

# 'Snowstorm' Forage Kochia: A new species for rangeland rehabilitation



By Charlie D. Clements, Blair L. Waldron, Kevin B. Jensen, Dan. N. Harmon, and Matt Jeffress

## On the Ground

- Forage kochia is a perennial semi-shrub that can germinate and establish on a variety of soils and varying climate conditions that range from 127-686 mm of annual precipitation.
- 'Snowstorm' forage kochia, was released in 2012 as a rehabilitation species to improve forage production for livestock and wildlife.
- 'Snowstorm' forage kochia is more than 60% taller in stature, produces nearly 70% more forage, and has higher crude protein than 'Immigrant' forage kochia.
- Overall, land managers believe that 'Snowstorm' forage kochia, with all its' attributes of taller stature, increased forage and crude protein can enhance wildlife habitat.

**Keywords:** *Bassia prostrata*, forage kochia, rangeland rehabilitation, 'Snowstorm' forage kochia  
*Rangelands* 42(1):17–21  
doi 10.1016/j.rala.2019.12.001  
© 2020 The Society for Range Management.  
Published by Elsevier Inc. All rights reserved.

## Description of 'Snowstorm' forage kochia

Forage kochia, (*Bassia prostrata*) formerly (*Kochia prostrata*), native to the semi-arid regions of Eurasia has been referred to as "Russian alfalfa" as well as "alfalfa of the desert."<sup>1,2</sup> Forage kochia was first introduced to the western United States in the early 1960s by researchers looking for plant materials that could biologically suppress exotic and noxious weeds, such as Halogeton (*Halogeton glomeratus*) and cheatgrass (*Bromus tectorum*).<sup>3</sup> Crested wheatgrass (*Agropyron cristatum*) was widely planted on big sagebrush sites throughout the Great Basin and successfully suppressed Halogeton and cheatgrass, however crested wheatgrass lacks the ability to persist on saline soils, therefore scientists proposed the use of

forage kochia as a candidate species on these soils.<sup>2</sup> Forage kochia belongs to the Chenopod family, which contains other highly nutritional arid rangeland species like winterfat (*Krascheninnikovia lanata*) and four-wing saltbush (*Atriplex canescens*). Forage kochia is a perennial semi-shrub that has the inherent potential to germinate and establish on a variety of soils including, clay, sandy, and loamy as well as in climates that range from 127-686 mm of annual precipitation.<sup>3</sup> Forage kochia persists under heavy grazing, as it evolved in heavily grazed arid environments, and resprouts following wildfires.<sup>4</sup> For centuries, forage kochia has been an important fall and winter forage for cattle, sheep, horses, camels, and wildlife in Kazakhstan, Uzbekistan, and surrounding regions.<sup>2</sup> Early on researchers recognized its' nutritional quality, including 8-14% crude protein in the fall and early winter, therefore suggesting this species be used to improve winter forage for wildlife, especially mule deer (*Odocoileus hemionus*).<sup>2,5</sup> In 1984, the cultivar 'Immigrant' forage kochia (*Bassia prostrata* ssp. *virescens*) was released to aide in rangeland rehabilitation efforts.<sup>3</sup> 'Immigrant' forage kochia can reach plant heights ranging from 0.30-1 m, competes with the exotic and invasive annual grass cheatgrass (*Bromus tectorum*), stays green throughout the fire season and provides a nutritional forage on arid rangelands (Fig. 1).<sup>1,3,6</sup> Following its' release, 'Immigrant' forage kochia was used for livestock and wildlife forage, soil stabilization, rangeland rehabilitation/reclamation and suppression of wildfires.<sup>3</sup> 'Immigrant' forage kochia has been reported to increase rangeland forage production by up to six-fold and cattle grazing on 'Immigrant' during the fall and winter months maintained or improved their body condition without any additional protein or nutrient supplementation.<sup>6</sup>

Although 'Immigrant' forage kochia can be successfully established on harsh, arid, and severely degraded habitats, its' short stature often makes forage unavailable during the winter due to snow depths. The development of a taller forage kochia, 'Snowstorm' (*Bassia prostrata* ssp. *grisea*) was released to provide a protein-rich forage during the winter in the temperate deserts of the western U.S. (Fig. 2).<sup>7</sup> Dr. Blair Waldron, Research Geneticist, USDA, Agricultural Research Service, Forage and Range Research Unit visited Uzbekistan



**Figure 1.** Even though 'Immigrant' forage kochia has excellent nutritional qualities, you can see in this figure that due to its' short stature it can be inaccessible during winter months compared to the taller 'Snowstorm' forage kochia.



**Figure 2.** Scientists standing in a field of 'Snowstorm' forage kochia, 60% taller and provides nearly 70% more forage than 'Immigrant' forage kochia, which improves nutritional quality and availability year-round.

in 2002 where he initiated a germplasm exchange where he obtained and brought back 22 collections of Uzbek forage kochia. Following nearly 10 years of testing of the Uzbek germplasm throughout the western United States, 'Snowstorm' forage kochia was released in 2012 by USDA-Agricultural Research Service and the Utah Agricultural Experiment Station as a rehabilitation species to improve forage production for livestock and wildlife in semi-arid saline environments.<sup>7</sup> The USDA reported the differences between 'Snowstorm' and 'Immigrant' in the 'Snowstorm' forage kochia release notice.<sup>7</sup> In brief, 'Snowstorm' was compared to 'Immigrant' in replicated trials at 10 semi-arid rangeland sites (nine seeded and one as transplants) across the western U.S., including in Utah, Idaho, Oregon, Montana, and Wyoming.<sup>7</sup> Six locations were selected that are predominately within big sagebrush and salt desert shrub plant communities.<sup>7</sup> Seedling establishment, plant height, forage mass, and forage nutritive value were determined. Results indicated that

'Snowstorm' forage kochia is similar to 'Immigrant' in its' adaptation to the semi-arid environments, but 'Snowstorm' is more pubescent and grayish in color than 'Immigrant', which is green and turns reddish during seed maturity. 'Snowstorm' is more than 60% taller in stature, produces nearly 70% more forage, and has higher crude protein and digestibility than 'Immigrant' (Table 1).<sup>7</sup> 'Snowstorm' seed mass weight is also about 40% heavier than 'Immigrant' seed, but the two varieties have similar seedling establishment and vigor in the western U.S.<sup>7</sup>

## Potential issues with seeding forage kochia

Forage kochia should not be mistaken for the exotic weed, annual kochia (*Kochia scoparia*) which is a distant relative, even though these two species have been shown to be phenotypically and genetically distinct and lack the ability to cross-hybridize with each other.<sup>7</sup> Annual kochia is not a typical weed of sagebrush rangelands, but has invaded roadsides, barren areas and row crops throughout the west and is rarely utilized by large herbivores.<sup>1</sup> Not only is forage kochia grazed by wildlife and livestock but has also been used to rehabilitate severely degraded rangelands where invasive annuals such as cheatgrass and Halogeton have displaced native perennials.<sup>8,9,10,11</sup> Forage kochia has been reported to be one of a few species capable of establishing and competing with cheatgrass in a salt desert shrub environment where repeated wildfires, severe wind erosion of topsoil, and drought (annual precipitation of 140 mm) have denuded the landscape.<sup>11</sup> Forage kochia has also been reported to establish, persist, and reduce the frequency of cheatgrass on a semiarid rangeland with an annual precipitation of 127–200 mm where overgrazing and repeated wildfires have eliminated all perennial shrubs leaving only a monoculture of cheatgrass.<sup>11</sup> Other researchers have reported successful establishment and rehabilitation by forage kochia on low-laying, harsh salt desert sites where the poisonous annual forb Halogeton had invaded and replaced native shrubs including Gardner's saltbush (*Atriplex gardneri*).<sup>10,12</sup>

However, because of its competitive nature, some people have worried about forage kochia invading and suppressing native plant populations in the Central Great Basin rangelands of the western U.S.<sup>13,14</sup> Research was conducted on the fringe of forage kochia recruitment outside of planted areas at 81 known forage kochia plantings within five western states (Idaho, Oregon, Nevada, Utah, Washington), which ranged from 1 to 30 years since planting.<sup>15</sup> They determined that the mean fringe of recruitment was just 6 m and was unrelated to age of planting, which suggested that forage kochia did not behave as typical for an invasive species.<sup>15</sup> Moreover, Harrison et al.<sup>15</sup>, Pendleton et al.<sup>16</sup>, and Clements and Young<sup>1</sup> concluded that forage kochia competes well with annuals, but does not invade perennial plant communities. However, forage kochia was also reported to be more apt to recruit into the droughty, alkali soils of southwestern Idaho, USA, especially if bare or predominated by annual species.<sup>15</sup> Likewise, and more recently, Gray and Muir<sup>13</sup> have reported

**Table 1. ‘Snowstorm’ performance compared to ‘Immigrant’ forage kochia. Data from 5 locations in Utah, Idaho, Wyoming, Oregon, and Washington. ‘Snowstorm’ forage kochia numbers followed by different letters than ‘Immigrant’ indicate statistical difference. Adopted from United States Department of Agriculture, Agricultural Research Service, Plant Releases, Forage and Range Research Laboratory, Logan, Utah. April 2016.**

Entry	Snowstorm	Immigrant
Height (cm)	76.2 <sup>a</sup>	45.7 <sup>b</sup>
Forage (kg/ha)	2,528 <sup>a</sup>	1,505 <sup>b</sup>
Protein (%)	7.9 <sup>a</sup>	6.5 <sup>b</sup>
Neutral detergent fiber (%)	48.2 <sup>a</sup>	47.0 <sup>a</sup>
Acid detergent fiber (%)	34.4 <sup>b</sup>	33.0 <sup>a</sup>
In vitro true digestibility (%)	67.4 <sup>a</sup>	64.8 <sup>b</sup>
Mature seed	Mid-Nov	Early-Dec
Seed yield (kg/ha)	133.4 <sup>a</sup>	186.1 <sup>a</sup>
Seeds (per kg)	617,293 <sup>a</sup>	1,168,449 <sup>b</sup>

that following investigations of 28 forage kochia seedlings within the western Snake River Plain and surrounding uplands in southwestern Idaho that forage kochia had spread on 89% of the sites, ranging from 0 to 710 m. In contrast to other reports, they concluded that the spread of forage kochia was not dependent upon plant community (e.g., perennial versus annual).<sup>13</sup> A scientific comparison between ‘Snowstorm’ and ‘Immigrant’ recruitment has not been done, but their similarity in adaptation<sup>7</sup> and observations by Waldron et al.<sup>7</sup> indicated that recruitment potential of these two cultivars is probably very similar. Overall, the evidence suggests that forage kochia is not likely to be an aggressive, invasive species in most environments.

Lack of seed availability and variable establishment success are also potential drawbacks for the use of forage kochia to rehabilitate degraded Great Basin rangelands.<sup>17</sup> Hence many studies have been conducted to examine seed harvest, germination, and planting of forage kochia.<sup>18,19,20</sup> Overall, the successful establishment of forage kochia is greatly dependent upon its’ peculiar seed biology.<sup>17</sup> In brief, the most reliable establishment in the Great Basin comes from broadcast plantings (as opposed to drilling) done during the months of December through February (as opposed to spring plantings) using freshly harvested forage kochia seed (as opposed to seed one-year or older).<sup>17</sup> These recommendations are the result of forage kochia’s inability to emerge from depths >1 cm, rapid loss of seed viability under normal storage conditions, and delayed, asynchronous germination of fresh seed.<sup>18</sup> These appear to be adaptive traits that have evolved enabling forage kochia propagation in the wild.<sup>20</sup> Lack of seed availability is primarily because forage kochia seed is commonly harvested from October through January and thus current-year seed is not always available in time for fall and early winter seeding projects.<sup>17</sup> ‘Snowstorm’ seed matures slightly earlier than ‘Immigrant’<sup>21</sup>, but recent anecdotal reports suggest that ‘Snowstorm’ seed is more likely to shatter than ‘Immigrant’, further limiting its’ availability.<sup>21</sup>

### Potential for ‘Snowstorm’ forage kochia to enhance wildlife habitat

Many habitats within the Great Basin have been converted from formerly big sagebrush (*Artemisia tridentata*)/bunchgrass communities to habitats dominated by exotic annual weeds such as cheatgrass which has negatively impacted wildlife habitats.<sup>1</sup> Cheatgrass truncates secondary succession by out-competing native perennial species for limited resources at the seedling stage while at the same time providing a fine-textured, early maturing fuel that has increased the chance, rate, spread, and season of wildfires.<sup>7,15,24,26</sup> As wildfire frequencies have increased, the ability to restore native perennial species back into these habitats has been extremely challenging and largely unsuccessful.<sup>22</sup> Many resource managers have given up on these degraded rangelands.<sup>22</sup> However, the use of forage kochia in greenstrips to break up fuel continuity, especially on cheatgrass dominated rangelands, is well documented as a rangeland rehabilitation tool that not only reduces the rate and spread of wildfires, but also protects against further loss of browse communities.<sup>1,3,15,23,24</sup>

As the native plant communities of the semi-arid Intermountain region of the western U.S. continue to be replaced by invasive exotic weeds, critical wildlife habitats will continue to be threatened by increased fuel loads and increased wildfire frequency.<sup>1,4,22,23</sup> Therefore, there is a need by resource managers for plant materials that can both protect critical habitats against erosion and provide nutritional forage.<sup>2</sup> In the 1990s, we worked on rehabilitating rangelands degraded by wildfires in northern Nevada.<sup>1</sup> We conducted large rangeland seedings using native and introduced plant species which included ‘Immigrant’ forage kochia.<sup>1</sup> In this area of northern Nevada, the mule deer herd in the 1960s was estimated at 35,000–38,000, but in 1995 the population was estimated at 6,000–8,000 animals, which represents an 80% decline. This decline was primarily due to degraded rangelands and lack of winter habitat.<sup>24</sup> After decades of seeding forage kochia into



**Figure 3.** ‘Snowstorm’ forage kochia respond well following heavy grazing pressure.



**Figure 4.** ‘Snowstorm’ forage kochia is highly preferred by domestic livestock and wildlife browsers, and its’ ability to sustain heavy use and exhibit vigorous regrowth with minimal precipitation is a very desirable trait.

these cheatgrass dominated habitats, into what we often refer to as “food plots”, the mule deer population increased to an estimated 14,000–16,000 in 2015.<sup>25</sup> Furthermore, the pronghorn (*Antilocapra americana*) population had increased from an estimated 700–1,000 in 1995 to more than 7,000 in 2015.<sup>25</sup> By 2014, ‘Snowstorm’ forage kochia was used in these evaluations, and in testing of both fall and spring grazing of rehabilitation plots, ‘Snowstorm’ responded excellently to heavy grazing (>80%).<sup>1</sup> ‘Snowstorm’ was grazed down to less than 0.25 m in May, yet by late September the heavily grazed plants had grown back to over 1.2 m, despite the site receiving less than 13 mm of summer precipitation (Figs. 3 and 4).<sup>1</sup> Even though this is an anecdotal observation, it is one that has repeatedly been observed.

Mule deer are the only declining big game species in North America and their population decline is believed to be primarily due to loss of critically important fall and winter browse.<sup>27</sup> Antelope bitterbrush (*Purshia tridentata*), where present, has been reported to be >50% of the mule deer diet from October through December.<sup>26</sup> Dietz and Nagy<sup>26</sup> also reported that as bitterbrush leaves fall to the ground the crude

protein of antelope bitterbrush declined to <7%, their diet then shifted to big sagebrush which had a crude protein level just above 10%.<sup>26</sup> Grasses and forbs are normally deficient in crude protein during late fall and winter months, often dropping to 3–4%, as well as being inaccessible during deep snow events.<sup>26</sup> Semi-evergreen shrubs such as big sagebrush or rabbitbrush (*Chrysothamnus* spp.) retain higher levels of crude protein, but these shrubs contain tannins and essential oils that inhibit digestibility.<sup>26</sup> If mule deer are forced to consume high amounts of big sagebrush with limited amounts of other plant species in their diet, they can die with full stomachs because their digestive system stops functioning.<sup>26</sup> During times of prolonged deep snow events, winter mortality can be quite significant as recruitment levels fall below population sustainability.<sup>24</sup> ‘Snowstorm’ forage kochia is reported to have no negative trade-offs when compared to ‘Immigrant’ forage kochia,<sup>7,21</sup> therefore, ‘Snowstorm’ forage kochia with its’ high fall and winter nutrition value and added benefit of its’ taller stature can significantly decrease winter mortality of big game species and ultimately increase populations by increasing winter survivability.

In addition to improved big game survival, forage kochia may be utilized and benefit other wildlife species. For example, in Utah, using microhistological techniques, small quantities of ‘Immigrant’ forage kochia were discovered in fecal pellets of sage-grouse (*Centrocercus urophasianus*).<sup>28</sup> Nutrient analysis confirmed that the forage kochia samples collected from the sites exhibited a high protein content and low secondary metabolite content, similar to that of black sagebrush (*Artemisia nova*).<sup>28</sup> These fecal pellets were collected in habitat adjacent to greenstrips designed to protect sage-grouse habitat from wildfire.<sup>28</sup> Since the forage kochia greenstrips made up such a small percentage of the habitat (<1%), yet were present in the sage-grouse diets, it is possible that ‘Immigrant’ or ‘Snowstorm’ forage kochia could be a preferred species by sage-grouse during certain times of the year.

Overall, land managers believe that ‘Snowstorm’ forage kochia, with all its’ attributes of taller stature and increased forage and crude protein can be very beneficial for wildlife.<sup>7</sup> Especially on degraded big game winter ranges where forage kochia has been shown to provide critical nutrition during both deep snow level years, as well as drought years when other species are desiccated and lack sufficient forage and nutrition.<sup>1</sup> ‘Snowstorm’ forage kochia provides resource managers with an added tool to increase grazing resources and wildlife habitat by improving the nutritional quality of degraded rangelands year-around.

## References

1. CLEMENTS, C.D., AND J.A. YOUNG. 1997. Forage Kochia: To seed or not to seed. *Rangelands* 19:29-31.
2. WALDRON, B.L., R.D. HARRISON, A. RABBIMOV, T.C. MUKIMOV, S.Y. YUSUPOV, AND G. TURNOVA. 2005. Forage kochia-Uzbekistan’s desert alfalfa. *Rangelands* 27:7-12.

3. STEVENS, R., K.R. JORGENSEN, E.D. MCARTHUR, AND J.N. DAVIS. 1985. 'Immigrant' Forage Kochia. *Rangelands* 7:22-23.
4. HARRISON, R.D., B.L. WALDRON, K.B. JENSEN, et al. 2002. Forage kochia helps fight range fires. *Rangelands* 24:3-7.
5. PLUMMER, A.P., D.R. CHRISTENSEN, R. STEVENS, AND K.R. JORGENSEN. 1970. Highlights, results and accomplishments of game range restoration studies. *Utah State Division of Fish and Game, Publication* 70-3:3-4.
6. WALDRON, B.L., J.S. EUN, D.R. ZOBELL, AND K.C. OLSEN. 2010. Forage kochia (*Kochia prostrata*) for fall and winter grazing. *Small Ruminant Research* 91:47-55.
7. WALDRON, B.L., S.R. LARSON, M.D. PEEL, et al. 2013. 'Snowstorm', A new forage kochia cultivar with improved stature, productivity and nutritional content for enhanced fall and winter grazing. *Journal of Plant Registrations* 7:140-150.
8. BAILEY, D.W., R.A. TABINI, B.L. WALDRON, et al. 2010. Potential of *Kochia prostrata* and perennial grasses for rangeland restoration in Jordan. *Rangeland Ecology & Management* 63:707-711.
9. NEWHALL, R.L., T.A. MONACO, W.H. HORTON, R.D. HARRISON, AND R.J. PAGE. 2004. Rehabilitating salt-desert ecosystems following wildfire and wind erosion. *Rangelands* 26:3-7.
10. SMITH, R.C., B.L. WALDRON, J.E. CREECH, R.A. ZOBELL, AND D.R. ZOBELL. 2016. Forage kochia and Russian wildrye potential for rehabilitating Gardner's saltbush ecosystems degraded by Halogeton. *Rangeland Ecology & Management* 69:390-398.
11. MONACO, T.A., B.L. WALDRON, R.L. NEWHALL, AND W.H. HORTON. 2003. Re-establishing perennial vegetation in cheatgrass monocultures. *Rangelands* 25:26-29.
12. STEVENS, R. AND E.D. MCARTHUR. 1990. 'Immigrant' forage kochia competition with Halogeton following various seeding techniques. In: McArthur, E.D., Romney, E.M., Smith, S.D., Tueller, P.T. editors, Proceedings-Symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management. USDA Forest Service. General Technical Report INT-276. Ogden, UT, USA, 351 p.
13. GRAY, E.C., AND P.S. MUIR. 2013. Does *Kochia prostrata* spread from seeded sites? An evaluation from southwestern Idaho, USA. *Rangeland Ecology & Management* 66:191-2013.
14. WALDRON, B., D.R. HARRISON, N.J. CHATTERTON, AND B.W. DAVENPORT. 2001. Forage Kochia: Friend or Foe. In: McArthur, E.D., Fairbanks, D.J. editors, Proceedings-Symposium on Shrubland ecosystem genetics and biodiversity. USDA Forest Service General Technical Report RMRS-P-21. Ogden, UT, USA, 365 p.
15. HARRISON, R.D., N.J. CHATTERTON, B.L. WALDRON, B.W. DAVENPORT, A.J. PALAZZO, W.H. HORTON, AND K.H. ASSAY. 2000. Forage kochia: Its compatibility and potential aggressiveness on Intermountain rangelands. Utah Agricultural Experiment Station Resource Report 162. Utah State University, Logan, UT, USA. 5 p.
16. PENDLETON, R.L., N.C. FRISCHKNECHT, AND E.D. MCARTHUR. 1992. Long-term survival of 20 selected plant accessions in a Rush Valley, Utah, planting. USDA Forest Service Research Note INT-403, Ogden, UT, USA, 7 p.
17. KITCHEN, S.G., AND S.B. MONSEN. 2001. Forage kochia seed germination response to storage time and temperature. *Journal of Range Management* 54:299-306.
18. YOUNG, J.A., R.A. EVANS, R. STEVENS, AND R.L. EVERETT. 1981. Germination of *Kochia prostrata* seed. *Agronomy Journal* 73:957-961.
19. STEWART, A., V.J. ANDERSON, AND S.G. KITCHEN. 2001. 'Immigrant' forage kochia seed viability as impacted by storage methods. *Journal of Range Management* 54:396-399.
20. CREECH, C.F., B.L. WALDRON, C.V. RANSOM, D.R. ZOBELL, AND J.E. CREECH. 2013. Factors influencing the field germination of forage kochia. *Crop Science* 53:2202-2208.
21. CREECH, C.F., B.L. WALDRON, C.V. RANSOM, D.R. ZOBELL, AND J.E. CREECH. 2018. Influence of harvest date on seed yield and quality in forage kochia. *Frontiers of Agricultural Science and Engineering* 5:71-79.
22. CLEMENTS, C.D., D.N. HARMON, R.R. BLANK, AND M. WELTZ. 2017. Improving Seeding Success on Cheatgrass Infested Rangelands in Northern Nevada. *Rangelands* 39:174-181.
23. PELLANT, M. 1994. History and application of the Intermountain greenstripping program. In: Monsen, S.B. and Kitchen, S. G., editors. Proceedings-Symposium on ecology and management of annual rangelands. General Technical Report INT-GTR-313. USDA Forest Service, Intermountain Research Station, Ogden, UT, USA. 416 p.
24. CLEMENTS, C.D., AND J.A. YOUNG. 1997. A Viewpoint: Rangeland health and mule deer habitat. *Journal of Range Management* 60:129-138.
25. COX, M. Personal communication. Big game staff biologist, Nevada Department of Wildlife, Reno, Nevada.
26. DIETZ, D.R., AND J.G. NAGY. 1976. Mule deer nutrition and plant utilization. In: WORKMAN GW, & LOW JB, editors. Proceedings-Symposium Mule deer decline in the west. Logan, UT, USA: Utah State Agricultural Experiment Station. p. 134.
27. BERGMAN, E.J., P.F. DOHERTY, G.C. WHITE, AND A. HOLLAND. 2015. Density dependence in mule deer: a review of evidence. *Wildlife Biology* 21:18-29.
28. GRAHAM, S.E. 2013. Greater sage-grouse habitat selection and use patterns in response to vegetation management practices in northwestern Utah. Thesis: Utah State University, Logan, UT, USA. 176 p.

---

*Authors are with the USDA, Agricultural Research Service, Greta Basin Rangelands Research Unit, 920 Valley Road, Reno, NV 89512, United States; Agricultural Research Service, Forage and Range Research Unit, United States; Agricultural Research Service, Greta Basin Rangelands Research, United States; Nevada Department of Wildlife, United States*