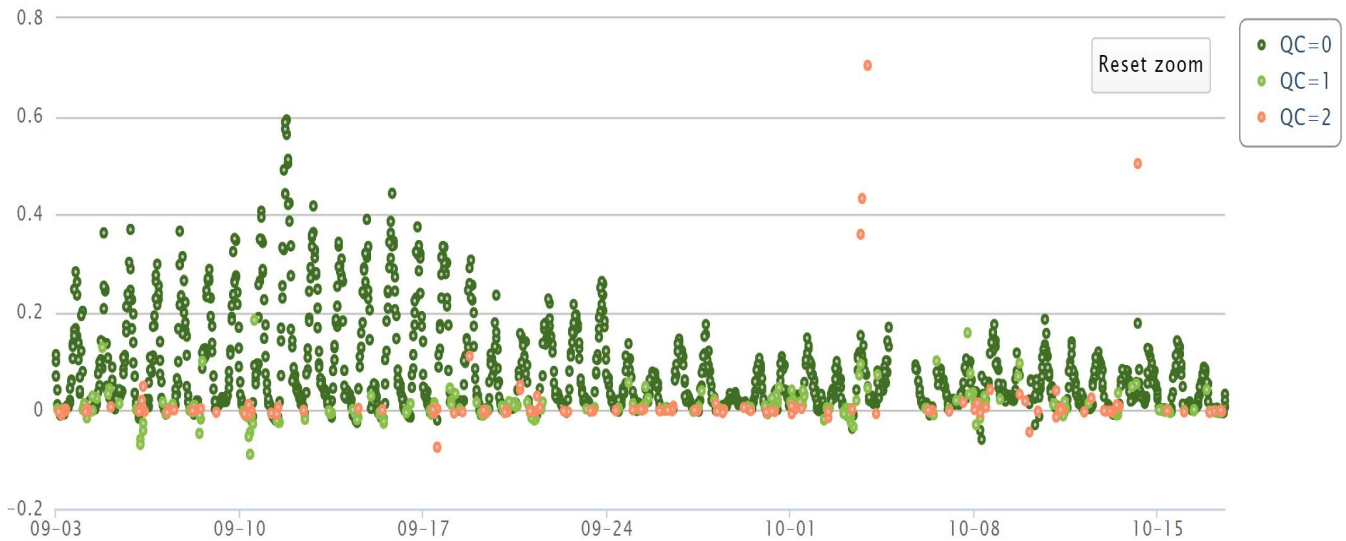
ET (mm)

Field: ET

Start Date: 2018-09-03

End Date: 2018-10-18

☑ QA/QC



ET

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LI-COR

Grant NE 01

Date 2021-09-30

ET Units ◉ inches ○ mm

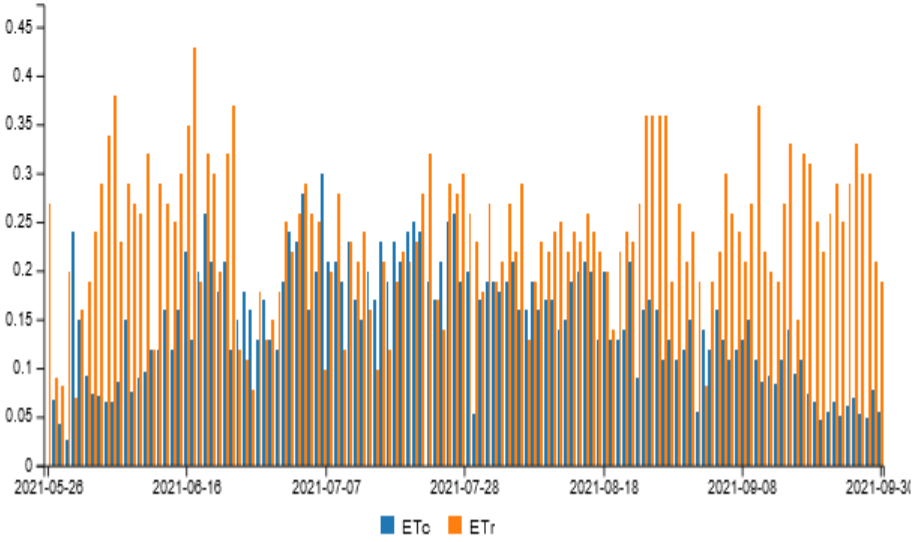
ETc of Previous 7 Days

2021-09-24	2021-09-25	2021-09-26	2021-09-27	2021-09-28	2021-09-29	2021-09-30
0.051	0.063	0.07	0.054	0.05	0.078	0.056

ETr of Previous 7 Days Source: HPRCC

2021-09-24	2021-09-25	2021-09-26	2021-09-27	2021-09-28	2021-09-29	2021-09-30
0.25	0.29	0.33	0.3	0.3	0.21	0.19

Graph of Daily ETc & ETr Values for Date Selected and Previous 128 Days



◉ inches ○ mm

waterforfood.nebraska.edu

Thank you

HUC 12 #102500060403
33,459 Acres

Irrigated Crop Acres in 2017. 30% Irrigated

Corn	Wheat	Soybeans	Pinto's	Sudan	Sunflowers	Milo	J Millet	Proso	Fallow	Total Acres
6,555	292	2,592	393	195						10,027

Rain Fed (dryland) Crop Acres in 2017. 46.3 % Rain Fed

7,261	2,608	98	913	207	186	530	262	3410		15,475

Total tilled crop acres in 2017. 76.2 % Tilled

13,816	2,900	2,690	393	1,108	207	186	530	262	3,410	25,502

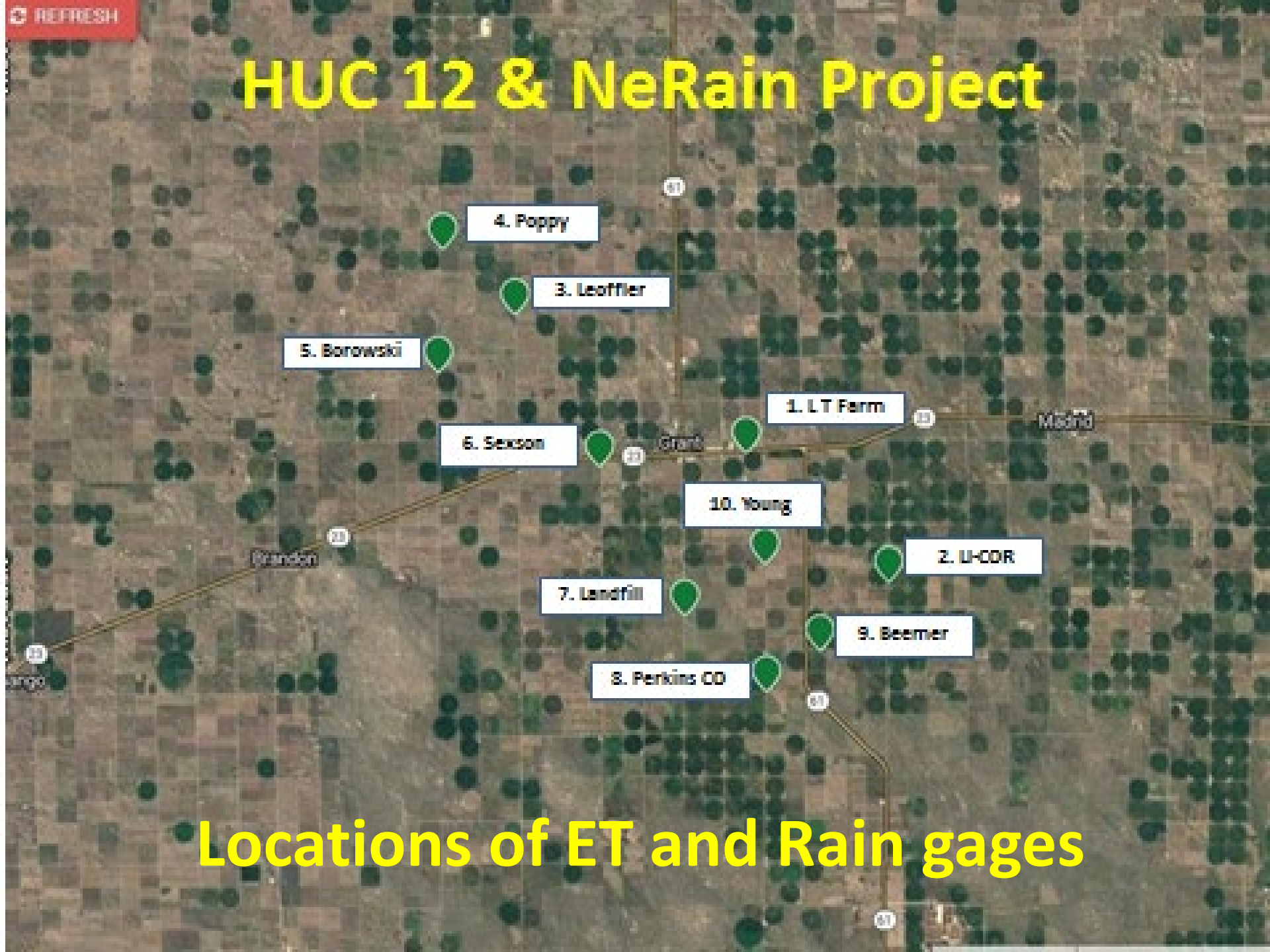
Pasture, Grass CRP, Shelter Belts, Buildings/City Roads/Waste. 15.5 % Pasture

5,181	452	135	127	572	1,629	7,957

33,459

Total tilled and pasture acres equals 91.7%

HUC 12 & NeRain Project



Locations of ET and Rain gages

Name# 1 LT Farm

Legal	NE 18-10-38				
NeRain	Perk032				
Revised	10/27/2022				
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)
March	0			2.67	2.67
Arril	0.00	0.000	0.000	2.02	4.69
May	6.10	0.197	6.100	5.68	10.37
June	6.70	0.223	12.800	1.73	12.10
July	4.70	0.152	17.500	0.27	12.37

Name# 2 LI-COR Lampman

Legal	NW 35 10-38				
NeRain	Perk4170				
Revised	10/28/2022				
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)
March	0			2.70	2.70
Arril	0.00	0.000	0.000	1.87	4.57
May	5.40	0.174	5.400	4.20	8.77
June	8.30	0.277	13.700	0.83	9.60
July	8.50	0.274	22.200	0.07	9.67

2021 ET & Rain gage summary

Name	# 3 Hatch 2021		NeRain	Perk4337	
Legal	SW 29-11-39		Revised	10/28/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)
March	0			3.00	3.00
Arril	0.00	0.000	0.000	1.35	4.35
May	4.40	0.142	4.400	8.90	13.25
June	6.90	0.230	11.300	2.89	16.14
July	5.30	0.171	16.600	0.07	16.21
Aug	9.00	0.290	25.600	0.92	17.13
Sep	**9.50**	**0.317**	**35.100**	**1.68**	**18.81**

2021 ET & Rain gage summary

Name	# 4 Poppe 2021		NeRain	Perk4338	
Legal	SW 24-12-40		Revised	10/28/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			3.10	**3.10**
Arril	0.00	0.000	0.000	1.30	**4.40**
May	4.00	0.129	4.000	5.92	**10.32**
June	7.50	0.250	11.500	2.23	**12.55**
July	9.30	0.300	20.800	0.05	**12.60**
Aug	8.30	0.268	29.100	0.61	**13.21**
Sep	**7.20**	**0.240**	**36.300**	**1.69**	**14.90**

Name$ 5 Jessen 2021			NeRain Perk4339				Name# 6 Sexson 2021			NeRain Perk4340		
Legal	SW 36-11-40		Revised	10/28/2022			Legal	NE 16-10-39		Revised	10/29/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)		2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			3.00	3.00		March	0			2.67	**2.67**
Arril	0.00	0.000	0.000	1.45	4.45		Arril	0.00	0.000	0.000	1.75	**4.42**
May	4.10	0.132	4.100	7.00	11.45		May	2.60	0.084	2.600	5.90	**10.32**
June	9.40	0.313	13.500	4.43	15.88		June	4.40	0.147	7.000	1.92	**12.24**
July	8.30	0.268	21.800	0.16	16.04		July	11.40	0.368	18.400	0.03	**12.27**
Aug	8.70	0.281	30.500	0.86	16.90		Aug	4.30	0.139	22.700	1.37	**13.64**
Sep	**7.60**	**0.253**	**38.100**	**1.99**	**18.89**		**Sep**	**3.90**	**0.130**	**26.600**	**1.24**	**14.88**

Name# 7 Landfill 2021			NeRain	Perk4341			Name# 8 Perkins 2021			NeRain	Perk4348	
Legal	NW 1-9-39		Revised	10/29/2022			Legal	NW 17-9-38		Revised	10/29/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)		2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			2.65	2.65		March	0			2.70	**2.70**
Arril	0.00	0.000	0.000	1.40	4.05		Arril	0.00	0.000	0.000	1.66	**4.36**
May	5.30	0.171	5.300	5.91	9.96		May	3.30	0.106	3.300	5.62	**9.98**
June	7.40	0.247	12.700	1.41	11.37		June	5.20	0.173	8.500	0.98	**10.96**
July	15.00	0.484	27.700	0.03	11.40		July	6.50	0.210	15.000	0.23	**11.19**
Aug	9.30	0.300	37.000	2.83	14.23		Aug	5.70	0.184	20.700	3.82	**15.01**
Sep	**7.30**	**0.243**	**44.300**	**0.55**	**14.78**		**Sep**	**4.50**	**0.150**	**25.200**	**0.71**	**15.72**

Name# 9 Beemer 2021			NeRain	Perk4348			Name# 10 Young 2021			NeRain	Perk4350	
Legal	NW 9-9-39		Revised	10/29/2022			Legal	SE 33-9-38		Revised	10/29/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)		2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			2.65	2.65		March	0			2.65	**2.65**
Arril	0.00	0.000	0.000	1.67	4.32		Arril	0.00	0.000	0.000	1.63	**4.28**
May	4.50	0.145	4.500	6.54	10.86		May	5.20	0.168	5.200	6.27	**10.55**
June	9.00	0.300	13.500	1.14	12.00		June	8.80	0.293	14.000	0.92	**11.47**
July	10.20	0.329	23.700	0.12	12.12		July	10.00	0.323	24.000	0.15	**11.62**
Aug	8.60	0.277	32.300	3.16	15.28		Aug	8.70	0.281	32.700	3.39	**15.01**
Sep	**7.20**	**0.240**	**39.500**	**0.87**	**16.15**		**Sep**	**7.70**	**0.257**	**40.400**	**0.64**	**15.65**

Summary of the 10 ET & Rain gages					
Revised	10/29/2022	**Average for the 10 ET & Rain gages**			
2021 Monthly summary	Monthly ET (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain ave (inches)	**Yearly Total Rain (inches)**
March	0.00	0	0	2.78	**2.78**
April	0.00	0	0	1.61	**4.39**
May	4.49	0.145	4.49	6.19	**10.58**
June	7.36	0.245	11.85	1.85	**12.43**
July	8.92	0.288	20.77	0.12	**12.55**
Aug	7.48	0.241	28.25	2.26	**14.81**
Sep	**6.77**	**0.226**	**35.02**	**1.13**	**15.94**

ET and Rainfall summary: **Diff from Average**

Name	ET	Rainfall	ET	Rainfall
1. LT Farm	27.1	15.65	- 7.92	-0.29
2. LI-COR	37.6	13.96	+2.58	-1.98
3. Hatch	35.1	18.81	- 0.08	+2.87
4. Poppe	36.3	14.90	+ 1.28	- 1.04
5. Jessen	38.1	18.89	+ 3.08	+2.95
6. Sexson	26.6	14.88	-8.42	-1.06
7. Landfill	44.3	14.78	-9.28	-1.16
8. Perkins	25.2	15.72	-9.82	**-0.22**
9. Beemer	39.5	16.15	+4.48	+0.22
10. Young	40.4	15.65	+5.38	-0.29
Summary	**35.02**	**15.94**		

NEWBA Budget Proposal

4 Davis station upgrades $230 each	= $920
5 All weather rain gauges $41 each	= $205
10 Elec tipping bucket rain gauges $190 each	=$1900
2 Arable weather stations $1800 each	= $3600
Programmer(s) (furnished by DWFI)	?
Repairs and maintenance	= $1000
Travel expense	= $3000
Administration	= $7500
Education and training	= $1000
Total	$19,125

Additional Sources of information about Parallel 41 & HUC 12

Parallel 41.nebaska.edu

nednr.nebraska.gov

www.urnrd.org

>(HUC 12rain gauges)