**ANNUAL REPORT (20*17* to 20*18*)**

**Multistate Project NC1181:** Enhancing Resiliency of Beef Production Under Shifting Forage Resources

Period the Report Covers: October, 1 2017 to September 30, 2018

Date of Annual Meeting: August 9-10, 2018, Salina, KS

**Objectives**

1. Optimize the utilization of crop residues by grazing and harvesting and determine the effects on agroecosystems.
2. Evaluate strategies to increase efficient use and productivity of range and pasturelands through strategic timing and density of stocking and shifting species composition to more productive species.
3. Evaluate effects of integrating annual forage crops into year-round forage systems for beef production.
4. Develop innovative beef systems that match shifting forage resources.
5. Conduct multi-faceted education/extension program to disseminate research results, to include extension papers as well as regional conferences on the use of crop residues, annual forages, and range and pastureland by livestock.

**Accomplishments**

*Short-term outcomes:*

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* Objective 1

Ammoniated corn residue can be fed in round bale feeders to cows without excessive waste, thereby allowing beef producers to use this feed resource in place of medium quality grass hay during times of low hay stocks or high hay prices.

* Objective 2

The cool-season annual invasive Bromus tectorum can only be utilized early in the growing season in western Nebraska. Strategic grazing on these grasses provides high quality forage for cattle and may increase the prevalence of native perennial grasses that are more sustainable and productive for longer periods in the spring.

Forage production on native rangelands is temporally and spatially variable. Greater understanding of factors that influence this variability allows producers to better match livestock demand with forage availability in both wet and dry years, thereby increasing the efficient use and increasing productivity per acre.

Breeding heifers strategically stocked and bred at a greater density early in the grazing season, and then removing open heifers at the growing season mid-point, provided producers with significantly more pounds of beef produced per acre as well as more heifers that remained on pasture with a similar calving due date. Production results were similar to intensive early stocking studies performed with stocker steers in which productivity increased per acre and beef was produced more efficiently.

After 7 years of treatment application on Sandhills meadow, there is no difference in botanical composition and aboveground plant production among grazing systems (mob grazing, simple rotation grazing, and continuous grazing); and trampling of standing live vegetation is the greatest and harvest efficiency and yearling weight gain are the lowest for mob grazing.

* Objective 3

Late summer planted oats and brassica are high in energy and protein. They can be stockpiled for winter grazing with little loss in nutritive value. These forages can be used to background fall weaned calves over the winter.

Oat-pea forage mixtures provide an option for producers to balance to quantity and quality of an early-season annual forage. The ratio of the mixture can be adjusted to better supply the producer with the best option for the growing region (eastern vs, western Nebraska) and the type of grazing livestock.

Cow preference for annual forages indicates that grass species are the most preferentially selected in both summer and winter forages. In the winter, low glucosinolate radish and winter peas were intermediate with many of the other brassicas a low preference. During the summer sunflower and sunn hemp were intermediate in preference with mungbean, safflower, and okra least preferred.

* Objective 4

Complete chopped sugar beets can be mixed and packed with crop residue and used as an energy source for cattle in an alternative beef production system.

* Objective 5

Information related to objectives 1 through 4 was disseminated to over 5,000 producers, consultants and advisors through presentations as at face-to-face meetings

Information related to the outcomes of objectives 1 through 4 were disseminated online through the beef.unl.edu website which had 359,000 users.

*Outputs:*

* 8 peer-reviewed journal articles
* 20 scientific abstracts
* 14 research reports or proceedings
* 9 popular press article
* 3 webinars

*Activities*

* Objective 1
* A study was conducted to determine the effect of corn residue harvest method and ammoniation on feeding waste when corn residue bales were fed to cows in a round bale feeder
* Objective 2
	+ The second year of a student evaluating selectivity of cattle for cheatgrass and perennial grasses early in the growing season was completed.
	+ A 17 year data set of forage production at different topographic positions was analyzed to better understand and model forage production on Sandhills range in central Nebraska.
	+ The eighth and final year of treatment application was completed for grazing studies on meadow and upland range at UNL’s Barta Brothers Ranch. Final plant and soil data collection to measure the cumulative effects of treatments are currently in progress during the 2018 field season.
* Objective 3
	+ The second year evaluating the effects of adding rapeseed in to late summer planted oats to background calves and its subsequent effect on finishing performance was completed.
	+ The third year data evaluating the use of oats planted after corn silage or high moisture corn for background calves and the subsequent impact on summer cash crop productivity was conducted.
	+ An on-farm research experiment evaluating the profitability of grazing rye with growing calves within an integrated production system was continued
	+ A survey of the nitrate content of annual forages (n = 443) grown for grazing in Nebraska was conducted.
	+ The second year of evaluating oat-pea mixtures at 3 locations across Nebraska was completed.
	+ Two cow preference studies for annual forages were completed. The third was planted and awaiting a freeze before preference study.
* Objective 4
* A demonstration was conducted on chopping, mixing, packing, and storing sugar beets and straw for use in alternative beef production systems
* Objective 5
	+ Research results were translated for use by producers and disseminated through meetings, electronic newsletters, podcasts, extension publications, and distributed through social media.
	+ Information related to the outcomes of objectives 1 through 4 was disseminated to beef producers at workshops held in Nebraska (objective 1-4), Iowa (objective 1, 3, and 4), Kansas (objective 1-4) and Minnesota (objective 3 and 4).
	+ Nebraska (Drewnoski and Jenkins) and Kansas (Farney) conducted a three meeting series on the Kansas-Nebraska border covering management of the cow herd with limited perennial pasture acres that was attended by 181 producers.

*Milestones:*

Data on the long-term impacts of grazing strategy on vegetation productivity and utilization, harvest efficiency, and rangeland health continues to be collected on meadow and upland range at the Barta Brothers Ranch.

**Impacts**

Lower feed cost for cow calf producers in the north central region can be achieved with the use of crop residues and cover crops. Participants of the three meeting series on this topic valued the knowledge gained at $28/cow.

Although mob grazing, using ultrahigh stocking density during the growing season, is commonly reported to increase aboveground plant production and to increase soil organic matter and soil depth, we have found no improvement in vegetation characteristics or soil properties relative to other grazing strategies after 7 years on Sandhills meadows. Furthermore, mob grazing has not resulted in an increase in harvest efficiency, carrying capacity, or livestock performance. The additional infrastructure and human resource requirements of mob grazing compared to other grazing strategies does not appear to be justified.

**Outputs**

*Abstracts/Posters/Professional Presentations*

1. MacDonald, J. C., M. E. Drewnoski, and Z. Carlson. 2018. Systems approaches to beef cattle production: Maximizing use of alternative forages to optimize agricultural ecosystems. Cactus Beef Symposium American Society of Animal Science National Meeting.
2. Lenz, M. E., R. Kern, and M. E. Drewnoski. 2018. Nitrate Concentrations of Annual Forages Grown for Grazing in Nebraska. J. Animal Science.
3. Riley, H. K. Hales, S. Shackelford, H. Freetly, and M. E. Drewnoski. 2018. Effect of rapeseed inclusion in late-summer planted oat pasture on growing performance of beef steers. J. Animal Science.
4. Conway, A. C., R. G. Bondurant, J. C. MacDonald, T. J. Klopfenstein and M. E. Drewnoski. 2018. The Effect of Harvest Method and Ammoniation of Corn Residue on Growing Calf Performance. J. Animal Science, 96 (E-Supplement 2):221-222.
5. Lenz, M. E., J. L. Cox, K. E. Hales, H. C. Wilson and M. E. Drewnoski. 2018. Late Summer Planted Oat-Brassica Forage Quality and Change during Winter. J. Animal Science, 96 (E-Supplement 2): 219-220.
6. Stephenson, M. B., W. Schacht, J. Volesky, N. Lawrence. 2018. Factors influencing plant functional group yields on Sandhills rangelands. Abstracts of 71st annual meetings of the Society for Range Management. Reno, NV.
7. Pflueger, N., M. B. Stephenson, D. Redfearn, J. Volesky. 2018. Effect of varying oat-pea seeding rates on annual forage quality and quantity. Abstracts for the 2018 ASA annual meetings. Baltimore, MD.
8. Pflueger, N, M. B. Stephenson, R. Bolze. 2018. Incorporating grazed annual forages and cover crops into cropping systems. Abstracts for the 7th National Grazing Lands Conference. Reno, NV.
9. Blanco, H., M.E. Drewnoski, C. Burr, G. Lesoing, T. Williams, D.D. Redfearn, and J. Parsons. 2018. Does Grazing or Harvesting of Cover Crops Affect Soils and Crop Production? Assessment in Different Soil Types and Management Scenarios. Symposium--Cover Crops and Forage Utilization in Integrated Crop-Livestock Systems III. ASA-CSSA SSSA Annual Meetings.
10. Redfearn, D., R. Mitchell, M. Drewnoski, J. Parsons, J. MacDonald, M. Schmer, H. Blanco, and V. Jin. 2018. Forage and Crop Residue Utilization in Corn and Beef Systems in the Midwest. Symposium--Cover Crops and Forage Utilization in Integrated Crop-Livestock Systems I. ASA-CSSA SSSA Annual Meetings.
11. Redfearn, D., and M. Drewnoski. 2018. Planting decisions for alternative forages:plant and animal considerations. 18th Annual Nebraska Grazing Conference.
12. Shropshire, A. J., W. Schacht, and J. Volesky. 2018. Evaluating Methods of Estimating Forage Intake by Grazing Cattle. In Abstracts: Society for Range Management 71st Annual Meeting. Jan. 28 – Feb. 2. Sparks, NV. Available online at: http://rangelands.org/wp-content/uploads/2018/01/2018-Abstracts.pdf
13. Shine, A. 2018. Use of an Unmanned Aerial Vehicle (UAV) to Evaluate Grazing Strategies in the Nebraska Sandhills. In Abstracts: Society for Range Management 71st Annual Meeting. Jan. 28 – Feb. 2. Sparks, NV. Available online at: <http://rangelands.org/wp-content/uploads/2018/01/2018-Abstracts.pdf>
14. Coufal, E., Parsons, J., Drewnoski, M., and Redfearn, D. 2018. Modeling Crop-Livestock Production Systems Using Agent Based Principles/Techniques. Accepted paper presentation at the Western Agricultural Economics Association Annual Meeting. Anchorage, AK.
15. Parsons, J. 2018. “Precipitation Risk Management for Second Crop Annual Forages.” Proceedings 2018 Nebraska Crop Management Conference. pp. 34-35.
16. Parsons, J., Drewnoski, M., and Redfearn, D. 2018. “Online Crop Residue Exchange Links Growers and Grazers.” Proceedings 2018 Nebraska Crop Management Conference. pp. 18-19.
17. Hansen, B. H., Z. E. Carlson, R. G. Bondurant, M. L. Jolly-Breithaupt, F. H. Hilscher, G. E. Erickson, and J. C. MacDonald. 2018. Growing performance and metabolism of steers fed increasing inclusions of condensed distillers solubles in forage-based diets. J. Anim. Sci. 96 (Suppl. 2): 220 (Abstr.). https://doi.org/10.1093/jas/sky073.407.
18. Jones, R. M., R. G. Bondurant, F. H. Hilscher, and J. C MacDonald. 2018. Steer performance grazing corn residue and supplemented with modified distillers grians plus solubles with or without urea. J. Anim. Sci. 96 (Suppl. 2): 221 (Abstr.). https://doi.org/10.1093/jas/sky073.409.
19. Troyer, B. C., H. L. Greenwell, A. K. Watson, J. C. MacDonald, and K. H. Jenkins. 2018. Economics of field pea supplementation for cattle grazing crested wheat grass. J. Anim. Sci. 96 (Suppl. 2): 223-224 (Abstr.). https://doi.org/10.1093/jas/sky073.413.**Farney, J. K.** C. Davis, D. Presley, D. Shoup, and G. Sassenrath. 2017. Using annual forages (cover crops) for cattle. *In* ASA-CSSA-SSSA Abstracts 2017 [CD-ROM]. ASA, CSSA, and SSSA, Tampa, FL.

*Journal Articles*

1. Ulmer, K. M., M. Rakkar. H. Blanco, R. J. Rasby, J. L. Cox-O’Neill, K. H. Jenkins, J. C. MacDonald and M. E. Drewnoski. 2018. Baling or Grazing of Corn Residue Does Not Reduce Crop Production in Central United States. Agronomy Journal (accepted)
2. Drewnoski, M. E., J. Parsons, H. Blanco, D. Redfearn, K. Hales and J. MacDonald. 2018. Can Cover Crops Pull Double Duty: Conservation and Profitable Forage Production in the Midwestern U.S.? J. of Animal Sci. <https://doi.org/10.1093/jas/sky026>
3. Cox-O’Neill, J. L., K. E. Hales, K. M. Ulmer, R. J. Rasby, J. Parsons, S. D. Shackelford, H. C. Freetly, and M. E. Drewnoski. 2017. The effects of backgrounding system on growing and finishing performance, and carcass characteristics of beef steers. J. of Animal Sci. 95:5309-5319.
4. Stephenson, M. B., J. D. Volesky, W. H. Schacht, N. Lawrence, J. Soper, J. Milby. 2018. Influence of precipitation on plant production at different topographic positions in the Nebraska Sandhills. In Press with Rangeland Ecology and Management.
5. Stephenson, M. B., H. Wilmer, R. Bolze, and B. Schiltz. 2017. Evaluating an on-ranch rangeland monitoring program in Nebraska. Rangelands 39:143-151.
6. Greenwell, H. L., K. H. Jenkins, and J. C. MacDonald. 2018. Evaluating field peas as an energy source for growing and finishing beef cattle. Prof. Anim. Sci. 34:202-209. doi:10.15232/pas.2017-01666.
7. Farney, J. K., G. F. Sassenrath, C. J. Davis, and D. Presley. 2018. Production, forage quality, and economics of three-way cover crop mixes. Crop Forage Turfgrass Manage. Accepted with minor revisions. 4:170038. doi:10.2134/cftm2017.11.0081.
8. Farney, J. K., G. F. Sassenrath, C. J. Davis, and D. Presley. 2018. Composition, forage production, and costs are variable in three-way cover crop mixes used as fall forage. Crop Forage Turfgrass Manage. doi: 10.2134/cftm2018.03.0020.

*Extension Research Reports/Publications*

1. Conway, A. C., K. Glewen and M.E. Drewnoski. 2018. Corn planted after spring grazed or no grazed rye cover crop. In. Nebraska Extension On farm Research [2017 growing season results](https://cropwatch.unl.edu/OnFarmResearch/2017GrowingSeasonResults.pdf). 28-31.
2. Conway, A. C., R. G. Bondurant, H. F. Hilscher, J. C. MacDonald, T. J. Klopfenstein and M. E. Drewnoski. 2018. Effect of Harvest Method and Ammoniation of Corn Residue on Growing Calf Performance. Nebraska Beef Report. [MP105:57-59](https://beef.unl.edu/documents/2018-beef-report/2018-19-Effect-of-Harvest-Method-and-Ammoniation-of-Corn-Residue-on-Growing-Calf-Performance.pdf).
3. Lenz, M. E., J. L. Cox, K. Hales, H. C. Wilson and M. E. Drewnoski. 2018. Late Summer Planted Oat-Brassica Forage Quality Change during Winter Grazing. Nebraska Beef Report. [MP105:60-62](https://beef.unl.edu/documents/2018-beef-report/2018-20-Late-Summer-Planted-Oat-Brassica-Forage-Quality-Changes-during-Winter-Grazing.pdf).
4. Jenkins, K.H. and J.A. Hansen. 2018. Chopped Sugar beets as a Component of Beef Cow Diets. Nebraska Beef Report. MP105:28-29.
5. Gardine, S.E., J. M. Warner, R.G. Bondurant, F.H. Hilscher, K.H. Jenkins, G.E. Erickson, T.J. Klopfenstein. 2018. Effects of Production System on Cow and Calf Performance. Nebraska Beef Report. MP105:30-32.
6. Harmoney, K. R. and J. R. Jaeger. 2018. Can Modified Intensive Early Stocking Be Used in Cow/Calf Production?. Kansas Agricultural Experiment Station Research Reports: Vol. 4: Iss. 2. <https://doi.org/10.4148/2378-5977.7559>
7. Harmoney, K. R. and J. Guretzky. 2018. Interseeding Warm-Season Annual Grasses into Perennial Cool-Season Western Wheatgrass Pasture. Kansas Agricultural Experiment Station Research Reports: Vol. 4: Iss. 2. <https://doi.org/10.4148/2378-5977.7560>
8. Harmoney, K. R. and J. R. Jaeger. 2018. Using Modified Intensive Early Stocking for Grazing Replacement Heifers. Kansas Agricultural Experiment Station Research Reports: Vol. 4: Iss. 2. <https://doi.org/10.4148/2378-5977.7558>
9. Shropshire, A.J., W. Schacht, J. Volesky. 2018. Evaluating Methods of Estimating Forage Intake by Grazing Cattle. University of Nebraska Beef Cattle Report. MP105:70-71.
10. Jones, R. M., R. G. Bondurant, F. H. Hilscher, and J. C. MacDonald. 2018. Steer performance grazing corn residue and supplemented with modified distillers grains plus solubles with or without urea. Nebr. Beef Cattle Rep. MP 105. Pp. 35-37.
11. Welchons, C. A., R. G. Bondurant, F. H. Hilscher, A. K. Watson, G. E. Erickson, and J. C. MacDonald. 2018. Effect of backgrounding system on performance and profitability of yearling beef steers. Nebr. Beef Cattle Rep. MP 105. Pp. 40-44.
12. Hansen, B. H., R. G. Bondurant, F. H. Hilscher, G. E. Erickson, and J. C. MacDonald. 2018. Evaluation of corn distillers solubles on growing steer performance. Nebr. Beef Cattle Rep. MP 105. Pp. 45-46.
13. Welchons, C. A., R. G. Bondurant, F. H. Hilscher, T. J. Klopfenstein, A. K. Watson, and J. C. MacDonald. 2018. Effect of continuous or rotational grazing on growing steer performance and land production. Nebr. Beef Cattle Rep. MP 105. Pp. 67-69.
14. Farney, J., G. F. Sassenrath, C. Davis, and D. Presley. 2018. Growth, forage quality, and economics of cover crop mixes for grazing. Kansas Agricultural Experiment Station Reports. Vol 4: Issue 3. doi:10.4148/2378-5977.7576.

*Extension publications (peer-reviewed)*

1. Report. [MP105:33-34](https://beef.unl.edu/documents/2018-beef-report/2018-10-Effect-of-Injectable-Trace-Mineral-on-Reproductive-Performance-in-Beef-Heifers.pdf). Ulmer, K. and M.E. Drewnoski. 2018. Drought-stressed Corn: A Feed Opportunity. BeefWatch Electronic Newsletter. [July](http://newsroom.unl.edu/announce/beef/8158/46711).
2. Redfearn, D. and M. E. Drewnoski. 2018. Considerations for forage cover crops after hail in corn and soybeans. CropWatch Electronic Newsletter. [July](https://cropwatch.unl.edu/2018/forage-cover-crop-considerations-after-hail-corn-and-soybean)
3. Drewnoski, M. E. and D. Redfearn. 2018. Reducing Nitrate Concerns When Grazing Forage Cover Crops. CropWatch Electronic Newsletter. [July](https://cropwatch.unl.edu/2018/reducing-nitrate-concerns-when-grazing-forage-cover-crops).
4. Whitney, T., J. Rees, M. Drewnoski, B. Anderson and G. Erickson. 2018. Wheat forage options and considerations. CropWatch Electronic Newsletter. [May](https://cropwatch.unl.edu/2018/wheat-forage-options-and-considerations).
5. Parsons, J., M. Drewnoski, and D. Redfearn. 2018. Economics of producing forage on cropland. BeefWatch Electronic Newsletter. [March](http://newsroom.unl.edu/announce/beef/7621/43984).
6. Drewnoski, M. E. 2017. Studies Show Minimal Soil Compaction with Winter Grazing. 2017. CropWatch Electronic Newsletter. [October](https://cropwatch.unl.edu/2017/impacts-cattle-grazing-corn-residue).
7. Drewnoski, M. E. 2017. Wintering Growing Calves Using Corn Residue: The Value of Bypass Protein. BeefWatch Electronic Newsletter. [October](http://newsroom.unl.edu/announce/beef/6982/40117).
8. Jenkins, K.H. 2018. A Reminder about Forage Intake in the Nursing Calf Raised in a Limit Fed Confinement System. BeefWatch Newsletter [May 18](https://newsroom.unl.edu/announce/beef/7865/45837)
9. Jenkins, K.H. 2018. Mineral Supplementation Changes when Supplementing Distillers Grains. BeefWatch Newsletter [Jan 18](https://newsroom.unl.edu/announce/beef/7388/42343)
10. Jenkins, K.H. 2017. Meeting the Nutrient Demands of Cows Grazing Cornstalks. BeefWatch Newsletter [Nov 17](https://newsroom.unl.edu/announce/beef/7148/40941)
11. Volesky, J. and M. Stephenson 2018. Dry, wet, or average: Planning for the grazing season. April BeefWatch Newsletter
12. Stephenson, M. 2018. Dryland pastures for western Nebraska. April BeefWatch Newsletter
13. Redfearn, D., and R. Elmore. 2018. How planting date, varieties affect spring cover crop growth. CropWatch Electronic Newsletter. <https://cropwatch.unl.edu/2018/how-planting-date-varieties-affect-spring-cover-crop-growth>
14. Parsons, J., Berger, A., and Volesky, J. 2018. “Precipitation Risk Management for Annual Forages.” UNL BeefWatch Newsletter, June.
15. Parsons, J., Berger, A., and Volesky, J. 2018. “Precipitation Risk Management for Annual Forages.” NebGuide G2300. University of Nebraska-Lincoln.

*Articles in the Popular Press (non-peer reviewed)*

1. Drewnoski, M. E. 2018. Shrinking silage shrink. Hay and Forage Grower. August/September. p 20.
2. Jenkins, K.H. 2018. Mineral Supplementation Changes when Supplementing Distillers Grains. Progressive Cattlemen. February. Issue 2. P.22.
3. Stephenson, M. B. 2017. Understanding grazing management terms and improving harvest efficiency. Progressive Cattleman, September issue. p 48-49.
4. Stephenson, M. B., 2018. Managing rangelands with temporal and spatial variability. Progressive cattleman. September issue, p. 46-47
5. Parsons, J., Hewlett, J., and Tranel, J. E. 2018. “Whole-farm and forage risk management.” Progressive Forage, 19(3):10-13.
6. Farney, J. 2018. Options for managing cows through the winter with limited forages. Beef Tips. September 4.
7. Farney, J. 2018. Warm season annual forages potential toxicity issues. KLA Connection. August.
8. Farney, J. K. 2018. Considerations for use of drought-stressed corn for cattle. Beef Tips. July 2.
9. Sassenrath, G. and J. Farney. 2018. Fall cover crops for grazing. Montgomery County NRCS newsletter.

*Webinars/Videos and URL for online access*

1. Parsons, J., D. Redfearn, and M.E. Drewnoski. 2018. Economics of forage on cropland. <https://beef.unl.edu/economics-producing-forage-cropland>
2. Drewnoski, M. E. and L. Meyers. 2017. Integrating Livestock and Cover Crops for Profit in Nebraska. PFI farminar. [www.practicalfarmers.org/farmer-knowledge/farminar-archive/integrating-livestock-cover-crops-profit-nebraska/](http://www.practicalfarmers.org/farmer-knowledge/farminar-archive/integrating-livestock-cover-crops-profit-nebraska/)
3. Drewnoski, M. E. 2017. Myths and Merits of Grazing Corn Residue. NE SARE webinar. <https://unl.app.box.com/s/7j6k6s7ileahw0f707fpmo71c7ny65pl>

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1. Nebraska Environmental Trust. $149,848. 7/1/18- 6/30/20. Impact of cover crops and grazing on soil health and systems economics. Drewnoski, M., D. Redfearn, J. Parsons, H. Blanco
2. Western Sugar $6,800 1/31/18-1/31/19. Complete sugar beets for finishing cattle. Jenkins, K.H.