

# Patch Burn Grazing

## An Annotated Bibliography

(ok, incompletely annotated)

### Patch Burn Grazing: Primary and/or Peer-reviewed Literature

The following represent research conducted with a primary or secondary purpose of describing the effects of patch burn grazing management strategies in the United States. Includes both articles published in peer-reviewed journals as well theses and dissertations.

Allred, B. W., S. D. Fuhlendorf, D. M. Engle, and R. D. Elmore. 2011a. Ungulate preference for burned patches reveals strength of fire-grazing interaction. *Ecology and Evolution* 1:132–144.

- *Oklahoma*
- *Bison and domestic cattle*
- *Effects on animal distribution, effects on forage quality and quantity*

Allred, B. W., S. D. Fuhlendorf, and R. G. Hamilton. 2011b. The role of herbivores in Great Plains conservation: comparative ecology of bison and cattle. *Ecosphere* 2:art26. doi:10.1890/ES1810-00152.00151.

- *Oklahoma*
- *Bison and domestic cattle*
- *Effects on animal distribution*

Anderson, J. D. 2012. Influence of habitat heterogeneity on small mammals in the Central Platte River Valley, Nebraska. MS Thesis, Fort Hayes State University. Fort Hayes, KS. 58 pp.

Anderson, R. A. H. 2005. Effects of fire and grazing driven heterogeneity on N cycling in tallgrass prairie. MS Thesis, Oklahoma State University. Stillwater, OK. 80 pp.

- *Oklahoma*
- *Domestic cattle*
- *Effects on N availability; effects on microbial biomass*

Anderson, R. H., S. D. Fuhlendorf, and D. M. Engle. 2006. Soil nitrogen availability in tallgrass prairie under the fire-grazing interaction. *Rangeland Ecology & Management* 59:625–631.

- *Oklahoma*
- *Domestic cattle*
- *Effects on N availability*

Baum, K. A. and W. V. Sharber. 2012. Fire creates host plant patches for monarch butterflies. *Biology Letters* 8:968–971.

- *Oklahoma*
- *Domestic cattle*
- *Effects on the abundance of milkweed, a butterfly host plant (research was conducted in a patch burn grazing landscape but results **were not** presented in the context of a fire-grazing interaction but were instead focused on the effect of recent summer fires).*
- *Effects on the abundance of butterfly eggs and larvae (research was conducted in a patch burn grazing landscape but results were not presented in the context of a fire-grazing interaction but were instead focused on the effect of recent summer fires).*

- Bell, N. E. 2012. Impact of patch-burn grazing on aboveground net primary productivity and sericeae *Lespedeza* (*Lespedeza cuneata*) seed viability. MS Thesis, Emporia State University. Emporia, KS. 95 pp.
- Biondini, M. E., A. A. Steuter, and R. G. Hamilton. 1999. Bison use of fire-managed remnant prairies. *Journal of Range Management* 52:454–461.
- *Nebraska, Oklahoma*
  - *Bison*
  - *Effects on animal distribution*
- Breland, A. 2008. Black-tailed prairie dog and large ungulate response to fire on mixed-grass prairie. MS Thesis, Oklahoma State University. Stillwater, OK. 188 pp.
- *Oklahoma*
  - *Texas longhorn, bison, black-tailed prairie dogs*
  - *Effects on prairie dog colony expansion; effects on bison and cattle distribution; effects on vegetation structure, composition and biomass*
- Churchwell, R. T., C. A. Davis, S. D. Fuhlendorf, and D. M. Engle. 2008. Effects of patch-burn management on dickcissel nest success in a tallgrass prairie. *Journal of Wildlife Management* 72:1596–1604.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on dickcissel nest predation; nest parasitism, reproductive success*
- Cook, T. 2008. A comparison of patch-burn grazing and continuous grazing in the Northern Tallgrass Prairie. M.S. Thesis, South Dakota State University.
- Coppedge, B. R., D. M. Engle, C. S. Toepfer, and J. H. Shaw. 1998. Effects of seasonal fire, bison grazing and climatic variation on tallgrass prairie vegetation. *Plant Ecology* 139:235–246.
- *Oklahoma*
  - *Bison*
  - *Effects on vegetation biomass and composition*
- Coppedge, B. R., D. M. Leslie, and J. H. Shaw. 1998. Botanical composition of bison diets on tallgrass prairie in Oklahoma. *Journal of Range Management* 51:379–382.
- *Oklahoma*
  - *Bison*
  - *Effects on diet selectivity and composition*
- Coppedge, B. R., S. D. Fuhlendorf, W. C. Harrell, and D. M. Engle. 2008. Avian community response to vegetation and structural features in grasslands managed with fire and grazing. *Biological Conservation* 141:1196–1203.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on vegetation composition and structure; effects on breeding bird abundance*
- Coppedge, B. R. and J. H. Shaw. 1998. Bison grazing patterns on seasonally burned tallgrass prairie. *Journal of Range Management* 51:258–264.
- *Oklahoma*
  - *Bison*
  - *Effects on bison distribution*

- Cummings, D. C., S. D. Fuhlendorf, and D. M. Engle. 2007. Is altered grazing selectivity of invasive forage species with patch burning more effective than herbicide treatments? *Rangeland Ecology & Management* 60:253–260.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on sericea lespedeza cover; effects on vegetation composition*
- Debinski, D. M., R. A. Moranz, J. T. Delaney, J. R. Miller, D. M. Engle, L. B. Winkler, D. A. McGranahan, R. J. Barney, J. C. Trager, A. L. Stephenson, and M. K. Gillespie. 2011. A cross-taxonomic comparison of insect responses to grassland management and land-use legacies. *Ecosphere* 2: 131. doi:10.1890/ES11-00226.1
- Doxon, E. D. 2009. Nesting and feeding ecology of grassland birds in mixed-grass prairie managed with patch-burn techniques. PhD Dissertation, Oklahoma State University, Stillwater, OK. 273 pp.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on breeding bird density, nest success, diet, and levels of stress hormones; effects on invertebrate abundance and diversity*
- Doxon, E. D., C. A. Davis, S. D. Fuhlendorf, and S. L. Winter. 2011. Aboveground Macroinvertebrate Diversity and Abundance in Sand Sagebrush Prairie Managed With the Use of Pyric Herbivory. *Rangeland Ecology & Management* 64:394–403.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on invertebrate diversity and abundance*
- Duvall, V. L. and L. B. Whitaker. 1964. Rotation burning: a forage management system for longleaf pine-bluestem ranges. *Journal of Range Management* 17:322–326.
- *Louisiana*
  - *Domestic cattle*
  - *Effects on forage production and utilization; effects on animal productivity*
  - *The first known instance where the effects of patch burn grazing were quantified*
- Engle, D. M., S. D. Fuhlendorf, A. Roper, and D. M. Leslie, Jr. 2008. Invertebrate community response to a shifting mosaic of habitat. *Rangeland Ecology & Management* 61:55–62.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on invertebrate biomass and abundance; effects on vegetation cover*
- Fuhlendorf, S. D. and D. M. Engle. 2004. Application of the fire-grazing interaction to restore a shifting mosaic on tallgrass prairie. *Journal of Applied Ecology* 41:604–614.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on vegetation structure and composition; effects on animal performance*
  - *Presents a conceptual model for the fire-grazing interaction illustrating the interaction of herbaceous fuels, fire occurrence, grazing animal distribution and vegetation structure and composition*
- Fuhlendorf, S. D., W. C. Harrell, D. M. Engle, R. G. Hamilton, C. A. Davis, and D. M. Leslie, Jr. 2006. Should heterogeneity be the basis for conservation? Grassland bird response to fire and grazing. *Ecological Applications* 16:1706–1716.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on breeding bird abundance; effects on vegetation structure and composition*

- Fuhlendorf, S. D., D. E. Townsend II, R. D. Elmore, and D. M. Engle. 2010. Pyric-herbivory to promote rangeland heterogeneity: evidence from small mammal communities. *Rangeland Ecology & Management* 63:670–678.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on small mammal abundance and community composition; effects on vegetation composition and structure*
- Griebel, R. L., S. L. Winter, and A. A. Steuter. 1998. Grassland birds and habitat structure in sandhills prairie managed using cattle or bison plus fire. *Great Plains Research* 8:255–268.
- *Nebraska*
  - *Domestic cattle and bison*
  - *Effects on breeding bird abundance; effects on vegetation structure*
- Harrell, W. C. Importance of heterogeneity in a grassland ecosystem. PhD Dissertation, Oklahoma State University. Stillwater, OK. 114 pp.
- Helzer, C. J. and A. A. Steuter. 2005. Preliminary effects of patch-burn grazing on a high-diversity prairie restoration. *Ecological Restoration* 23:167–171.
- *Nebraska*
  - *Domestic cattle*
  - *Effects on grazing selectivity of a suite of prairie forbs*
- Hovick, T. J. 2010. Survival of grasshopper sparrows (*Ammodramus savannarum*) during two important life stages in grassland managed with fire and grazing. MS Thesis, Iowa State University. Ames, IA.
- *Iowa*
  - *Domestic cattle*
  - *Effects on grasshopper sparrow nest survival and survival after they have left the nest.*
- Hovick, T. and J. Miller. 2013. Broad-scale heterogeneity influences nest selection by brown-headed cowbirds. *Landscape Ecology* 28:1493–1503.
- Hovick, T. J., J. R. Miller, R. R. Koford, D. M. Engle, and D. M. Debinski. 2011. Postfledging survival of grasshopper sparrows in grasslands managed with fire and grazing. *Condor* 113:429–437.
- *Iowa*
  - *Domestic cattle*
  - *Effects on grasshopper sparrow chicks after they have left the nest*
- Hovick, T. J., M. J. R., S. J. Dinsmore, D. M. Engle, D. M. Debinski, and S. D. Fuhlendorf. 2012. Effects of fire and grazing on grasshopper sparrow nest survival. *Journal of Wildlife Management* 76:19–27.
- *Iowa*
  - *Domestic cattle*
  - *Effects on grasshopper sparrow nest survival*
- Huffington, M. P. 2011. Rangeland and pasture improvements for southeastern North Dakota. M.S. Thesis, North Dakota State University. Fargo, ND. 138 pp.
- Kerby, J. D. 2002. Patch-level foraging behavior of bison and cattle on tallgrass prairie. MS Thesis, Oklahoma State University. Stillwater, OK. 78 pp.
- *Oklahoma*
  - *Bison and domestic cattle*
  - *Effects on animal behavior*

- Leis, S., L. Morrison, and M. Debacker. Spatiotemporal variation in vegetation structure resulting from pyric-herbivory. *Prairie Naturalist* 45:13–20.
- Limb, R. F., S. D. Fuhlendorf, D. M. Engle, J. R. Weir, R. D. Elmore, and T. G. Bidwell. 2011. Pyric-herbivory and cattle performance in grassland ecosystems. *Rangeland Ecology & Management* 64:659–663.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on animal productivity*
- McGranahan, D. A. 2008. Degradation and restoration in remnant tallgrass prairie: grazing history, soil carbon, and invasive species affect community composition and response to the fire-grazing interaction. MS Thesis, Iowa State University. Ames, IA.
- *Iowa*
  - *Domestic cattle*
  - *Effects on tall fescue defoliation and abundance, vegetation structure, and animal performance*
- McGranahan, D. A. 2011. Species richness, fire spread, and structural heterogeneity in tallgrass prairie. PhD Dissertation, Iowa State University. Ames, IA.
- *Iowa*
  - *Domestic cattle*
  - *Effects on vegetation spatial heterogeneity and functional group composition.*
- McGranahan, D. A., D. E. Engle, S. D. Fuhlendorf, J. R. Miller, and D. M. Debinski. 2012. An invasive cool-season grass complicates prescribed fire management in a native warm-season grassland. *Natural Areas Journal* 32:208–214.
- *Iowa*
  - *Domestic cattle*
  - *Effects of an exotic grass (tall fescue) on fire behavior (research was conducted in part within patch burn grazing pastures but results **were not** presented in the context of a fire-grazing interaction)*
- McGranahan, D. A., D. E. Engle, S. D. Fuhlendorf, S. J. Winter, J. R. Miller, and D. M. Debinski. 2012. Spatial heterogeneity across five rangelands managed with pyric herbivory. *Journal of Applied Ecology* 49:903–910.
- *Multiple sites in the United States*
  - *Domestic cattle*
  - *Effects on vegetation structural heterogeneity*
- McGranahan, D. A., D. E. Engle, S. D. Fuhlendorf, S. J. Winter, J. R. Miller, and D. M. Debinski. 2013. Inconsistent outcomes of heterogeneity-based management underscore importance of matching evaluation to conservation objectives. *Environmental Science and Policy* 31:53–60.
- *Multiple sites in the United States*
  - *Domestic cattle*
  - *Effects on vegetation structural heterogeneity*
- McGranahan, D., G. Raicovich, W. Wilson, and C. Smith. 2013. Preliminary evidence that patch burn-grazing creates spatially heterogeneous habitat structure in old-field grassland. *Southeastern Naturalist* 12:655–660.
- Meek, M. G., S. M. Cooper, M. K. Owens, R. M. Cooper, and A. L. Wappel. 2008. White-tailed deer distribution in response to patch burning on rangeland. *Journal of Arid Environments* 72:2026–2033.
- *Texas*
  - *Domestic cattle, white-tailed deer*
  - *Effects on deer distribution; effects on cattle distribution; effects on vegetation composition*

- Moranz, R. A. 2010. The effects of ecological management on tallgrass prairie butterflies and their nectar sources. PhD Dissertation, Oklahoma State University. Stillwater, OK. 106 pp.
- *Missouri*
  - *Domestic cattle*
  - *Butterfly preference for nectar sources (research was conducted in a patch burn grazing landscape but results **were not** presented in the context of a fire-grazing interaction)*
  - *Effects on butterfly detectability (research was conducted in a patch burn grazing landscape but most results **were not** presented in the context of a fire-grazing interaction)*
  - *Effects on abundance of a butterfly (*Speyeria idalia*) and its preferred nectar sources (research was conducted in a patch burn grazing landscape and results **were** presented in the context of a fire-grazing interaction)*
- Moranz, R. A., D. M. Debinski, D. A. McGranahan, D. M. Engle, J. R. Miller. 2012. Untangling the effects of fire, grazing, and land-use legacies on grassland butterfly communities. *Biodiversity and Conservation* 21:2719–2746.
- Pillsbury, F. C. 2011. Grassland bird response to a fire-grazing interaction in a fragmented landscape. MS Thesis, Iowa State University. Ames, IA. 120 pp.
- *Iowa*
  - *Domestic cattle*
  - *Effects on bird density; effects on vegetation structure*
- Pillsbury, F. C., J. R. Miller, D. M. Debinski, and D. M. Engle. 2011. Another tool in the toolbox? Using fire and grazing to promote bird diversity in highly fragmented landscapes. *Ecosphere* 2:art28. doi.org/10.1890/ES1810-00154.00151
- *Iowa*
  - *Domestic cattle*
  - *Effects on breeding bird abundance; effects on vegetation structure and composition*
- Polito, V. 2012. Effects of patch mosaic burning on tick burden on cattle, tick survival and tick abundance. MS Thesis. Department of Veterinary Biomedical Sciences, Oklahoma State University, Stillwater. 162 pp.
- Polito, V., K. Baum, M. Payton, S. Little, S. Fuhlendorf, and M. Reichard. 2013. Tick abundance and levels of infestation on cattle in response to patch burning. *Rangeland Ecology and Management* 66:545–552.
- Ramirez Yáñez, L. 2011. Impact of Alternative Range Management Systems on Grasslands in the Central Platte River Valley, Nebraska. PhD Dissertation. School of Natural Resources, University of Nebraska-Lincoln. 167 pp.
- Rensink, C. B. 2009. Impacts of patch-burn grazing on livestock and vegetation in the tallgrass prairie. MS Thesis, Kansas State University, Manhattan, KS.
- *Kansas*
  - *Domestic cattle*
  - *Effects on animal performance and forage utilization; effects on vegetation composition; effects on sericea lespedeza utilization by cattle and sericea lespedeza density*
- Roper, A. 2003. Response of invertebrates to habitat management for heterogeneity in a tallgrass prairie. MS Thesis, Oklahoma State University. Stillwater, OK. 54 pp.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on invertebrate biomass, abundance, and nutritional quality; effects on vegetation cover*
  - *See Engle et al 2008 for published results*

- Scasta, J. D., D. M. Engle, J. T. Talley, J. R. Weir, J. C. Stansberry, S. D. Fuhlendorf, and R. N. Harr. 2012. Pyric-herbivory to manage horn flies (Diptera: Muscidae) on cattle. *Southwestern Entomologist* 37:325–334.
- *Oklahoma and Iowa*
  - *Domestic cattle*
  - *Effects on horn fly abundance on cattle*
- Schuler, K. L., D. M. Leslie, Jr., J. H. Shaw, and E. J. Maichak. 2006. Temporal-spatial distribution of American bison (*Bison bison*) in a tallgrass prairie fire mosaic. *Journal of Mammalogy* 87:539–544.
- *Oklahoma*
  - *Bison*
  - *Effects on animal distribution*
- Stroppel, D. J. 2009. Evaluation of patch-burn grazing on species richness and density of grassland birds. MS Thesis, University of Missouri-Columbia, Columbia, MO.
- *Missouri*
  - *Domestic cattle*
  - *Effects on breeding bird richness and density*
- Teague, W. R., S. L. Dowher, S. A. Baker, R. J. Ansley, U. P. Kreuter, D. M. Conover, and J. A. Waggoner. 2010. Soil and herbaceous plant responses to summer patch burns under continuous and rotational grazing. *Agriculture Ecosystems & Environment* 137:113–123.
- *Texas*
  - *Domestic cattle*
  - *Effects on soil temperature, bulk density, penetration resistance, infiltration rate, aggregate stability, and soil carbon; effects on vegetation composition*
- Teague, W. R., S. E. Duke, J. A. Waggoner, S. L. Dowhower, and S. A. Gerrard. 2008. Rangeland vegetation and soil response to summer patch fires under continuous grazing. *Arid Land Research and Management* 22:228–241.
- *Texas*
  - *Domestic cattle*
  - *Effects on soil bulk density, penetration resistance, infiltration, and aggregate stability; effects on vegetation composition*
- Townsend, D. E. 2004. Ecological heterogeneity: evaluating small mammal communities, soil surface temperature and artificial nest success with grassland ecosystems. PhD Dissertation, Oklahoma State University. Stillwater, OK. 161 pp.
- Tunnell, T. R. 2002. Effects of patch burning on livestock performance and wildlife habitat on Oklahoma rangelands. MS Thesis, Oklahoma State University. Stillwater, OK. 49 pp.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on vegetation structure and composition; effects on animal performance*

Vermeire. 2002. The fire ecology of sand sagebrush-mixed prairie in the southern Great Plains. PhD Dissertation, Oklahoma State University, Stillwater, OK. 100 pp.

- *Oklahoma*
- *Domestic cattle*
- *Effects on forage utilization (research was conducted in a patch burn grazing landscape and results **were** presented in the context of a fire-grazing interaction)*
- *Effects on sand sagebrush carbohydrate reserves, survival, and growth (research was conducted in a patch burn grazing landscape but results **were not** presented in the context of a fire-grazing interaction)*
- *Effects on grasshopper abundance (research was conducted in a patch burn grazing landscape but results **were not** presented in the context of a fire-grazing interaction)*

Vermeire, L. T., R. B. Mitchell, S. D. Fuhlendorf, and R. L. Gillen. 2004a. Patch burning effects on grazing distribution. *Journal of Range Management* 57:248–252.

- *Oklahoma*
- *Domestic cattle*
- *Effects on forage utilization*

Vermeire, L. T., R. B. Mitchell, S. D. Fuhlendorf, and D. B. Wester. 2004b. Selective control of rangeland grasshoppers with prescribed fire. *Journal of Range Management* 57:29–33.

- *Oklahoma*
- *Domestic cattle*
- *Effects on grasshopper abundance (research was conducted in a patch burn grazing landscape but results **were not** presented in the context of a fire-grazing interaction)*

Vermeire, L. T., D. B. Wester, R. B. Mitchell, and S. D. Fuhlendorf. 2005. Fire and grazing effects on wind erosion, soil water content, and soil temperature. *Journal of Environmental Quality* 34:1559–1565.

- *Oklahoma*
- *Domestic cattle*
- *Effects on soil movement, water content, and temperature*

Winter, S. L. 2010. The interaction of fire and grazing in Oklahoma *Artemisia filifolia* shrubland. PhD Dissertation, Oklahoma State University. Stillwater, OK. 105 pp.

- *Oklahoma*
- *Domestic cattle*
- *Effects on sagebrush density and structure (research was conducted in a patch burn grazing landscape but results **were not** presented in the context of a fire-grazing interaction)*
- *Effects on vegetation structure and composition (research was conducted in a patch burn grazing landscape and results **were** presented in the context of a fire-grazing interaction)*
- *Interactive effects of fire, grazing, and topoedaphic variability on vegetation structure and composition; Interactive effects of fire, grazing, and topoedaphic variability on grazing distribution (research was conducted in a patch burn grazing landscape and results **were** presented in the context of a fire-grazing interaction)*

Winter, S. L., S. D. Fuhlendorf, C. L. Goad, C. A. Davis, and K. R. Hickman. 2011a. Topoedaphic variability and patch burning in sand sagebrush shrubland. *Rangeland Ecology and Management* 64:633–640.

- *Oklahoma*
- *Domestic cattle*
- *Interactive effects of fire, grazing, and topoedaphic variability on vegetation structure and composition; Interactive effects of fire, grazing, and topoedaphic variability on grazing distribution (research was conducted in a patch burn grazing landscape and results **were** presented in the context of a fire-grazing interaction)*

- Winter, S. L., S. D. Fuhlendorf, C. L. Goad, C. A. Davis, K. R. Hickman, and D. M. Leslie. 2011. Fire tolerance of a resprouting *Artemisia* (Asteraceae) shrub. *Plant Ecology* 212:2085–2094.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on sagebrush density and structure (research was conducted in a patch burn grazing landscape but results **were not** presented in the context of a fire-grazing interaction)*
- Winter, S. L., S. D. Fuhlendorf, C. L. Goad, C. A. Davis, K. R. Hickman, and D. M. Leslie. 2012. Restoration of the fire–grazing interaction in *Artemisia filifolia* shrubland. *Journal of Applied Ecology* 49:242–250.
- *Oklahoma*
  - *Domestic cattle*
  - *Effects on vegetation structure and composition (research was conducted in a patch burn grazing landscape and results **were** presented in the context of a fire-grazing interaction)*
- Winter, S., K. Hickman, C. Goad, S. Fuhlendorf, and M. Gregory. 2013. Seasonal fires, bison grazing and the tallgrass prairie forb *Arnoglossum plantagineum* Raf. *Natural Areas Journal* 33:327–338.
- *Oklahoma*
  - *Bison*
  - *Effects on measures of growth and reproduction of a perennial forb, Arnoglossum plantagineum.*

### **Patch Burn Grazing: Non-technical and/or Non-peer Reviewed Literature**

*The following represent websites, review articles from peer-reviewed periodicals, extension publications, non-technical and non-peer reviewed periodicals, published presentations from conferences and symposia, and informational brochures.*

Oklahoma State University, Department of Natural Resource Ecology and Management website:

<http://fireecology.okstate.edu/patch-burning>

Leopold Center for Sustainable Agriculture (Iowa State University patch-burn grazing research team) website:

<http://www.leopold.iastate.edu/patch-burn-grazing-research-team>

Biondini, M. E. and A. A. Steuter. 1997. Spatial distribution of bison grazing as a function of fire and range site. Pages 71–80 *International Symposium on Bison Ecology and Management*.

Chasteen, B. 2010. A win-win for prairie-chickens and ranchers. *Missouri Conservationist* 71:22–27.

Engle, D. 2009. Patch burning on grasslands: an alternative approach for rangeland management. *Joint Fire Science Program Fire Science Brief*, 78:1–6. Available at: [http://www.firescience.gov/projects/briefs/01-1-6-07\\_FSBrief78.pdf](http://www.firescience.gov/projects/briefs/01-1-6-07_FSBrief78.pdf)

Elwell, H., H. Daniel, F. Fenton. 1941. The effects of burning pasture and woodland vegetation. Oklahoma Agricultural Experiment Station Bulletin No. B-247. Stillwater. 14 pp.

Fuhlendorf, S. D., B. W. Allred, and R. G. Hamilton. 2010a. Bison as keystone herbivores on the Great Plains: can cattle serve as proxy for evolutionary grazing patterns? *American Bison Society*. Available at: <http://www.americanbisonsocietyonline.org/Publications/tabid/3140/Default.aspx>

- Fuhlendorf, S. D. and D. M. Engle. 2001. Restoring heterogeneity on rangelands: Ecosystem management based on evolutionary grazing patterns. *BioScience* 51:625–632.
- *Reviews evidence for the fire-grazing interaction*
  - *Compares and contrasts range management strategies that can make rangelands homogeneous or heterogeneous*
  - *Identifies patch burn grazing as a range management strategy that would have conservation benefits*
- Fuhlendorf, S. D., D. M. Engle, J. Kerby, and R. Hamilton. 2009. Pyric herbivory: rewilding landscapes through the recoupling of fire and grazing. *Conservation Biology* 23:588–598.
- *Compares and contrasts the research framework that treats fire and grazing as independent effects with the research framework that treats fire and grazing as an interactive effect*
  - *Compares and contrasts conservation strategies that focus on the reintroduction of animals and their resultant ecosystem impacts with strategies that reintroduce animals along with fire, and the resultant interactive ecosystem impacts*
- Hamilton, R. G. 1996. Using fire and bison to restore a functional tallgrass prairie landscape. *Transactions of the North American Wildlands and Natural Resource Conference* 61:208–214.
- Hamilton, R. G. 2007. Restoring heterogeneity on the Tallgrass Prairie Preserve: applying the fire-grazing interaction model. Pages 163–169 in *Proceedings of the 23rd Tall Timbers Fire Ecology Conference: Fire in Grassland and Shrubland Ecosystems*. Tall Timbers Research Station, Tallahassee, Florida.
- Helzer, C. 2011. Patch-burn grazing for biological diversity. Available at: <http://prairienebraska.files.wordpress.com/2011/05/patch-burning-for-biodiversity.pdf>
- Kerby et al. undated. Undated. Patch-burning: “rotational grazing without fences”. Available at: <http://fireecology.okstate.edu/patch-burning/resources/Patchburn-Handout.pdf>
- McGranahan, D. and K. Kirkman. 2013. Multifunctional rangeland in southern Africa: managing for production, conservation, and resilience with fire and grazing. *Land* 2:176–193.
- NPS. undated. Tallgrass Prairie: Patch-Burn Grazing. Department of Interior. Available at: <http://www.nps.gov/tapr/upload/PBG%20Brochure,%20version%201%20of%203.pdf>
- NRCS. 2004. Designing a Patch Burn Grazing System. Conservation Practice Information Sheet IS-MO528A. Available at: <http://forestkeepers.org/wp-content/uploads/2013/05/Patch-Burn-Grazing.pdf>
- NRCS. 2006. Patch Burn Grazing - Attachment to Biology Technical Note No. KS-34. US Department of Agriculture. Available at: [ftp://ftp-fc.sc.egov.usda.gov/KS/Outgoing/Web\\_Files/Technical\\_Resources/tech\\_notes/ecs/bio34att.pdf](ftp://ftp-fc.sc.egov.usda.gov/KS/Outgoing/Web_Files/Technical_Resources/tech_notes/ecs/bio34att.pdf)
- Rensink, C. B., W. H. Fick, C. E. Blocksome, and T. C. Todd. undated. Patch-burn grazing: a tool to reduce smoke emissions in Kansas? Available at: [http://www.tallgrasslegacy.com/document\\_center.cfm?fid=5](http://www.tallgrasslegacy.com/document_center.cfm?fid=5)
- Rodgers, R. undated. New answers to burning questions. *Wildlife and Parks*:2–8. Available at: [http://www.republicofgrass.com/Rodgers\\_Patch\\_Burn\\_Article.pdf](http://www.republicofgrass.com/Rodgers_Patch_Burn_Article.pdf)
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Sensinig, R. 2008. Fire ecology in Laikipia, Kenya: A report of the S.A.F.E. project (Scale & Fire Ecology). University of California-Davis. 78 pp. Available at: [http://tpyoung.ucdavis.edu/publications/2008FIRE\\_ECOLOGY\\_REPORT.pdf](http://tpyoung.ucdavis.edu/publications/2008FIRE_ECOLOGY_REPORT.pdf)

Smart, S. undated. Managing for biodiversity and livestock: fire and grazing. South Dakota State University. 7 pp. Available at: [http://grassland.unl.edu/c/document\\_library/get\\_file?uuid=588ad9e2-4112-4637-8929-2764e6621d0b&groupId=1980339&.pdf](http://grassland.unl.edu/c/document_library/get_file?uuid=588ad9e2-4112-4637-8929-2764e6621d0b&groupId=1980339&.pdf)

Steuter, A. A., C. E. Grygiel, and M. E. Biondini. 1990. A synthesis approach to research and management planning: the conceptual development and implementation. *Natural Areas Journal* 10:61–68.

- *Nebraska*
- *Bison, pocket gophers*
- *Presents a conceptual model of the fire-grazing interaction*
- *Presents a conceptual model of the effect of scale on the interaction of disturbances (fire and grazing) with vegetation dynamics*
- *Describes a research framework for studying fire-grazing interactions in a conservation context*

Weigelt, M. J. Koger, C. Simmons, and R. Blackwell. Patch-Burn Grazing. Poster presentation at Farming with Grass: Achieving Sustainable Mixed Agricultural Landscapes in Grassland Environments, A Special Conference hosted by the Soil & Water Conservation Society in Oklahoma City, OK. Available at: [http://www.swcs.org/documents/resources/17\\_Patchburn\\_Grazing\\_A6E59D02A39BD.pdf](http://www.swcs.org/documents/resources/17_Patchburn_Grazing_A6E59D02A39BD.pdf)

Weir, J. R., S. D. Fuhlendorf, D. M. Engle, T. G. Bidwell, G. S. Cumming, and D. Elmore, R. Limb, B. Allred, J. Scasta, and S. Winter. 2013. Patch burning: integrating fire and grazing to promote heterogeneity. Oklahoma State University Extension Publication E-998. Available at: <http://fireecology.okstate.edu/images/E-998.pdf>

### **Fire-Grazing Interaction: Primary and/or Peer-reviewed Literature**

*The following represent peer-reviewed literature that, while not conducted within a framework for studying patch burn grazing, was conducted within landscapes characterized by a heterogeneous distribution of burned areas, resulting in a heterogeneous distribution of foraging animals.*

*While a vast body of knowledge about the effects of fire and grazing on tallgrass prairie has been generated from the Konza Long Term Ecological Research site (<http://www.konza.ksu.edu/KNZ/pages/publications/knzpubs.aspx>), most is not treated here for two reasons: 1) it's a vast body of knowledge beyond the scope of this bibliography and is best accessed from the link above; and 2) it typically represents research that is conducted within a conceptual framework whereby fire and grazing are treated as independent factors (see Fuhlendorf et al. 2009 for a discussion of this topic).*

Allen H. 2008. Fire: plant functional types and patch mosaic burning in fire-prone ecosystems. *Progress in Physical Geography* 32:421–437.

Anderson, T., J. Hopcraft, S. Eby, M. Ritchie, J. Grace, and H. Olf. Landscape-scale analyses suggest both nutrient and antipredator advantages to Serengeti herbivore hotspots. *Ecology*. 91:1519–1529.

Anderson, T. M., M. E. Ritchie, E. Mayemba, S. Eby, J. B. Grace, and S. J. McNaughton. Forage nutritive quality in the Serengeti Ecosystem: the roles of fire and herbivory. *American Naturalist* 170:343–357.

- Archibald, S. 2008. African grazing lawns - how fire, rainfall, and grazer numbers interact to affect grass community states. *Journal of Wildlife Management* 72:492–501.
- *South Africa*
  - *Wildebeest*
  - *Effects on the development of grazing lawns/vegetation structure*
- Archibald, S. and W. J. Bond. 2004. Grazer movements: spatial and temporal responses to burning in a tall-grass African savanna. *International Journal of Wildland Fire* 13:377–385.
- *South Africa*
  - *Multiple native herbivores*
  - *Effects on animal distribution*
- Archibald, S., W. J. Bond, W. D. Stock, and D. H. K. Fairbanks. 2005. Shaping the landscape: Fire-grazer interactions in an African savanna. *Ecological Applications* 15:96–109.
- *South Africa*
  - *Multiple native herbivores*
  - *Effects on vegetation structure and vegetation type*
- Augustine, D. J., J. Cully, J. F., and T. L. Johnson. 2007. Influence of fire on black-tailed prairie dog colony expansion in shortgrass steppe. *Rangeland Ecology & Management* 60:538–542.
- *Colorado*
  - *Cattle and black-tailed prairie dogs*
  - *Effects on prairie dog colony expansion*
- Bachelet, D., J. Lenihan, C. Daly, and R. Neilson. 2000. Interactions between fire, grazing, and climate change at Wind Cave National Park, SD. *Ecological Modelling* 134:229–244.
- Ballard, W. B., P. R. Krausman, S. Boe, S. Cunningham, and H. A. Whitlaw. 2000. Short-term response of gray wolves, *Canis lupis*, to wildfire in northwestern Alaska. *Canadian Field Naturalist* 114:241–247.
- *Alaska*
  - *Gray wolves*
  - *Effects on wolf distribution*
- Bleich, V. C., H. E. Johnson, S. A. Holl, L. Konde, S. G. Torres, and P. R. Kruausman. 2008. Fire history in a chaparral ecosystem: implications for conservation of a native ungulate. *Rangeland Ecology & Management* 61:571–579.
- *California*
  - *Mountain sheep*
  - *Effects on animal distribution*
- Bosak dos Santos, A., F. Ferreira de Quadros, G. Rossi, L. Pereira de Pereira, B. Kuinchtner, and R. Roos de Carvalho. 2013. Valor nutritive de gramineas nativas do Rio Grande do Sul/Brasil, classificadas Segundo uma tipologia funcional, sob quime e pastejo (Nutritive value of Rio Grande do Sul/Brazil's native grasses, ranked according to functional typology under fire and grazing regimes). *Ciência Rural* 43:342–347.
- Cazau, M., M. Garel, and D. Maillard. 2011. Responses of heather moorland and Mediterranean mouflon foraging to prescribed-burning and cutting. *Journal of Wildlife Management* 75:967–972.
- *France*
  - *Mouflon*
  - *Effects on animal distribution; effects on forage quality; effects on vegetation composition*

- Clark, P., J. Lee, K. Ko, R. Nielson, D. Johnson, D. Ganskopp, J. Chigrow, F. Pierson, and S. Hardegree. 2014. Prescribed fire effects on resource selection by cattle in mesic sagebrush steppe. Part 1: spring grazing. *Journal of Arid Environments* 100-101:78–88.
- Coops, N. C. and P. C. Catling. 2002. Prediction of the spatial distribution and relative abundance of ground-dwelling mammals using remote sensing imagery and simulation models. *Landscape Ecology* 17:173–188.
- *Australia*
  - *Macropods (potoroos and wallabys)*
  - *Effects on animal distribution and abundance*
- Coppock, D. L. and J. K. Detling. 1986. Alteration of bison and black-tailed prairie dog grazing interaction by prescribed burning. *Journal of Wildlife Management* 50:452–455.
- *South Dakota*
  - *Black-tailed prairie dog, bison, antelope*
  - *Effects on animal distribution*
- Davies, G. M., A. A. Smith, A. J. MacDonald, J. D. Bakker, and C. J. Legg. 2010. Fire intensity, fire severity and ecosystem response in heathlands: factors affecting the regeneration of *Calluna vulgaris*. *Journal of Applied Ecology* 47:356–365.
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  - *Exotic deer and domestic sheep*
  - *Effects on fuel loads*
  - *Effects on fire behavior*
- Diamond, J. C. Call, and Nora Devoe. 2009. Effects of targeted cattle grazing on fire behavior of cheatgrass-dominated rangeland in the northern Great Basin, USA. *International Journal of Wildland Fire* 18:944–950.
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- Gambiza, J., B. M. Campbell, S. R. Moe, and I. Mapaure. 2008. Season of grazing and stocking rate interactively affect fuel loads in *Baikiaea plurijuga* Harms woodland in northwestern Zimbabwe. *African Journal of Ecology* 46:637–645.
- *Zimbabwe*
  - *Domestic cattle and goats*
  - *Effects on fuel load (phytomass, litter)*
- Gureja, N. and N. Owen-Smith. 2002. Comparative use of burnt grassland by rare antelope species in a lowveld game ranch, South Africa. *South African Journal of Wildlife Research* 32:31–38.
- *South Africa*
  - *Zebra and multiple species of antelope*
  - *Effects on animal distribution and grazing selection; effects on vegetation structure*
- Halofsky, J. S., W. J. Ripple, R. L. Beschta. 2008. Recoupling fire and aspen recruitment after wolf reintroduction in Yellowstone National Park, USA. *Forest Ecology and Management* 256:1004–1008.
- *Wyoming*
  - *Elk*
  - *Effects on elk browsing of aspen*

- Hassan, S. N., G. M. Rusch, H. Hytteborn, C. Skarpe, and I. Kikula. 2008. Effects of fire on sward structure and grazing in western Serengeti, Tanzania. *African Journal of Ecology* 46:174–185.
- *Tanzania*
  - *Multiple species of native herbivores*
  - *Effects on dynamics of phytomass components (live leaf, live stem, flower/fruit, standing dead)*
  - *Effects on consumption (forage removal); effects on vegetation bulk density and height*
- Hebblewhite, M. and E. Merrill. 2008. Modelling wildlife-human relationships for social species with mixed-effects resource selection models. *Journal of Applied Ecology* 45:834–844.
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  - *Gray wolves*
  - *Effects on wolf distribution*
- Hobbs, N. T. and R. A. Spowart. 1984. Effects of prescribed fire on nutrition of mountain sheep and mule deer during winter and spring. *Journal of Wildlife Management* 48:551–560.
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- Holdo, R. M., R. D. Holt, J. M. Fryxell. Grazers, browsers, and fire influence the extent and spatial pattern of tree cover in the Serengeti. *Ecological Applications* 19:95–109.
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  - *Multiple species of ungulates*
  - *Effects on animal distribution*

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  - *Domestic livestock and exotic herbivores*
  - *Effects on animal distribution; effects on vegetation cover; effects on fire behavior*
- Krook, K. W. J. Bond, and P. A. R. Hockey. 2007. The effect of grassland shifts on the avifauna of a South African savanna. *Ostrich* 78:271–279.
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  - *Domestic cattle*
  - *Effects on vegetation cover; effects on invertebrate abundance*
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  - *Domestic sheep and native macropods (kangaroo, wallaby, wombat)*
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- Leonard, S., J. Kirkpatrick, and J. Marsden-Smedley. 2010. Variation in the effects of vertebrate grazing on fire potential between grassland structural types. *Journal of Applied Ecology* 47:876–883.
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  - *Effects on vegetation cover and height; effects on fuel load*
- Mao, J. S., M. S. Boyce, D. W. Smith, F. J. Singer, D. J. Vales, J. M. VOre, and E. H. Merril. 2005. Habitat selection by elk before and after wolf reintroduction in Yellowstone National Park. *69:1691–1707.*
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  - *Multiple native herbivores*
  - *Effects on axis deer distribution*

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  - *Multiple native herbivores*
  - *Effects on forage composition and quality; effects on axis deer distribution*
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  - *Effects on native herbivore distribution*
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  - *Bison*
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  - *Multiple species of native herbivore*
  - *Effects on birds and arthropods*
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  - *Effects on abundance of savanna hares; effects on abundance and behavior of predators*
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  - *Effects on vegetation composition; effects on fire behavior*

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  - *Effects on animal distribution*
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  - *Multiple native herbivores; small (hare) to large (elephant); hindgut fermenters and foregut fermenters*
  - *Effects on forage quality; effects on animal distribution*
- Shaw, J. H. and T. S. Carter. 1990. Bison movements in relation to fire and seasonality. *Wildlife Society Bulletin* 18:426–430.
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  - *Bison, elk, white-tailed deer, longhorn cattle*
  - *Effects on bison distribution*
- Singer, F. J. and M. K. Harter. 1996. Comparative effects of elk herbivory and 1988 fires on northern Yellowstone National Park grasslands. *Ecological Applications* 6:185–199.
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  - *Elk*
  - *Effects on forage quality; effects on animal distribution*
- Smith, T. S., P. J. Hardin, and J. T. Flinders. 1999. Response of bighorn sheep to clear-cut logging and prescribed burning. *Wildlife Society Bulletin* 27:840–845.
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  - *Effects on animal distribution; effects on vegetation biomass and greenness*
- Styger, J. K., J. B. Kirkpatrick, J. O. N. Marsden-Smedley, and S. W. J. Leonard. 2011. Fire incidence, but not fire size, affects macropod densities. *Austral Ecology* 36:679–686.
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  - *Macropods (kangaroo, wallaby, wombat, pademelon)*
  - *Effects on animal distribution; effects on vegetation composition*
- Tomor, B. M. and N. Owen-Smith. 2002. Comparative use of grass regrowth following burns by four ungulate species in the Nylsvley Nature Reserve, South Africa. *African Journal of Ecology* 40:201–204.
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  - *Four species of native ungulate*
  - *Effects on animal distribution*
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  - *Elk and bison*
  - *Effects on foraging dynamics and survival*

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  - *Elk*
  - *Effects on vegetation communities and forage quality; effects on animal distribution*
- Van Dyke, F. and J. A. Darragh. 2006b. Short- and longer-term effects of fire and herbivory on sagebrush communities in south-central Montana. *Environmental Management* 38:365–376.
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  - *Effects on vegetation communities and forage quality; effects on animal distribution*
- Van Dyke, F. and J. A. Darragh. 2007. Response of elk to changes in plant production and nutrition following prescribed burning *Journal of Wildlife Management* 71:23–29.
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  - *Elk*
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  - *Effects on vegetation composition and diversity*
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  - *Bison*
  - *Effects on vegetation communities; effects on animal distribution*
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  - *Effects on vegetation structure; effects on fire behavior; effects on abundance of grazers other than white rhino*
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  - *Bison*
  - *Effects on forage quantity and quality; effects on animal distribution*

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- *Multiple species of native ungulates*
- *Effects on animal distribution*

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- *South Africa*
- *Multiple species of native herbivores*
- *Effects on vegetation structure; effects on small mammal communities*

Zavala, M. A. and R. M. Holdo. 2005. Delayed effects of fire on habitat use by large herbivores in *Acacia drepanolobium* savanna. *African Journal of Ecology* 43:155–157.

- *Kenya*
- *Multiple species of native and domestic herbivore*
- *Effects on animal distribution and abundance*

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