Autecology of American Wildvetch on the Northern Mixed Grass Prairie

Llewellyn L. Manske PhD
Research Professor of Range Science
North Dakota State University
Dickinson Research Extension Center
Report DREC 17-1125

The autecology of American wildvetch, *Vicia americana*, 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).

American wildvetch, *Vicia americana* Muhl. ex Willd., is a member of the legume (bean, pea) family, Fabaceae, syn.: *Vicia sparsifolia* Nutt., and is a native, perennial, dicot, herb that is strongly drought tolerant and shade intolerant. The first North Dakota record is Bolley 1891. Annual aerial growth has a single climbing vine 20-100 cm (8-39 in) long usually branched above arising from a perennating crown (caudex). Stem leaves are alternate even pinnately compound with 8 to 12 linear, oval, or oblong leaflets 1-3 cm (0.4-1.2 in) long terminating in a tendril. The root system has a moderate to deeply branched taproot that can descend 100 cm (40 in) in depth and has few to several lateral rhizomes arising from the subterranian crown at 1.5-5 cm (0.6-2.0 in) below the soil surface. Regeneration is by vegetative and sexual reproduction. Vegetative growth is by annual sprouts from the crown and by sprouts from the rhizomes forming dense but limited colonies. Inflorescence are a raceme of 3 to 9 flowers clustered close together on one side of a stalk 5-10 cm (2.0-3.9 in) long arising from leaf axils. Flowers are perfect, pea shaped with 5 bluish or reddish purple petal appearing during late May to late June. Fruits are flattened bean like pods 2-4 cm (0.8-1.6 in) long that split at maturity. Aerial parts are eaten by livestock and are totally consumed by fire. The buds on the crown and rhizomes usually survive burning unless soil is dry and several sprouts develop resulting in an increase following fire. This summary information on growth development and regeneration of American wildvetch was based on works of Weaver and Fitzpatrick 1934, Stevens 1963, Zaczkowski 1972, Great Plains Flora Association 1986, Coladonato 1993, Larson and Johnson 2007, and Kirk and Belt 2010.

Procedures

The 1955-1962 Study

American wildvetch plant growth in height was determined by measuring ungrazed stems from ground level to top of leaf or to the tip of the inflorescence of an average of 10 plants of each species at approximately 7 to 10 day intervals during the growing seasons of 1955 to 1962 from early May until early September. Dates of first flower (anthesis) were recorded as observed. These growth in height and flower data were reported in Goetz 1963.

The 1969-1971 Study

The range of flowering time of American wildvetch was 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 1984-1985 Study

American wildvetch plant growth in height was determined by measuring stems from ground level to top of stem or leaf or to the tip of the inflorescence of 28 ungrazed specimens randomly selected on three replications of grazed sandy, shallow, silty, and clayey ecological sites biweekly during June, July, and August of the growing seasons of 1984 and 1985. Phenological growth stage of each specimen was recorded as vegetative, budding, anthesis, seed developing, seed shedding, or mature. Percentage of stem dryness of each specimen was recorded as 0, 0-2, 2-25, 25-50, 50-75, 75-98, or 100 percent dry. Mean stem weight was determined by clipping at ground level 11 specimens at typical phenological growth stages at biweekly sample dates on separate grazed areas of the sandy, shallow, silty, and clayey ecological sites. Clipped stems at each

sample site were placed in separate labeled paper bags of known weight, oven dried at 62° C (144° F), and weighed in grams.

The 1983-2012 Study

A long-term study on change in abundance of American wildvetch 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 American wildvetch was determined with plant species stem density by 0.1 m^2 frame density method and with plant species basal cover by the ten-pin point frame method (Cook and Stubbendieck 1986).

The stem density method was used to count individual stems of each plant species rooted inside twenty five 0.1 m^2 quadrats placed along permanent transect lines at each sample site both inside (ungrazed) and outside (grazed) each exclosure. Stem density per 0.1 m^2 quadrat, relative stem density, percent frequency, relative percent frequency, and importance value were determined from the stem density data. Plant species stem density data collection was 1984, 1986 to 2012 on the twice-over treatment and was 1987 to 2012 on the long-term nongrazed and seasonlong treatments. However, stem density data was not collected during 1991, 1993 to 1997 on the sandy, shallow, and silty ecological sites of all three management treatments, stem density data was not collected during 1992 on the sandy ecological site of all three management treatments, and stem density data was not collected during 1999 on the sandy and silty ecological sites of the long-term nongrazed treatment.

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 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 or the stem density 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 density or 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 a growing season. Density importance value ranks the forbs and shrubs and 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

American wildvetch resumed growth in spring as a branched single stem that is a climbing vine arising from a perennating crown that has a moderate to deep branching taproot. Short rhizomes extend laterally from the crown. Inflorescence is a cluster of 3 to 9 perfect, pea shaped flowers with bluish to reddish purple petals forming on one side of a raceme stalk. On the fall grazed pastures of the 1955-1962 study, the earliest first flowers appeared 6 May, the mean first flowers occurred on 22 May, and a long 8 week flower period extending from late May through the third week of July was observed during

the 1969-1971 study (table 1) (Goetz 1963, Zaczkowski 1972). A mean flower stalk height of 13.8 cm (5.4 in) with an annual variance in height from 9.0 cm (3.5 in) to 19.0 cm (7.5 in) was reached during July (table 2) (Goetz 1963). The reported normal flower stalk height in the Northern Plains ranged from 5 cm to 10 cm (2.0-4.0 in) tall. The flower stalk heights measured during the 1955-1961 study were within or taller than the normal flower stalk heights for the Northern Plains.

Changes in phenological growth stages from the 1984-1985 study are summarized on tables 3, 4, 5, and 6. A total of 1,885 American wildvetch stems were sampled during this study with, 141 stems (7.5%) from the sandy sites, 625 stems (33.2%) from the shallow sites, 609 stems (32.3%) from the silty sites, and 510 stems (27.1%) from the clayey sites. American wildvetch can grow on sandy, shallow, silty, and clayey ecological sites. It appears to grow better on the shallow and silty sites and grow poorly on the sandy sites. The mean flower stalk height reached during June to early July was , 8.3 cm (3.3 in) on the sandy sites, 10.8 cm (4.4 in) on the shallow sites, 11.6 cm (4.6 in) on the silty sites, and 10.9 cm (4.3 in) on the clayey sites and they were not significantly different. The flower stalk heights measured during the 1984-1985 study were within or taller than the normal flower stalk height for the Northern Plains. The mean stem weight was, 0.15 g on the sandy sites, 0.13 g on the shallow sites, 0.11 g on the silty sites, and 0.10 g on the clayey sites and they were not significantly different.

During the growing season, most of the stems, 95.1% remained at the vegetative growth stage. A mean 4.9% of the stems passed through the anthesis growth stage during June and only 2.0% of the stems produced flowers during early July. Flowers were observed during a 5 week flower period from early June through the first week of July duirng the 1984-1985 study.

Plant species composition in rangeland ecosystems is variable during a growing season and dynamic among growing seasons. Patterns in the changes in 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 7, 8, and 9).

On the sandy site of the nongrazed treatment, American wildvetch was not present where basal cover data were collected and was present during 11.1% of the years that density data were collected with a mean 0.03 stems/m^2 density during the total 30 year period. During the early period (1983-1992), American wildvetch was not present on the sandy site of the nongrazed treatment. During the later period (1998-2012), American wildvetch was present during 14.3% of the years with a mean 0.04 stems/m^2 density. American milkvetch was not very abundant on the sandy site of the of the nongrazed treatment during the later period (1998-2012) (tables 7, 8, and 9).

On the sandy site of the ungrazed seasonlong treatment, American wildvetch was not present during the 30 year period of this study (tables 7, 8, and 9).

On the sandy site of the grazed seasonlong treatment, American wildvetch was not present where basal cover data were collected and was present during 21.1% of the years that density data were collected with a mean 0.04 stems/m^2 density during the total 30 year period. During the early period (1983-1992), American wildvetch was present during 25.0% of the years with a mean 0.08 stems/m^2 density. During the later period (1998-2012), American wildvetch was present during 20.0% of the years with a mean 0.03 stems/m^2 density. The percent present for the density data and stem density decreased on the sandy site of the grazed seasonlong treatment over time (tables 7, 8, and 9). The percent present for the density data and stem density 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, American wildvetch was present during 19.1% and 3.4% of the years that density and basal cover data were collected with a mean 0.03 stems/m^2 density and a mean 0.0004% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was not present where basal cover data were collected and was present during 16.7% of the years with a mean 0.05 stems/m^2 density. During the later period (1998-2012), American wildvetch was present during 20.0% and 6.7% of the years that density and basal cover were collected with a mean 0.02 stems/m^2 density and a mean 0.001% basal cover, respectively. American milkvetch had low abundance on the sandy site of the ungrazed twice-over treatment (tables 7, 8, and 9).

On the sandy site of the grazed twice-over treatment, American wildvetch was present during 28.6% and 3.4% of the years that density and basal cover data were collected with a mean 0.07 stems/m^2

density and a mean 0.002% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 33.3% and 11.1% of the years with a mean 0.17 stems/m^2 density and a mean 0.006% basal cover, respectively. During the later period (1998-2012), American wildvetch was not present where basal cover data were collected and was present during 26.7% of the years with a mean 0.03 stems/m^2 density. The percent present, stem density, and basal cover all decreased on the sandy site of the grazed twice-over treatment over time (tables 7, 8, and 9). The percent present of the density data , stem density, and basal cover were slightly greater on the sandy site of the grazed twice-over treatment than those on the sandy site of the ungrazed twice-over treatment.

On the shallow site of the nongrazed treatment, American wildvetch was not present where basal cover data were collected and was present during 26.3% of the years that density data were collected with a mean 0.90 stems/m^2 density during the total 30 year period. During the early period (1983-1992), American wildvetch was not present on the shallow site of the nongrazed treatment. During the later period (1998-2012), American wildvetch was present during 35.7% of the years with a mean 1.43 stems/m^2 density. The percent present of the density data and stem density increased on the shallow site of the nongrazed treatment over time (tables 7, 8, and 9).

On the shallow site of the ungrazed seasonlong treatment, American wildvetch was not present where basal cover data were collected and was present during 5.0% of the years that density data were collected with a mean 0.005 stems/m^2 density during the total 30 year period. During the early period (1983-1992), American wildvetch was not present on the shallow site of the ungrazed seasonlong treatment. During the later period (1998-2012), American wildvetch was present during 6.7% of the years with a mean 0.007 stems/m^2 density. American wildvetch had low abundance on the shallow site of the ungrazed seasonlong treatment (tables 7, 8, and 9).

On the shallow site of the grazed seasonlong treatment, American wildvetch was present during 10.0% and 7.7% of the years that density and basal cover data were collected with a mean 0.10 stems/m^2 density and a mean 0.01% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 40.0% and 33.3% of the years with a mean 0.38 stems/m^2 density and a mean 0.03% basal cover, respectively. During the later period (1998-2012), American wildvetch was not present on the shallow site of the grazed seasonlong treatment. The percent present, stem density, and basal cover all decreased on the shallow site of the grazed seasonlong treatment over time (tables 7, 8, and 9). American wildvetch had low abundance on the shallow sites of both the ungrazed and grazed seasonlong treatments.

On the shallow site of the ungrazed twice-over treatment, American wildvetch was present during 63.6% and 17.2% of the years that density and basal cover data were collected with a mean 0.78 stems/m^2 density and a mean 0.004% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 57.1% and 22.2% of the years with a mean 1.17 stems/m^2 density and a mean 0.01% basal cover, respectively. During the later period (1998-2012), American wildvetch was present during 66.7% and 20.0% of the years with a mean 0.59 stems/m^2 density and a mean 0.003% basal cover, respectively. The percent present of the density data increased slightly and the percent present of the basal cover data decreased slightly. The stem density and basal cover decreased on the shallow site of the ungrazed twice-over treatment over time (tables 7, 8, and 9).

On the shallow site of the grazed twice-over treatment, American wildvetch was present during 63.6% and 16.7% of the years that density and basal cover data were collected with a mean 0.36 stems/m^2 density and a mean 0.003% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 57.1% and 10.0% of the years with a mean 0.30 stems/m^2 density and a mean 0.003% basal cover, respectively. During the later period (1998-2012), American wildvetch was present during 66.7% and 26.7% of the years with a mean 0.39 stems/m^2 density and a mean 0.005% basal cover, respectively. The percent present, stem density, and basal cover increased slightly on the shallow site of the grazed twice-over treatment over time (tables 7, 8, and 9). The percent present and basal cover were similar on the shallow sites of the ungrazed and grazed twice-over treatments. The stem density was greater on the shallow site of the ungrazed twice-over treatment than that on the shallow site of the grazed twice-over treatment.

On the silty site of the nongrazed treatment, American wildvetch was not present where basal cover data were collected and was present during 31.6% of the years that density data were collected

with a mean 1.15 stems/m^2 density during the total 30 year period. During the early period (1983-1992), American wildvetch was present during 20.0% of the years with a mean 0.04 stems/m^2 density. During the later period (1998-2012), American wildvetch was present during 35.7% of the years with a mean 1.43 stems/m^2 density. The percent present for the density data and stem density increased on the silty site of the nongrazed treatment over time (tables 7, 8, and 9).

On the silty site of the ungrazed seasonlong treatment, American wildvetch was present during 20.0% and 7.7% of the years that density and basal cover data were collected with a mean 0.06 stems/m^2 density and a mean 0.01% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 20.0% and 16.7% of the years with a mean 0.02 stems/m^2 density and a mean 0.02% basal cover, respectively. During the later period (1998-2012), American wildvetch was present during 20.0% and 6.7% of the years with a mean 0.07 stems/m^2 density and a mean 0.002% basal cover, respectively. The percent present and basal cover had very little change and stem density increased slightly on the silty site of the ungrazed seasonlong treatment over time (tables 7, 8, and 9).

On the silty site of the grazed seasonlong treatment, American wildvetch was present during 40.0% and 11.5% of the years that density and basal cover data were collected with a mean 0.19 stems/m^2 density and a mean 0.01% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 40.0% and 33.3% of the years with a mean 0.24 stems/m^2 density and a mean 0.03% basal cover, respectively. During the later period (1998-2012), American wildvetch was present during 40.0% and 6.7% of the years, with a mean 0.17 stems/m^2 density and a mean 0.01% basal cover, respectively. The percent present changed little and the stem density and basal cover decreased slightly on the silty site of the grazed seasonlong treatment over time (tables 7, 8, and 9). The percent present, stem density, and basal cover were slightly greater on the silty site of the grazed seasonlong than those on the silty site of the ungrazed seasonlong treatment.

On the silty site of the ungrazed twice-over treatment, American wildvetch was present during 63.6% and 20.7% of the years that density and basal cover data were collected with a mean 0.78 stems/m^2 density and a mean 0.007% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 28.6% and 22.2% of the years with a mean 0.09 stems/m^2 density and a mean 0.004% basal cover, respectively. During the later period (1998-2012), American wildvetch was present during 80.0% and 26.7% of the years with a mean 1.11 stems/m^2 density and a mean 0.01% basal cover, respectively. The percent present, stem density, and basal cover all increased a little on the silty site of the ungrazed twice-over treatment over time (tables 7, 8, and 9).

On the silty site of the grazed twice-over treatment, American wildvetch was present during 50.0% and 16.7% of the years that density and basal cover data were collected with a mean 0.33 stems/m^2 density and a mean 0.006% basal cover during the total 30 year period, respectively. During the early period (1983-1992), American wildvetch was present during 57.1% and 10.0% of the years with a mean 0.09 stems/m^2 density and a mean 0.002% basal cover, respectively. During the later period (1998-2012), American wildvetch was present during 46.7% and 26.7% of the years with a mean 0.45 stems/m^2 density and a mean 0.011% basal cover, respectively. The percent present for the density data decreased slightly and the percent present for the basal cover data increased slightly, the stem density increased, and the basal cover increased slightly on the silty site of the grazed twice-over treatment over time (tables 7, 8, and 9). The percent present, stem density, and basal cover were slightly greater on the silty site of the ungrazed twice-over treatment than those on the silty site of the grazed twice-over treatment.

American wildvetch was not in great abundance on any ecological site or management treatment. On the sandy sites, American wildvetch was present during 16.0% and 1.4% of the years that density and basal cover data were collected with a mean 0.03 stems/m^2 density and a mean 0.0005% basal cover, respectively. On the shallow sites, American wildvetch was present during 33.7% and 8.3% of the years that density and basal cover data were collected with a mean 0.43 stems/m^2 density and a mean 0.003% basal cover, respectively. On the silty sites, American wildvetch was present during 41.0% and 11.3% of the years that density and basal cover were collected with a mean 0.50 stems/m^2 density and a mean 0.005% basal cover, respectively. American wildvetch can grow on the sandy, shallow, silty, and clayey ecological sites. It grows better on the silty and shallow sites and grows poorly on the sandy sites. The basal cover data was sparse on all ecological sites and management treatments. The stem density was extremely low on the sandy sites and low on the silty and shallow sites. The stem densities on the silty and shallow sites were greater

on the not grazed treatments than those on the grazed treatments and was the greatest on the silty and shallow sites of the nongrazed treatment.

During the drought growing season of 1988, American wildvetch was not present on the sandy, shallow, or silty ecological sites of the nongrazed, ungrazed and grazed seasonlong, or ungrazed and grazed twice-over treatments. American wildvetch was present during the growing season of 1989 on the silty sites of the nongrazed, ungrazed and grazed seasonlong, and ungrazed and grazed twice-over treatments.

Discussion

American wildvetch, *Vicia americana*, is a native, late succession perennial forb of the legume family that is present at low abundance on healthy mixed grass prairie plant communities. American wildvetch can grow on sandy, shallow, silty, and clayey ecological sites. It appears to grow better on the silty and shallow sites and grows poorly on the sandy sites. Early spring aerial growth consists of a single branched stem that cannot support itself upright arises from a perennating caudex with a moderate to deep branched taproot system. Short rhizomes can produce annual sprouts forming dense limited colonies. Several flowers develop on clusters on a raceme. The flowers are bluish or reddish purple, perfect, pea shaped on one side of the flower stalks arising from leaf axils. The mean first flower date is 22 May (1955-1962 study) with an 8 week flower period from late May through the third week of July (1969-1971 study) and with a 5 week flower period from early June through the first week of July (1984-1985 study). The total observed flower period flower period resulting from the three studies is a 12 week period from early May through the third week of July. The mean flower stalk height was 13.8 cm (5.4 in) (1955-1962 study) and 10.4 cm (4.1 in) (1984-1985 study) which are both taller than the normal flower stalk heights of 5-10 cm (2.0-4.0 in) for the Northern Plains. The mean stem weight was 0.12 g (1984-1985 study). During the growing season, 95.1% of the stems remained vegetative, with 4.9% passing through the anthesis phase in June and 2.0% of the stems passing through anthesis during early July (1984-1985 study). Basal cover data was sparse with, 0.001% basal cover on the sandy sites, 0.003% basal cover on the shallow sites, and 0.005% basal cover on the silty sites. Stem density data was low with, 0.03 stems/m^2 on the sandy sites, 0.43 stems/m^2 on the shallow sites, and 0.50 stems/m^2 on the silty sites. American wildvetch was not present during the drought growing season of 1988 on any of the ecological sites of all of the management treatments.

The perennating caudex, moderate to deep branching taproot system, and short sprouting rhizomes help American wildvetch to persist through the harsh conditions of the Northern Mixed Grass Prairie.

Acknowledgment

I am grateful to Sheri Schneider for assistance in the production of this manuscript and for development of the tables.

Table 1. First flower and flower period of American wildvetch, Vicia americana.

	Apr	May	Jun	Jul	Aug	Sep
First Flower						
1955-1962						
Earliest		6				
Mean		22				
Flower Period						
1969-1971		X	XX XX XX X			

First Flower data from Goetz 1963.
Flower Period Data from Zaczkowski 1972.

Table 2. Autecology of American wildvetch, Vicia americana, with growing season changes in mature height.

				Percent of Mature Height Attained					
Data Period	Minimum Annual Mature Height cm	Maximum Annual Mature Height cm	Mean Mature Height cm	Apr %	May %	Jun %	Jul %	Aug %	Sep %
1955-1962	9.0	19.0	13.8		70.6	94.5	100.0		

Data from Goetz 1963.

Table 3. Phenological growth stage changes during the growing season for American wildvetch, Vicia americana, 1984-1985.

Site Sandy	8 Jun	23 Jun	8 Jul	23 Jul	8 Aug	23 Aug
% Population						
Veg	100.0	100.0	75.0	100.0	-	100.0
Bud			25.0			
Anth						
Seed Dev						
Seed Shed						
Mat						
Mean Height (cm)						
Veg	9.9	7.7	4.7	12.1	-	13.9
Bud			7.1			
Anth						
Seed Dev						
Seed Shed						
Mat						
% Dryness						
Veg	9.9	26.6	0.0	14.6	-	78.6
Bud			2.0			
Anth						
Seed Dev						
Seed Shed						
Mat						
Mean Weight (g)	0.26	0.15	0.15	0.09	0.08	-

Phenological Growth Stages: Vegetative (Veg), Budding (Bud), Anthesis (Anth), Seed Developing (Seed Dev), Seed Shedding (Seed Shed), Mature (Mat).

Table 4. Phenological growth stage changes during the growing season for American wildvetch, Vicia americana, 1984-1985.

Site Shallow	8 Jun	23 Jun	8 Jul	23 Jul	8 Aug	23 Aug
% Population						
Veg	76.4	98.4	100.0	100.0	100.0	100.0
Bud	10.9	1.6				
Anth	10.9					
Seed Dev	1.8					
Seed Shed						
Mat						
Mean Height (cm)						
Veg	8.8	8.8	8.7	11.2	10.3	7.4
Bud	9.0	12.7				
Anth	10.8					
Seed Dev	10.5					
Seed Shed						
Mat						
% Dryness						
Veg	15.4	42.5	52.9	60.7	76.2	100.0
Bud	4.2	2.0				
Anth	0.0					
Seed Dev	25.0					
Seed Shed						
Mat						
Mean Weight (g)	0.05	0.15	0.09	0.10	0.06	0.30

Phenological Growth Stages: Vegetative (Veg), Budding (Bud), Anthesis (Anth), Seed Developing (Seed Dev), Seed Shedding (Seed Shed), Mature (Mat).

Table 5. Phenological growth stage changes during the growing season for American wildvetch, Vicia americana, 1984-1985.

Site Silty	8 Jun	23 Jun	8 Jul	23 Jul	8 Aug	23 Aug
% Population						
Veg	93.8	96.5	78.7	100.0	100.0	100.0
Bud	3.1	3.5	13.4			
Anth	3.1		0.8			
Seed Dev			0.8			
Seed Shed						
Mat			6.3			
Mean Height (cm)						
Veg	10.9	10.0	11.1	13.5	11.3	9.1
Bud	6.0	10.3	12.1			
Anth	6.8		20.6			
Seed Dev			13.8			
Seed Shed						
Mat			9.7			
% Dryness						
Veg	10.9	38.9	54.7	36.2	84.4	88.9
Bud	0.0	20.4	1.1			
Anth	1.0		0.0			
Seed Dev			2.0			
Seed Shed						
Mat			46.6			
Mean Weight (g)	0.13	0.09	0.22	0.06	0.05	-

Phenological Growth Stages: Vegetative (Veg), Budding (Bud), Anthesis (Anth), Seed Developing (Seed Dev), Seed Shedding (Seed Shed), Mature (Mat).

Table 6. Phenological growth stage changes during the growing season for American wildvetch, Vicia americana, 1984-1985.

Site Clayey	8 Jun	23 Jun	8 Jul	23 Jul	8 Aug	23 Aug
% Population						
Veg	87.0	99.0	83.6	100.0	100.0	100.0
Bud	9.3		8.2			
Anth	1.9					
Seed Dev	1.9					
Seed Shed						
Mat		1.0	8.2			
Mean Height (cm)						
Veg	9.1	10.0	9.5	11.1	11.0	12.0
Bud	9.0		11.5			
Anth	14.4					
Seed Dev	11.1					
Seed Shed						
Mat		11.4	8.4			
% Dryness						
Veg	7.1	28.6	61.5	59.0	79.6	66.7
Bud	0.4		0.7			
Anth	2.0					
Seed Dev	2.0					
Seed Shed						
Mat		2.0	52.8			
Mean Weight (g)	0.20	0.06	0.10	0.10	0.04	0.08

Phenological Growth Stages: Vegetative (Veg), Budding (Bud), Anthesis (Anth), Seed Developing (Seed Dev), Seed Shedding (Seed Shed), Mature (Mat).

Table 7. Autecology of Vicia americana, American wildvetch, with growing season changes in density importance value, 1983-2012.

Ecological Site Year Period	Nongrazed	Seasonlong		Twice-over	
		Ungrazed	Grazed	Ungrazed	Grazed
Sandy					
1983-1987	0.00	0.00	0.00	0.00	0.00
1988-1992	0.00	0.00	0.39	0.91	2.79
1993-1998	0.00	0.00	0.00	0.00	0.00
1999-2003	0.38	0.00	0.24	0.00	0.31
2004-2009	0.00	0.00	0.09	0.35	0.27
2010-2012	0.38	0.00	0.29	0.00	0.00
Shallow					
1983-1987	0.00	0.00	0.00	5.17	1.76
1988-1992	0.00	0.00	2.91	2.61	1.92
1993-1998	0.00	0.00	0.00	2.54	0.00
1999-2003	0.00	0.15	0.00	1.97	1.07
2004-2009	10.00	0.00	0.00	1.88	1.22
2010-2012	2.36	0.00	0.00	0.10	0.86
Silty					
1983-1987	0.00	0.53	1.65	1.13	0.70
1988-1992	0.44	0.00	1.79	0.00	0.77
1993-1998	0.00	0.00	1.97	1.98	0.00
1999-2003	0.00	0.20	0.09	4.04	1.33
2004-2009	9.49	0.31	0.83	8.37	1.98
2010-2012	2.51	1.19	0.45	16.29	2.56

Table 8. Autecology of Vicia americana, American wildvetch, 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	0.00	0.00	0.00	0.00	0.00
1988-1992	0.00	0.00	0.00	0.00	0.12
1993-1998	0.00	0.00	0.00	0.00	0.00
1999-2003	0.00	0.00	0.00	0.03	0.00
2004-2009	0.00	0.00	0.00	0.00	0.00
2010-2012	0.00	0.00	0.00	0.00	0.00
Shallow					
1983-1987	0.00	0.00	0.00	0.08	0.03
1988-1992	0.00	0.00	0.44	0.04	0.00
1993-1998	0.00	0.00	0.00	0.00	0.00
1999-2003	0.00	0.00	0.00	0.02	0.05
2004-2009	0.00	0.00	0.00	0.04	0.03
2010-2012	0.00	0.00	0.00	0.00	0.00
Silty					
1983-1987	0.00	0.00	0.00	0.00	0.00
1988-1992	0.00	0.18	0.30	0.06	0.04
1993-1998	0.00	0.00	0.00	0.00	0.00
1999-2003	0.00	0.00	0.00	0.02	0.06
2004-2009	0.00	0.04	0.07	0.21	0.16
2010-2012	0.00	0.00	0.00	0.22	0.02

Table 9. Autecology of Vicia americana, American wildvetch, with growing season changes in density, 1983-2012.					
Ecological Site Year Period	Nongrazed	Seasonlong		Twice-over	
		Ungrazed	Grazed	Ungrazed	Grazed
Sandy					
1983-1987	0.00	0.00	0.00	0.00	0.00
1988-1992	0.00	0.00	0.01	0.01	0.03
1993-1998	0.00	0.00	0.00	0.00	0.00
1999-2003	0.01	0.00	0.01	0.00	0.00
2004-2009	0.00	0.00	0.00	0.01	0.00
2010-2012	0.01	0.00	0.00	0.00	0.00
Shallow					
983-1987	0.00	0.00	0.00	0.24	0.04
1988-1992	0.00	0.00	0.05	0.02	0.02
1993-1998	0.00	0.00	0.00	0.04	0.00
1999-2003	0.00	0.00	0.00	0.07	0.03
2004-2009	0.25	0.00	0.00	0.08	0.06
2010-2012	0.07	0.00	0.00	0.00	0.02
Silty					
1983-1987	0.00	0.01	0.04	0.02	0.01
1988-1992	0.01	0.00	0.02	0.00	0.01
1993-1998	0.00	0.00	0.03	0.01	0.00
1999-2003	0.00	0.01	0.00	0.07	0.04
2004-2009	0.32	0.01	0.04	0.15	0.05
2010-2012	0.03	0.01	0.00	0.14	0.06

Literature Cited

Coladonato, M. 1993. *Vicia americana*. Fire Effects Information System. USDA. Forest Service. http://www.fs.fed.us/database/feis/

Cook, C.W., and J. Stubbendieck. 1986. Range research: basic problems and techniques. Society for Range Management, Denver, CO. 317p.

Goetz, H. 1963. Growth and development of native range plants in the mixed prairie of western North Dakota. M. S. Thesis, North Dakota State University, Fargo, ND. 165p.

Great Plains Flora Association. 1986. Flora of the Great Plains. University of Kansas, Lawrence, KS.

Larson, G.E., and J.R. Johnson. 2007. Plants of the Black Hills and Bear Lodge Mountains. 2nd Edition. South Dakota State University, Fargo, ND. 219p.

Kirk, S., and S. Belt. 2010. Plant fact sheet for American vetch (*Vicia americana*). USDA. Natural Resources Conservation Service. Norman A. Berg National Plant Materials Center, Bettsville, MD. http://plants.usda.gov.

Manske, L.L. 2016. Autecology of prairie plants on the Northern Mixed Grass Prairie. NDSU Dickinson Research Extension Center. Range Research Report DREC 16-1093. Dickinson, ND.

Stevens, O.A. 1963. Handbook of North Dakota plants. North Dakota Institute for Regional Studies. Fargo, ND.

Weaver, J.E., and T.J. Fitzpatrick. 1934. The Prairie. Ecological Monographs 4(2):109-295.

Zaczkowski, N.K. 1972. Vascular flora of Billings, Bowman, Golden Valley, and Slope Counties, North Dakota. PhD. Thesis. North Dakota State University, Fargo, ND. 219 p.