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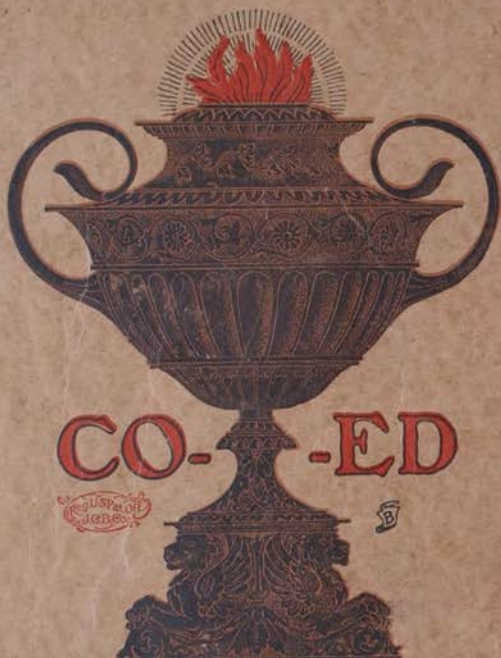
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About the Institute

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.



CO.-ED

"LET THERE BE LIGHT"
COMPOSITION

No. 2295

This note book belongs to
T. J. Fitzpatrick - Station A
Lincoln, Nebraska.
University of Nebraska

It contains field notes and sketches
of regions near Colorado Springs -
Austin Bluffs - Gravel Slides at or
near Minnehaha - Alpine Laboratory

Alates aculeis

Krinitzia virgata. IIII I II I II I II I II I II I IIII

44

Mentzelia multiflora

79

Thlaspi coloradense Nutt. 

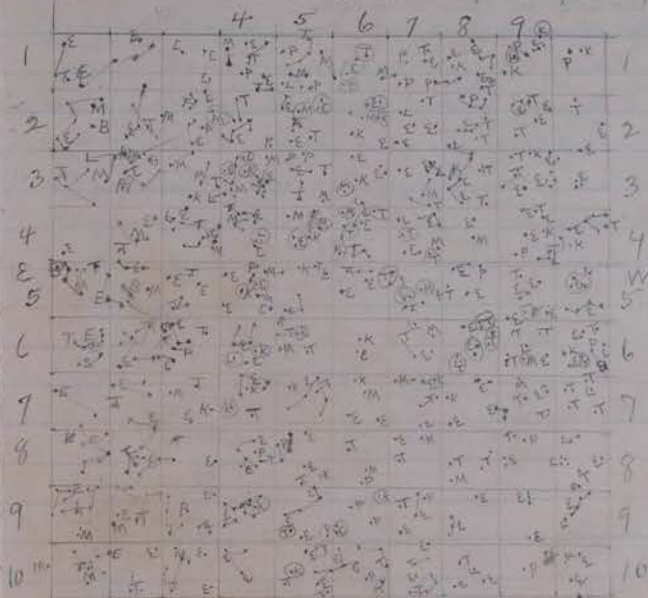
164

Paronychia jamesii

⁵¹ *Aragallus multicaps* ||| ||| ||| ||| (Guth.) Halder

Eriogonum flavum III

Podilymba podiceps podiceps Gray



45

Phrynosoma macleayi

Is *Sibogona* (flavus)?

A or H = *Paronychia foveola*

B = $\frac{1}{2} \pi$ (in radians)

E = *Alates aculeatus*

Austin Bluffs is essentially an escarpment, 200-400 feet above the general plain level. It is due to a fault probably which lies near the ~~the~~ foot of the escarpment which in general faces the south or south-west.

Some thin layers possess considerable iron and being harder resist erosion much more than other layers, hence erosion pillars are frequent, capped by the iron bearing layer of which has recently fallen off, leaving the pillars to become needle shaped and subject to more rapid erosion.

Austin Bluffs, El Paso Co, Colorado Springs, Colo.
Cross section up ravine beyond Fountain

July 24, 1921

valley along in fountain dominant shrub
Quercus garibaldii which usually grows in thickets of
varying but not large size, with grassy interspaces between
the thickets. Trees usually 1-3 inches in diameter and from
6 to 12 feet high. The taller thickets being in the richer and
moister soil. One or two inches in diameter and 10 feet high
another 4 inches in diam and about 7 feet high. These are
exceptional trees on edge or by dry wash. The oak thickets
cover about half of the ground and seem to reach their
greatest development about half way from central wash
to foot of cliff. Occasionally a yellow pine is found
between thickets by a near edge of grassy shallow
wash. Seeds evidently brought down from hillside
during heavy rains. Chokecherry infrequent in oak thickets
usually near margin and lower or west side and south. Rose in
same situations. Most oak thickets are nearly or quite pure
stands, with no undershrubs or herbs or grass. Some have
chokecherry as an undershrub, also rhod. tobiago, symphoricarpos
which tends toward margin. Width 1-4 inches
thick, 2" perhaps average, quite loose, spongy, seems to hold moisture
quite well. In the more open thickets symphoricarpos
ranges throughout the thicket.

The undergrowth in thickets consists of

Arabis holboellii, infreq.

✓ *Leptilan canadense* Frey.

✓ *Chevopodium*
Oak, shrubs 3 in to 12 in high, frag.

✓ Choke Cherry

✓ Rose
✓ Oak

✓ .. - a thicket of shallow lobed, 4-5 feet high.

Symphoricarpos // infrequent. In one lot

stand throughout the night.
Goss - thin weak stand to no

thickets

A typical oak thicket, isolated, was 18 x 20 acres and somewhat oval in outline, trees averaged 2 1/2" in diameter and 10 to 12 feet in height. In the majority of situations the oak leaves are deeply lobed, in dry places deeply serrate only and more oblong in outline, in former case being oval to oblongate in outline.

In very open thickets the grasses and herbs of the open ^{places} range throughout the thicket but in dense ^{open} ~~thickets~~ ^{places},
Cakes frequently 6-10 on a square meter, 2-3 inches diam.

* One pine 6" in diameter and 15 feet high, other pines small down to less than foot high. Only 4 or 5 noticed in this locality. Another pine 4 inches in diameter, 7 or 10 feet high.

July 24, 1924, continued

- ✓ *Artemisia* infreq. in open thickets
- ✓ *Pentstemon* " " "
- ✓ *Silene* " " "
- ✓ *Aphyllon* one specimen in open grassy place, not near other plants, 20 feet outside of thicket
- ✓ *Platanus* (white) fine along margin of oak thicket, infrequent, belongs to more open and waste places
- ✓ *Pentstemon unilateralis*, margin of oak thicket, infrequent
- ✓ *Brickellia* with tuberous root, frequent in thickets
- ✓ *Bromus* frequent in open thickets
- ✓ *Andropogon scoparius* (little blue stem) freq. in tufts in open grassy places
- ✓ *Andropogon furcatus*, freq. in open grassy places in moist soil
- ✓ *grama* freq. to com. in open grassy places.
- ✓ *Sitanion* freq. to infreq. in open oak thickets
- ✓ *Bromus* margin of oak thickets, freq. to infreq.
- ✓ *Tridacantha* inner margin of oak thicket, in soil watered by dry wash, belongs to open places

Naturally on the cliff side the pine zone ^{lesser} succeeds the oak zone where there is a cliff with much bare rock, then follows the Cercocarpus zone near the brow of the cliff and for a short distance beyond. The development of the pine zone depends much upon conditions but steepness, uncovered rock, and lack of moisture are favorable conditions. The oak zone extends into the pine zone in small clumps and dies out entirely, as in favorable places may extend in scanty quantity and low stature clear through the pine zone. The oak extends up the ravines in favorable situations in usually narrow strips to the top and for a short distance beyond. The pine belt is usually narrow, poorly developed, with scattering trees, averaging about a foot in diameter, and 30 to 50 feet high, herbage beneath scanty and undershrubs none or of scattering oak or Cercocarpus.

Occasionally there is a Cercocarpus thicket below the pine zone where there is a flattening of the slope, the soil conditions being more favorable to Cercocarpus than to oak and pine. The pines are confined pretty definitely within narrow limits, the width usually only a few rods. In case the slope is small there is no development of the pine zone. The Quercus and Cercocarpus zone extend up to down over the intermediate area as conditions are favorable to either.

Pine in protected situations have symmetrical development of branches, the exposed ones have a few short poorly developed branches on the windward side but have a heavy development of branches on the southward or east side, usually to the south or east.

- Andropogon scoparius* extends from the dry open places in the Quercus zone, up, in a thin stand through the pine zone
- Andropogon furcatus* drops out except where a wet pocket occurs a few stray stalks may be found in the pine zone.
- ✓ Grass with half inch awns begins in pine zone, extends on through Cercocarpus zone beyond into prairie at the top.
- At or near the upper limit of the pine zone there is a small and sparse development of *Pinus* trees few in number, scraggly, some more than foot in diameter, one nearly two feet, all of low stature, 10 to 12 feet high, the biggest one about 12 feet high.
- ✓ The *Cercocarpus* zone is well developed

Next the *Andropogon scoparius* zone, well developed with a numerous flora
Aphyllon - freq.

Last zone *Bouteloua-Aristida-Artemisia* zone

Helianthus infr. *Pinus* zone.

Austin Bluffs, Aug. 29, 1921, soil samples

Grass land near fountain		wt	dry	car	net	H ₂ O	%
0"-6" #1	196.4	183.6	43.3	145.2	7.9	5.44	
6"-12" #3	187.4	183.3	45.2	138.1	4.1	2.97-	
1'-2' #16	191.2	185.8	44.1	141.8	5.4	3.81-	
2'-3' #18	178.1	174.6	44.5	130.1	3.5	2.69	
3'-4' #19	194.	188.3	43.1	145.3	5.7	3.92	
Soil temp, surface 33°C; 6" deep 22°C; 12" deep 23°C						11 a.m.	

33°
18
26.4
33
59.4
32
91.4°F

Austin Bluffs 8-13-1921

Soil samples in grass land valley near fountain		wt	dry	car	net	H ₂ O	%
249 0"-6"	204.3 grams.	190.9	50.7	140.2	13.4	9.56%	
250 6"-12"	181.3	178.7	47.3	131.4	2.6	1.98%	
256 1'-2'	202.9	198.6	46.9	151.7	4.3	2.83%	
257 2'-3'	190.9	186.4	44.8	141.6	4.5	3.18%	
258 3'-4'	210.	205.2	46.8	158.4	4.8	3.03%	

Temp. on surface 11 a.m. 32°C sunny
" 6" below " " 21.5°C
" 12 " " " 21°C

Dominant *Bouteloua oligostachya*; *Artemisia frigida*, *Stipa comata*, *Helianthus patularis*, *Mentzelia*, *Thelaspis gracilis*, *Artemisia canadensis*, *Aristida purpurea*, *Silene alba*, *Onagra*, *Opuntia cananensis*, *Polycarpha*, *Eriogonum*, *Carduus undulatus*, *Tridactylon*, *Chrysopsis*, *Eriogonum microthamn*, *Rudbeckia*, *Ambrosia artemisiifolia*, *Lupinus*, *Dysodia*, *Euphorbia*, *Argemone*

The wetter portions have as dominant *Calamovilfa*, *Ambrosia purpurea*, *Rosa*, drier places *Andr. scoparius*

Temp. 2:15 surface 21° C cloudy
" " 6" below 22° C
" " 12" " 21° C

As above - Aug 23		wt	dry	car	net	H ₂ O	%
0"-6" #1	208.6	192.7	43.3	144.4	16.9	10.06%	
6"-12" #3	179.4	175.4	45.2	130.2	4.0	3.07%	
1'-2' #18	186.9	182.5	44.5	138.0	4.4	3.19%	
2'-3' #19	177.7	172.7	43.	129.7	5.0	3.85%	
3'-4' #24	187.6	178.2	40.5	137.7	9.4	6.83%	
Temp. Aug 23 9:50 a.m. 24.3°C Surface 6" deep 19.4°C; 1 foot 21°C							

✓ Austin Bluffs-Oak Thicket, 8-29-1921

Soil samples

		Wet	dry	can	net	H ₂ O	%
0"-6" #24	164.4	152.2	40.4	116.8	12.2	10.91	
6"-12" 28	158.	151.4	41.6	109.8	6.6	6.01	
1'-2' 45	186.7	181.2	41.2	140.	5.5	3.93	
2'-3' 59	192.6	184.4	^{42.5} 42.9-4	141.9	8.2	5.78	
3'-4' 63	182.2	174.5	^{40.8} 41.2-4	133.7	7.7	5.76	

✓ Soil temp, surface mulch in shade 27°C , under mulch 17°
6" below mulch 17°C ; 12" below mulch, 17°C ; sunny, 11:20 a.m.

Austin Bluffs.

✓ Soil samples in midst of oak thicket, valley near fountain
Under 3" mulch 8-13-1921

		net	dry	can	net	H ₂ O	
259	0"-6"	182.7 grams	160.0	44	116.	22.7	19.57%
267	6"-12"	164.8 "	157.3	41.6	115.7	7.5	6.48%
270	1'-2'	187.6 "	181.8	46.	135.8	5.8	4.27%
273	2'-3'	191.7 "	186.8	47.3	139.5	4.9	3.51%
279	3'-4'	201.2 "	189.2	47.7	141.5	12.	8.48%

air temp in shade on top of mulch 22.10°C cloudy 11:45 a.m.
 " " " under 17.0 " " "
 " " " 6" under ground 17.0 " " "
 " " " 12 " " " 16.0 " " "
 " " " on top of mulch 21.5 " " 2:35 p.m.
 " " " under 17.0 " " "
 " " " 6" under ground 16.0 " " "
 " " " 12 " " " 16.0 " " "

✓ As above, Aug. 23, 1921, soil samples
met day cone

Soil			dry can			wet H ₂ O		
Depth	#	wt	wt	wt	wt	wt	H ₂ O	%
0'-6"	#27	176.1	156.1	44.2	111.9	20.	17.87%	
6"-12"	#29	151.	145.5	43.4	102.1	5.5	5.39%	
1'-2'	#70	183.1	177.5	42.7	134.8	5.6	4.15%	
2'-3'	#76	187.1	180.5	43.2	137.3	6.6	4.81%	
3'-4'	#83	190.2	182.6	42.8	139.8	7.6	5.44%	

✓ Temp. 10 a.m. surface of mulch 20°C under mulch 16.8°
6" below mulch 16.2°C. sunny

✓ Austin Bluffs, 8-29-1921
 Soil samples in *Andropogon scoparius* zone.

				H ₂ O	net	%	
0"-6"	#253	197.1	188.2	47.3-3	8.9	141.2	6.30
6"-12"	#256	181.	174.9	46.9	6.1	128	4.76
1'-2'	#257	289.9	273.2	44.8	16.7	228.4	7.31
2'-3'	#259	253.4	236.2	44.8	17.2	191.4	8.98+
3'-4'	#267	264.	247.7	41.6	16.3	206.1	7.91

Temp. surface 30.6°C.; 6" deep 25°; 12" deep ; sunny 2:40 p.m.

(23±?)

Austin Bluffs, 8-13-1921
Andropogon scoparius zone, prairie top
 ✓ Soil samples

						net	H ₂ O	
#282	0"-6"	171.8 grams	162.9	45.9	117	8.9	7.61%	
#283	6"-12"	170.7 ..	165.7	48.2	117.5	5.0	4.26%	
#285	1'-2'	175.4 ..	169.6	47.7	121.9	5.8	4.76%	
#295	2'-3'	209.7 ..	203.5	50.5	153	6.2	4.05%	
#297	3'-4'	215.7 ..	209.	48.3	160.7	6.7	4.17%	

✓ Temperature on surface 12:35 p.m. 30.2°C. Cloudy sprinkling
 6" below 21°C.
 12" below 20°C.
 on surface 1:35 p.m. 24°C.
 6" below 21.5°C.
 12" below 20.2°C.

✓ As above, August 23, 1921, soil samples

					net	H ₂ O	
0"-6"	#256	216.8	199.8	47.1	152.7	11.13%	
6"-12"	#257	170.	165.1	45.	120.1	4.9	4.03%
1'-2'	#259	194.1	186.9	44.8	142.1	7.2	5.07%
2'-3'	#267	252.2	240.2	41.8	198.4	12.	6.05%
3'-3 1/2'	#270	153.4	148.9	46	102.9	4.5	4.37%

Temp. 11:50 a.m. surface 22.6°C; 6" below 20.5°; 12" below 18.5° Cloudy

Pictures #5 from same spot looking south across fountain canyon to east prairie

#6 Looking north from observation point.

#7 " north west from " " toward sanitarium, second bottom prairie

#8 from observation point, looking southeastward Cercocarpus belt above pines, few scattering junipers, a little oak, larger trees are pines

#9 from observation point looking northeast, near Austin bluffs pines, horizon older escarpment, with valley of mixed prairie between

✓ The older Cercocarpus shrubs are dying & dead in situations near their upper limit, the young sprouts are not vigorous, showing retreating conditions, the Andr. scoparius zone following.

✓ Bont.-Aristida-Artem. society has a considerable remnant of *Art. canadensis*, showing former overgrazed conditions. The Andr. scop. zone is closing in on the Bont. Arist.-Artem. soc. and will eventually dispossess it.

#10 Picture - showing contact prairie scrub and pine in ravine east of observation point

#11 Looking southeast from ravine east of observation point showing vestiges of older escarpment (vegetatively) - east of Austin bluffs.

Austin Bluffs, west prairie, top, 8-13-1921
✓ Bontelona-Aristida-Artemesia zone.

Soil samples

		met	dry	can	net	H ₂ O	
298	0"-6"	191.2 grams	176.8	46.9	129.9	14.4	11.09%
299	6"-12"	178.8	169.8	48.4	121.4	9.	7.41%
300	1'-2'	192.8	180.	46.9	133.1	12.8	9.62%
302	2'-3'	205.	190.1	46.7	143.4	14.9	10.39%
307	3'-4'	204.4	193.6	49.	144.6	10.8	7.47%

✓ Temperature at surface, 1:15 p.m., 22°C. cloudy
" 6" below " 22°C. 23°C.
" 12" " " 21°C. "

✓ As above, August 23, 1921, Soil samples

		met	dry	can	net	H ₂ O	
0"-6"	#104	205.2	190.	42.4	147.6	15.2	10.29%
6"-12"	110	146.9	140.6	43.3	97.3	6.3	6.48%
1'-2'	120	158.9	151.4	44.9	106.5	7.5	7.04%
2'-3'	249	194.5	183.4	50.7	132.7	11.1	8.36%
3'-4'	250	173.8	170.7	42.	128.7	8.1	6.29%

✓ Soil temp. surface 24.5°C. 6" under 19.5°C. 12" under 20°C. partly cloudy, 11 a.m.

#1 picture - looking N.W. from fountain showing contact of grasses, chaparral, pines, on top of slope

#2 in same spot looking N.E. up slope showing same types

#3 on top west prairie, showing detail of *A. furcatus*, *A. scoparius*, *Y. glauca*, *Art. frigida*, *E. microthecum*, with *B. gracilis* in foreground, also *Astrag. drummondii*, *A. hypoglottis*

#4 from same spot looking N.W. across west prairie and pine breaks in the background.

Austin Bluffs, pine belt, 8-29-1921

Soil samples		wet	dry	can	H ₂ O	net soil	% H ₂ O
✓ 0'-6" # 87		209.5	190.6	$\frac{43}{3.1}$	18.9	147.5	12.81
6"-12" # 89		180.1	151.3	$\frac{43.3}{4.9}$	28.8	107.4	26.81
12"-18" # 94		204.7	182.3	$\frac{44.3}{4.7}$	22.4	137.4	16.30

✓ Temp. (12 noon) surface 27° in shade; 6" deep 24°; 12" deep 19.5°; sunny

Austin Bluffs - Pine belt 8-13-1921

Soil samples		wet	dry	can	% H ₂ O	net soil	% H ₂ O
✓ 317 0'-6"		305 grams	286.3	48.1	16.7	238.2	7.85
318 6"-12"		246.3	234.7	47.9	11.6	186.9	6.21

✓ Pine belt apparently disappearing, a little shelf shows *Androp.* *furcatus* & *A. scoparius* coming in rapidly; *Artemisia ludoviciana* a typical woods plant disappearing.

✓ Temperature surface 19°C 3:10 p.m. cloudy sprinkling
6" below 18°C

Soil samples as above		8-23-1921	H ₂ O	net soil	%	
0'-6" # 87	267.5	256.4	43.1	11.1	213.3	5.20
6"-12" # 89	226.1	213.3	43.9	12.8	169.4	7.55
12"-18" # 94	208.8	193.9	46.9	14.9	149.9	10.1

Temp. on surface 28.5°; 6" below 17.2°C at 10:20 a.m. sunny

✓ Temp. on surface 28.5°; 6" below 17.2°C at 10:20 a.m. sunny

Cercocarpus belt, 8-29-1921

Soil samples	wet wt	dry wt	H ₂ O	net soil	% H ₂ O	
✓ 0"-6" #268	206.5	200.7	48.3	5.8	152.4	3.80
6"-12" #270	225.5	217.4	$\frac{45.6}{8.1}$	171.8	4.71	
12"-18" #273	260.5	252.1	47.1	8.4	205.	4.09

Temp. surface 35.4°C; 6" deep 28.8°; 12" deep 23°C; sunny, 3:40 p.m.

35.4
11.8
28.32
3.54
6.372
32
95.72 F

Cercocarpus belt, 8-13-1921

Soil samples		gross wt	dry	can	H ₂ O	net soil	%
✓ 319 0'-6"		185.3 grams	174.6	46.7	16.7	127.9	8.34
320 6"-12"		181.1	174.7	45.3	6.4	129.4	4.94

✓ Temperature surface, 17°C, 3:40 p.m. cloudy, sprinkling
6" below 17°C
12" " 18°C

✓ Dominant plants in grassy open places, *Muhlenbergia gracillima* - sub. dom. in larger, open places *Andr. scoparius* & *Bont. curtipendula* almost pure stand

As above soil samples 8/23/1921		H ₂ O	net soil	% H ₂ O		
0"-6" # 273	276.5	244	47.3	32.5	196.7	16.52
6"-12" # 279	249.4	232.5	47.7	16.9	184.8	9.14

Temp. surface 24°C; 6" under 20.2°C, 12" below 19.8°C.

✓ Austin Bluffs, August 29, 1921

Soil samples top west prairie, Bout.-Aristida-Artemisia zone

	met	dry	can	met	H ₂ O	% H ₂ O
✓ 0"-6" #104	185.6	176.1	42.2	133.9	9.5	7.09%
6"-12" #110	181.1	172.4	43.1	129.3	8.7	6.73%
1'-2' #120	185.	175.3	44.9	130.4	9.7	7.44%
2'-3' #249	202.4	191.1	50.5	140.6	11.3	8.04%
3'-4' #250	186.1	177.	47.3	129.7	9.1	7.02%

✓ Temp. surface 31.8°C; 6" deep 29.8°C; 12" deep 28°C; sunny, 2 p.m.

Austin Bluffs, 8-29-1921 - West prairie

- ✓ Andropogon scoparius (dominant) zone - the dominant society
- ✓ Muhlenbergia gracilis, occasionally some ^{freq.} ^{much fewer} ^{limited areas}
- ✓ Astragalus drummondii freq.
- ✓ Psoralea tenuiflora "
- ✓ Chrysopsis villosa freq. - sometimes almost forms ^{some} societies
- ✓ Artemisia frigida freq. - becoming semi-dominant in ^{some places}
- ✓ Yucca ^{lower limit next oak & cercocarpus} freq. - becoming almost a society
- Liatris punctata infr.
- ~~Artemisia~~ Bouteloua oligostachya-freq. Thirsuta freq.
- ✓ Aristida purpurea freq.
- Helosperma gracilis infr. (no rays)
- Bouteloua curtipendula infr.
- Eriogonum alatum infr. & flamm., fr. large flower.
- Andropogon furcatus infr. in spots more freq. in wetter ^{places}
- Sitanion ^{brevifolium?} infr.
- Opuntia cananuchica infr. more freq. in Artem. frigida soc.
- Artemisia canadensis infr. in disturbed places
- ✓ Comandra pallida freq. in drier sterile places
- Tradescantia infr. ^{residualis?}
- ✓ Aphyllon ^{lutidum} ^{was freq.} - falling away
- Helosperma trifida (rays) infr. in disturbed places.
- Lithospermum ^{multiflorum} infr.
- Senecio fremontii infr. toward inner edge
- Eriogonum microthamn infr. toward inner edge
- Lepidium infreq. in disturbed places
- Lygodesmia juncea "
- Anogon coronifolia "
- Andropogon furcatus forms small societies in wetter places.
- Plantago purshii infr. in disturbed places.

Austin Bluffs, west prairie, August 29, 1921.

- Cercocarpus* belt - dominant.
- ✓ *Rhus trilobata* infr. near upper limit.
 - ✓ *Muhlenbergia gracili* frequent throughout in open places forming small societies, crawls in under.
 - ✓ *Euthiergia sarothamni* freq. - [Cercocarpus clumps]
 - ✓ *Bouteloua linearis* freq. in drier sterile places.
 - ✓ *Opuntia pamauehica* freq. espec. in sterile places
 - ✓ *Yucca* infr.
 - ✓ *Commandra* infr. more freq. near upper limit.
 - ✓ *Liatris punctata* infr.
 - ✓ *Aristida purpurea* infr. to freq.
 - ✓ *Bouteloua curtipendula* infr.
 - ✓ *Arabis holboellii* infr, past prime
 - ✓ *Andropogon scoparius* infr. to nearly freq. near upper border
 - ✓ *Thelesperma trifida* (rays) infr.
 - ✓ *Cercocarpus* dying out along upper limit, many dead stems in some places, grasses coming in thickly and pushing back the *Cercocarpus* belt.
 - ✓ *Eriogonum flavum* (large fl.) infr.
 - ✓ *Opuntia polyacantha* infr.
 - ✓ *Artemisia frigida* infr. near upper limit
 - ✓ *Andropogon furcatus* infr. in more favored places.

Austin Bluffs, Sept. 2, 1921

- ✓ Mountain valley is about 100-125 yards wide, $\frac{1}{2}$ to $\frac{3}{4}$ covered with oak according to location. The open meadowy places typical grassland. About 338 (steps) yards above the fountain the valley branches, the narrow one turning nearly south a little east; the main branch going nearly east.
- ✓ *Symphoricarpos* (white) freq. on margins of oak thickets and *Clematis* freq. by clumps among them.
- ✓ *Gerardia* and *Chrysopsis* freq., the latter almost forming societies in some places. At fork of road a sand area of small extent with a *Glycerhiza lepidota* colony. Solidago in margin of oak, freq.
- ✓ The immediate cliffs along valley are about 100 to 125 feet in height.
- East south of fountain a small thicket of *Rhus trilobata*, also a smaller but taller thicket at forks of valley road. *Sambucus fragrans* freq. near road, *Aplopappus* freq. in dry soil. *Liatris punctata* fr. *Artemisia canadensis* freq. in disturbed places, *Artemisia frigida* freq. at road forks.
- ✓ narrow valley 60-75 yards wide and 900 (steps) long. veg. much as larger valley. *Aster multiflorus* quite common. Oak chapparal had a burn. A short valley fork to southwestward about 500 yards up. *Chrysopsis* and *Artemisia canadensis* freq. to some. Societies in some places, a few clumps of *Rhus trilobata* by oaks next to central openings. Openings dominated by grasses, *Andropogon scoparius*, *Calamovilfa*, and *Andropogon furcatus* etc., especially at middle of valley and above. Cliffs lower, 75 to 100 feet, due to rising of valley floor. Fine belt fairly well developed on east side of valley. A colony of *Symphoricarpos* in grassy center where there is some shallow wash about half way up. A few pines 10-12 feet high in valley due to wash from above.
- At upper end of valley much *Calamovilfa* forming societies, also small society of *Chrysopsis* in dry sand wash, and *Artemisia frigida* in similar situations. A small society of *Andropogon scoparius* mixed with it. *Liatris punctata* a small clump of *Rhus trilobata* isolated near center of grassy valley. *Andropogon furcatus* a small area in wetter or lower part next *Calamovilfa*. The *Andropogon scoparius* occupying the higher and drier sloping portion next the oak belt up on at foot of hillside. The head of valley mostly crested by oak chapparal where there is more mesophytic conditions. At head of the upper third of valley runs bearing more eastward. At head a smaller valley runs eastward for 100 yards, and 25 to 30 yards wide, a grassy valley with oak across the head. *Andropogon furcatus* the dominant grass with some *Calamovilfa*, *Sorghastrum*, and *Andropogon scoparius* in drier places. *Rhus trilobata* on margin

perhaps to a 100 feet high.

The hills and ridges to the eastward are poorly covered by trees or shrubs, many are almost entirely grass covered, probably formerly covered by forest, the grass becoming the climax as the hills became much eroded and broad rounded.

On a secondary ridge, near east prairie the *Pisocarpus*
belt shows signs of retreating, the shrubs being low, mostly
of growth and Andropogon scoparius or bawn, a variety
belonging to the old grassy meadow zone of three square rods
the plants are Muhlenbergia inf. Andropogon scop. inf., better
slag granite frag. Eriogonum alatum var. commutatum inf.
true pine (2 needles) Chrysothrix frag. Rubber plant inf. Cercocar-
pus frag.

Certain layers of rock have much iron, resist erosion from pillars of capped cliffs.

✓ Junipers are few and restricted in location usually near the upper limits of the pine belt, mostly old trees which may be two feet in diameter but only 10 or 12 feet high. Contorted twisted, deformed, the older ones all dying or dead. Very few young ones found or seedlings scarcely a few found.

✓ Pine belt scanty of trees on south and west hills.

Pinel. belt, scarcity of moss on summit. On west slope 1890.
On summit of west cliff, east of observation hill
there is quite a development of *Rhus triloba*, seems to come
between the two *Cercocarpus* belts coming up from either
side. The *Cercocarpus* belts near here are much open and
under. scap. come on higher places and Muhl. come on slightly
lower places, a few *Juglans* near. Other plants *Gaultheria*,
Bont. cart., *artem.* and other usual plants.

On east prairie Andre scop has outliers often far out in sout. arst. art. zone, sometimes a bunch & several bunches, invading rapidly the retreating *Cercocarpus* belt.

✓ *Gentiana* found a few near upper limit
of oak chaparral, east side.
✓ *Solidago* here too

One opening on east side in oak belt on
(in second canyon)
second bench (pine stand of Andr. scop. with heli-
anthus, liatris, etc. Another opening similarly situated
and a little farther on had Andr. scop. much of
Andr. fasciata, regular prairie opening. Other usual
prairie plants frequent to frequent.
Pillars here show erosion 8-10 feet, about to base level
across road cliffs and pillars indicate erosion 25-30 ft.

East prairie 150 & 275 faces

East prairie - Austin Bluffs - 9-2-1921

Bouteloua aristida-*Artemisia* zone

Astragalus drummondii fr.

Chrysopsis

Artemisia frigida com. - dominant in much of ground

canadensis " to freq. in disturbed places

Yucca infr.

Aristida purpurea com.

Bouteloua oligostachya com.

Aplopappus fr.

Eriogonum alatum infr.

Liatris punctata infr. freq.

Thelipernum gracile (rayless) infr.

Asclepias tuberosa infr. to freq. in fruit

Chief present disturbance gophers and ants, several hills of good silt and gravel around completely denuded, 4' x 5' or more has not been grazed for several years.

Opuntia saw one (more)

Lithospermum infr.

Macraethera few

Senecio fremontii few

On *Andropogon scoparius* zone

Bouteloua hirsuta freq.

Commandra freq.

Chrysopsis freq.

Artemisia frigida from next zone, freq.

Liatris punctata freq.

Eriogonum flavum (large flowered) infr.

Yucca infr., local

Astragalus drummondii infr.

Eriogonum alatum infr.

Muhlenbergia freq. in open places, becoming domi-

nant where the *Andropogon scoparius* is absent.

Aplopappus freq.

Aristida purpurea from next zone

Sitania infr., more freq. next oaks.

Pine belt. 9-2-1921

Some places due to poor soil and erosion surface bare, *Andropogon scop.* wales in, freq. in some places where slope is less.

Oak and *Cercocarpus* infr. to freq.

Chrysopsis infr.

Bouteloua oligostachya infr.

Andropogon furcatus infr.

Liatris punctata infr.

Artemisia frigida infr.

✓ Pine trees develop more to south side, showing north winds are severe

Opuntia freq.

Eriogonum alatum infr.

Aster multiflorus infr.

Rhus trilobata infr. freq.

Heuchera a few

Thermopsis montana a few } both next oak

Pulsatilla a few leaves } Chaparral

Solidago infr.

Acorium androsacmifolium infr. - more fr. locally

Allium cernuum scarce

✓ The steeper the slope the less the undergrowth

✓ A few of the pines near their lower limit are

nearly two feet in diameter and fifty feet high,

good specimens.

On east side beyond mouths of first & second canyons

a prairie of 100 acres or more, the dominant grass being *Andropogon scoparius* the oak Chaparral on the north side being a very thin narrow belt, much of which is dead or dying, the cliffs behind 30-75 feet covered with pine which reach up over top. Conditions here are old and are at a climax in the prairie and are sub-climax on the cliff side and at the foot of it. Farther on east are three more or less isolated hills with only a remnant of pines and behind these an older ridge with a few isolated shrubs, the grass covering the whole ridge and rapidly covering the three isolated cliffs - like hills.

On this prairie *Calamagrostis* infr. to freq.

Liatris punctata freq. *Aster multiflorus* freq.

Chrysopsis fr. *Artemisia* silvery white leaf, freq. dwarfed,

mostly the flowering or fruiting, *Pentstemon glaber* infr.

Artemisia canadensis infr. *Bouteloua hirsuta* infr.

Tradescantia infr. *Achillea millefolium* infr.

Aristida purpurea infr. *Bouteloua oligostachya* freq.

Thelipernum gracile (rayless) infr. *Artemisia frigida* freq. in lower

Senecio fremontii freq. in lower places.

Eriogonum alatum info.
Eriogonum microthecum info. *Eriogonum annuum*?
whitish stem and whitish middle sized flowered, freq.
Aplopappus freq.

In an area at upper or west end where the broad shallow wash, sandy - is an area of *Bauletona aristata* *artemisia* society. This appears again in a considerable area farther down on second bottom, the hillside above it being *Andropogon scop.* society, as it is lower down and beyond and on slope on farther side. The soil is evidently sandier and drier but there is a considerable mixture of plants from *Andropogon scop.* society being more abundant nearer the margins.

Euphorbia montana info. *Lithospermum* info.

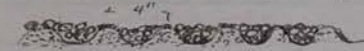
Mammillaria info. *Petalostemon* freq.

Opuntia info. one what seems to be *Helianthus* (dead) ^{near} ^{few} ^{chumps} a few *Yuccas* near upper part with small chumps of *Rhus triloba*. Here a society of *Sorghastrum* of considerable extent, blanketed by *Andropogon scop.* one *Lygodesmia* noticed.

The *Sorghastrum* society goes up the hillside plump against the thinning chaparral belt of oak. The oak chaparral becomes a few small rounded chumps and disappears mostly at east end of southern cliff the *Cercocarpus* belt above being here mostly a remnant the grasses pushing up to the foot of the cliff. *Psoralea tenuiflora* a few near the gate.

Next the plain on the south side of the bluff the oak chaparral is intermittent and poorly developed, very narrow. The pines above few and scattering. The plain gradually rises towards the base of the cliff and at the east side where undisturbed is a typical mixed prairie.

Sept 5, 1921. Gravel slide south of laboratory. The harrowed gravel surface - shows level on surface but gravel sorted into rows, the heavier particles, size of marbles, alternate with finer particles in rows. The rows from crest to crest are usually about 4 inches, some were a little over $3\frac{1}{2}$, but usually measured 4". The depression in valleys is about an inch from surface. The ridges are of finer particles and silt, and are covered by the fine gravel for a depth of $\frac{3}{4}$ to a half inch.

 3". The ridges and valleys are rounded. Conspicuous especially on the upper $\frac{1}{3}$ of the gravel slide. The common plant is *Aletris* and the younger plants are in the valleys, in fact all seem that way but the oldest ones having clogged up the valleys there is some effacement of the drilling of rows. As the plants are in the depressions there is a considerable alignment of the plants either in the same row or diagonally across the rows. Farther down the gravel slide the surface does not show the drilling as distinctly, the vegetation (*Aletris*) is older and more of it but the alignment is readily noticeable, especially diagonally. Hillside mostly west sloping, portions veering slightly to the north, a few yellow pines on top, mostly fir at the bottom, with some

limber pine above the fir, a few of which get about a third of way up, also here and there a yellow pine which ranges nearer the fir. The west hillside is barren or nearly so of trees for the upper $\frac{4}{5}$ th, and alates is the principal plant growing over the hillside. The lower $\frac{1}{5}$ is quite well wooded with fir as dominant and the limber pine as subdominant with a few yellow pines, the next fourth has very few firs, limber pine one to every 1 to 3 or more square rods, occasionally a yellow pine or small fir. Around on the north side of hill fir is a thick woods up to or quite near the top. Alates very scarce in the lower $\frac{1}{5}$, occasionally a foot one ^{or a few} in a more open place, shade too much for them. *Drymonia*, strawberry, *Halictum*, *Edwinia*, Rose (*Rhus* lower down) and maple coming in as an undergrowth.

Gravel slides are usually 30° to 35° ; a slight obstruction runs them up to or near 45° . Near top 10° to 15° or 20° .

Sept. 7, 1921, South sloping hillside
about 30 degree angle, a meter quadrat had 67 *Vagnera stellata*, a good clump of *Paronychia Jamesii*, a clump of *Elmus* was just coming in at one corner. *Drymonia* was frequent in the immediate neighborhood. The quadrat also had *Centella brittonii*.

Another quadrat near by had 61 *Vagnera stellata*; two *Salvia aggregata*; two *Drymonia*, lichens 3 semi cristose; one young rosette of *Aster multiflorus*; one rosette *Mentzelia*.

The order of succession seems to be about as follows: *Vagnera* dominant, mosses less drilled; *Paronychia*, *Drymonia*, *Elmus*, *Aster multiflorus*. This is the earliest stage. Later stages show much more *Elmus*, *Mucklenbergia*, *Geranium caespitosum*, *Campylosiphon rotundifolius*, more *Aster multiflorus*, more *Centella brittonii*, seedling yellow pine, seedling yucca at or above its limit. *Mentzelia multiflora* in all cases appears as a ruderal. Another quadrat near by had 132 *Vagnera stellata*; 12 *Drymonia fissa*, 2 *Centella brittonii*; 3 *Paronychia*, *Aster multiflorus* 3 rosettes and two small clumps in bloom, one seedling yucca, two tiny rosettes of *Krynitzia virgata*.

Elder stage of the slide shows no *Vagnera*, the dominant being *Elmus* with a little of *Campylosiphon*, less of *Aster* and *Centella* and *Lithospermum*. *Halodiscus* frequent. Shrubs come in *Prunus* often dominant, *Rubus* frequent, *Yucca* and *Puffinballia* infrequent, elder stage shows *Quercus chapaensis*. In many places rabbits drill and *Vagnera* rows up in the valleys under the larger boulders.

The above work was on the lower third of slide north of cog from cross cabin.

Elder quadrat lower down had 70 *Vagnera stellata*; one *Paronychia*; one *Prunus* 10"; two raspberries; two *Drymonia*; 3 *Salvia stellata*; 10 rosettes *Aster multiflorus*; one *Campylosiphon rotundifolius*; one rosette *Pachylobus caespitosus*. Immediately by was a thicket of *Halodiscus*, considerable *Prunus*, *Elmus*, some *Rubus deliciosus*, *Paronychia*, *Geranium caespitosus*, and to one side *Quercus chapaensis*. *Vagnera* seems to passant early.



$$g \cos \alpha - F \cos \beta$$

$$F = r g$$

$$R = g \cos \alpha - r g \cos \beta$$

$$R = g(\cos \alpha - r \cos \beta)$$

$$g = l \cos \alpha$$

$$\frac{g}{l} = \cos \alpha \quad \left| \quad \frac{F}{l} = \cos \beta \right.$$

A

$$\cancel{\frac{g}{l}} = \cancel{\cos \alpha} = g \cos \alpha$$

$$R = g(\cos \alpha - r \cos \beta)$$

$$R = g \cos \alpha$$



$$\frac{l}{g} = \cos \alpha$$

$$l = \frac{g \cos \alpha}{\cos \alpha}$$



$$\frac{x}{g} = \tan \alpha$$

$$x = g \tan \alpha$$



$$R = g \cos \alpha$$



$$\begin{aligned} R &= g \cos \alpha - F \cos \beta \\ &= g \cos \alpha - n g \cos \beta \\ &= g (\cos \alpha - n \cos \beta) \end{aligned}$$

T. J. STEPHENSON 20760000
Nebraska, Nebraska

$$= g \cos \alpha$$

$$g \approx 2 \text{ m/s}^2$$



mentzelia discolorata of
Pomatocarpus ^{waste place} glaucous
Lithospermum angustifolium
Dipsacalis fissa (yellow) (long)
Arenaria fendleri
Leptala floribunda - small
blue flower

Aquilegia chrysantha - yellow
Calico
Physalis

Jun 1 *Gnaphalium missouriensis*

July 1 *Rubellaria hirta*

Aug 1 *Arenaria fendleri* (small)

Sept 1 *Breweria regia* - small

Oct 1 *Chrysantha* heavy fringed

Nov 1 *Chrysantha* - small

Dec 1 *Chrysantha* - small

Jan 1 *Helianthus divaricatus*

Feb 1 *Pycnanthemum*

Mar 1 *Cosmos occidentalis* - yellow

above timber line. Pikes
Peak

Monticola decolorata of
Pseudotsuga ^{Wash. State} ~~glauca~~
Lithospermum angustifolium
Dryas octopetala (yellow fls)
Arenaria fendleri
Hoffmannia floribunda - small
blue flowers

Aquilegia chrysantha - yellow
Colubine
Physocarpus monogynus
Minuartia laevis - yellow
P. hirsuta *speciosa* *serotina*
Asplenium platyneuron (red)
Polypodium macropodium *hookeri*
Like *P. caespitosum*
Sedum neo-mexicanum
Stachys serotina
Vicia americana
Pseudotsuga barbatula (red)
Vicia linaria
Pseudotsuga secundiflora
Rosa woodsii & *R. rugosa*



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No. 11

Looking southeast from ravine
east of observation point showing
vestiges of older escarpment (vegeta-
tively) - east of Austin Bluffs.



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No. 10

From plain southwest of Austin
Bluffs - showing contact of
prairie, scrub, and pine in ravine
east of observation point.



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No. 9

An observation point looking
northeast - foreground Austin
Bluffs pines, horizon older es-
carpment, with valley of mixed
prairie between



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No. 8

On observation point looking
southeastward - Cercocarpus belt
above pine, a few scattering
junipers, a little oak, the
larger trees are pines



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No. 7

An observation point looking
northwest across below mouth
of fountain canyon



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No. 6

An observation point looking
north across fountain canyon



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No. 5

On top of west prairie looking
south across fountain canyon
to east prairie

From same spot as No. 3



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No. 4

On top of west prairie looking
northwest across west prairie
and pine brakes in background.
From same place as No. 3.



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No. 3

On top of west prairie, showing
detail of *Andropogon furcatus*,
A. scoparius, *Yucca glauca*,
Artemisia frigida, *Eriogonum*
microthecum with *Bouteloua*
gracilis & *B. hirsuta* in foreground,
also *Astragalus drummondii*,
A. hypoglottis



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No. 2

Looking northeast from fountain
showing contact of grasses,
valle chaparral, pines



Hunt Institute for Botanical Documentation

No. 1

Looking northwest from fountain
showing contact of grasses,
chaparral, pines

DEPARTMENT OF BOTANY
THE UNIVERSITY OF NEBRASKA
LINCOLN, NEBRASKA, U. S. A.

April 27, 1923

Pres. L. E. Holden
The James M. Smith University
Lebanon, Illinois

DEAR SIR:

President Harmon
Transylvania University College
Lexington, Kentucky

9/26/23

Dear Sir:- I understand the Professorship of Biology in ~~the~~ Transylvania College is vacant. I shall be pleased to be considered a candidate for the position.

Concerning myself I may say that I have held a position for the past ten years in the University of Nebraska, department of botany, ~~being~~ ~~now the rank of~~ ~~senior~~ holding much of the time the rank of assistant professor. Previously I was a teacher in the public schools and colleges, holding a principalship in one school and a professorship of science in two different colleges.

I obtained my educational training at the Iowa Wesleyan University, the University of Iowa, the University of Chicago, and the University of Nebraska. I have the degrees of B.S. and M.S. from the University of Iowa. I have nearly completed my work leading to the doctorate degree.

I am a fellow of the American Association for the Advancement of Science, and of various academies and learned societies. You will find me included in the book - "American Men of Science", a copy of which may be in your city or college library.

I refer you to Dr. R. J. Pool, the head of the department of botany, University of Nebraska; ~~Prof~~^{Dr.} J. E. Weaver, of the same department, and ~~Dr.~~^{Dr.} H. L. Latimer of the department of zoology, all of Station A, Lincoln, Nebraska. I also refer you to Dr. L. H. Parmelee of Iowa State College, Ames, Iowa; and ~~Prof~~^{Dr.} Dr. Clarence E. Bennett of Tulane University, New Orleans, Louisiana.

I have done considerable research work. During two seasons I was in the employ of the Carnegie Institution of Washington, engaged in research work. I am the author of three books and many articles in the scientific journals. One of my books is on Rafinesque—an early teacher in Pennsylvania College. A copy is in the college library.

Any further information will be gladly given.

Yours truly

F

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T. J. FITZPATRICK.

M. F. L. FITZPATRICK.

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Ginseng
Secretary of Agriculture
Division of Botany
Washington
D. C.



Iowa City, Iowa.
3/27/95.

Sir: - shall be pleased to receive
Bulletin No. 16. Division of Botany,

Yours

T. J. Fitzpatrick
711 Jefferson St.