Management Effects on Carbon Dioxide Exchange over Northeastern Pastures

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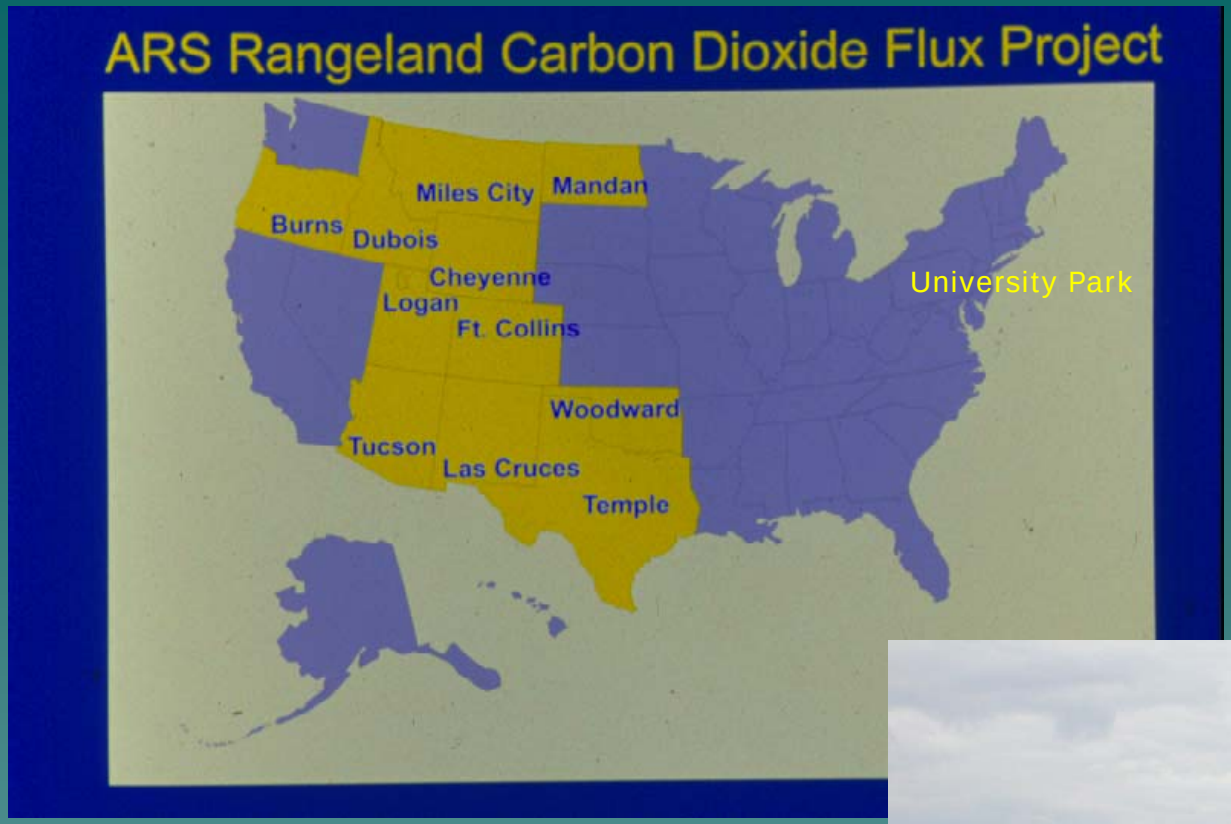


Site Description:

Pastures cut for hay and rotationally grazed by beef cattle approximately 4-5 time per year

Flux data collected in 2003 and 2004

Grass Site:

Grazed since 1968, last renovated in 1982

mixture of cool-season grasses:

orchardgrass
tall fescue
smooth bromegrass
Kentucky bluegrass

Other common species included:

dandelion
Alfalfa

readily mineralized soil organic C in the top 5 cm = 1.26 mg C g soil^{-1}

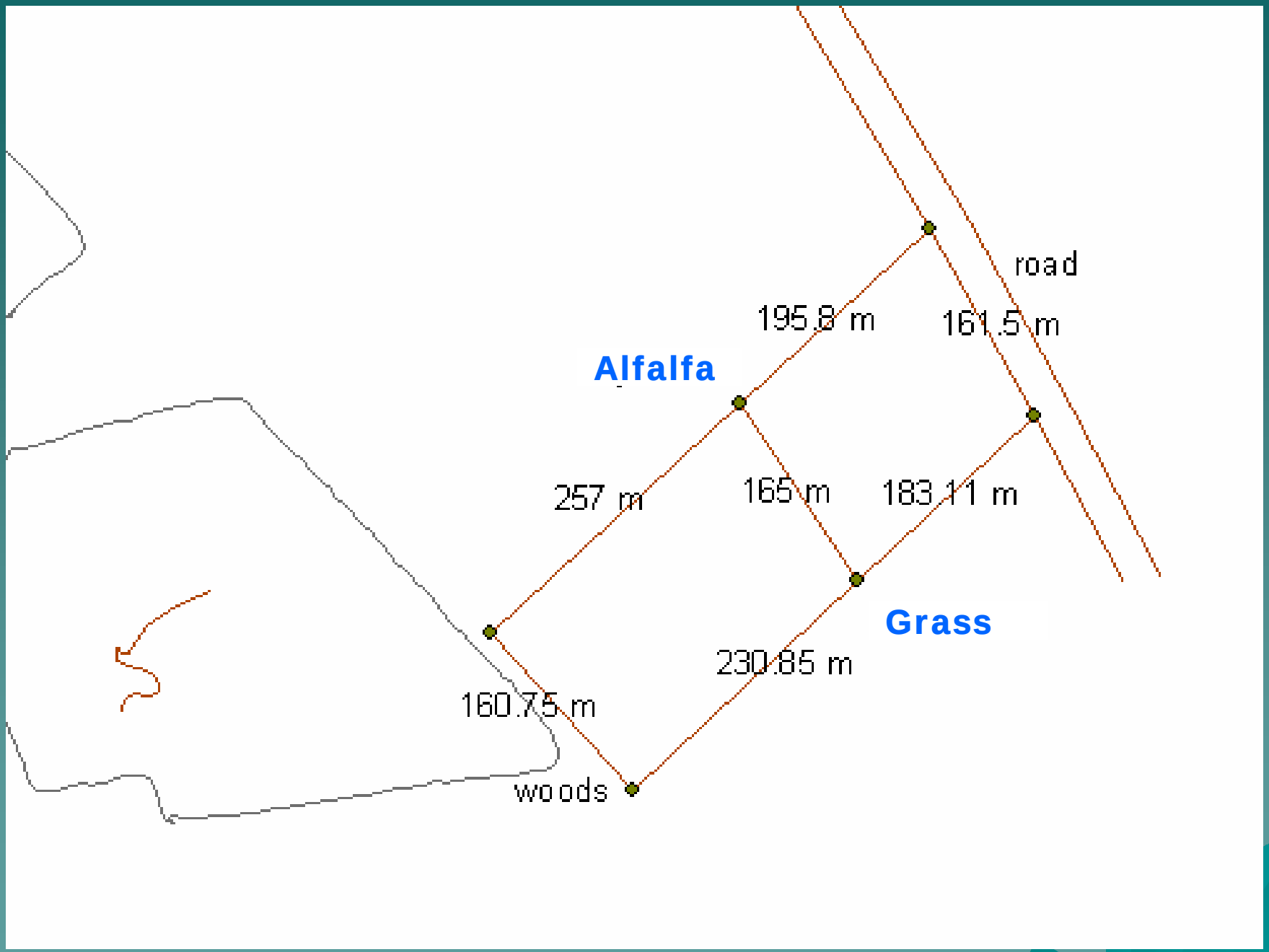
Alfalfa Site:

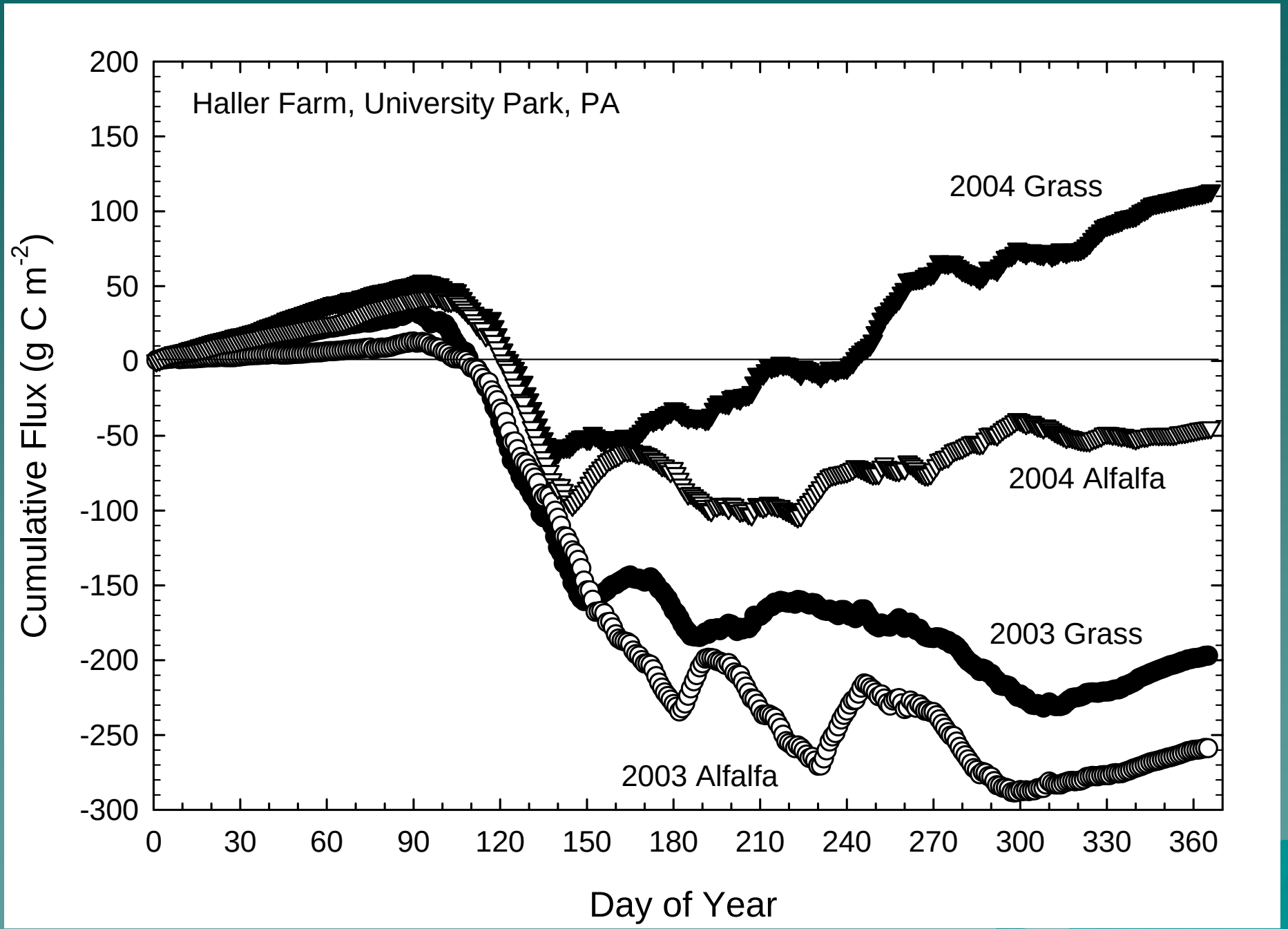
Planted in 1995

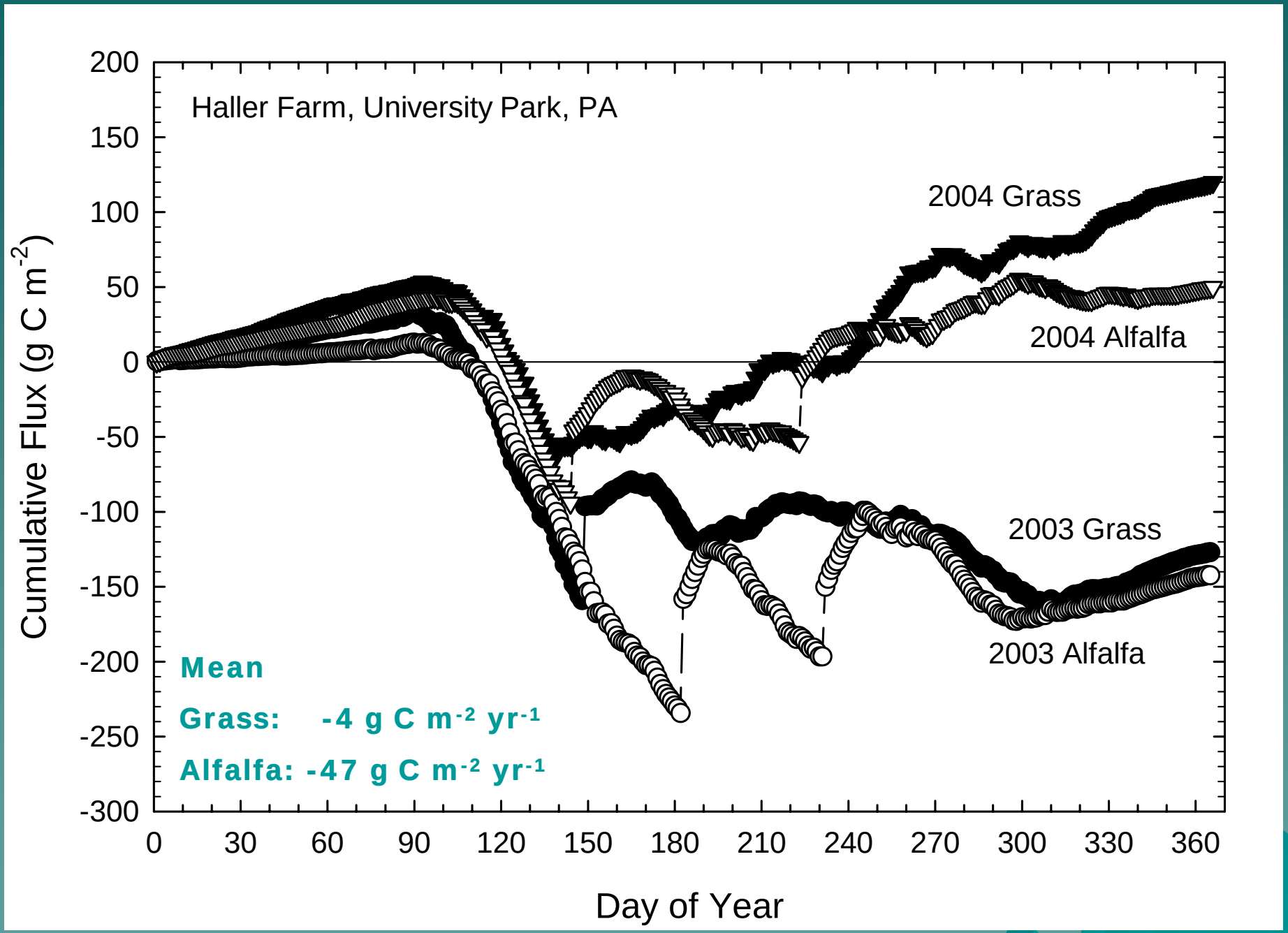
Alfalfa intermixed with:

orchardgrass
smooth brome
dandelion
Kentucky bluegrass
tall fescue

readily mineralized soil organic C in the top 5 cm = 0.88 mg C g soil^{-1}


road
195.8 m
161.5 m
Alfalfa
257 m
165 m
183.11 m
Grass
230.85 m
160.75 m
woods


Haller Farm, University Park, PA
2004 Grass
2004 Alfalfa
2003 Grass
2003 Alfalfa
Cumulative Flux (g C m-2)
Day of Year
200
150
100
50
0
-50
-100
-150
-200
-250
-300
0
30
60
90
120
150
180
210
240
270
300
330
360


Haller Farm, University Park, PA
2004 Grass
2004 Alfalfa
2003 Grass
2003 Alfalfa
Mean
Grass: -4 g C m-2 yr-1
Alfalfa: -47 g C m-2 yr-1
Cumulative Flux (g C m-2)
Day of Year
200
150
100
50
0
-50
-100
-150
-200
-250
-300
0
30
60
90
120
150
180
210
240
270
300
330
360

Alfalfa pasture monthly fluxes

	2003	2004	Difference
		g C m^{-2}	
January	3	14	11
February	3	11	8
March	7	16	9
April	-45	-41	4
May	-122	-78	44
June	-78	-1	77
July	-6	-16	-10
August	10	24	14
September	-16	6	22
October	-45	22	67
November	12	-8	-20
December	17	5	-12
Total	-260	-46	214

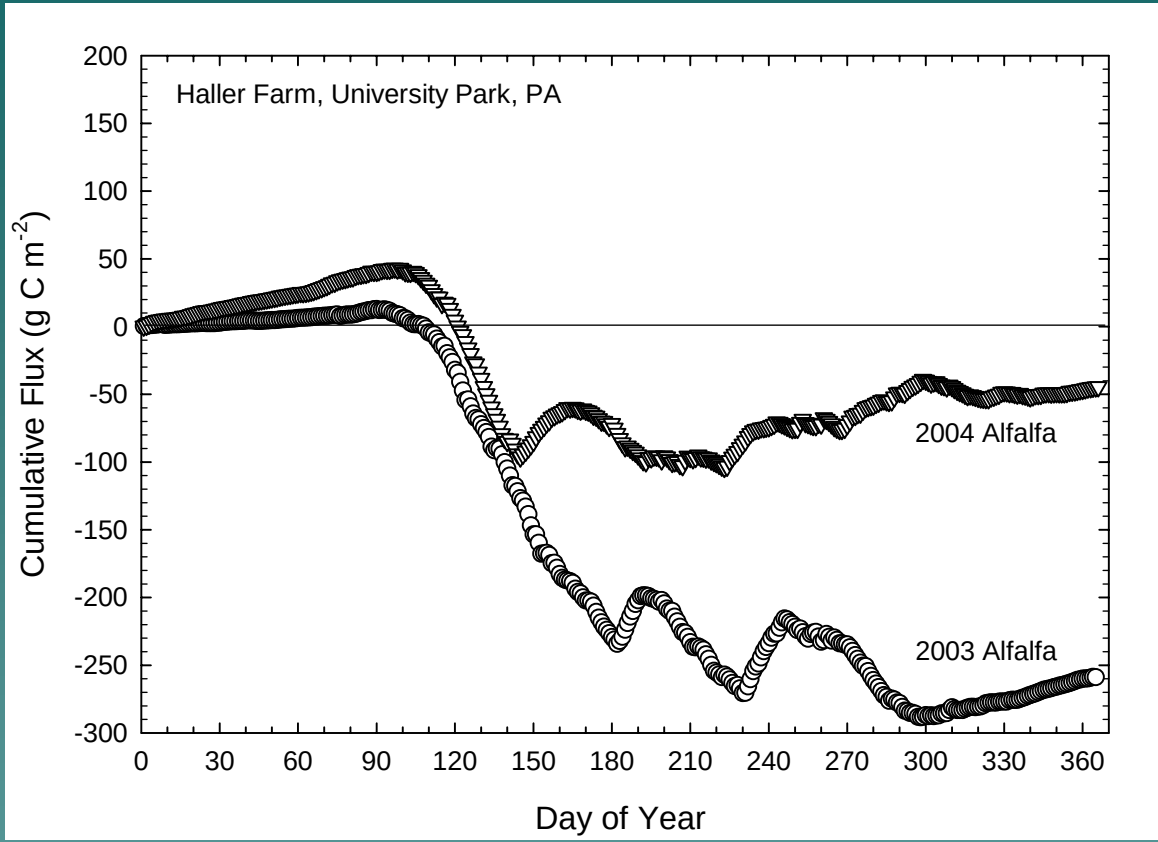
87%

Alfalfa: 2003

2-3 July (cut)
12 Aug (cut)
17-21 Oct & 18-20 Nov (grazed)

Alfalfa: 2004

21 May (cut)
11 Aug (cut)
25-27 Sep & 2-5 Oct (grazed)



In the alfalfa pasture, harvest timing had the greatest effect on differences in C fluxes between years, with environment playing a secondary role. Poor management from the forage quality perspective resulted in greater C sequestration.

Grass pasture monthly fluxes

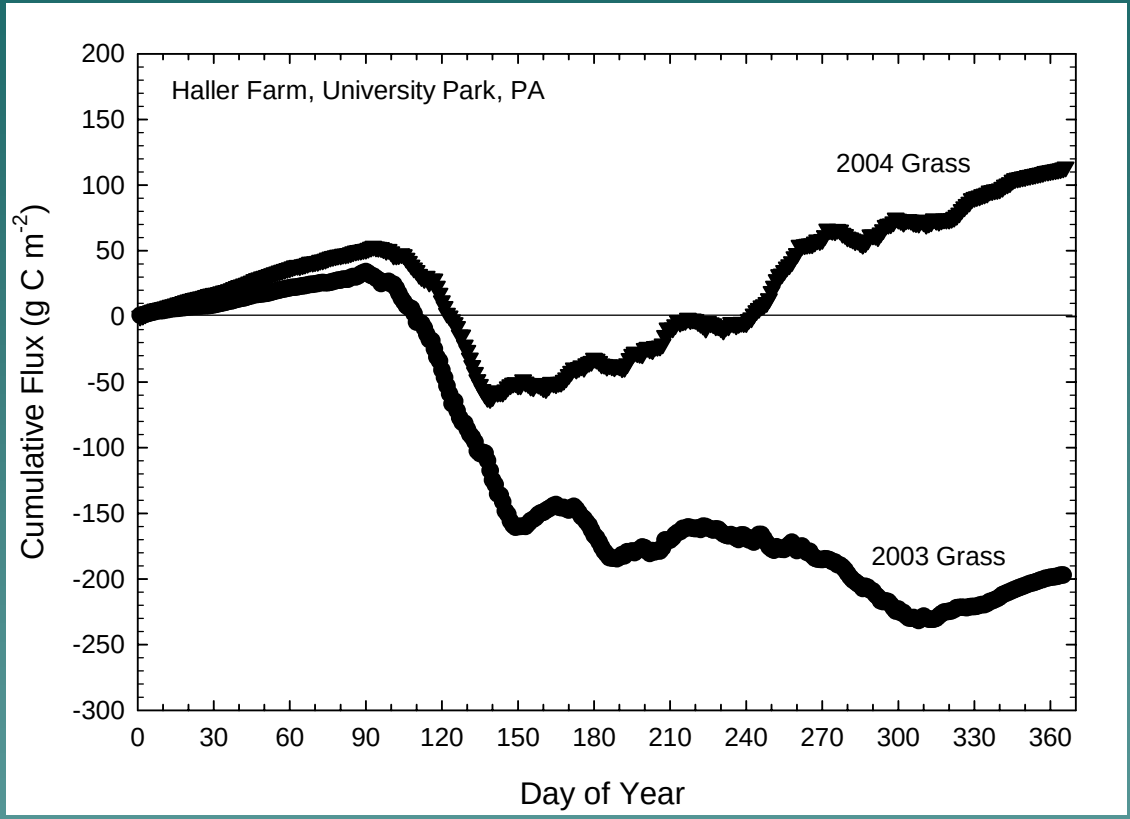
	2003	2004	Difference
		g C m^{-2}	
January	9	18	9
February	12	19	7
March	13	15	2
April	-75	-47	28
May	-119	-56	63
June	-9	14	23
July	2	31	29
August	-6	8	14
September	-14	61	75
October	-44	6	50
November	10	24	14
December	23	20	-3
Total	-197	113	310
			61%

Grass: 2003

28 May (cut)
11-16 July & 26-29 July (grazed)
19-21 Aug & 8-10 Sep (grazed)
25-28 Sep & 11-14 Nov (grazed)
9-11 Nov (grazed)

Grass: 2004

2-5 May & 14-21 May (grazed)
11-16 June & 6-11 July (grazed)
26-30 Aug & 3-7 Sep (grazed)
7-10 Nov & 18-21 Nov (grazed



Rainfall

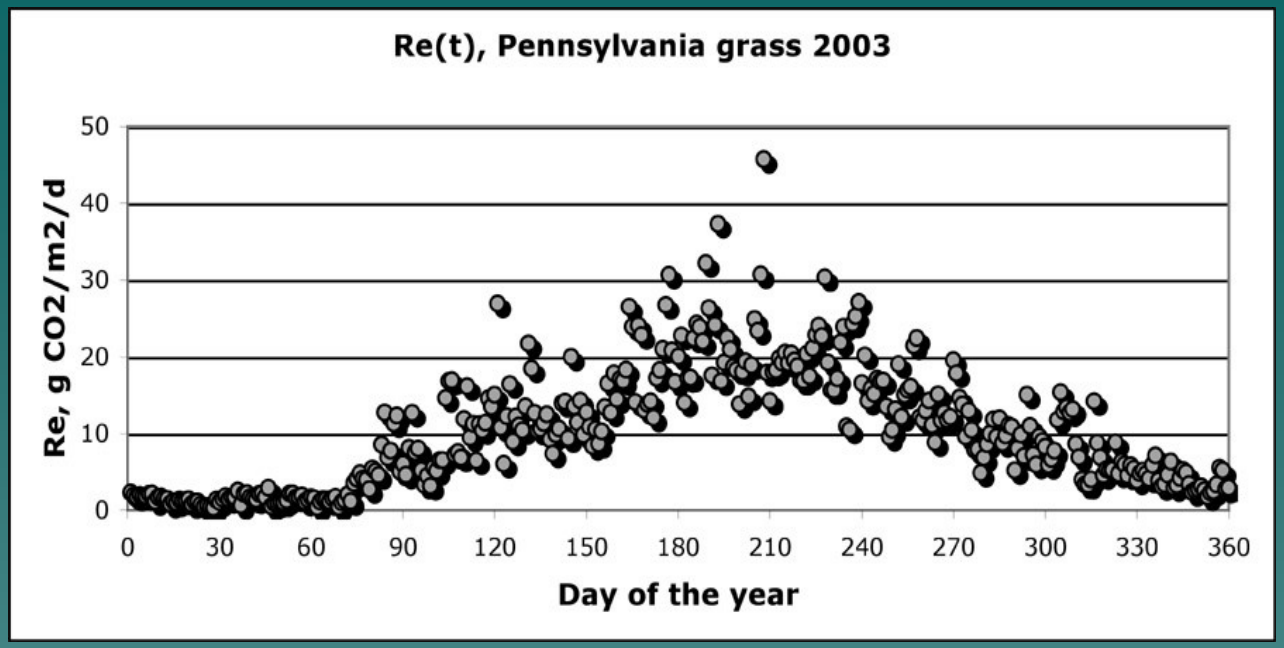
	2003	change	2004	change	Normal
			mm		
January	47	-26	49	-24	73
February	63	-4	27	-40	67
March	61	-25	55	-31	86
April	62	-18	112	32	80
May	94	0	97	3	94
June	118	9	94	-15	109
July	115	24	175	84	91
August	163	77	126	40	86
September	136	**43**	267	**174**	93
October	75	**1**	48	**-26**	74
November	105	19	67	-19	86
December	68	-4	72	0	72
Total	1107	**96**	1189	**178**	1011

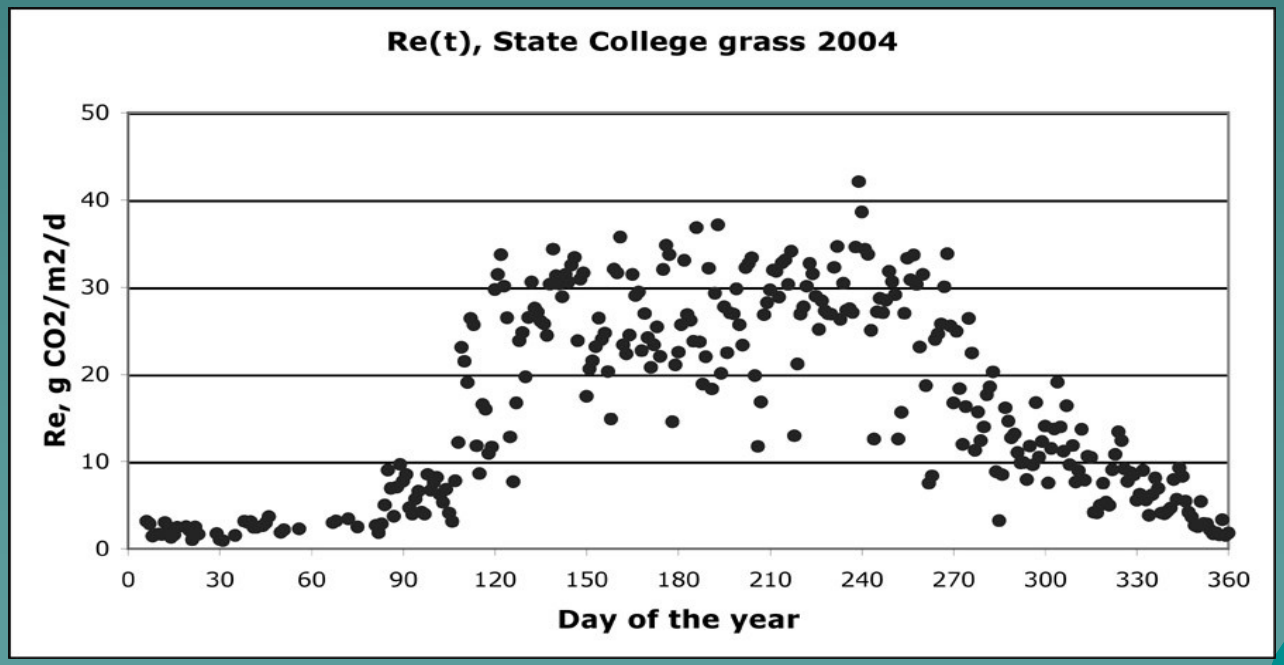
Daily Average PPFD

	2003	2004	Difference
		μmol m^{-2} s^{-1}	
January	146	127	-19
February	204	246	42
March	311	277	-34
April	383	331	-52
May	325	416	91
June	348	462	114
July	479	384	-95
August	389	379	-10
September	272	304	32
October	230	194	-36
November	129	141	12
December	119	93	-26
Mean	278	280	2

Air Temperature

	2003	2004	Normal
		°C	
January	-6.0	-6.9	-3.7
February	-4.4	-2.3	-2.2
March	2.8	3.9	0.4
April	9.4	9.8	8.8
May	13.2	17.8	14.8
June	18.1	18.5	19.5
July	21.0	20.4	21.9
August	21.3	19.7	20.8
September	16.1	17.4	16.5
October	9.2	10.1	10.3
November	7.0	6.4	4.7
December	-0.7	-0.5	-0.8
Mean	8.9	9.5	9.2





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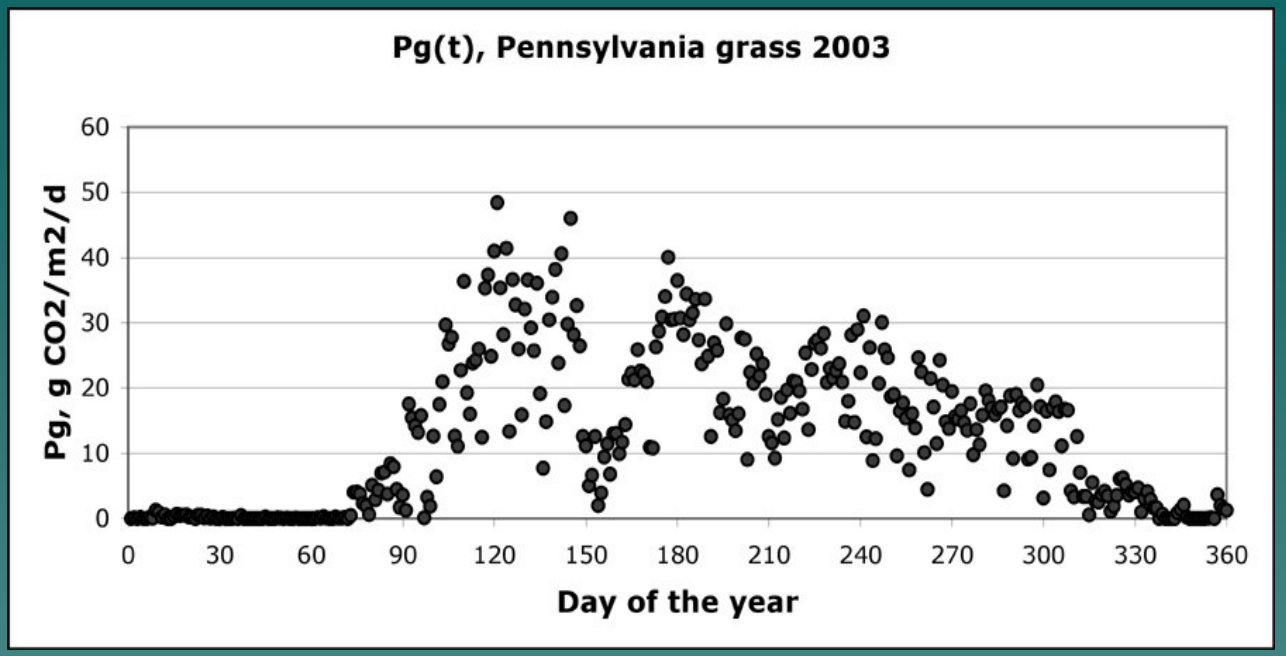

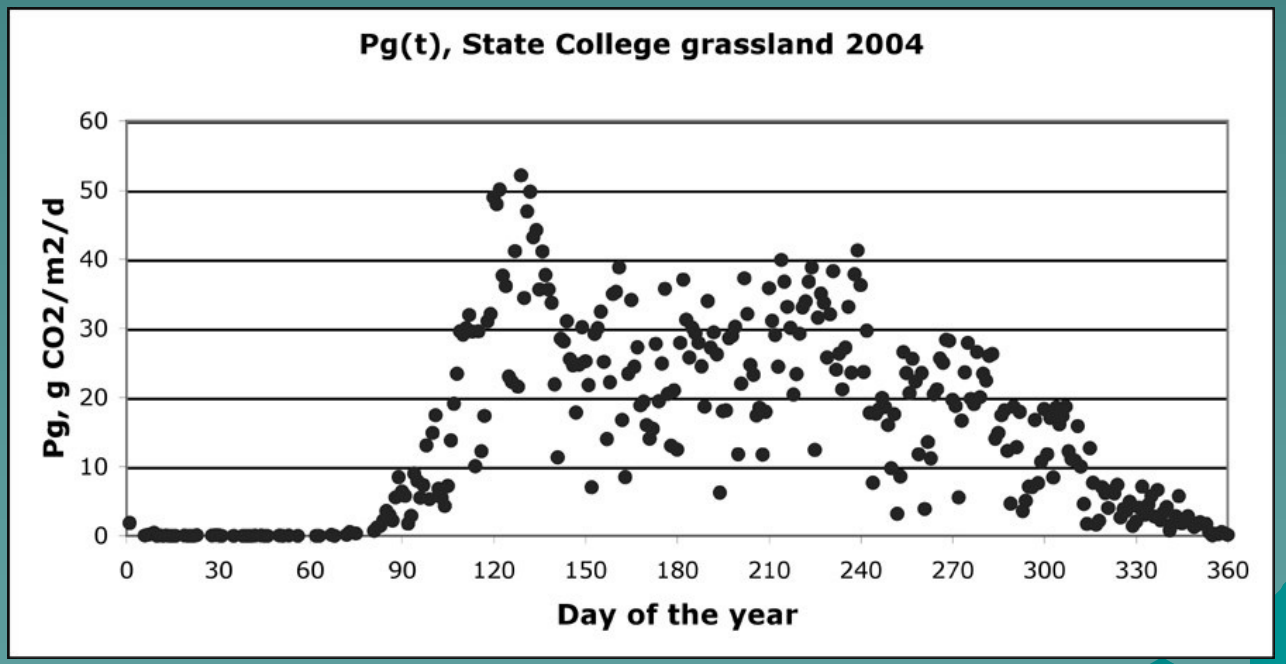

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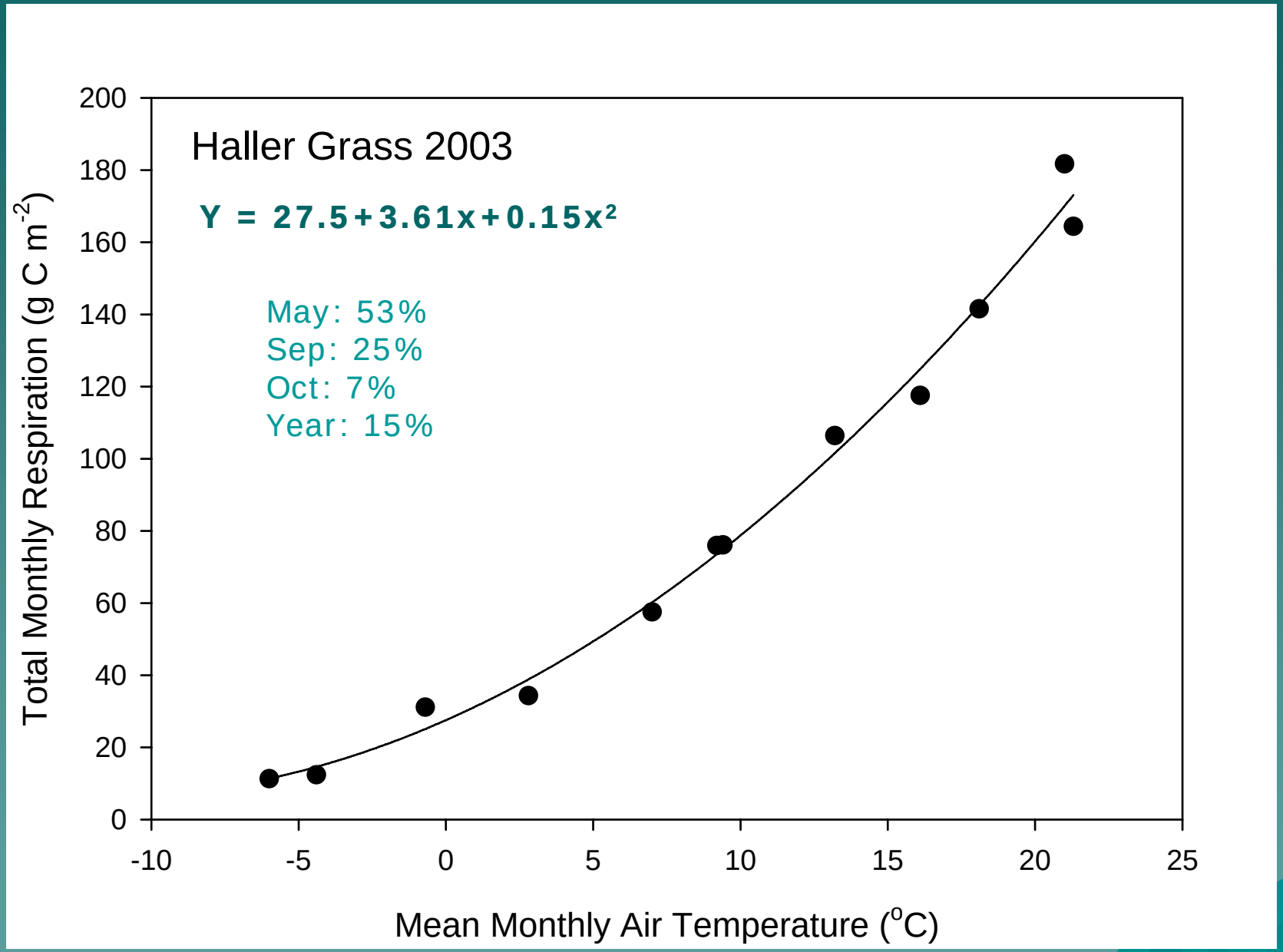
Haller Grass 2003
Y = 27.5+3.61x+0.15x²
May: 53%
Sep: 25%
Oct: 7%
Year: 15%
Total Monthly Respiration (g C m-2)
Mean Monthly Air Temperature (°C)
200
180
160
140
120
100
80
60
40
20
0
-10
-5
0
5
10
15
20
25

In the grass pasture, both management and environment appeared to play significant roles in determining differences between years. Increased respiration rather than reduced photosynthesis appeared to be the major cause of differences between years