Autecology of Threadleaf Sedge on the Northern Mixed Grass Prairie

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The autecology of Threadleaf sedge, *Carex filifolia*, is one of the prairie plant species included in a long ecological study conducted at the NDSU Dickinson Research Extension Center during 67 growing seasons from 1946 to 2012 that quantitatively describes the changes in growth and development during the annual growing season life history and the changes in abundance through time as affected by management treatments for the intended purpose of the development and establishment of scientific standards for proper management of native rangelands of the Northern Plains. The introduction to this study can be found in report DREC 16-1093 (Manske 2016).

Threadleaf sedge, *Carex filifolia* Nutt., is a member of the sedge family, Cyperaceae, and is a native, long lived perennial, monocot, cool-season, short graminoid, that is shade tolerant. The first North Dakota record is Bolley 1891. Early aerial growth consists of basal leaves arising from rootstock buds. Basal leaf blades are very fine, thread like, wiry, densely clustered at base with 3 per stem, 7.6-15.2 cm (3-6 in) long, 0.25 mm wide, tapering to a point, usually with edges rolled in, and dark green. Previous years stem and leaf bases are persistent during the following growing season and are chestnut brown. The sheath is papery and squared off at top. The ligule is very a short. The rhizomes are short and black. The extensive fibrous root system has numerous tough, wiry main roots 0.8 mm or less thick, that are resistant to decay as a result of the increased strength from the black pigment, melanin. The lateral spread is from 38 cm (15 in) to 76 cm (30 in) with roots growing obliquely downward, branching profusely, with numerous roots 5 cm (2 in) long. Most main roots descending to 61 cm (24 in) deep and a few long main roots reaching 76 cm (30 in) deep. The terminal ends of the roots are densely appearing broom like (genista). The densest concentration of root mat occurs in the upper 30.5 cm (12 in) of soil. Regeneration is primarily asexual propagation by tiller buds. Flower stalks are erect, triangular in cross section, 10-20 cm (4-8 in) tall. Inflorescence is a solitary terminal narrow spike, 10-25 mm long with male flowers above and a few female flowers below (monoecious). Flower period is from late April to mid June. Aerial parts are highly palatable to livestock. Fire top kills aerial parts and consumes entire crown when soil is dry. This summary information on growth development and regeneration of Threadleaf sedge was based on works of Stevens 1963, Zaczkowski 1972, Dodds 1979, Great Plains Flora Association 1986, Hauser 2006, and Johnson and Larson 2007.

Procedures

The 1946-1947 Study

Grass and upland sedge species samples to determine crude protein and phosphorus content were collected weekly during the growing seasons of 1946 and 1947 from two seeded domesticated grasslands and a native rangeland pasture at the Dickinson Research Extension Center located at Dickinson in western North Dakota. Current year's growth of lead tillers of each species was included in the sample; previous year's growth was separated and discarded. Ungrazed samples were collected for each species except for Kentucky bluegrass, which only grew along a watercourse where almost all of the plants had been grazed and remained in an immature vegetative stage, however, a small number of plants escaped grazing and developed normally providing the phenological development data. Crude protein (N X 6.25) content was determined by the procedure outlined in the Official and Tentative Methods of Analysis (A.O.A.C. 1945). Phosphorus content was determined by the method outlined by Bolin and Stamberg (1944). Data were reported as percent of oven-dried weight.

Plant condition by stage of plant development and growth habit was collected for each species on sample dates. These data are reported as phenological growth stage in the current report. The grass nutritional quality and phenological growth data were published in Whitman et al. 1951.

The 1955-1962 Study

Grass and upland sedge tiller growth in height of leaves and stalks were collected from ungrazed plants during the growing seasons of 1955-1962. Basal leaves were measured from ground level to the tip of the extended leaves. Culm leaves were measured from ground level to the apex of the uppermost leaf. Stalk measurements were from ground levels to the tip of the stalk or to the tip of the inflorescence after it had developed. An average of 10 plants of each species were measured at approximate 7 to 10 day intervals from early May until early September. In addition, phenological growth stages were recorded to include stalk initiation, head emergence, flowering (anthesis), seed development, seed maturity, earliest seed shedding, and an estimation of percent of leaf dry in relation to total leaf area. The grass growth in height and phenological data were reported in Goetz 1963.

The 1964-1969 Study

Phenological data of grass and upland sedge at anthesis stage was determined by recording observation dates. Leaf senescence by date was determined as an estimation of percentage of dry leaf in relation to total leaf area. Grass and upland sedge tiller growth in height of leaves were collected from ungrazed plants during the growing seasons of 1964-1966. Basal leaves were measured from ground level to the tip of the extended leaf. Culm leaves were measured from ground level to the apex of the uppermost leaf. An average of 20 plants at approximately 7 to 10 day intervals during the growing season from mid April to late August from control treatment on sandy, silty, overflow, and thin claypan ecological sites. Phenological data of anthesis stage, leaf senescence, and growth in leaf height were reported in Goetz 1970. Crude protein content of grasses and upland sedges was determined from a composite of 10 samples of each species collected systematically at biweekly intervals from mid May to early September, 1964-1969 on sandy, silty, overflow, and thin claypan ecological sites. Plant material was oven dried at 105°F. Analysis of the samples were made by the Cereal Technology Department, North Dakota State University, using standard crude protein determinations and reported in Goetz 1975.

The 1969-1971 Study

The range of flowering time of grasses and upland sedges were determined by recording daily observations of plants at anthesis on several prairie habitat type collection locations distributed throughout 4,569 square miles of southwestern North Dakota. The daily observed flowering plant data collected during the growing seasons of 1969 to 1971 from April to August were reported as flower sample periods with 7 to 8 day duration in Zaczkowski 1972.

The 1983-2012 Study

A long-term change in grass and upland sedges species abundance study was conducted during active plant growth of July and August each growing season of 1983 to 2012 (30 years) on native rangeland pastures at the Dickinson Research Extension Center ranch located near Manning, North Dakota. Effects from three management treatments were evaluated: 1) long-term nongrazing, 2) traditional seasonlong grazing, and 3) twice-over rotation grazing. Each treatment had two replications, each with data collection sites on sandy, shallow, and silty ecological sites. Each ecological site of the two grazed treatments had matching paired plots, one grazed and the other with an ungrazed exclosure. The sandy, shallow, and silty ecological sites were each replicated two times on the nongrazed treatment, three times on the seasonlong treatment, and six times on the twice-over treatment.

During the initial phase of this study, 1983 to 1986, the long-term nongrazed and seasonlong treatments were at different locations and moved to the permanent study locations in 1987. The data collected on those two treatments during 1983 to 1986 were not included in this report.

Abundance of each grass and upland sedge species was determined with plant species basal cover by the ten-pin point frame method (Cook and Stubbendieck 1986). The point frame method was used to collect data at 2000 points along permanent transect lines at each sample site both inside (ungrazed) and outside (grazed) each exclosure. Basal cover, relative basal cover, percent frequency, relative percent frequency, and importance value were determined from the ten-pin point frame data. Point frame data collection period was 1983 to 2012 on the twice-over treatment and was 1987 to 2012 on the long-term nongrazed and on the seasonlong treatments. However, point frame data was not collected during 1992 on the sandy ecological sites of all three treatments.

During some growing seasons, the point frame method did not document the presence of a particular plant species which will be reflected in the data summary tables as an 0.00 or as a blank spot.

The 1983-2012 study attempted to quantify the increasing or decreasing changes in individual plant species abundance during 30 growing seasons by comparing differences in the importance values of individual species during multiple year periods. Importance value is an old technique that combines relative basal cover with relative frequency producing a scale of 0 to 200 that ranks individual species abundance within a plant community relative to the individual abundance of the other species in the community during the growing season. Basal cover importance value ranks the grasses, upland sedges, forbs, and shrubs in a community. The quantity of change in the importance value of an individual species across time indicates the magnitude of the increases or decreases in abundance of that species relative to the changes in abundance of the other species.

Results

Threadleaf sedge resumes active leaf growth when liquid water becomes available in the soil for at least during the daylight hours. Basal leaves arise from rootstock buds and rhizome buds. Growth of new leaves is visible by 8 April (table 2). Growth of flower stalks is visible between 13 and 29 April (tables 1 and 3). Leaf growth is very rapid during April and May, by late April, the tallest leaf has reached 52.0% of maximum height and by late May, the leaves have reached 95.0% of maximum height (table 2). Flower stalk growth is also very rapid. The flower stalk is at the boot stage during 13 to 29 April, the first flowers appear 25 April and mean first flower occur on 5 May, with a 5 week flower period from early May though the first week of June (tables 1, 3, 4, and 5). The lead tillers drop below the phosphorus requirements of lactating cows duirng May (tables 1 and 6). The flower stalk reaches 81.9% of maximum height at the end of May (table 3). The lead tiller contains 13.8% crude protein during late May (table 1). Seeds are developing from early May, are mature by 9 or 13 June, start being shed on 17 June, and reach maximum height on 22 June (tables 1, 3, and 5). Leaves reach maximum height on 22 June and lead tillers drop below the crude protein requirements of lactating cows during mid July (tables 1, 2, and 6). Leaf dryness starts during late June and continues through July and August into September (tables 1 and 5). Leaf dryness on the 1964-1969 study appears to start earlier and proceed more rapidly (table 7) than those on the 1955-1962 study (table 5). Mean anthesis occurs at about the same time (tables 4, 5, and 7). Leaf height is taller on the 1964-1969 study after mid June (table 8) than those on the 1955-1962 study (table 2). Crude protein content of tillers growing on sandy sites (table 9) is slightly lower than that for tillers growing on silty sites (table 1). Even though the upland sedges drops below the crude protein requirements of lactating cows during mid July, it remains above 8.0% crude protein from mid to late July, above 7.0% crude protein during August, and above 6.0% crude protein during September (tables 1 and 9).

Upland sedge species composition in rangeland ecosystems is variable during a growing season and dynamic among growing seasons. Patterns in the changes of individual plant species abundance was followed for 30 growing seasons during the 1983-2012 study on the sandy, shallow, and silty ecological sites of the long-term nongrazed, traditional seasonlong, and twice-over rotation management treatments (tables 10 and 11).

On the sandy site of the nongrazed treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 6.23% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 4.89% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 6.34% basal cover. The percent present remained at 100.0% and basal cover increased on the sandy site of the nongrazed treatment over time (tables 10 and 11).

On the sandy site of the ungrazed seasonlong treatment, Threadleaf sedge was present during 40.0% of the years that basal cover data were collected with a mean 1.16% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was not present. During the later period (1998-2012), Threadleaf sedge was present during 66.7% of the years with a mean 1.94% basal cover. Threadleaf sedge was not present during the early period and all basal cover observations were made during the later period indicating a low abundance of upland sedge (tables 10 and 11).

On the sandy site of the grazed seasonlong treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 6.12% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 4.09% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 4.92% basal cover. The percent present remained at 100.0% and the basal cover increased on the sandy site of the grazed seasonlong treatment over time (tables 10 and 11). The percent present and basal cover were greater on the sandy site of the grazed seasonlong treatment than those on the sandy site of the ungrazed seasonlong treatment.

On the sandy site of the ungrazed twice-over treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 5.96% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 4.80% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 5.27% basal cover. The percent present remained at 100.0% and the basal cover increased on the sandy site of the ungrazed twice-over treatment over time (tables 10 and 11).

On the sandy site of the grazed twice-over treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 8.30% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 5.99% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 8.83% basal cover. The percent present remained at 100.0% and the basal cover increased on the sandy site of the grazed twice-over treatment over time (tables 10 and 11). The percent present was the same at 100.0% and the basal cover was greater on the sandy site of the grazed twice-over treatment than that on the sandy site of the ungrazed twice-over treatment.

On the shallow site of the nongrazed treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 12.58% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 11.72% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 12.34% basal cover. The percent present remained at 100.0% and basal cover increased on the shallow site of the nongrazed treatment over time (tables 10 and 11).

On the shallow site of the ungrazed seasonlong treatment, Threadleaf sedgewas present during 38.5% of the years that basal cover data were collected with a mean 3.38% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was not present. During the later period (1998-2012), Threadleaf sedge was present during 66.7% of the years with a mean 5.86% basal cover. Threadleaf sedge was not present during the early period and all basal cover observations were made during the later period indicated abundant upland sedge (tables 10 and 11).

On the shallow site of the grazed seasonlong treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 11.17% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 10.02% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 10.99% basal cover. The percent present remained at 100.0% and basal cover increased on the shallow site of the grazed seasonlong treatment over time (tables 10 and 11). The percent present and basal cover were greater on the shallow site of the grazed seasonlong treatment than those on the shallow site of the ungrazed seasonlong treatment.

On the shallow site of the ungrazed twice-over treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 6.46% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 5.08% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 6.98% basal cover. The percent present remained at 100.0% and basal cover increased on the shallow site of the ungrazed twice-over treatment over time (tables 10 and 11).

On the shallow site of the grazed twice-over treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 7.72% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 6.29% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 8.04% basal cover. The percent present remained at 100.0% and basal cover increased on the shallow site of the grazed twice-over treatment over time (tables 10 and 11). The percent present was the same at 100.0% and the basal cover was greater on the shallow site of the grazed twice-over treatment than that on the shallow site of the ungrazed twice-over treatment.

On the silty site of the nongrazed treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 4.64% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 5.03% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 3.88% basal cover. The percent present remained at 100.0% and the basal cover decreased on the silty site of the nongrazed treatment over time (tables 10 and 11).

On the silty site of the ungrazed seasonlong treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 7.63% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 5.30% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 7.62% basal cover. The percent present remained at 100.0% and basal cover increased on the silty site of the ungrazed seasonlong treatment over time (tables 10 and 11).

On the silty site of the grazed seasonlong treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 5.96% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 4.29% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 5.71% basal cover. The percent present remained at 100.0% and basal cover increased on the silty site of the grazed seasonlong treatment over time (tables 10 and 11). The percent present was the same at 100.0% and the basal cover was greater on the silty site of the ungrazed seasonlong treatment than that on the silty site of the grazed seasonlong treatment.

On the silty site of the ungrazed twice-over treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 4.23% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 4.23% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 3.32% basal cover. The percent present remained at 100.0% and basal cover decreased on the silty site of the ungrazed twice-over treatment over time (tables 10 and 11).

On the silty site of the grazed twice-over treatment, Threadleaf sedge was present during 100.0% of the years that basal cover data were collected with a mean 5.55% basal cover during the total 30 year period. During the early period (1983-1992), Threadleaf sedge was present during 100.0% of the years with a mean 5.23% basal cover. During the later period (1998-2012), Threadleaf sedge was present during 100.0% of the years with a mean 5.34% basal cover. The percent present remained at 100.0% and basal cover increased on the silty site of the grazed twice-over treatment over time (tables 10 and 11). The percent present was the same at 100.0% and basal cover was greater on the silty site of the grazed twice-over treatment than that on the silty site of the ungrazed twice-over treatment.

On the sandy site, Threadleaf sedge was present during 88.0% of the years with a mean 5.55% basal cover. On the shallow site, Threadleaf sedge was present during 87.7% of the years with a mean 8.26% basal cover. On the silty site, Threadleaf sedge was present during 100.0% of the years with a mean 5.60% basal cover. The percent present was greater on the silty site and basal cover was greater on the shallow site.

On the sandy site of the nongrazed treatment, Threadleaf sedge was present during 100.0% of the years with a mean 6.23% basal cover. On the sandy site of the seasonlong treatment, Threadleaf sedge was present during 70.0% of the years with a mean 3.64% basal cover. On the sandy site of the twice-over treatment, Threadleaf sedge was present during 100.0% of the years with a mean 7.13% basal cover. On the sandy site, Threadleaf sedge was present during 100.0% of the years on the nongrazed and twice over treatments and basal cover was greatest on the twice-over treatment.

On the shallow site of the nongrazed treatment, Threadleaf sedge was present during 100.0% of the years with a mean 12.58% basal cover. On the shallow site of the seasonlong treatment, Threadleaf sedge was present during 69.2% of the years with a mean 7.28% basal cover. On the shallow site of the twice-over treatment, Threadleaf sedge was present during 100.0% of the years with a mean 7.09% basal cover. On the shallow site, Threadleaf sedge was present during 100.0% of the years on the nongrazed and twice over treatments and basal cover was greatest on the nongrazed treatment.

On the silty site of the nongrazed treatment, Threadleaf sedge was present during 100.0% of the years with a mean 4.64% basal cover. On the silty site of the seasonlong treatment, Threadleaf sedge was present during 100.0% of the years with a mean 6.80% basal cover. On the silty site of the twice-over treatment, Threadleaf sedge was present during 100.0% of the years with a mean 4.89% basal cover. On the silty site, Threadleaf sedge was present 100.0% of the years on the nongrazed, seasonlong, and twice over treatments and basal cover was greatest on the seasonlong treatment.

Threadleaf sedge was present on the nongrazed treatment during 100.0% of the years with a mean 7.82% basal cover. Threadleaf sedge was present on the seasonlong treatment during 79.7% of the years with a mean 5.90% basal cover. Threadleaf sedge was present on the twice-over treatment during 100.0% of the years with a mean 6.37% basal cover. Threadleaf sedge was present during 100.0% of the years on the nongrazed and twice-over treatments and basal cover was greatest on the nongrazed treatment.

Discussion

Threadleaf sedge, *Carex filifolia*, is a native, long-lived perennial, cool season, short graminoid, monocot, of the upland sedge family that is common on healthy mixed grass prairie plant communities. Threadleaf sedge can grow on sandy, shallow, and silty ecological sites. Threadleaf sedge has the greatest percent present on the silty site and basal cover was greatest on the shallow site. Threadleaf sedge has the greatest percent present of 100.0% of the years on the nongrazed and twice-over treatments and basal cover was greatest on the nongrazed treatment. Threadleaf sedge resumes leaf and stalk growth early from rootstock buds and rhizome buds. New leaves of Threadleaf sedge are visible by 8 April and new stalks are visible between 13 and 29 April. Leaf growth is at 28% height on mid April, 78% height on mid May, 98% height on mid June, and 100% maximum height on 22 June. Stalk growth is at 61% height on mid May, 93% height on mid June, and 100% of maximum height on 22 June. The stalk is at boot stage between 13 and 29 April, mean first flower occurs on 5 May, with a 5 week flower period from early May to the first week of June. Seeds are developing from early May, reach mature stage between 9 and 13 June, and start being shed on 17 June. Leaf dryness starts late June and continues through July and August into September. Tillers drop below the phosphorus requirements of lactating cows during mid May. Crude protein content of tillers is at 13% during early June, at 11% during early July, drops below the requirements of lactating cows during mid July, remains above 8% during mid to late July, remains above 7% during August, and remains above 6% during September. Threadleaf sedge has an extensive fibrous root system and a network of short rhizomes that are tough and wiry because of increased strength from the black pigment, melanin, that are resistant to decay and hold the prairie soil in place. Threadleaf sedge is a valuable asset on the Northern Mixed Grass Prairie.

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Table 1. Threadleaf sedge, Carex filifolia, weekly percent crude protein, percent phosphorus, and phenological growth stages of ungrazed lead tillers in western North Dakota, 1946-1947.

Sample Date	Crude Protein %	Phosphorus %	Phenological Growth Stages
Apr 1			
13	14.6	0.270	Flower stalk developing
19	22.2	0.317	
25	15.1	0.210	Flowering (Anthesis)
May 4	15.3	0.210	Seed developing
10	13.2	0.185	
16	15.0	0.170	
23	13.7	0.176	
28	13.8	0.162	Seed maturing
Jun 6	12.9	0.160	
13	14.2	0.160	Seed mature
19	11.3	0.179	
26	12.1	0.152	
Jul 2	11.0	0.153	Drying
8	9.7	0.155	
16	9.8	0.128	
24	8.4	0.122	
30	8.4	0.115	
Aug 6	8.0	0.097	Drying
13	7.5	0.109	
20	7.1	0.118	
26	8.0	0.091	
Sep 3	9.6	0.135	Drying
12	6.3	0.085	
21	-	-	
29	6.8	0.083	
Oct			
Nov 5	6.9	0.096	Drying

Data from Whitman et al. 1951.

Table 2. Mean leaf height in cm and percent of maximum leaf height attained by Threadleaf sedge, Carex filifolia, 1955-1962.

	April				
	1	8	15	22	29
cm		1.5	3.0	3.0	5.5
%		14.0	28.0	28.0	52.0
	May				
	1	8	15	22	29
cm	6.3	7.0	8.2	8.9	10.1
%	59.0	66.0	78.0	84.0	95.0
	June				
	1	8	15	22	29
cm	10.3	10.4	10.4	10.6	
%	97.0	98.0	98.0	100.0	
	July				
	1	8	15	22	29
cm					
%					
	August				
	1	8	15	22	29
cm					
%					

Data from Goetz 1963.

Table 3. Mean stalk height in cm and percent of maximum stalk height attained by Threadleaf sedge, Carex filifolia, 1955-1962.

			April		
	1	8	15	22	29
cm					2.5
%					17.4
			May		
	1	8	15	22	29
cm	4.0	6.5	8.8	11.7	11.8
%	27.8	45.1	61.1	81.3	81.9
			June		
	1	8	15	22	29
cm	12.2	13.0	13.4	14.4	
%	84.9	90.3	93.1	100.0	
			July		
	1	8	15	22	29
cm					
%					
			August		
	1	8	15	22	29
cm					
%					

Data from Goetz 1963.

Table 4. First flower and flower period of Threadleaf sedge, Carex filifolia.

	Apr	May	Jun	Jul	Aug	Sep
First Flower						
1955-1962						
Earliest	25					
Mean		5				
Flower Period						
1969-1971		XX XX	X			

First Flower Data from Goetz 1963 and Whitman et al. 1951.
Flower Period Data from Zaczkowski 1972.

Table 5. Flower stalk seed development and percent leaf dryness of Threadleaf sedge, Carex filifolia.

	Flower Stalk Development			Seed Development	
Data Period	Boot	Emerge	Flower	Mature	Shed
1955-1962	29 April		5 May	9 Jun	17 Jun
			Percent Leaf Dryness		
Data Period	Leaf Tip Dry	0-25 %	25-50 %	50-75 %	75-100 %
1955-1962	13 Jun	29 Jun	10 Jul	7 Aug	9 Sep

Data from Goetz 1963.

Table 6. Intake nutrient requirements as percent of dry matter for range cows with average milk production.

	Dry Gestation	3rd Trimester	Early Lactation	Lactation (Spring, Summer, Fall)
1000 lb cows				
Dry matter (lbs)	21	21	24	24
Crude protein (%)	6.2	7.8	10.5	9.6
Phosphorus (%)	0.11	0.15	0.20	0.18
1200 lb cows				
Dry matter (lbs)	24	24	27	27
Crude protein (%)	6.2	7.8	10.1	9.3
Phosphorus (%)	0.12	0.16	0.19	0.18
1400 lb cows				
Dry matter (lbs)	27	27	30	30
Crude protein (%)	6.2	7.9	9.8	9.0
Phosphorus (%)	0.12	0.17	0.19	0.18

Data from NRC 1996.

Table 7. Mean date of first flower and date of percentage categories of leaf senescence for Threadleaf sedge, 1964-1966.

Ecological Site	Anthesis	Leaf Tip Dry	Leaf 0-25% Dry	Leaf 25%-50% Dry	Leaf 50%-75% Dry
Sandy	4 May	5 Jun	19 Jun	30 Jun	27 Jul
Silty	5 May	26 May	9 Jun	30 Jul	31 Jul
Overflow	No Data				
Thin claypan	No Data				

Data from Goetz 1970.

Table 8. Mean leaf height in cm for Threadleaf sedge, 1964-1966.

Ecological Site	15 Apr	30 Apr	15 May	31 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	31 Aug	Maximum Height
Sandy	2.50	4.70	7.59	11.00	14.40	13.11	13.00	13.00	13.00	13.00	14.50
Silty	3.00	3.81	5.00	9.09	11.71	11.71	11.61	11.51	11.51	11.51	11.81
Overflow	No Data										
Thin claypan	No Data										

Data from Goetz 1970.

Table 9. Percent crude protein for Threadleaf sedge, 1964-1966.

Ecological Site		1 Jun	15 Jun	1 Jul	15 Jul	1 Aug	15 Aug	1 Sep	Mean
Sandy		12.4	11.2	8.8	8.5	7.4	6.4	7.0	8.8
Silty	No Data								
Overflow	No Data								
Thin claypan	No Data								

Data from Goetz 1975.

Table 10. Autecology of Carex filifolia, Threadleaf sedge, with growing season changes in basal cover, 1983-2012.					
Ecological Site Year Period	Nongrazed	Seasonlong		Twice-over	
		Ungrazed	Grazed	Ungrazed	Grazed
Sandy					
1983-1987	1.40	0.00	4.80	5.30	7.78
1988-1992	5.76	0.00	3.91	4.30	5.24
1993-1998	6.13	0.00	10.13	8.79	10.44
1999-2003	6.00	1.25	5.63	5.23	9.40
2004-2009	6.70	2.90	4.89	5.59	9.07
2010-2012	8.08	1.75	4.76	5.39	8.41
Shallow					
1983-1987	8.10	0.00	6.43	4.29	6.36
1988-1992	12.44	0.00	10.74	5.71	6.21
1993-1998	12.85	0.00	12.06	6.77	8.85
1999-2003	12.87	2.01	12.45	7.12	8.97
2004-2009	12.42	8.95	9.72	6.91	7.73
2010-2012	13.59	11.35	12.48	7.96	8.13
Silty					
1983-1987	2.75	2.90	2.57	3.44	5.14
1988-1992	5.49	5.78	4.63	4.86	5.32
1993-1998	5.61	9.66	7.60	6.21	6.16
1999-2003	4.77	8.90	5.57	0.53	5.50
2004-2009	4.01	7.47	5.70	3.26	5.42
2010-2012	2.98	6.43	7.17	3.37	5.74

Table 11. Autecology of Carex filifolia, Threadleaf sedge, with growing season changes in basal cover importance value, 1983-2012.					
Ecological Site Year Period	Nongrazed	Seasonlong		Twice-over	
		Ungrazed	Grazed	Ungrazed	Grazed
Sandy					
1983-1987	12.94	0.00	30.36	35.10	44.02
1988-1992	39.32	0.00	24.58	32.89	42.53
1993-1998	49.68	0.00	61.61	62.03	66.30
1999-2003	47.35	11.71	37.83	49.94	63.00
2004-2009	57.79	25.81	34.98	61.12	65.03
2010-2012	59.89	16.87	33.22	55.55	58.05
Shallow					
1983-1987	59.49	0.00	41.74	29.39	37.25
1988-1992	92.35	0.00	82.08	48.63	54.46
1993-1998	87.15	0.00	81.37	49.00	57.38
1999-2003	85.61	59.51	68.38	46.65	55.80
2004-2009	93.10	65.40	57.26	58.02	49.61
2010-2012	89.35	77.93	65.15	58.86	47.75
Silty					
1983-1987	20.42	24.13	18.18	18.34	24.47
1988-1992	33.62	44.53	35.18	34.37	41.62
1993-1998	44.64	56.67	46.68	37.71	37.44
1999-2003	10.08	45.13	33.87	32.84	30.90
2004-2009	34.49	52.49	38.85	35.98	34.20
2010-2012	26.29	44.98	37.94	29.71	29.81

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