Citation	Intersection	Quality						Relevance								Quality Average Score	Relevance Average Score
		Literature Type		Duration-Length of Study		Replicated Findings (across studies)		Relevance of Question		Species Behavior / Human Interaction		Ecosystem/ Habitat/ Species		Spatial Scale			
		Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments		
Bender et al. 1999	Elk x Hunting	4	Most Preferred, Journal of Wildlife Management	4	Most Preferred, 7 years of hunting seasons '84-'91	4	Most Preferred, Clearly replicated increased flight distance during hunting	4	Most Preferred, Focus on hunting impacts on elk flight distances	4	Most Preferred, Elk and hunting	2	Less Preferred, Michigan forest/ elk	3	Preferred, 1,500 km^2 (370,658 acres) centered on state forest	**4.00**	**3.25**
Brough et al. 2017	Elk x Hunting	4	Most Preferred, Journal of Forest Ecology and Management	2	Less Preferred, Summer-fall seasons of 1996 and 1997 (looking at how many return from one year to the next)	3	Preferred, Generally replicated home range fidelity (but limited large-scale studies)	4	Most Preferred, Focus on home-range fidelity of female elk	4	Most Preferred, Bow and rifle hunting impacts on elk movements	3	Preferred, NW Colorado, mix of coniferous forest and grasslands/elk	3	Preferred, White River Study Area: mix of private ranches (34%) and mostly USFS managed public land (66%), 1,121,858 acres (4540 km^2) in Northeast CO	**3.00**	**3.50**
Conner et al. 2001	Elk x Hunting	4	Most Preferred, Journal of Wildlife Management	3	Preferred, 2-year study during 1996 and 1997	4	Most Preferred, Clear replication, start of hunting corresponds to elk movement	4	Most Preferred, Focus on bow and rifle hunting impacts on elk movements	4	Most Preferred, Elk and hunting	3	Preferred, NW Colorado, mix of coniferous forest and grasslands/ elk	3	Preferred, White River Study Area: mix of private ranches (34%) and mostly USFS managed public land (66%), 1,121,858 acres (4540 km^2) in Northeast CO	**3.67**	**3.50**
DeVoe et al., 2019	Elk x Hunting	4	Most Preferred, Journal of Wildlife Management	3	Preferred, Summer & fall for 2014 and 2015	3	Preferred, Generally replicated - elk select for areas further from roads. Not as much replication on maintenance of nutrition	4	Most Preferred, Elk response to archery hunting on foraging	4	Most Preferred, Elk and bow hunting	3	Preferred, West central Montana	2	Less Preferred, 2482 km^2 northern Sapphire Mountains and Bitterroot River valley of west central Montana	**3.33**	**3.25**
Proffitt et al. 2009	Elk x Hunting	4	Most Preferred, Journal of Wildlife Management	3	Preferred, December-April of 2004-05 and 2005-06	4	Most Preferred, Clear replication, elk move to private lands when hunting pressures increase	4	Most Preferred, Focus on impact of both hunting and wolf predation on elk movement	4	Most Preferred, Focus on impact of both hunting and wolf predation on elk movement	3	Preferred, Mix of Montana elk-hunting districts and private ranches grazed by livestock	3	Preferred, Some urban roads, 74,132 acres (300 km^2), primarily private ranchlands	**3.67**	**3.50**
Proffitt et al. 2010	Elk x Hunting	4	Most Preferred, Journal of Wildlife Management	3	Preferred, Dec-Mar of 2005-06 and Dec-Feb of 2005-07	4	Most Preferred, Clear replication, elk shift to private refuge during hunting season	4	Most Preferred, Effects of hunting and landscape attributes on elk resource selection	4	Most Preferred, Elk and hunting	3	Preferred, Mix of bunchgrass-dominated grasslands, sagebrush steppe, and coniferous forests/ elk	3	Preferred, Madison Valley of SW Montana and Greater Yellowstone Area: 106,255 acres (430 km^2) with private ranchlands grazed by livestock and surrounded by public lands and wildlife management areas with some highways	**3.67**	**3.50**
Ranglack et al. 2017	Elk x Hunting	4	Most Preferred, Journal of Wildlife Management	4	Most Preferred, Archery and rifle hunting seasons from 2005-2014	4	Most Preferred, Clear replication elk select for areas restricting hunting	4	Most Preferred, Focus on bow and rifle hunting impacts on elk movements	4	Most Preferred, Elk and hunting	3	Preferred, Mix of montane forest with grasslands	3	Preferred, SE Montana, mix of USFS public lands and private lands open to hunters	**4.00**	**3.50**
Schuttler et al., 2017	Elk x Hunting	4	Most Preferred, Journal of Zoology	3	Preferred, Apr-Nov 2012 and 2013	3	Preferred, Generally replicated - vigilance of deer with hunting	3	Preferred, Vigilance of deer related to human and coyote hunting	3	Preferred, Deer and hunting	1	Least Preferred, Appalachia and deer	2	Less Preferred, 4-1200 km^2 site sizes, mean=140km^2	**3.33**	**2.25**
Vieria et al. 2003	Elk x Hunting	4	Most Preferred, Journal of Wildlife Management	4	Most Preferred, 4 years of hunting seasons '96-'99	3	Preferred, Generally replicated - replication of elk movement during hunting; less replication about reduced hunter #s	4	Most Preferred, Focus on hunting impacts on elk movement	4	Most Preferred, Elk and hunting	3	Preferred, Northwest CO	3	Preferred, White River area of Colorado 4,560 km^2 , 34% private and 66% public land	**3.67**	**3.50**

Citation	Intersection	Quality						Relevance								Quality Average Score	Relevance Average Score
		Literature Type		Duration-Length of Study		Replicated Findings (across studies)		Relevance of Question		Species Behavior / Human Interaction		Ecosystem/ Habitat/ Species		Spatial Scale			
		Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments		
Ciuti et al., 2012	Elk x Trails	4	Most Preferred, PLOS One	2	Less Preferred, Observation from June 2010-May 2011, one year	4	Most Preferred, Clear replication, elk affected by human activity (hunting and trails to different degrees)	4	Most preferred, Human disturbance on elk	4	Most Preferred, Human activities (ATV, hunting, fishing, hiking) and elk	3	Preferred, Elk in Canadian Rockies - grassland, hardwood mixed conifers., mountains	3	Preferred; 5000 km^2 (1.2M acres) Canadian Rockies	3.33	3.50
Cook et al., 1996	Elk x Trails	4	Most Preferred, Journal of Wildlife Management	3	Preferred, 2 years - Aug-Nov, 1991 and 1993	4	Most Preferred, Nutritional ecology requirements for growth	1	Least Preferred, Nutritional growth relations of elk calves - no rec/human interest	1	Least Preferred, Elk calves captured, raised, bottle fed, exercised in pens	3	Preferred, Starkey Experimental Forest, OR and study site near Kamela, OR, elk	1	Least Preferred, Elk raised in a barn and small pens	3.67	1.50
Kie et al., 2005	Elk x Trails	4	Most Preferred, Landscape Ecology	4	Most Preferred, Spring 1993, '95, '96	4	Most Preferred, Clear replication, elk move along water access	1	Least Preferred, Information about elk movement that may impact recreational planning	1	Least Preferred, Does not include human interaction or disturbance factors	3	Preferred, Starkey Experimental Forest and Range, NE Oregon, mix of coniferous forest and grasslands and elk	2	Less Preferred, Northeast, 10,125 ha (=19,180 acres), fenced in	4.00	1.75
Longshore et al., 2013	Elk x Trails	4	Most Preferred, Wildlife Society Bulletin	3	Preferred, 2 years	4	Most Preferred, Clear replication; avoidance of higher use rec areas	4	Most Preferred, Effects of recreation on habitat use of bighorn sheep	3	Preferred, Study on bighorn sheep but similar recreation	2	Less Preferred, Joshua Tree and bighorn sheep	3	Preferred, Queen Mountain–Wonderland of Rocks Region of JOTR	3.67	3.00
Miller et al., 2001	Elk x Trails	4	Most Preferred, Wildlife Society Bulletin	2	Less Preferred, April-July 1996	4	Most Preferred, Consistent that off-trail rec results in greater sensitivity and dogs raised alert distance of deer	3	More Preferred, Wildlife response to human/dog recreation (broadly)	3	Preferred, Humans/dogs on trails, different species	2	Preferred, Boulder Open Space, deer and song birds	4	More Preferred, 19000 ac Boulder Open Space, more urban with some parts in Boulder	3.33	3.00
Parker et. al 1999	Elk x Trails	4	Most Preferred, Wildlife Monographs	3	Preferred, 2 years	4	Most Preferred, General study on forage requirements and behavioral study	1	Least Preferred, Assessing other studies on black-tail deer	1	Least Preferred, Black-tail deer (does not focus on humans)	1	Least Preferred, White tail deer, Alaska	1	Least Preferred, 65 ha island in Alaska	3.67	1.00
Preisler et al., 2013	Elk x Trails	4	Most Preferred, Ecosphere. 4(3):32	3	Preferred, Same data as Wisdom 2018	2	Less Preferred, Found greater avoidance of bikers than hikers, which conflicts with some studies and is backed by others	4	Most Preferred, Response of elk to anthropogenic disturbances	4	Most Preferred, Studied hiking and biking effects on elk. Also included ATVs, which may not be relevant	3	Preferred, Interior western ecosystem with bunchgrass scabland, ponderosa pine, doug fir, and mixed conifer, elk	2	Less Preferred, Oregon - northeast plots total 3600 acres, fenced in	3.00	3.25
Scholten et al., 2018	Elk x Trails	4	Most Preferred, European Journal of Wildlife Research	2	Less preferred, Visited twice but only collected data in spring. Used pellets instead of animals as proxy so May have more info than a short study would imply. Also used camera traps - set in may, picked up in Oct & again in Dec	4	Most Preferred, Clear replication. Deer, like other ungulates, avoid trails to an extent when in use	4	Most Preferred, Effects of mtn biking on wildlife	3	Preferred, Red deer instead of elk	1	Least Preferred, Pine-bilberry forest in Norway and red deer	2	Less Preferred, Not specified, but sometimes transects were within 50 m of roads/buildings and had to be redone.	3.33	2.50
Shively et al., 2005	Elk x Trails	4	Most Preferred, The Journal of Wildlife Management	4	Most Preferred, 5 years, 2 years of recreation during calving in the middle	2	Less Preferred, Some replicated studies but not many	4	Most Preferred, Elk reproductive success and human rec disturbance	4	Most Preferred, Elk reproductive success after removal of human disturbance during calving season	3	Preferred, Colorado near Vail, elk	3	Preferred, Large-scale, but not clearly defined in the study	3.33	3.50
Sisk, 1989	Elk x Trails	1	Least Preferred, Unpublished, observational in nature	1	Least Preferred, Several observations Jan-April, but white tailed deer data collected from roadkill and talking to residents	4	Most Preferred, Generally replicated, deer show reduced wariness in areas	1	Least Preferred, Report wasn't seeking similar questions	2	Less Preferred, Looking primarily at deer, no specific human interaction	2	Less Preferred, Boulder Open Space and city of Boulder, mule deer and white-tailed deer	4	Most Preferred, Boulder Open Space 17 mi^2 in the year of 1989	2.00	2.25
Taylor et al., 2003	Elk x Trails	4	Most Preferred, Ecological Applications	3	Preferred, May-August 2000, April - June 2001	2	Less Preferred, No difference found in response between mtn biking and hiking. Other studies lack social science component	4	Most Preferred, One of few papers that examines both animal response and hiker/human interpretation of recreation	4	Most Preferred, Effects of on- and off-trail hikers and mountain bikers on ungulate movement	2	Less Preferred, Bison, pronghorn antelope, and mule deer, similar ecosystem - sagebrush, grassland, juniper	3	Preferred, Antelope Island is state park that is 104-km2 (11 330-ha, 25700ac) located in the southeast corner of the Great Salt Lake	3.00	3.25
Westekemper et al., 2018	Elk x Trails	4	Most Preferred, Wildlife Biology	1	Least preferred, Oct & Nov of 2011, plus tracking data from 2011	4	Most Preferred, Consistent with many other studies of ungulates	4	Most Preferred, Effects of on and off-trail hiking ungulates	4	Most Preferred, Effects on and off trails hiking	1	Least Preferred, German forest -lower elevation and mostly beech & red deer	3	Preferred, 14000 acres National Park	3.00	3.00
Wisdom et al., 2018	Elk x Trails	4	Most Preferred, Forest Ecology Management	3	Preferred, Over 3 seasons over 2003-2004, there were 5 days of recreation activity and 9 days of no activity (control) replicated twice a year	2	Less Preferred, Some studies replicate pieces of findings but no definitive replication yet; experimental design makes it difficult to replicate. Studies have no consensus on relative disturbance between mtn biking vs. hiking	4	Most Preferred, Hiking and biking effects on elk	4	Most Preferred, Studied hiking and biking effects on elk. Also included ATVs, which may not be relevant	3	Preferred, Starkey USFS says its typical interior western ecosystem with bunchgrass scabland, ponderosa pine, doug fir, and mixed conifer	2	Less Preferred, Oregon - northeast plots total 3600 acres	3.00	3.25

Citation	Intersection	Quality						Relevance								Quality Average Score	Relevance Average Score
		Literature Type		Duration-Length of Study		Replicated Findings (across studies)		Relevance of Question		Species Behavior / Human Interaction		Ecosystem/ Habitat/ Species		Spatial Scale			
		Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments		
Frey, 2005	Mouse x Trails	3	Preferred, Report to New Mexico Department of Game and Fish	2	Less Preferred, Summer of 2005	2	Less Preferred, Very limited research on NMMJM at this time, especially on effects of grazing and rec	3	Preferred, Some recreational impact on NMMJM mouse	3	Preferred, NMMJM and some trails (but bigger effects of ATVs and camping)	4	Most Preferred, Montane riparian habitats in New Mexico	3	Preferred, Public lands of Jemez, Sacramento, and San Juan Mountains of New Mexico with livestock grazing, some development (ski resort), and recreational activities like camping	2.33	3.25
Frey, 2011	Mouse x Trails	3	Preferred, Report to Arizona Department of Game and Fish	4	Most Preferred, 2008-2009	3	Preferred, Recreation through social trails can damage necessary vegetation	3	Preferred, Overview of NMMJM and some recreational/grazing impacts	3	Preferred, NMMJM and generic recreation (as one of several disturbances mentioned)	4	Most Preferred, Riparian	3	Preferred, Large-scale natural areas in New Mexico and Arizona	3.33	3.25
Harrow et al. 2018	Mouse x Trails	4	Most Preferred, Wildlife Society Bulletin	4	Most Preferred, 2017 -2018	2	Less Preferred, Limited studies on species life history and habitat use	1	Least Preferred, Tracking of NMMJM and other rodent species	1	Least Preferred, Tracking of NMMJM by footprints, no recreation component	4	Most Preferred, NMMJM, riparian	3	Preferred, Large-scale natural areas in New Mexico and Arizona	3.33	2.25
Meaney et al., 2002	Mouse x Trails	2	Less Preferred, Draft for Boulder Transportation Dept.	4	Most Preferred, 2 years	3	Preferred, Generally replicated lower abundance of species near trails	4	Most Preferred, Trails on small mammals w/ particular interest in preble's meadow jumping mouse	3	Preferred, Preble's MJM instead of NMMJM	3	Preferred, Boulder Creek, more urban	2	Less Preferred, Much more populated on the trail side than FPSP is likely to be	3.00	3.00
Mamuscia et al., 2020	Mouse x Trails	3	Preferred, USFWS Status Report	4	Most Preferred, 2014 - 2018	3	Preferred, Destruction of habitat through recreation remains a concern	3	Preferred, NMMJM and riparian, grazing, recreation	3	Preferred, General summary of recreation impacts	4	Most Preferred, Montane riparian in AZ, CO, NM	3	Preferred, Large-scale natural areas in New Mexico and Arizona	3.33	3.25
Ballantyne et al., 2014	Large Block x Trails	4	Most Preferred, Landscape and Urban Planning	2	Less Preferred, Single data collection in 2013 and compared to 2006 data	3	Preferred, Generally replicated fragmentation occurs through informal trails	4	Most Preferred, Effects of hiking and biking trails on fragmentation	4	Most Preferred, Hiking and biking and fragmentation	1	Least Preferred, Australia, fragmented habitat in urban areas	2	Less Preferred, 829ha	3.00	2.75
Barros and Pickering, 2017	Large Block x Trails	4	Most Preferred, Environmental Management	1	Least Preferred, Single collection with no comparison	4	Most Preferred, Clear replication off-trail travel damages vegetation	4	Most Preferred, Fragmentation due to off-trail hiking	4	Most Preferred, Hiking effect on plants	1	Least Preferred, Aconcagua, Argentina / alpine meadows and steppe vegetation	2	Less Preferred, 239ha (586 acres) area of the park surveyed	3.00	2.75
Benniger-Truax et al., 1992	Large Block x Trails	4	Most Preferred, Landscape Ecology	1	Least Preferred, No comparison to past conditions only current	3	Preferred, Vegetation affected by trail presence, including use of trails as conduits	4	Most Preferred, Whether trail corridors act as conduits for vegetation species	3	Preferred, Hiking on species habitat and transport	3	Preferred, Rocky Mountain National Park	3	Preferred, Larger RMNP	2.67	3.25
Bötsch, et al. 2018	Large Block x Trails	4	Most Preferred, Frontiers in Ecology and Evolution	4	Most Preferred, Two years, 2-3 collections per year	3	Preferred, Generally replicated density and species richness of birds reduced near higher use trails. Depends on species traits	4	Most preferred, Separate the effect of trails on the change in vegetation from the effect of human use of trails, on forested bird communities	3	Preferred, Effects of hikers, several different bird species & trails	1	Least Preferred, French/Swiss forests, forest bird communities	2	Less Preferred, Looked at 4 different forests, 2 remote and 2 more urban sites	3.67	2.50
Miller et al, 2020	Large Block x Trails	4	Most Preferred, Journal for Nature Conservation	3	Preferred, Three phases, before trail building (Aug 2014-Feb 2015), during trail building (Feb-June 2015) , and after trail building (June-Sep 2015)	2	Less Preferred, Replicated animal/trail studies, but few if any on effects of trail building specifically on wildlife	4	Most Preferred, Investigate the impacts of trail building on terrestrial vertebrates	4	Most Preferred, Trail construction and recreational trail use	1	Least Preferred, Stone Mountain State Park, foothills of the Appalachian Mountains in North Carolina, white tail deer and other species	4	Most Preferred, Square state park, 14085 acres	3.00	3.25
Rogala et al., 2011	Large Block x Trails	4	Most Preferred, Ecology and Society	4	Most Preferred, Data collected over several years	4	Most Preferred, Consistent avoidance of used trails	4	Most preferred, Elk on trail avoidance	4	Most Preferred, Elk avoidance of trails	3	Preferred, Canadian Rockies, elk/wolves	3	Preferred, 3 national parks in Canada	4.00	3.50
Thompson, 2015	Large Block x Trails	4	Most Preferred, Environmental Management	1	Least Preferred, May and June samples averaged	4	Most Preferred, Consistently shows density positively influenced by 'refuge' habitat	4	Most Preferred, Impacts of trails on ground-dwelling bird species	4	Most Preferred, Hiking/biking effects on bird density	2	Less Preferred, Ontario, 24 sites, some with trails and some without	1	Least Preferred, Mostly under 100ha, few in the 200ha range	3.00	2.75
Wilson, 1994	Large Block x Trails	4	Most Preferred, Journal of Mountain Research and Development	3	Preferred, Multiple collection events over short time	2	Less Preferred, Hikers created more sediment on-trail than bikers	4	Most Preferred, Effects of hikers/bikes on runoff and sediment yield	4	Most Preferred, Hiking and biking on trails	2	Less Preferred, Gallatin National Forest, MT	3	Preferred, Significantly bigger and near Bozeman	3.00	3.25

Citation	Intersection	Quality						Relevance								Quality Average Score	Relevance Average Score
		Literature Type		Duration-Length of Study		Replicated Findings (across studies)		Relevance of Question		Species Behavior / Human Interaction		Ecosystem/ Habitat/ Species		Spatial Scale			
		Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments		
Hanna et al., 2020	Riparian x Trails	4	Most Preferred, Conservation Biology	1	Least Preferred, Sept- Oct 2017	3	Preferred, Replicated among other studies - more intact forests offer higher yields of ecosystem services	2	Less Preferred, Effect of watershed protection status and land use on biodiversity and ecosystem services	3	Preferred, Trail-based recreation: effects of different land use types and their impact on trail quality without human presence	1	Least Preferred, Unprotected and protected forested watersheds, riparian habitats in Canada	3	Preferred, 4 watersheds in Canada with differing surrounding land use types - protected, unprotected, agricultural, and timber harvest. about 60 km across	**2.67**	**2.25**
Miller et al., 2003	Riparian x Trails	4	Most Preferred, Ecological Applications	4	Most Preferred, 1995-97	4	Most Preferred, Clearly replicated, humans reduce species richness and maintaining habitat can help mitigate effects	2	Less Preferred, Development effects on riparian	2	Less Preferred, Development	3	Preferred, Some species overlap, but not the same as FPSP	3	Preferred, Boulder county riparian woodlands ~60 m wide	**4.00**	**2.50**
Miller and Hobbs, 2000	Riparian x Trails	4	Most Preferred, Landscape and Urban Planning	3	Preferred, 1995-96 June	3	Preferred, Generally replicated - responses depend on species and env./rec. pressures	4	Most Preferred, Looks at trails and avian impact	4	Most Preferred, Defining stimuli as trail in riparian zone	3	Preferred, Some species overlap, but not the same as FPSP	3	Preferred, Boulder county riparian woodlands ~60 m wide	**3.33**	**3.50**
Shelby and Wittaker, 2020	Riparian x Trails	3	Preferred, USFS document	3	Preferred, Compared past and present data - photographic aerial surveys, habitat quality assessments, and interviews	2	Less Preferred, Habitat assessment is common however social science analysis of recreationists and impacts on riparian trails is not	4	Most Preferred, Recreation and its impact on riparian zones	3	Preferred, Related recreational activities like hiking but also includes beach-goers	2	Less Preferred, Riparian/beach recreational zone in Yosemite Valley, CA	3	Preferred, Larger scale but related recreational land use	**2.67**	**3.00**
Opdahl et al., 2021	Riparian x Trails	4	Most Preferred, Scientific Reports	2	Less Preferred, Comparison of data in a season	3	Preferred, Replicated among other studies but rare study with social sciences component	4	Most Preferred, Riparian effects on recreationists	4	Most Preferred, Hiker in riparian areas	2	Less Preferred, Peri-urban Boise foothills in southwest Idaho	2	Less Preferred, 6.3 mile heavily used hiking trail on a 300 acre site outside of Boise, ID	**3.00**	**3.00**

Citation	Intersection	*Meta-analysis
Stankowich, 2008	Elk x Hunting	Ungulate flight responses to human disturbance: A review and meta-analysis
Graham et al., 2010	Elk x Trails	Ameliorating conflicts among deer, elk, cattle and/or other ungulates and other forest uses: a synthesis
Hebblewhite 2008	Elk x Trails	A literature review of the effects of energy development on ungulates: Implications for central and eastern Montana
Johnson et al. 2004	Elk x Trails	Issues of elk productivity for research and management.
Larson et al., 2019	Mouse x Trails	Effects of recreation on animals revealed as widespread through a global systematic review
Prugh et al., 2008	Large Block x Trails	Effect of habitat area and isolation on fragmented animal populations
Tromulak and Frissell, 1999	Large Block x Trails	Review of ecological effects of roads on terrestrial and aquatic communities
Gonzalez et al., 2017	Riparian x Trails	Integrative conservation of riparian zones
Johnson and Carothers, 1982	Riparian x Trails	Riparian habitats and recreation: Interrelationships and impacts in the southwest and Rocky Mountain Region
Patten, 1998	Riparian x Trails	Riparian ecosystems of semi-arid North America: Diversity and human impacts
Rocchio, 2006	Riparian x Trails	Rocky Mountain lower montane riparian woodland and shrubland ecological system

Notes:
Scoring criteria details included in attached table
* Meta-analyses were reviewed and used to inform management recommendations, however they were not included in the scoring