Wyoming Weed and Pest Council Legislative Report

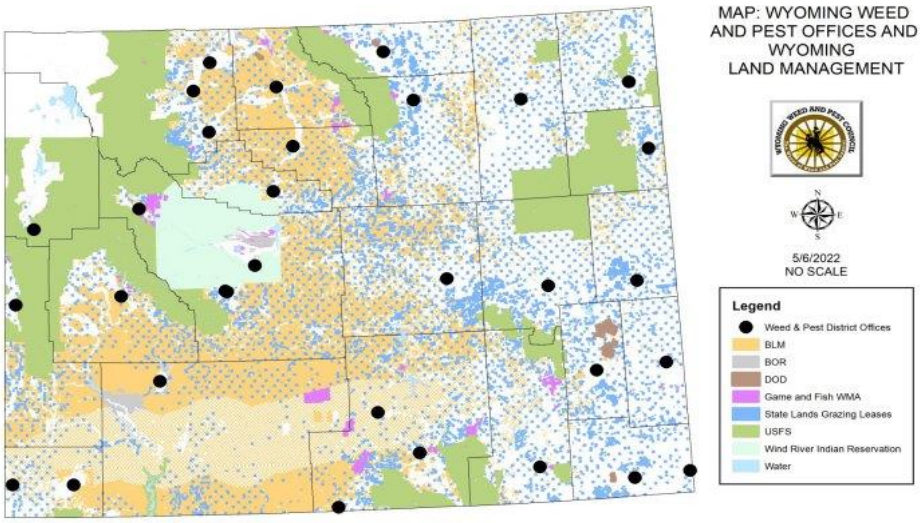
LSO Report ID: 1422
REPORTING PERIOD BFY 23

WS § 11-5-120 "On a biennial basis, reporting to the joint agriculture, state and public lands and water resources committee on the status of current funding models, existing or new funding challenges and opportunities to improve funding for designated and declared invasive plant species."

Background:

The Wyoming Weed & Pest Council provides unified support and leadership for integrated management of noxious weeds and pests to protect economic and ecological resources in the State of Wyoming. Districts are Wyoming's first line of defense against destructive weeds and pests.

Weed & Pest Districts and the Council were established in 1973 by the Wyoming Weed and Pest Control Act (WS 11-5-101 through 120). The Wyoming Weed and Pest Council comprises 23 Weed & Pest Districts which are managed by 135 board members appointed by County Commissioners and employs over 120 district employees statewide.



Weed and Pest District boards are directed by statute (W.S. §§ 11-5-1-5(a)(i)) to implement and pursue effective programs for designated weeds and pests that are identified as a state-wide concern, in addition to pursuing programs for declared species identified in their individual districts.

Weed and Pest Council activities are coordinated through the Wyoming Department of Agriculture (W.S. §§ 9-2-2016) and an Executive Board. The Executive Board also includes representation from the University of Wyoming, which provides research and extension to the Council to assure the use of the latest technology and research in the ongoing management of noxious weeds and pests.

As required by statute, this report is a comprehensive overview of funding resources, activities, projects, accomplishments, and barriers the State of Wyoming has encountered over the past biennium (and may face in the future) in the management of designated and declared species.

For additional information on the Wyoming Weed and Pest Council and Weed and Pest Control Districts visit wyoweed.org. The Council's website also has an embedded calendar with information on District and Council meetings, as well as other activities.

Weed and Pest Council President: Donley Darnell – Board Chair, Weston County Weed & Pest

	5 Years Service	10 Years Service	15 Years Service	20 Years Service	25 Years Service
2022	13	5	8	7	5
2023	10	10	4	7	1

Board Member and Employee Service Awards

30 Years of Service
Donley Darnell- Weston Co. Board
Jarrod Glanz- Washakie Co. Supervisor

35 Years of Service
Joe Wildman- Big Horn Co. Board
Rod Litzel- Johnson Co. Supervisor (Ret.)
Gail Mahnke- Niobrara Co. Supervisor
Terry Glanz- Washakie Co. Board

40 Years of Service
Arnold Pennoyer- Hot Springs Co. Board

45 Years of Service
Tom Brewster- Washakie Co. Board

50 Years of Service
Jim Wasserburger

Weed and Pest Control District Mill Levy Funds

- **W.S. 11-5-111. Tax levied on property in district; maximum amount; weed and pest control fund.**

The county commissioners shall annually levy a tax to carry out this act. The tax shall be levied upon all property in the district and shall not exceed one (1) mill on each one dollar ($1.00) of assessed valuation. The tax is not part of the general county or city mill levies. All taxes levied and collected shall be remitted to the district for a separate fund to be known as the weed and pest control fund, which shall be used only to carry out this act.

- **W.S. 11-5-303(e). – Special Management Program**

A district may levy, not to exceed, an additional one (1) mill on the assessed value of the taxable property within the district to fund its contributions under this section. Upon request by the district board, the board of county commissioners may levy the amount of tax requested not to exceed the mill levy authorized by W.S. 11-5-111 and this subsection.

District	2022 Levies	2022	2023 Levies	2023
Albany	1	$ 573,516	1	$ 650,988
Big Horn	2	$ 496,937	2	$ 606,993
Campbell	0.411	$ 1,865,640	0.341	$ 1,945,755
Carbon	1	$ 790,526	1	$ 943,192
Converse	0.435	$ 1,200,885	0.689	$ 3,020,845
Crook	2	$ 524,224	2	$ 656,232
Fremont	2	$ 1,692,721	1.98	$ 2,064,720
Goshen	2	$ 554,560	2	$ 633,254
Hot Springs	2	$ 333,296	2	$ 428,826
Johnson	2	$ 723,350	1.885	$ 962,965
Laramie	0.8	$ 1,984,411	0.5	$ 2,885,022
Lincoln	0.905	$ 839,780	0.934	$ 1,045,521
Natrona	1	$ 1,452,264	1	$ 1,707,287
Niobrara	2	$ 267,472	2	$ 365,162
Park	1	$ 874,635	1	$ 1,075,510
Platte	2	$ 463,278	2	$ 498,516
Sheridan	2	$ 1,221,344	2	$ 1,434,074
Sublette	0.384	$ 783,420	0.384	$ 1,595,364
Sweetwater	0.566	$ 1,398,217	0.259	$ 765,572
Teton	0.75	$ 2,403,772	1	$ 3,988,777
Uinta	0.86	$ 442,261	0.711	$ 472,927
Washakie	2	$ 321,986	2	$ 362,760
Weston	2	$ 362,278	2	$ 408,540

Funding Challenges and Opportunities

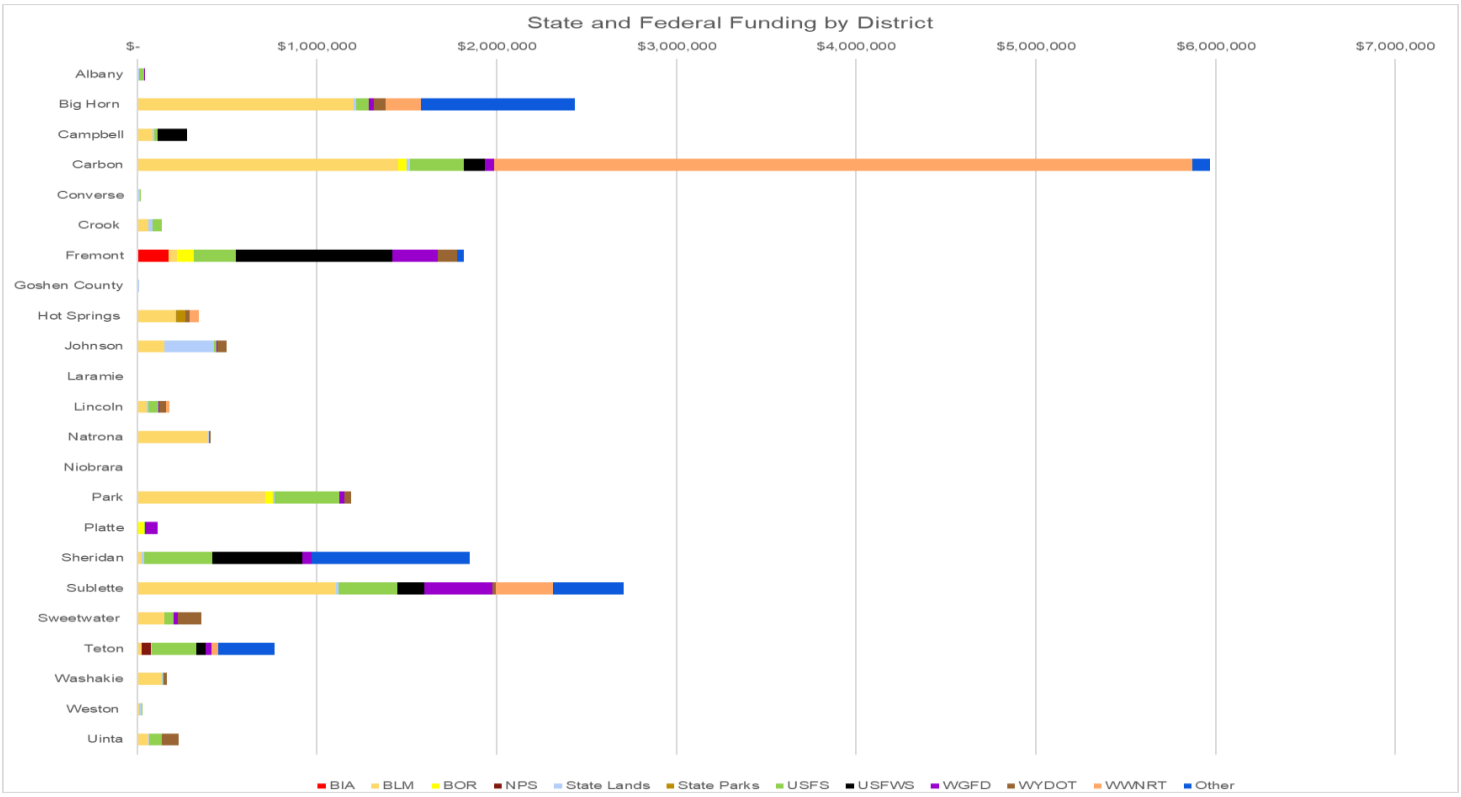
- **Districts are dependent on the tax levied upon property for base funding. Many are utilizing these funds to leverage additional funding for programs that benefit all landowners. Tens of millions of funds from other sources are unusable without this base district tax funding (as illustrated elsewhere in this report). Some proposed property tax reform measures, targeting mill levies, have the potential to erode this critical funding for districts. This is a concern for the stability of programs and the ability for Districts to carry out the Weed and Pest Control Act.**
- **Stretch limited funds to implement impactful district-wide weed and pest control projects on Wyoming State Lands**
- **Request Congressional Appropriations Subcommittees on Transportation to appropriate previously authorized funding for roadside invasive plant control**
- **Funding strategic invasive annual grass treatments to control dense and extensive infestations**
- **Work with WYDOT to explore the possibility of incorporating weed control into road construction projects**
- **Reduce bottleneck issues related to cooperative agreements with federal agencies that impede the districts' ability to do timely treatments for invasive species (i.e. GrantSolutions.com, BLM Funding process)**
- **Coordinate with BOR's field offices covering Wyoming to find a cohesive way to address invasives on BOR lands**
- **Speed up the process for USFS (Shoshone and Ashley Nat. Forests have not approved aerial treatments) and other federal partners to approve proven and safe technologies to allow for timely weed control**
- **Work with USDA to secure funding for potential grasshopper treatments in areas related to federal lands. Consistent baseline funding from partners is necessary to ensure effective future management.**
- **Work with UW to expand its economic impact findings for invasive species, and disseminate this information**
- **Work with Wyoming Wildlife & Natural Resource Trust to apply funds to invasive annual grass control, especially post wildfire**
- **Identify the extent of invasive species in the Wyoming State Trails system, and work with State Trails to fund and implement invasive species control measures**
- **Partner with State Parks to identify funding deficiencies and potential cooperative projects based on increased public utilization.**
- **Partner with WGFD to pursue habitat-based weed and pest control projects**
- **Collaborate with Wyoming DEQ to streamline multi-agency invasive species surveys and control projects**

District Funding

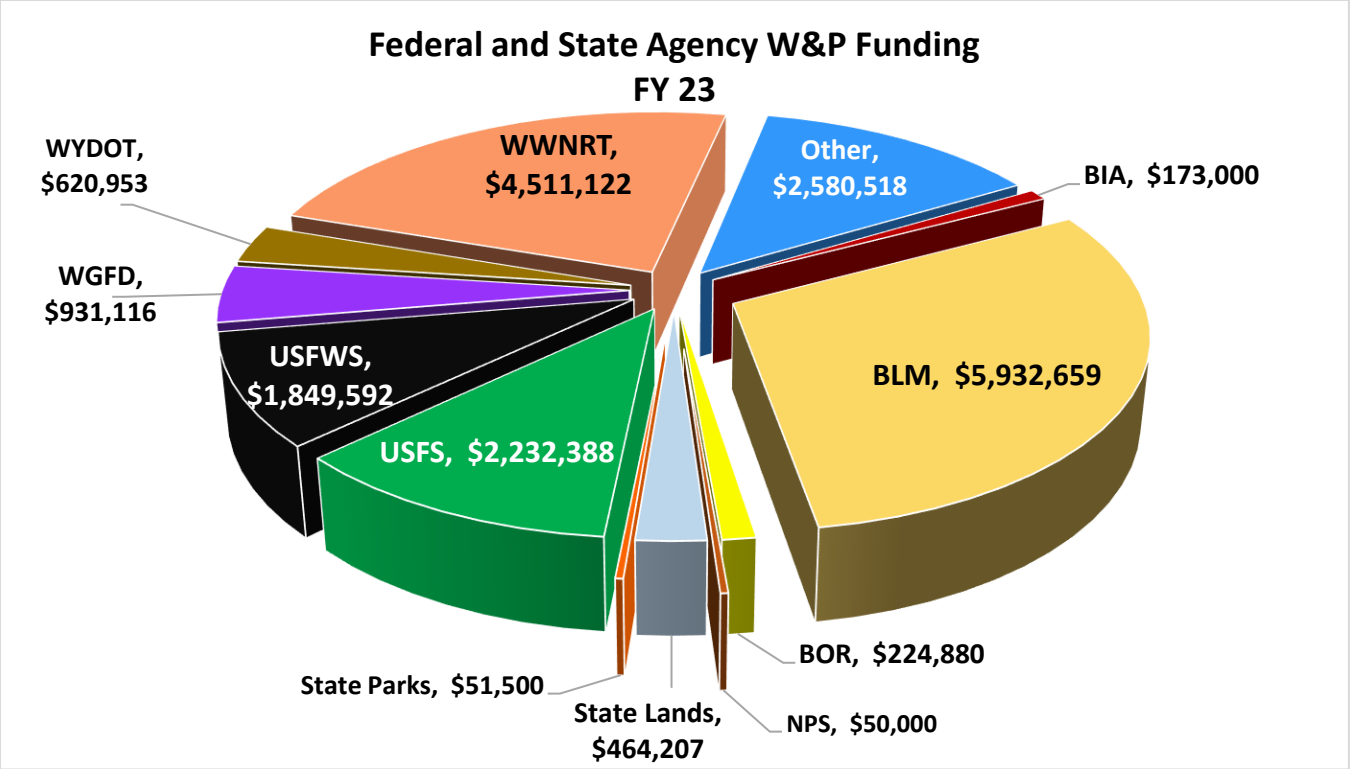
(Reported in W&P District survey)

Weed and Pest Control Districts have a long history of working with local, state and federal partners. Many play a leadership role in local Cooperative Weed Management Areas (CWMAs) to help coordinate funding, and provide expertise for on-the-ground projects. Effective management of invasive weeds and pests requires working across jurisdictional boundaries. This is often done through cooperative agreements (W.S. 11-5-105(b)(iii).

Weed and pest control districts can pursue competitive grants for programs they administer, and participate in as a partner. Various grants Districts have received include but are not limited to; Rocky Mountain Elk Foundation, Wyoming Wildlife and Natural Resource Trust, Pulling Together Initiatives, National Wildlife Foundation, Greater Yellowstone Coordinating Committee, National Association of Counties, Muley Foundation, North American Wild Sheep Foundation, WGFD Sage Grouse Working Groups, Center for Invasive Plant Management, and various local and private grants. Volunteers also play an important role, and Districts work closely with individuals and groups passionate about keeping Wyoming natural and beautiful.



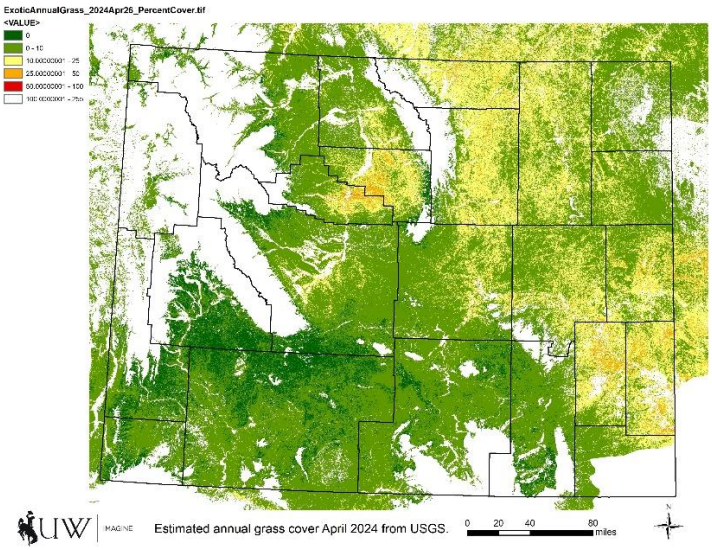
	BIA	BLM	BOR	NPS	State Lands	State Parks	USFS	USFWS	WGFD	WYDOT	WWNRT	Other
Albany	$ -	$ 6,500	$ -	$ -	$ 2,275	$ -	$ 30,000	$ -	$ 2,000	$ -	$ -	$ -
Big Horn	$ -	$ 1,201,338	$ -	$ -	$ 15,512	$ -	$ 70,000	$ -	$ 27,000	$ 68,041	$ 195,000	$ 856,068
Campbell	$ -	$ 83,000	$ -	$ -	$ 11,902	$ -	$ 17,796	$ 162,712	$ -	$ -	$ -	$ -
Carbon	$ -	$ 1,450,000	$ 50,000	$ -	$ 16,098	$ -	$ 303,000	$ 115,000	$ 50,000	$ -	$ 3,886,576	$ 100,000
Converse	$ -	$ -	$ -	$ -	$ 12,772	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ -
Crook	$ -	$ 60,000	$ -	$ -	$ 27,003	$ -	$ 50,000	$ -	$ -	$ 50,672	$ -	$ -
Fremont	$ 173,000	$ 46,250	$ 96,000	$ -	$ -	$ -	$ 230,900	$ 871,880	$ 253,000	$ 106,269	$ -	$ 40,000
Goshen County	$ -	$ 2,000	$ -	$ -	$ 7,022	$ -	$ -	$ -	$ 4,000	$ -	$ -	$ -
Hot Springs	$ -	$ 210,400	$ 880	$ -	$ 5,388	$ 50,000	$ -	$ -	$ -	$ 25,400	$ 49,520	$ -
Johnson	$ -	$ 150,000	$ -	$ -	$ 274,863	$ -	$ 15,000	$ -	$ 5,000	$ 54,000	$ -	$ -
Laramie	$ -	$ -	$ -	$ -	$ 4,426	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Lincoln	$ -	$ 53,617	$ -	$ -	$ 7,800	$ -	$ 56,548	$ -	$ 5,000	$ 36,519	$ 21,196	$ -
Natrona	$ -	$ 394,179	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ 12,330	$ -	$ -
Niobrara	$ -	$ -	$ -	$ -	$ 5,059	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Park	$ -	$ 710,000	$ 43,000	$ -	$ 8,800	$ 1,500	$ 360,000	$ -	$ 30,000	$ 34,000	$ -	$ -
Platte	$ -	$ 5,000	$ 35,000	$ -	$ 9,280	$ -	$ 3,000	$ -	$ 70,160	$ -	$ -	$ -
Sheridan	$ -	$ 23,305	$ -	$ -	$ 13,332	$ -	$ 380,000	$ 500,000	$ 52,829	$ -	$ -	$ 880,000
Sublette	$ -	$ 1,105,432	$ -	$ -	$ 14,179	$ -	$ 327,301	$ 150,000	$ 381,127	$ 15,984	$ 318,830	$ 391,950
Sweetwater	$ -	$ 150,000	$ -	$ -	$ 2,500	$ -	$ 50,000	$ -	$ 25,000	$ 130,000	$ -	$ -
Teton	$ -	$ 24,000	$ -	$ 50,000	$ 6,279	$ -	$ 250,024	$ 50,000	$ 30,000	$ -	$ 40,000	$ 312,500
Washakie	$ -	$ 137,000	$ -	$ -	$ 4,426	$ -	$ 3,102	$ -	$ -	$ 22,195	$ -	$ -
Weston	$ -	$ 10,000	$ -	$ -	$ 12,000	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -
Uinta	$ -	$ 60,000	$ -	$ -	$ 6,528	$ -	$ 70,000	$ -	$ -	$ 94,020	$ -	$ -

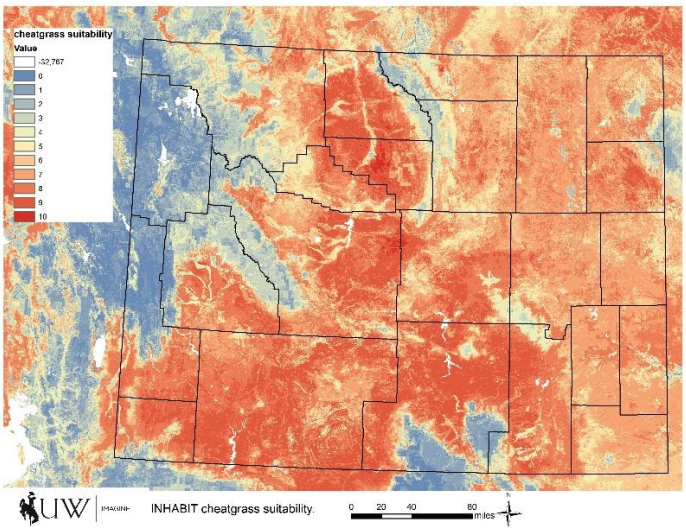


Invasive Annual Grasses

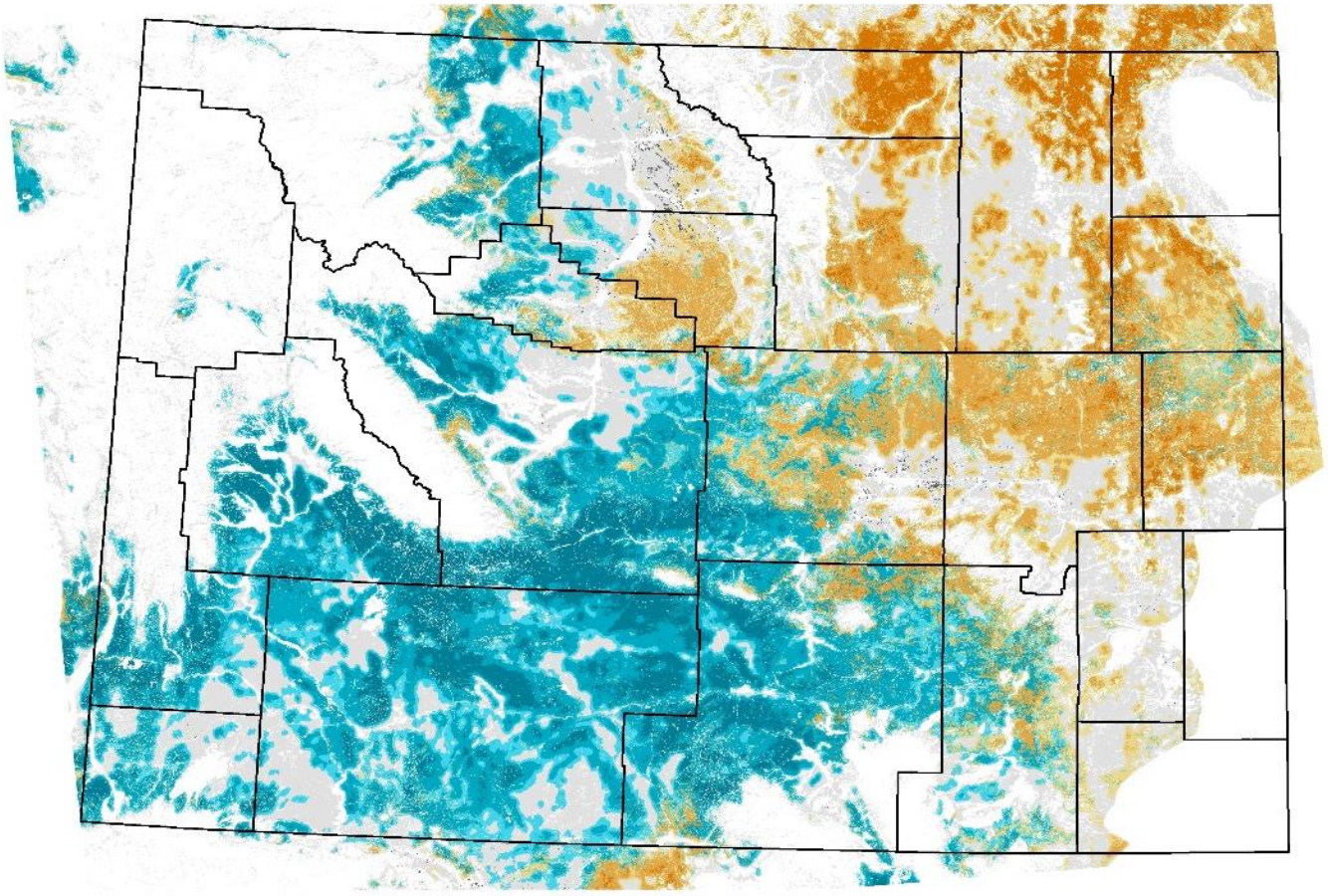
An estimated 5.3 million acres in Wyoming are impacted by cheatgrass, with an additional 10 million infested in at least some degree. Ventenata and medusahead impact an additional 132,000 acres. 49.4 million additional acres are suitable habitat for the establishment of invasive annual grasses (IAGs).

Economic impacts to grazing are estimated at $33 million annually, and could easily exceed $130 million if IAGs are allowed to spread. IAGs pose the highest potential economic loss of any noxious species studied. These figures do not account for the cost of IAG management, wildfire damage, impacts to recreation and tourism, impacts to the energy industry, or losses to wildlife habitat and forage.





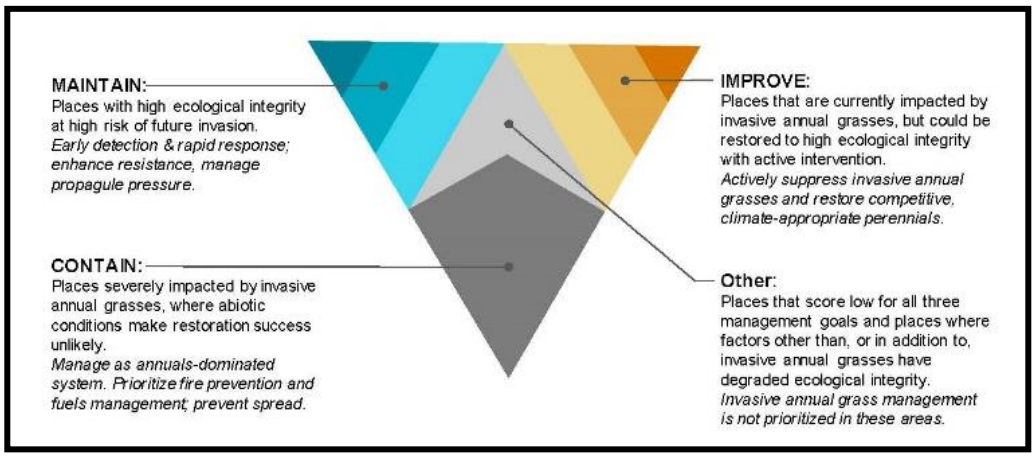
As both direct and potential impacts to agriculture from reduced rents on agricultural land in Wyoming, cheatgrass has the highest loss estimates statewide with $29 million in direct loss on observed acres and $110 million in potential loss from infestation on suitable habitat. Direct impacts from land with observed or impacted cheatgrass infestations in 2021 is equivalent to 11% of non-impacted agricultural value with potential impacts of 43% the value of Wyoming's agricultural lands. -From UW/WWPC noxious weeds economic impact study.



UW | IMAGINE

0 25 50 100 miles

Data from Boyd et al. 2024

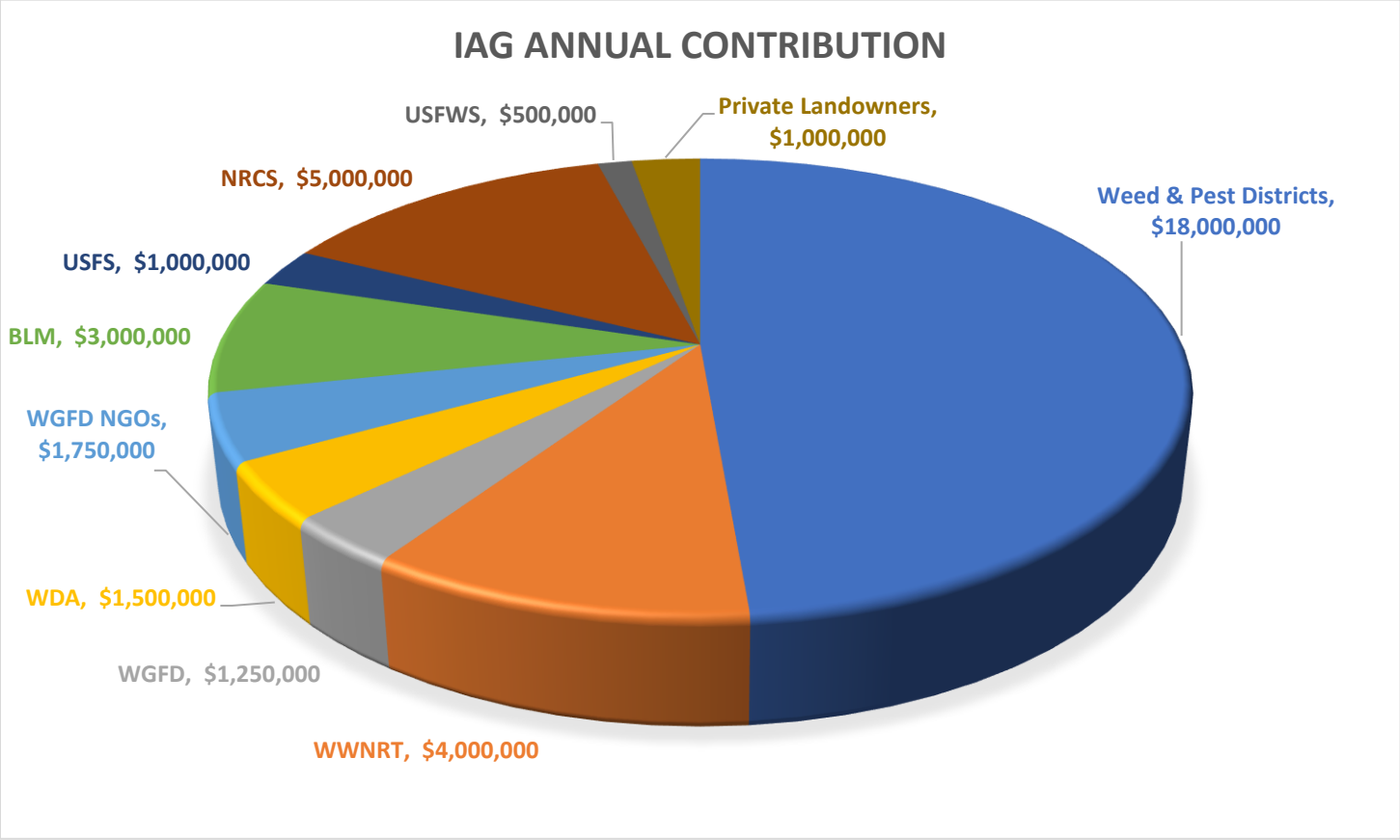


IAG project costs:

- Survey $3/acre
- Herbicide (indaziflam, imazapic) $45-$65/acre
- Application (almost always aerial) $14-$30/acre
- Monitoring (survey plus data analysis)
- Touch up treatments $59-$95/acre

= **Approximately $150/acre**

*Not included: costs for administration, fuel, district vehicles, travel, GIS equipment, etc.



2023 & 2024 State Allocations Committee (SAC) (W.S. §§ 11-5-113)(a)

An allocation committee composed of the director of the department of agriculture, three members appointed by the Wyoming Weed and Pest Council and one member of the board shall allocate the funds of any legislative appropriation to the district boards pursuant to a formula adopted by the committee. No district board shall receive an amount in excess of one-third of its actual expenditures from any appropriation, unless the appropriation provides assistance in control to a district board under subsection (b) of this section.

(b) If the district board determines a weed or pest is seriously endangering areas of a district or the state, assistance in control may be provided by legislative appropriation for this purpose, and the allocation committee shall allocate the appropriation accordingly, and the allocation committee and each affected district board shall be responsible for insuring that the funds are properly expended.

- **Special Management Program Funding (SMP)**. State of Wyoming general fund dollars allocated by SAC for Weed and Pest Control District special management programs developed under W.S. 11-5-301 through W.S. 11-5-303. Special management programs offer additional cost share opportunities for landowners and managers when controlling specific invasive plants or pests on their property. The program requires contractual landowner agreements which stipulates conditions of the program and landowner responsibilities for control and monitoring. Funding from this program is only allocated to districts that have implemented a district wide special management program and are utilizing their second mill levy.

- **Pesticide Registration Fee Grants (PRFG).** Under W.S. 35-7-356 every pesticide or device which is distributed within this state or delivered for transportation or transported in intrastate commerce or between points within this state through any point outside this state shall be registered with the department of agriculture by its manufacturer or formulator for an annual fee of $140/product. $125.00 of the fee collected pursuant to this subsection shall be deposited in the special natural resource account in the department of agriculture which is hereby created. Funds in the special natural resource account are continuously appropriated to the department and shall only be used to provide funding for the pesticide registration fee program. SAC allocates these funds to Weed and Pest Control District program for the control of designated and declared species.

- **State Lands.** Under W.S. 36-2-107 and 36-3-102, and beginning in 2023, funding for weed and pest control on Wyoming State Lands is administered by the Department of Agriculture. SAC allocates these funds annually to all 23 weed and pest districts, based on need, historic projects, and acres of state lands per district. Districts are required to provide a 1:1 match for this funding either from their budget, or from state lands lessees.

State Lands

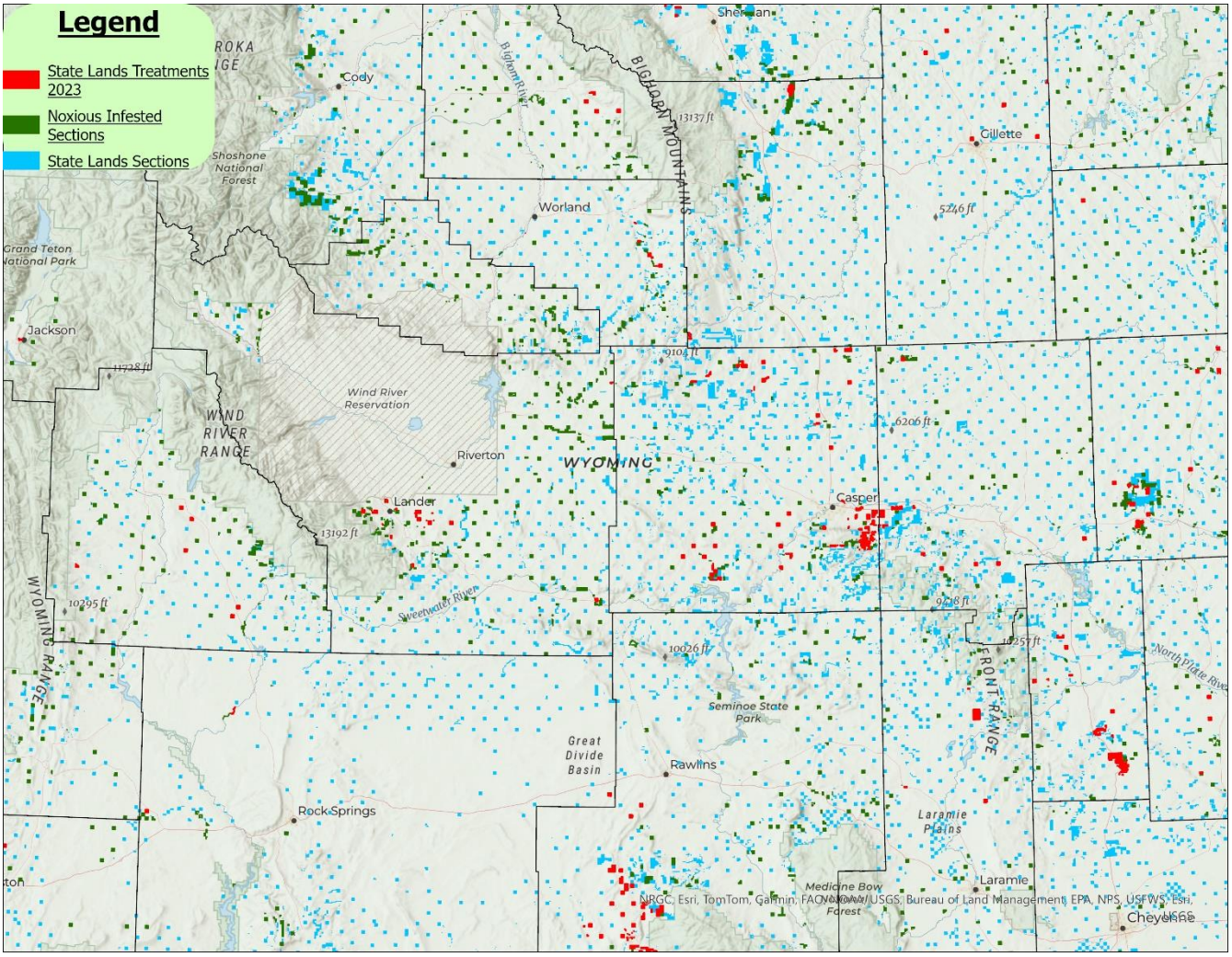
Beginning in 2023, the Wyoming Department of Agriculture was tasked with managing weed and pest control on Wyoming State Lands, and was allocated $300,000 in the 2023 biennial budget. WDA allocates this funding via SAC, and distributed $150,000 in both 2023, and 2024 among all 23 weed and pest districts. W&P districts provided $812,407 of matching funds in 2023 from their budgets, and from state land lessees. With this $150,000 in 2023, W&P districts were able to treat 40% of known infested acres (23,704), and to survey 16% of all acres that have ever had infestations reported (61,537). That means 0.6% of all Wyoming state lands were treated, and 1.7% were surveyed.

In addition to the $300,000 biennial allocation, some districts spent remaining Trust Lands Preservation and Enhancement (TP&E) funds from the Office of State Lands and Investments (OSLI) for noxious species control. These funds were allocated by OSLI in BFY21, and are no longer being granted for weed and pest control.

Districts requested around $300,000 for both 2023 and 2024 to implement control projects on state lands. This is their estimate for necessary funding to carry out projects for one spray season.

Wyoming State Lands Weed and Pest Control BFY23 Allocation				
	Acres	**% of Acres**	**2023 Allocation**	**2024 Allocation**
Albany	205,446	5.90%	$2,271	$3,101
Big Horn	67,648	1.94%	$6,208	$9,304
Campbell	183,613	5.28%	$11,902	$14,266
Carbon	313,056	9.00%	$5,264	$10,835
Converse	254,207	7.30%	$6,386	$3,101
Crook	121,951	3.50%	$13,333	$10,337
Fremont	248,842	7.15%	$3,970	$20,000
Goshen	85,461	2.46%	$2,342	$6,203
Hot Springs	80,813	2.32%	$2,494	$2,894
Johnson	213,362	6.13%	$15,559	$9,304
Laramie	135,353	3.89%	$4,426	$3,101
Lincoln	96,667	2.78%	$3,180	$7,236
Natrona	382,369	10.99%	$2,879	$4,962
Niobrara	161,655	4.65%	$7,379	$8,476
Park	145,557	4.18%	$5,762	$3,552
Platte	120,713	3.47%	$10,869	$16,540
Sheridan	106,688	3.07%	$13,332	$16,540
Sublette	112,597	3.24%	$14,668	$18,400
Sweetwater	179,702	5.16%	$2,645	$620
Teton	4,634	0.13%	$4,079	$2,200
Uinta	48,562	1.40%	$4,426	$2,102
Washakie	100,189	2.88%	$4,426	$3,101
Weston	110,265	3.17%	$2,200	$7,236

*Some districts were unable to spend their 2023 allocation due to remaining OSLI TP&E funds. Unspent funds were reallocated for 2024.



Pesticide Registration Fee Grants (PRF) & Special Management Program (SMP)

24 Pesticide Registration Fee and Special Management Program grants were awarded in 2023, totaling $1,301,143, and grantees provided matching funds of $3,519,423. PRF allocations allow W&P districts to fund a variety of weed and pest control work. Some are one-time special projects that may address one or two species, such as a new infestation of Dalmatian toadflax in the backcountry. Some are long-term control efforts that seek to maintain an infestation boundary, such as a hoary cress infestation contained to a single creek bottom. Some are statewide, such as biocontrol research and distribution.

SMP allocations allow W&P districts to focus on specific sections of their counties, and hone in on particular species, usually with a landscape-wide control objective. For example, a leafy spurge control program that encompasses an entire watershed, or a prairie dog program that allows all landowners in an infestation area to be able to afford treatments.

In 2024, $1,645,305 was awarded to 32 programs. Grantees will provide at least $2,890,852 in matching funds.

2023 Pesticide Registration Grants

	Grantee	Project Name	Amount Allocated	Match	Treated Acres	Surveyed Acres
	Big Horn W&P	Big Horn River Fuels and Invasives	$ 30,000	$ 420,000	80	254
	Campbell W&P	Campbell County Ventenata Control	$ 220,000	$ 991,630	20253	0
	Crook W&P	Green Mountain Management Project	$ 11,022	$ 6,000	500	250
	Crook W&P	Sundance Mountain Management Project	$ 5,233	$ 5,000	2	280
*	**Fremont W&P**	Government Draw Leafy Spurge and Cheatgrass	$ 46,675	$ 68,740	3841	3841
	Goshen W&P	Goshen County Dalmatian Toadflax Control Project	$ 20,000	$ 25,747	946	0
	Goshen W&P	The Goshen County Prairie Dog Control Project	$ 40,000	$ 120,661	4000	0
	Hot Springs W&P	Grass Creek Weed Management Area	$ 30,000	$ 11,365	496	0
*	**Hot Springs W&P**	Kirby Creek Special Weed Management	$ 45,000	$ 34,927	1613	0
	Johnson W&P	Johnson County Leafy Spurge SMP	$ 95,000	$ 576,154	14841	0
	Johnson W&P	Johnson County RO & SC Program	$ 30,000	$ 51,466	24	0
	Lincoln W&P	Greys River Spotted Knapweed Project	$ 100,000	$ 44,666	2622	5005
	NEWIGWG	Medusahead and Ventenata Treatments	$ 57,639	$ 57,639	1607	40000
	Park W&P	North Park Spotted Knapweed	$ 24,944	$ 42,525	1274	20000
	Platte W&P	Platte County Cheatgrass Countol	$ 60,160	$ 100,673	2000	2645
	Platte W&P	Platte County Blacktailed Prairie Dog Control SMP	$ 45,000	$ 135,074	9859	12230
	Uinta W&P	Cinquefoil-Oxeye Daisy Project	$ 45,445	$ 49,826	2784	6739
	Washakie W&P	Cottonwood Creek Riparian Enhancement Project	$ 30,000	$ 25,339	408	0
	Washakie W&P	South Big Horn Weed Project	$ 70,000	$ 33,661	1329	5000
	Weston W&P	Weston County Hoary Cress Project	$ 48,000	$ 15,562	1250	3100
	Weston W&P	Upton Leafy Spurge Project	$ 41,425	$ 55,228	4147	10000
	Wy. W&P Council GIS Committee	Statewide EDRR/GIS Infestation Recordation Program	$ 80,600	$ 18,400	n/a	n/a
	Laramie W&P	Curt Gowdy/Pole Mtn. 2022	$ 50,000	$ 472,370	7857	0
	Wy. W&P Council Biocontrol Committee	WWPC biocontrol	$ 75,000	$ 156,770	n/a	n/a
*	**Special Management Program**		**$ 1,301,143**	**$ 3,519,423**	**81,733**	**109,344**

US Forest Service Grants

The Wyoming Department of Agriculture (WDA) administers US Forest Service Grants. State and Private Forestry (SPF) grants fund invasive weed management on private and State of Wyoming lands. Projects funded with these grants require a 1:1 match, cannot be on National Forest System (NFS) lands, and cannot be matched by other federal dollars. WDA utilizes SAC to allocate these funds to districts after receiving a grant application that has been approved by their USFS district office.

Bipartisan Infrastructure Law (BIL) grants were awarded to WDA in 2023 and 2024, and sub-awarded to W&P districts and other partners. WDA collects the minimum allowable administrative costs on these federal grants.

	State & Private Forestry Projects	Grant Funds	Match Funds
2023	Albany Co. W&P- Laramie Peak	$ 25,000	$ 41,946
	Lincoln Co. W&P- Dyer's Woad Project	$ 15,000	$ 77,058
	Park Co. W&P- Northfork Project	$ 10,500	$ 44,437
	Park Co. W&P- Upper Clark's Fork/Wood River	$ 12,000	$ 38,828
	Teton- Snake River (2023)	$ 5,000	$ 50,604
	Uinta Co. W&P- Bear River Divide, 4 Rivers	$ 18,277	$ 22,915
2024	Lincoln Co. W&P- Dyer's Woad Project	$ 24,750	(committed) $ 24,750
BIL	Big Horn W&P- Devil's Canyon	$ 50,000	$ 161,520
	Carbon Co. W&P Cheatgrass	$ 95,480	$ 59,503
	Weston Co. W&P IAG	$ 200,000	$ 50,000

Story maps for PRF, SMP, and SPF projects are updated periodically on the WWPC website, www.wyoweed.org. More information about State Allocation Committee managed grants can be found in the appendix.

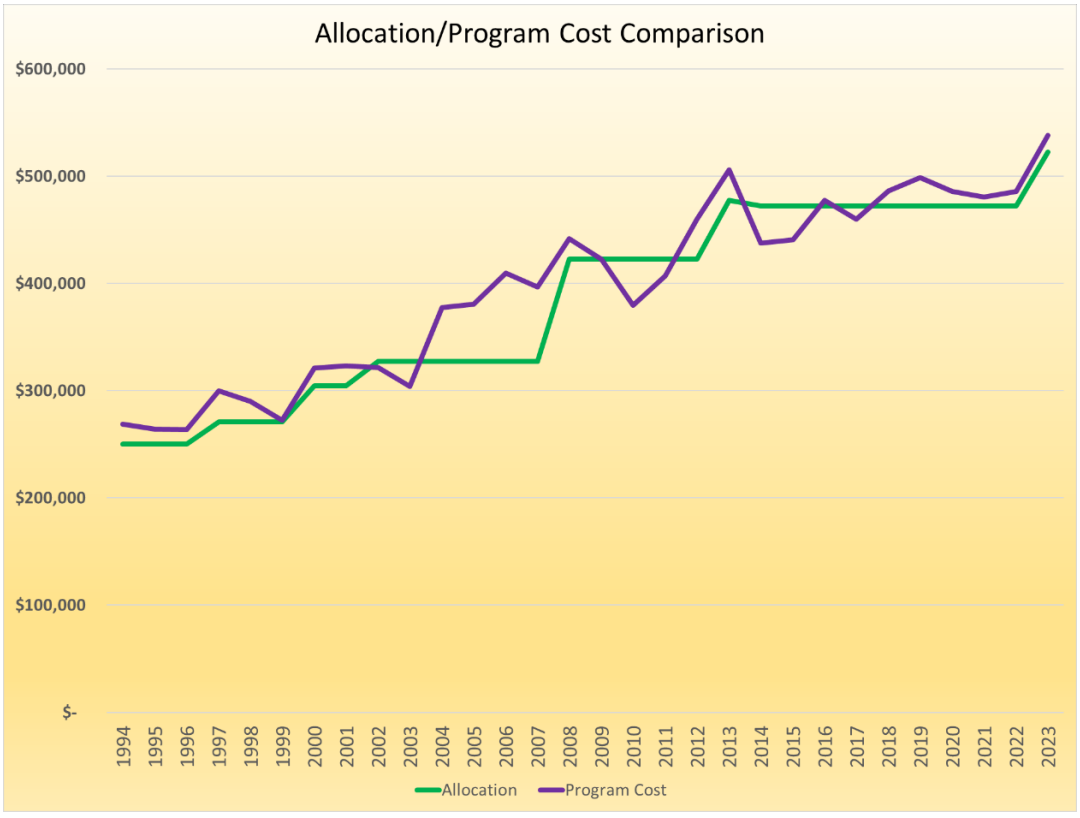
2023 & 2024 Wyoming Department of Transportation Noxious Weed Funding

The Wyoming Department of Agriculture (WDA) and the Wyoming Department of Transportation (WYDOT) maintain a memorandum of agreement allowing that WDA administers WYDOT funding for the management of designated and declared weeds and pests along state rights-of-way. The State Allocations Committee (SAC) allocates these funds to weed and pest districts for treatments. Districts may conduct treatment internally, or sub-contract as needed. At the end of the season the districts provide a report to the WDA. These are then compiled, and WDA submits a comprehensive report to WYDOT.

Funding shortfalls in this program (as reported below) reflect actual expenditures for completed noxious treatments. They do not represent what the cost would be to control all noxious species known to be present on state rights-of-way.

2022 WYDOT				
WP District	Allocation	Program Cost	**Overage Paid**	WP Dist. Cost
Albany	$21,480	$21,279		
Big Horn	$12,250	$16,656	$3,569	$837
Campbell	$23,015	$19,161		
Carbon	$26,880	$52,849	$21,035	$4,934
Converse	$22,400	$18,885		
Crook	$22,150	$23,150		$1,000
Fremont	$34,300	$35,866	$1,268	$298
Goshen	$14,560	$14,560		
Hot Springs	$13,500	$13,342		
Johnson	$22,960	$23,599		$639
Laramie	$31,080	$36,029	$4,009	$940
Lincoln	$21,280	$27,957	$5,408	$1,269
Natrona	$12,330	$4,760		
Niobrara	$11,875	$11,616		
Park	$34,160	$34,585		$425
Platte	$16,800	$17,096		$296
Sheridan	$30,800	$26,340		
Sublette	$19,780	$14,206		
Sweetwater	$13,000	$13,000		
Teton	$33,680	$30,371		
Uinta	$14,560	$15,005		$445
Washakie	$9,520	$7,330		
Weston	$10,140	$8,305		
Total	**$472,500**	**$485,945**	**$35,289**	**$11,081**

2023 WYDOT				
WP District	Allocation	Program Cost	**Overage Paid**	WP Dist. Cost
Albany	$22,256	$16,731		
Big Horn	$15,338	$21,842	$5,317	**$1,062**
Campbell	$23,791	$18,802		
Carbon	$42,905	$51,314	$6,874	**$1,373**
Converse	$23,176	$25,857	$2,192	**$438**
Crook	$22,926	$28,997	$4,963	**$991**
Fremont	$37,675	$42,185	$3,687	**$737**
Goshen	$15,336	$15,336		
Hot Springs	$14,276	$1,540		
Johnson	$27,372	$24,122		
Laramie	$34,014	$34,596		**$582**
Lincoln	$27,253	$38,475	$5,087	
Natrona	$13,106	$5,635		
Niobrara	$12,651	$11,081		
Park	$34,323	$34,486		
Platte	$17,576	$31,959	$11,758	
Sheridan	$31,576	$27,566		
Sublette	$20,556	$22,061	$1,230	
Sweetwater	$13,776	$13,778		
Teton	$34,456	$34,456		
Uinta	$16,950	$18,514	$1,278	**$255**
Washakie	$10,296	$7,460		
Weston	$10,916	$11,048		**$132**
Total	**$522,500**	**$537,841**	**$42,386**	**$5,571**



Prairie Dogs

Prairie dogs were identified as a nuisance rodent by the 1886 Territorial Legislature and were listed as a noxious species in 1973. Not all W&P districts conduct prairie dog control programs, and most sizeable programs are found in eastern Wyoming counties. Control programs reduce destruction of grazing and forage, and prevent outbreaks of sylvatic plague. W&P districts create management plans, apply rodenticides, and costshare with landowners for rodenticides and sometimes for contracted applications.

2023 Prairie Dog Control Contributions				
	W&P	Landowners	State Lands	USFS
Campbell	$ 122,990	$ 103,890		$ 6,080
Platte	$ 107,590	$ 41,896	$ 7,119	
Crook	$ 70,497	$ 40,648		
Weston	$ 40,000			$ 35,000
Goshen County	$ 120,000	$ 95,000		
Converse	$ 85,086	$ 17,132		
Johnson	$ 199,552			
Sheridan	$ 28,300	$ 28,300		
Niobrara	$ 52,721	$ 14,522	$ 2,320	
Natrona	$ 14,257	$ 1,786		
Total	$ 840,993	$ 343,174	$ 9,439	$ 41,080

Emergency Insect Management Program

The 2003 Wyoming Legislature passed the Emergency Insect Management Program Act (EIMPA) (W.S. 11-5-401 through 11-5-405) to provide funding to state agencies and political subdivisions such as cities, towns, counties, special districts, and tribes. This funding is to provide supplemental help to manage emergency outbreaks of insect pests and insect vectors of diseases for the protection of human health and safety, animal health including livestock and wildlife, agriculture and natural resources. Grantees are required to provide a 1:1 match.

Funding is allocated through the Emergency Insect Management Committee which is comprised of the Directors of the Wyoming Department of Agriculture, the Wyoming Game and Fish Department, the Wyoming Department of Health, the State Veterinarian, and the Governor (or their duly appointed designees).

In 2023, EIMP awarded $681,840, and grantees provided $2,453,509 in matching funds. In 2024, $716,593 was allocated, with $1,906,955 of pledged match. This program is usually able to fund around 80% of requests, but in 2024, only 62% could be funded.

	2024 EIMP	Requsted Funds	Approved Funds	Match Funds	Shortfall
Grasshopper	Carbon Co. W&P	$ 12,422	$ 8,199	$ 20,954	$ 4,223
	Crook Co. W&P	$ 88,229	$ 58,231	$ 58,231	$ 29,998
	Goshen Co. W&P	$ 20,000	$ 13,200	$ 13,200	$ 6,800
	Hot Springs Co. W&P	$ 4,000	$ 2,640	$ 7,103	$ 1,360
	Natrona Co. W&P	$ 9,844	$ 6,497	$ 42,863	$ 3,347
	Platte Co. W&P	$ 25,000	$ 16,500	$ 16,504	$ 8,500
	Uinta Co. W&P	$ 9,650	$ 6,369	$ 10,560	$ 3,281
	Grasshopper Programs Totals	**$ 169,144**	**$ 111,635**	**$ 169,415**	**$ 57,509**
West Nile Virus	Albany County Commissioners	$ 106,610	$ 72,495	$ 114,065	$ 34,115
	Town of Baggs	$ 29,645	$ 11,500	$ 71,494	$ 18,145
	Town of Byron	$ 13,388	$ 8,836	$ 8,836	$ 4,552
	Cheyenne-Laramie County Public Health	$ 90,000	$ 63,000	$ 154,000	$ 27,000
	Town of Cokeville	$ 3,000	$ 3,000	$ 3,000	$ -
	Town of Cowley	$ 6,000	$ 5,400	$ 7,290	$ 600
	Daniel Mosquito Abatemnt District	$ 7,000	$ 6,886	$ 6,886	$ 114
	Town of Deaver	$ 9,228	$ 6,000	$ 10,243	$ 3,228
	Goshen Co. W&P	$ 73,000	$ 65,700	$ 65,700	$ 7,300
	Town of Greybull	$ 5,000	$ 4,500	$ 12,915	$ 500
	Town of Guernsey	$ 10,000	$ 9,300	$ 27,343	$ 700
	Hot Springs Co. W&P	$ 50,065	$ 46,560	$ 62,439	$ 3,505
	City of Kemmerer	$ 2,998	$ 2,998	$ 12,513	$ -
	Town of LaBarge	$ 6,704	$ 5,429	$ 5,429	$ 1,275
	City of Lander	$ 5,580	$ 5,189	$ 5,194	$ 391
	City of Laramie	$ 38,165	$ 30,532	$ 740,297	$ 7,633
	Natrona Co. W&P	$ 61,799	$ 40,000	$ 42,252	$ 21,799
	Northern Arapahoe Tribe-Wind River Family & Community Health	$ 20,676	$ 18,500	$ 18,673	$ 2,176
	Town of Opal	$ 3,885	$ 2,800	$ 2,800	$ 1,085
	City of Powell	$ 10,700	$ 7,100	$ 7,100	$ 3,600
	City of Riverton	$ 35,250	$ 32,783	$ 32,783	$ 2,468
	Town of Saratoga	$ 36,134	$ 12,000	$ 20,684	$ 24,134
	Sheridan County Weed & Pest	$ 80,000	$ 53,000	$ 56,424	$ 27,000
	Town of Shoshoni	$ 1,450	$ 1,450	$ 1,450	$ -
	Sublette Co. Mosquito Abatemnt District #2	$ 21,000	$ 13,000	$ 42,730	$ 8,000
	Teton County Weed & Pest District	$ 40,000	$ 32,000	$ 160,000	$ 8,000
	Uinta County	$ 150,000	$ 45,000	$ 45,000	$ 105,000
	WNV Programs Totals	**$ 917,277**	**$ 604,958**	**$ 1,737,540**	**$ 312,319**
	2024 EIMP Totals	**$ 1,086,421**	**$ 716,593**	**$ 1,906,955**	**$ 369,828**

2023 EIMP	EIMP Funds	Match Funds
Goshen County Weed and Pest Control District	**$ 15,000**	**$ 33,303**
Albany County Commissioners	$ 83,024.00	$ 156,461
Town of Baggs	$ 11,500.00	$ 34,609
Cheyenne-Laramie County Health Department (CLCHD)	$ 75,000.00	$ 327,276
Town of Cokeville	$ 3,000.00	$ 3,000
Town of Cowley	$ 5,400.00	$ 7,500
Town of Deaver	$ 6,000.00	$ 9,444
Town of Frannie	$ 2,483.01	$ 4,920
Goshen County Weed and Pest Control District	$ 72,934.00	$ 74,811
Town of Greybull	$ 7,500.00	$ 20,298
Town of Guernsey	$ 10,000.00	$ 22,201
Hot Springs County Weed and Pest Control District	$ 50,467.00	$ 83,246
City of Kemmerer	$ 3,000.00	$ 11,802
Town of LaBarge	$ 5,429.00	$ 5,529
City of Lander	$ 9,732.00	$ 12,166
City of Laramie	$ 35,560.00	$ 806,263
Mosquito Abatement District #2 (Sublette County, WY)	$ 13,000.00	$ 75,673
Natrona County Weed and Pest Control District	$ 44,462.00	$ 50,606
Town of Opal	$ 1,395	$ 1,395
City of Powell	$ 8,100.00	$ 9,894
City of Riverton	$ 35,054.00	$ 35,054
Town of Saratoga	$ 12,000.00	$ 36,147
Sheridan County Weed & Pest	$ 47,500.00	$ 73,616
Town of Shoshoni	$ 1,450.00	$ 1,450
Teton County Weed & Pest	$ 40,000.00	$ 231,805
Uinta County Mosquito Control	$ 60,000.00	$ 240,000
Washakie County Weed & Pest	$ 22,850.00	$ 85,040
WNV Programs Totals	**$ 666,840.01**	**$ 2,420,206**
2023 EIMP Totals	**$ 681,840**	**$ 2,453,509**

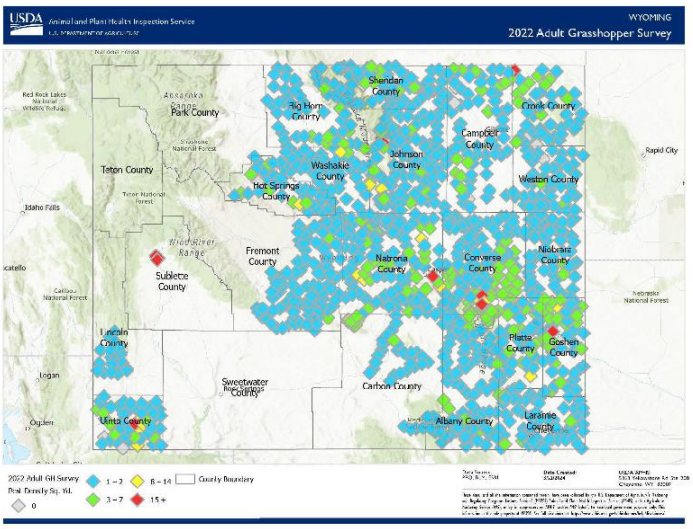
Grasshopper Outbreak Maps

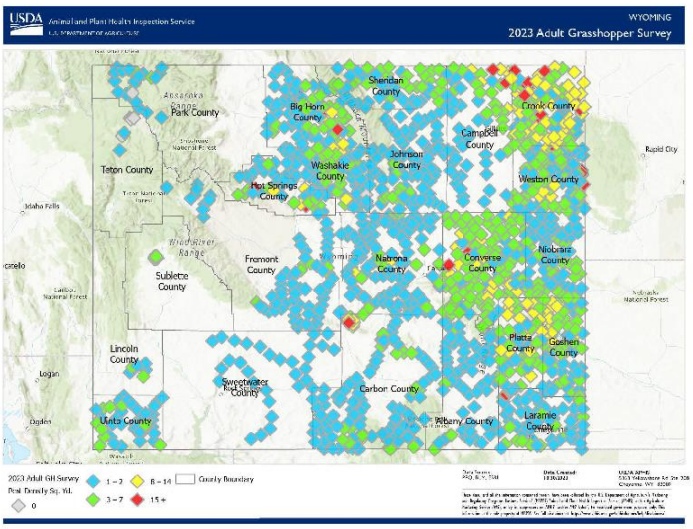
USDA, Animal & Plant Health Inspection Service (APHIS), Plant protection & Quarantine (PPQ) conducts two types of surveys for grasshoppers (GH) and Mormon crickets (MC) throughout Wyoming.

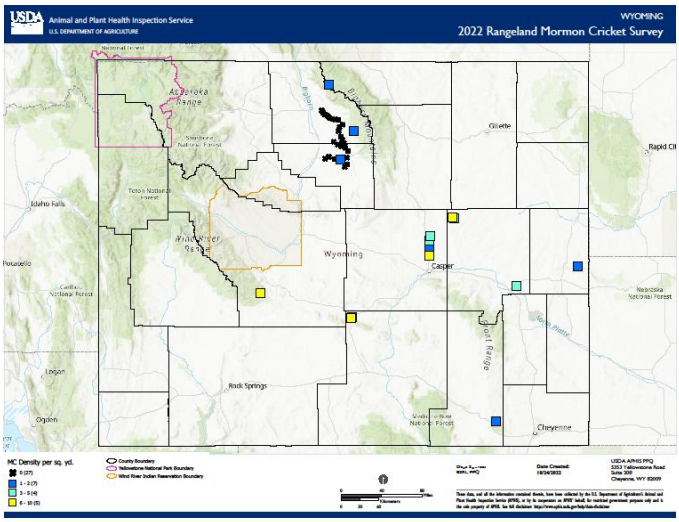
Nymphal surveys in late spring and early summer are focused in areas where landowners and/or land managers request surveys, and in areas that had high densities of adults the previous year. If surveys identify high densities of GH or MCs, that data and information is quickly relayed to cooperators (usually beginning with W&P districts) in order to make management decisions.

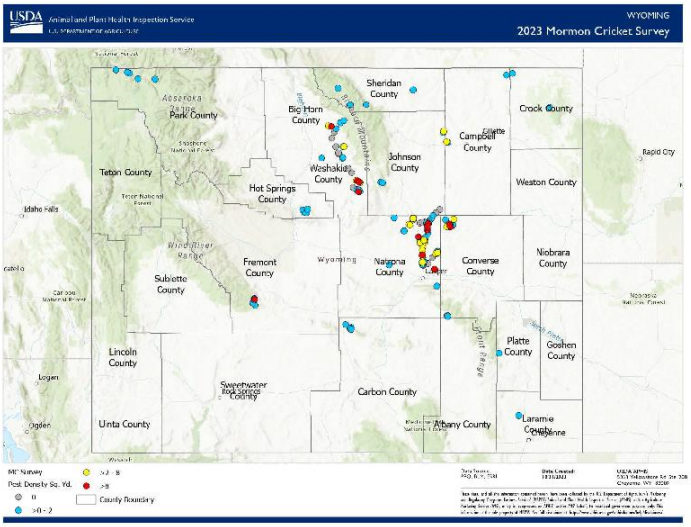
Adult surveys are conducted in late summer and early fall. The goal of the adult survey is to identify areas of Wyoming that have high densities of egg laying GH/MCs, which may result in large hatches the following spring. Adult surveys are conducted on as close to a five-mile grid as public roads and permission to access private lands allow. These data are mapped and used for outreach, landowner meetings, communication with cooperators, and some predictions of where outbreaks may occur the following year. The hazard map is national in scope and is based on the previous year's adult survey data.

Wyoming's APHIS-PPQ office has been a key partner in grasshopper and Mormon cricket control across the state for decades. They face a difficult budget situation almost every year. Often they have insufficient funding, and when they do receive their funding request, that authorization comes late in the control season. This makes planning extremely difficult for them, and difficult to make plans with their partner organizations. To fill this shortfall, districts draw from their mil levies, and make more requests from the EIMG.









Wyoming Weed & Pest Council Strategic Planning Committee

The WWPC Strategic Planning Committee was created to develop and monitor priorities and objectives for the Wyoming Weed and Pest Council and related committees. The initial creation of a Council-wide strategic framework involved several moderated sessions with all of the districts to develop priorities, objectives, and goals. The Governor's Invasive Species Initiative Report (GISI) and W.S. § 11-5-120 provided further direction for the Strategic Planning Committee. The duties assigned to the Council in § 11-5-120 12 were incorporated into the strategic framework document. This working document identifies priorities for the Council as well as short- and long-term goals, and is updated at least annually.

Mission Statement:	
Providing unified support and leadership for integrated management of noxious weeds and pests to protect economic and ecological resources in the State of Wyoming	
Core Values:	**Council Bylaw Objectives:**
Science and research	Provide for the exchange of information among its members, districts, and other agencies relative to the control of weeds and pests, through periodic meetings and other appropriate means
Commitment and fellowship	Cooperate with local, state, regional, and national agencies, both public and private, to solve problems relating to weeds and pests
Collaboration	Consider and refer to the proper agencies and organizations problems of mutual concern in the field of weed and pest research, education, and regulation
Healthy rangelands, ecosystems, and agricultural systems	Disseminate pertinent information to members, districts, the press, and the public
Adherence to state statutes, rules and regulations	Encourage research on weed and pest control through government, university, and private agencies
Valuable public service	Promote uniformity and coordination of activities among districts and regulatory agencies, who are concerned with weeds and pests
Leadership through integrity, candor and professionalism	Recommend desirable weed and pest laws, and amendments thereto, as may be essential to the state weed and pest program, and to serve as a clearinghouse for legislative requests of various organizations regarding the weed and pest program
	Perform such duties as may be required by Wyoming State law

Strategic Framework to address state statutes:					
To aid county weed and pest control districts in creating, managing and enhancing coordinated and comprehensive invasive species management programs					
W.S. § 11-5-120					
Coordinate with Stakeholders to increase public awareness	**Coordinate with the University of Wyoming and Community Colleges to assess impacts of invasive species on socio-ecological systems**	**Coordinate with the University of Wyoming, Community Colleges, and government agencies to support and expand outreach and provide applied reasearch on invasives species management**	**Development and impliment data systems to support local districts**	**Work with state and federal partners to reduce barriers to timely and effective invasive species management**	**Encouraging/incentivising cooperative, landscape scale invasive species managment**

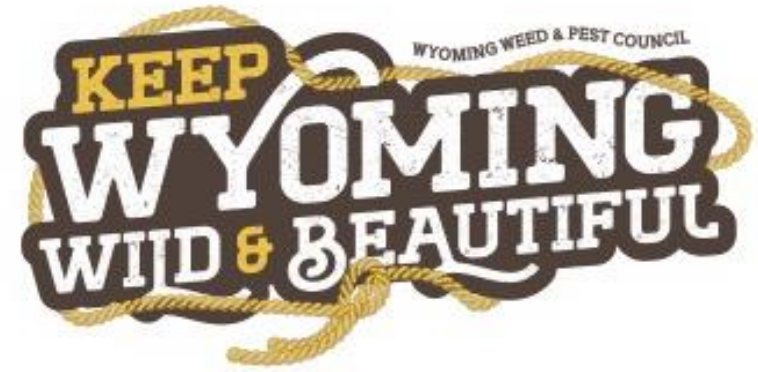
Thanks to funding from SAC, the Council, and individual Districts, a statewide outreach campaign has been launched to support the Council's Strategic Plan. The goals and objectives are: build the WWPC brand, simplify the invasive/pest message, increase awareness and modify behavior. Keep Wyoming Wild & Beautiful was launched in 2022.

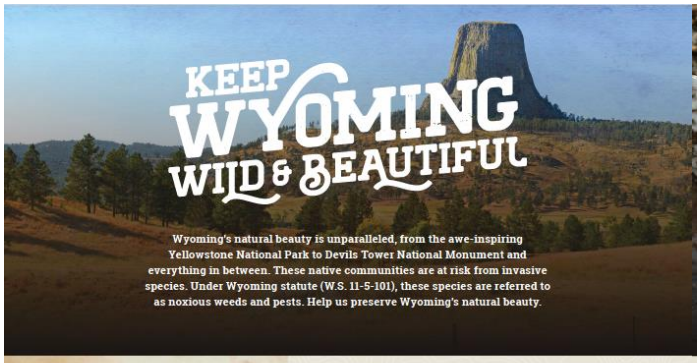
Highlights (2022 & 2023):

- Digital campaign delivered 3.5 million impressions (people exposed to message)
- Hiking/fishing audience both years saw the highest engagement rate- (click through to more info)
- Over 73% of WWPC message is received on smart phones
- 23 Press Releases with over 187 editorial hits across the state and 7.17 million impressions

- February 2023 Celebrated the 50th Anniversary of the WY Weed and Pest Control Act

Below are some examples of the outreach created as part of WWPC's campaign.



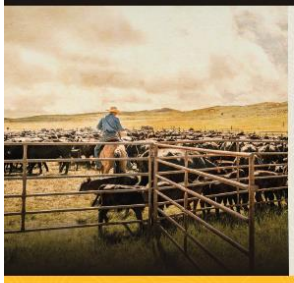


KEEP WYOMING WILD & BEAUTIFUL

Wyoming's natural beauty is unparalleled, from the awe-inspiring Yellowstone National Park to Devils Tower National Monument and everything in between. These native communities are at risk from invasive species. Under Wyoming statute (W.S. 11-5-101), these species are referred to as noxious weeds and pests. Help us preserve Wyoming's natural beauty.

TAKE ACTION

Whether you live, work, or play in Wyoming, curbing the spread of invasive species is a shared responsibility. Everyone can contribute to helping Keep Wyoming Wild and Beautiful.



ABOUT US

For more than 50 years, the Wyoming Weed and Pest Council has dedicated its resources and leadership to managing and limiting the spread of invasive species. The Council's effort and commitment ensure that Wyoming remains a beautiful and pristine environment for outdoor enthusiasts and landowners.

OUR MISSION

The Council's mission continues to be to provide unified support and leadership for the integrated management of noxious weeds and pests to protect economic and ecological resources in the state of Wyoming.

IF YOU WORK THE LAND OR MANAGE LIVESTOCK,

you can take a few simple actions to help protect crops and livestock, plus promote the health of agricultural operations.

1. Get involved.
2. Use certified weed free products.
3. Identify and report noxious weeds.

WYOMING WEED PEST COUNCIL

KEEP WYOMING WILD & BEAUTIFUL

Learn more at wyoweed.org/get-involved

Appendix

Pesticide Registration Fee (PRF) and Special Management Program (SMP) Projects

Big Horn Co. W&P
Horse Creek Project (2-year project)
Partners: BLM, Private Landowners, OSLI, USFS

Target species: whitetop, other listed noxious

Project Summary: Treatment of noxious species within the Horse Creek Drainage, prioritizing whitetop, but also treating other noxious species as found. This project included backpack, UTV, and aerial herbicide application, along with aerial and ground survey and monitoring recorded as GIS data.

Big Horn Co. W&P
Trapper Creek Project (2-year project)
Partners: BLM, Private Landowners, OSLI, USFS

Target species: any listed noxious species as found

Project Summary: Targeted coordination with landowners in the Trapper Creek Drainage to create management plans that can be perpetuated individually after the SAC funded project's completion. This project surveyed for and treated all noxious species found on each participant's property.

Campbell Co. W&P
Campbell County Ventenata Project
Partners: BLM, Private Landowners

Target species: ventenata grass

Project Summary: Aggressive treatments of large blocks encompassing private and BLM. This project expanded treatments previously performed by Campbell Co. W&P by recruiting new landowners with invaded acreage. This project included detailed mapping to plan additional work and assess previous treatments.

Crook Co. W&P
Green Mountain Project
Partners: Private Landowners

Target species: leafy spurge, spotted knapweed, other noxious as found

Project Summary: This project was created control leafy spurge and houndstongue on the entirety of Green Mountain. Once underway, unknown infestations of other noxious species were found and treated, notably, a large population of spotted knapweed. Much of this project was sprayed by landowners on their own property.

Crook Co. W&P
Sundance Mountain Project
Partners: Private Landowners

Target species: ventenata grass, medusahead grass

Project Summary: Complete survey of Sundance Mountain to determine the possible presence of ventenata and medusahead grasses. None was found. Following survey, other small noxious infestations were treated, including leafy spurge, spotted knapweed, Dalmatian toadflax, houndstongue, common mullein, and musk thistle.

Fremont Co. W&P
Government Draw Leafy Spurge and Cheatgrass (SMP)
Partners: WGFD

Target species: leafy spurge, cheatgrass

Project Summary: Large aerial blocks to treat cheatgrass and leafy spurge, along with landowner treatments of other noxious species adjacent to the treatment blocks. This project continues work previously done by FCWP in partnership with BLM and WWNRT.

Goshen Co. W&P
Goshen County Dalmatian Toadflax Control Project
Partners: Goshen Co. CRM, private landowners

Target species: Dalmatian toadflax

Project Summary: This project focuses on finding every Dalmatian toadflax plant on Goshen Co. rights-of-way. Landowners in Goshen Co. with toadflax infestations also receive assistance as part of this project. Infestation core is treated aerially.

Goshen Co. W&P
Goshen County Prairie Dig Control Project
Partners: WGFD, OSLI, Private Landowners

Target species: prairie dogs

Project Summary: This is a cost-share program for landowners in Goshen Co. for prairie dog control, both for rodenticide, and for application. GCWP also offers education and treatment plans as part of this program.

Hot Springs Co. W&P
Grass Creek Weed Management Area
Partners: Private Landowners

Target species: ox-eye daisy, spotted knapweed, whitetop, Russian knapweed, cheatgrass

Project Summary: This is a cooperative weed management area project. All landowners and land managers in the Grass Creek drainage work together to create weed control priorities and projects, and participate in field application days. This project has significantly and consistently reduced whole species infestations.

Hot Springs Co. W&P
Kirby Creek Weed Special Weed Management Zone (SMP)
Partners: Private Landowners, OSLI

Target species: whitetop

Project Summary: This is single species, whole drainage project. Aggressive aerial and ground treatments are applied to all whitetop infestations in the Kirby Creek drainage. Landowners are extremely proactive in this project, and conduct many treatments.

Johnson Co. W&P
Leafy Spurge SMP (SMP)
Partners: BLM, USFS, OSLI

Target species: leafy spurge

Project Summary: This is a long-term program to strategically control leafy spurge in Johnson County. Thousands of acres are treated each year, but those change to new areas as weed populations are reduced and native plants recover in previously treated parts of the county.

Johnson Co. W&P
Johnson County Russian Olive and Saltcedar Project
Partners: BLM, Sussex Irrigation District, Private Landowners

Target species: Russian olives, saltcedar

Project Summary: This project systematically clears Russian olive and saltcedar from the Powder River corridor. More than 100 stream miles and 3 tributaries have been cleared, and have restored lost grazing land.

Laramie Co. W&P
Curt Gowdy/Pole Mountain Cheatgrass/Invasive Weed Project
Partners: Muley Fanatics, WWNRT, WGFD, USFS, Laramie Co. Conservation Dist., Curt Gowdy State Park

Target species: cheatgrass

Project Summary: This project is aerial treatments of cheatgrass in Curt Gowdy State Park. Treatments were prioritized for areas likely to show good reestablishment of perennial species, and over the two years of this project, reestablishment has been exceptional.

Lincoln Co. W&P
Grey's River Spotted Knapweed Project
Partners: USFS, BLM, WGFD, OSLI, Town of Alpine

Target species: spotted knapweed

Project Summary: This project is a large-scale assault on spotted knapweed throughout northern Lincoln County (especially the Town of Alpine), and involves a work plan with Sublette and Teton Counties. It includes extensive mapping, and both herbicide application and lots of hand pulling.

Northeast Wyoming Invasive Grasses Working Group (NEWIGWG) via Sheridan Co. W&P

Northeast Wyoming Districts Ventenata and Medusahead Treatments
Partners: NRCS

Target species: ventenata, medusahead

Project Summary: This project aggressively treats the invasive annual grasses ventenata and medusahead in Sheridan, Campbell, Johnson, and Crook counties. It includes the aerial application of indaziflam on infestation blocks, and state-of-the-art aerial mapping and analysis to determine infestation and efficacy of herbicide treatments.

Park Co. W&P
North Park County Spotted Knapweed Project
Partners: Two Dot Ranch

Target species: spotted knapweed, houndstongue

Project Summary: This project built upon previous spotted knapweed treatments in northern Park County. Treatment areas were identified in a previously funded PRF grant. 278 acres of spotted knapweed and houndstongue were treated in difficult terrain.

Platte Co. W&P
Platte County Cheatgrass Control
Partners: WGFD, Private Landowners

Target species: cheatgrass

Project Summary: This project is strategic aerial applications of indaziflam on cheatgrass infestations in Platte County. It includes a five-year mapping/monitoring plan to ensure continued control, and assess the need for follow-up applications.

Platte Co. W&P
Platte County Cheatgrass Control
Partners: WDA (state lands allocation), Private Landowners

Target species: black-tail prairie dogs

Project Summary: This project is a comprehensive treatment of prairie dogs in Platte County. It includes extensive GIS mappings, rodenticide application, and follow-up treatments by landowners and lessees. Costshare to landowners for rodenticide in also included in this program.

Uinta Co. W&P
Ox-eye Daisy, Cinquefoil Grant
Partners: Private Landowners

Target species: ox-eye daisy, sulfur cinquefoil

Project Summary: This project targets ox-eye daisy and cinquefoil primarily in hay meadows at the base of the Uinta Range. UCWP coordinates a spray block for area landowners to create a contiguous spray block. This project increases hay production, grazing and forage, and prevents spread of these species into forest lands.

Washakie Co. W&P
Cottonwood/Gooseberry Creek Project

Target species: saltcedar, Russian knapweed, Russian olive, perennial pepperweed, whitetop

Project Summary: This is a continuation of a project in the entire Cottonwood Creek corridor to remove woody invasive species, which began with mastication of saltcedar and Russian olive. Successive control measures have included extensive treatments of re-sprouts, and herbicide application to control secondary weed species that germinate once canopy has been removed, such as pepperweed and whitetop.

Weston Co. W&P
Weston County Hoary Cress
Partners: Private Landowners

Target species: whitetop

Project Summary: This project focuses on containing whitetop to the Oil Creek drainage. A similar number of acres are aerially treated each season, but infestation densities continue to decline. Ground treatment acres are likewise similar, but include an increasing number of stream miles as density decreases.

Weston Co. W&P
Upton Leafy Spurge Program
Partners: BLM, USFS-TBNG, Inyan Kara Grazing, Private Landowners

Target species: leafy spurge

Project Summary: This project is an aggressive aerial treatment of leafy spurge in the Upton area. Treatment areas change progressively as control is gained, and new infestations are found. It includes extensive goat grazing control across treatment areas.

WWPC GIS Committee
Statewide EDRR/GIS Infestation Recordation Program
Partners: W&P Districts

Target species: all noxious

Project Summary: This project helps implement state statute for data exchange between W&P districts, the W&P Council, and UW. It includes the creation of infestation databases, preservation of legacy data, biocontrol distribution data, and a W&P project online hub.

WWPC Biocontrol Steering Committee
WY Biocontrol Steering Committee Budget and Grant
Partners: Various W&P Districts

Target species: n/a

Project Summary: This project funds research for new biocontrol agents which will be made available for control projects in Wyoming. It also helps fund biocontrol insect purchases for on-the-ground control projects.

State and Private Forestry (SPF) Projects

Albany Co. W&P
Laramie Peak Project
Partners: Private Landowners

Target species: leafy spurge, spotted knapweed, Dalmatian toadflax

Project Summary: This project is a combination of aerial and ground treatments in difficult terrain in the Laramie Peak and Centennial areas. Good repeated success has resulted from the continued focus on these three species.

Lincoln Co. W&P
Lincoln County Dyer's Woad Project
Partners: BLM, WGFD

Target species: dyer's woad

Project Summary: This project is a comprehensive treatment of dyer's woad in Lincoln County. It includes hand pulling by LCWP, and some costshare for herbicide, but predominantly, this is a bounty program for pulling dyer's woad. More than 21 tons are pulled by youth in Lincoln County at $0.50/pound.

Park Co. W&P
Northfork Project
Partners: Private Landowners

Target species: leafy spurge, Dalmatian toadflax, spotted knapweed, ow-eye daisy, common tansy

Project Summary: This project treats small infestations of high priority species in the Northfork drainage. Along with herbicide treatments, it focuses on education to area landowners. This has resulted in volunteer control efforts on USFS, BLM, and rights-of-way, as well as on private land.

Teton Co. W&P
Snake River Project
Partners: USFS, NPS, Private Landowners

Target species: perennial pepperweed, saltcedar, ox-eye daisy

Project Summary: This first facet of this project is locating target species with dogs specially trained to smell certain weed species. These detections are mapped, then treated by backpack crews. This method has resulted in extensive community support.

Uinta Co. W&P
Bear River Divide, Four Rivers CWMA
Partners: Private Landowners

Target species: blueweed, dyer's woad, Dalmatian toadflax

Project Summary: This project focus on the early detection and treatment of high priority species adjacent to forested areas of Uinta County. Quick and aggressive control of species that have only very small infestations has prevented spread to difficult-to-treat forested lands.

CURRENT & POTENTIAL ECONOMIC IMPACTS OF 10 INVASIVE WEED SPECIES IN WYOMING

A PILOT STUDY OF AGRICULTURAL LOSSES

Amy Nagler, Research Scientist, Department of Agricultural and Applied Economics, University of Wyoming

John Ritten, Professor and AgNext Agricultural Economist and Extension Specialist, Colorado State University

Brian A. Mealor, Professor and Director of Sheridan Research and Extension Center and the Institute for Managing Annual Grasses Invading Natural Ecosystems, Department of Plant Sciences, University of Wyoming

University of Wyoming | College of Agriculture, Life Sciences and Natural Resources

B-1398
November 2024

University of Wyoming | College of Agriculture, Life Sciences and Natural Resources

Current and Potential Economic Impacts of 10 Invasive Weed Species in Wyoming – A Pilot Study of Agricultural Losses

Amy Nagler, Research Scientist, Department of Agricultural and Applied Economics, University of Wyoming

John Ritten, Professor and AgNext Agricultural Economist and Extension Specialist, Colorado State University

Brian A. Mealor, Professor and Director of Sheridan Research and Extension Center and the Institute for Managing Annual Grasses Invading Natural Ecosystems, Department of Plant Sciences, University of Wyoming

Collaborators:

Wyoming Weed and Pest Guiding Principles Committee and all Wyoming Weed and Pest Control Districts

Brian P. Lee - Research Scientist, Department of Agricultural and Applied Economics, University of Wyoming

Andrew Kniss - Professor of Weed Science and Department Head, Department of Plant Sciences, University of Wyoming

Marshall Tanner Hart* - Research Assistant, Sheridan Research and Extension Center, College of Agriculture, Life Sciences and Natural Resources, University of Wyoming *at the time of writing

Acknowledgments:
IMPLAN model, 2022 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com.
Thanks to Dr. Roger Coupal, University of Wyoming Department of Agricultural and Applied Economics, for guidance with IMPLAN modeling.

B-1398 | November 2024

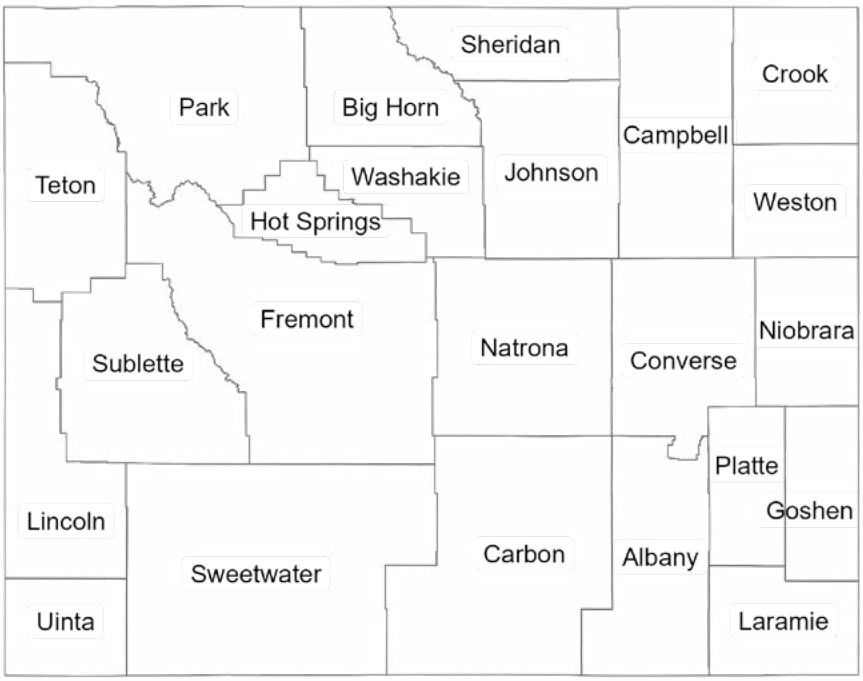
Editor: Brooke Ortel, University of Wyoming Extension
Layout & Design: Jeremy Cain, University of Wyoming Extension
Cover Photo: eleonimages, stock.adobe.com

Issued in furtherance of extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Mandy Marney, Director, University of Wyoming Extension, College of Agriculture, Life Sciences and Natural Resources, University of Wyoming Extension, University of Wyoming, Laramie, Wyoming 82071.

Palmer Amaranth. Photo by Andrew Kniss.

CONTENTS

Figure 1. Wyoming counties.



EXECUTIVE SUMMARY

The widespread and diverse negative impacts of invasive weeds on natural ecosystems of the western U.S. are often discussed in a general sense, but attempts to estimate specific economic impacts are not very common. In response to guidance from a diverse group of Wyoming stakeholders who developed the recommendations in the Governor's Invasive Species Initiative Report, the Wyoming Weed and Pest Council and the University of Wyoming initiated the pilot study reported here to estimate current and potential future impacts of a subset of 10 invasive weed species on Wyoming's agricultural sector with a specific focus on impacts to grazing resources.

We consider this report to be a pilot study because of the focus on a single aspect of the economy and because it does not include all of the state's designated noxious weeds. We used a combination of estimated current acres infested by each weed in each county and the predicted acreage of suitable habitat for each species to estimate 1) current grazing losses and 2) grazing losses if the species were allowed to spread, unmanaged, into all potentially suitable habitat.

While current estimated statewide grazing losses are in the tens of millions of dollars annually, county-level impacts vary widely across the state. Cheatgrass (*Bromus tectorum*) has the highest estimated current and future potential impacts, which may exceed $110 million annually if left unmanaged into the future. If considered in the broader context of Wyoming's economy, these numbers are likely a very conservative estimate of impacts because we only accounted for losses due to grazing reductions.

INTRODUCTION

In October 2020, the Wyoming Governor's Office issued a final report outlining the Governor's Invasive Species Initiative (OWG 2020). One of the priorities identified in the Governor's report is to assess the current extent of invasions and how to best use that information. The economic analysis presented in our pilot study provides an additional layer of information about the impacts of weed infestation across Wyoming. Quantifying the agricultural value at risk can aid in prioritizing species for control and provide a basis for comparison over time.

The analyses presented here focus on the agricultural value lost and at risk from 10 weed species in Wyoming at the county and state level. We consider both the current estimated agricultural value reduced by weed infestation in areas with observed weed presence as well as potential risk for future infestation in areas considered suitable habitat for the selected species. These analyses do not consider economic impacts related to recreation, ecosystem services, wildfire, wildlife habitat, or the like.

The report begins with background and justification for this work, then outlines objectives of the analysis, followed by a discussion of the methods used to define agricultural area and value. Next, the report details weed species distribution to estimate the reduction in agricultural value due to weed infestation and associated economic activity at risk. Statewide results are presented, followed by a summary of each individual species. The report concludes with implications and possible opportunities for extended and related analyses.

Table 1. Definition of agricultural land use categories from aggregated National Land Cover Database (NLCD) land class

NLCD land cover class	Acres in Wyoming	Agricultural land class	Acres in Wyoming
Open Water	445,776		
Perennial Snow / Ice	12,743		
Developed, Open Space	297,591		
Developed, Low Intensity	143,146		
Developed, Medium Intensity	81,125		
Developed, High Intensity	19,404	Non-agricultural	10,224,998
Barren Land	763,893		
Deciduous Forest	251,191		
Evergreen Forest	6,928,433		
Mixed Forest	47,118		
Woody Wetlands	460,226		
Emergent Herbaceous Wetlands	774,352		
Shrub / Scrub	35,453,478	Rangeland	50,622,241
Herbaceous	15,168,762		
Hay / Pasture	915,584	Pasture & hay land	915,584
Cultivated Crops	1,095,648	Cultivated cropland	1,095,648
Total	**62,858,471**		

Source: National Land Cover Database (NLCD) 2019.

BACKGROUND AND JUSTIFICATION

The Wyoming Weed and Pest Council Guiding Principles Committee submitted a proposal to the Wyoming State Allocations Committee to assess the economic impacts of terrestrial invasive weeds in Wyoming. The need to better incorporate economic impacts into planning for invasive weed management in Wyoming was emphasized by Governor Gordon's Invasive Species Initiative Report (OWG 2020). Other states have produced similar assessments, but statewide evaluations for Wyoming have not been undertaken.

The Wyoming Weed and Pest Council partnered with the University of Wyoming and other collaborators to develop this pilot assessment for a subset of species of interest in Wyoming in 2021–2022. This pilot assessment is designed to be used as a model that can be expanded in future years.

Of the 30 plants declared as weeds in Wyoming statute 11-5-105(b)(vi), 10 are included in the initial pilot project. The 10 focal species selected for analysis were chosen to provide a cross section of important weedy species, including both widespread and emerging species, a diversity in taxonomic status, and a variety of growth forms (grasses, forbs, trees, annuals, perennials, etc.). These species are:

- Cheatgrass / downy brome (*Bromus tectorum*)
- Hoary cress / whitetop (*Lepidium draba*)
- Leafy spurge (*Euphorbia esula*)
- Medusahead wildrye (*Taeniatherum caput-medusae*)
- Palmer amaranth (*Amaranthus palmeri*)
- Perennial pepperweed (*Lepidium latifolium* L.)
- Russian knapweed (*Acroptilon repens*)
- Russian olive (*Elaeagnus angustifolia*)
- Ventenata (*Ventenata dubia*)
- Yellow starthistle (*Centaurea solstitialis*)

OBJECTIVES

The overarching goals of this pilot study are 1) to accurately estimate current (2022) impacts of invasive weeds to primary sectors of Wyoming's economy, with a specific focus on agriculture, and 2) to estimate future agricultural value placed at risk if target species were allowed to expand into all suitable habitat. A multidisciplinary team (including weed and plant scientists, agricultural economists, and extension specialists) are collaborators in compiling and analyzing biological and ecological information to inform economic analyses at the state and county scales.

More specifically, objectives of this pilot project are to use best estimates of current spatial extent of infestations for each target species in Wyoming and to compile existing habitat suitability data for these species to estimate direct grazing and crop losses from weed infestations related to current infestation levels and potential future distribution in the absence of continued management.

In summary, our approach consisted of estimating economic impacts of invasive weed species across Wyoming by identifying and quantifying agricultural uses and values affected by each identified species, then combining use impact estimates for the extent of infestation of each species

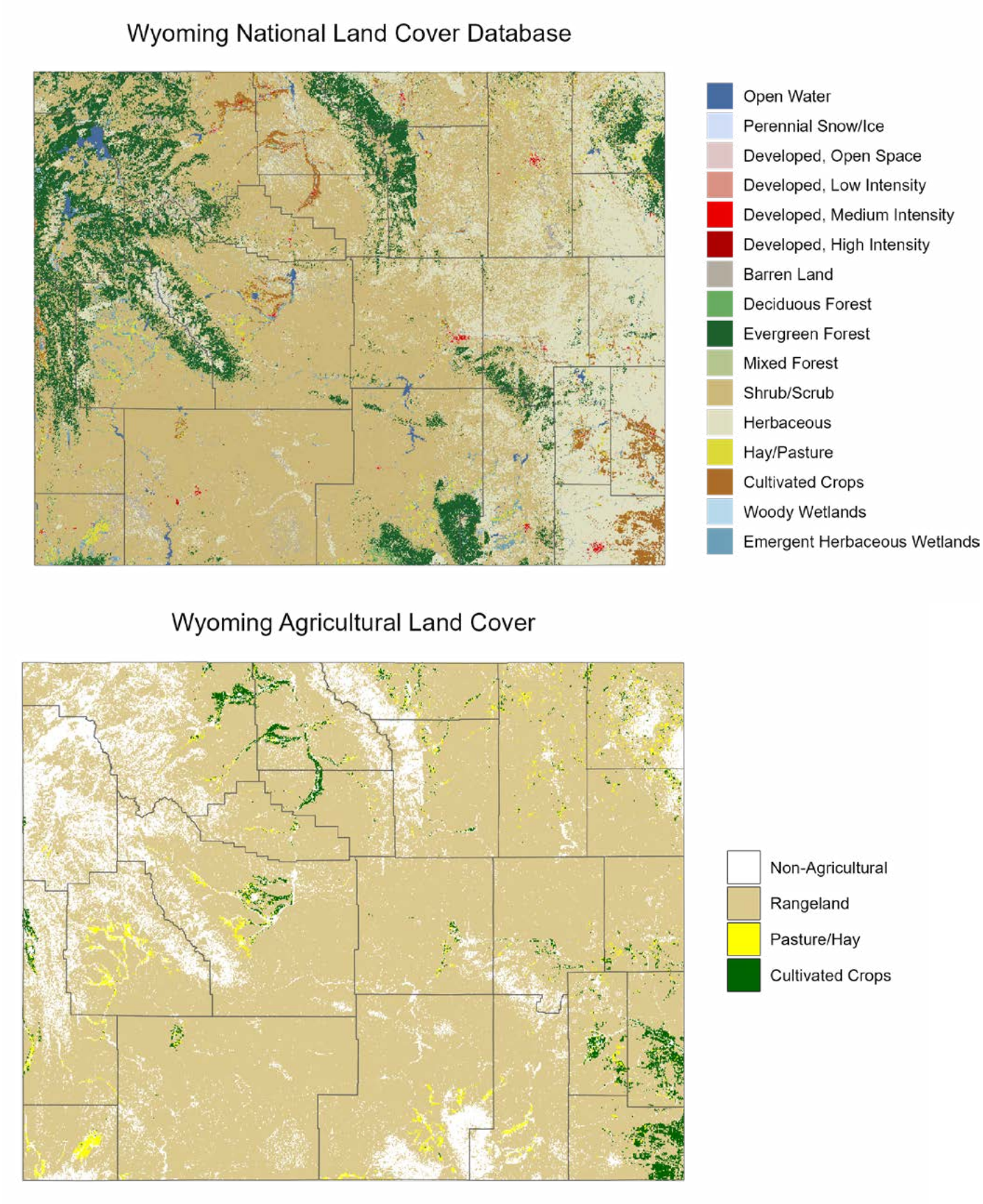


Figure 2. National Land Cover Database showing all land cover categories (above) and selected, aggregated agricultural land cover categories (below) for Wyoming counties.

to quantify direct agricultural costs (cash rent loss due to weed infestation) of infestation for each species at the county and state level. Use impacts are estimated as weed-specific loss in agricultural rents. This valuation method is further applied to all suitable habitat to estimate agricultural value at risk. Economic impact analysis extends loss valuation to consider secondary spending at risk from the loss of potential agricultural income. Total economic activity at risk considers primary loss in agricultural rents (Direct Loss) as well as secondary household spending, which is the portion of foregone household income that would otherwise have been spent and re-spent locally (Induced Loss). Economic impact analysis terms are defined in the "Methods: Total Economic Activity at Risk" section below.

METHODS

Estimating foregone economic value resulting from weed infestations on agricultural land requires 1) a non-impacted baseline economic value of agricultural production; 2) the proportion of areas impacted by weed infestations; and 3) the estimated reduction in production, on a per-acre basis, expressed as reduced grazing and crop production value due to each weed species. The cost of weed presence is estimated as the product of reduced grazing and crop values in each of Wyoming's 23 counties (Figure 1) for agricultural uses that are impacted by each of the 10 identified weed species. Summing across county estimates provides an estimate of statewide direct effects.

AGRICULTURAL LAND COVER AND VALUE

To estimate county-level cost associated with weed infestations, agricultural land cover combined with respective agricultural production values are used to quantify economic impacts of each weed species.

Land cover is described using the National Land Cover Dataset (NLCD) (Dewitz and USGS 2021) (Figure 2, top). Agricultural land cover is aggregated from NLCD land cover class as rangeland, pasture and hay, and cultivated crop production (described in Table 1). Table 1 includes statewide area totals. The proportion of each of these agricultural land cover categories multiplied by total county area provides a base agricultural use area in each county. The bottom map in Figure 2 shows how these aggregated land cover categories are distributed across the landscape in Wyoming; Table 2 reports agricultural land cover acreage for each category across individual Wyoming counties.

The value of agricultural production associated with livestock and crop land cover categories is estimated using county-level annual cash rent per acre (county estimates of the cash rent paid for different types of agricultural land) reported by the USDA's National Agricultural Statistics Service (NASS) for 2021 (Table 3). Annual agricultural value per acre of livestock-related land cover—rangeland and pasture and hay land cover categories—is estimated using annual cash rent for pastureland (NASS 2021a). Weed-infested cropland is considered to be non-irrigated for valuation purposes; agricultural value of cultivated cropland land cover is estimated using 2021 annual cash rent for non-irrigated cropland (NASS 2021b).

Multiplying county land cover acreage for each land use category (Table 2) by respective annual per-acre agricultural rent (Table 3) results in an estimated agricultural value for each county in Wyoming (Table 4). This value, reduced by weed presence and impact areas (described below), is used to calculate county-level and statewide economic loss for each of the 10 invasive weed species considered in this report.

WEED PRESENCE, IMPACTED AREA, AND SUITABLE HABITAT

We consulted Weed and Pest Control District personnel to provide county-specific information for each of the 10 species selected for economic impacts analysis, including two estimates of weed infestation:

- ***Presence:*** total acreage in a county where a weed is present; and
- ***Impacted:*** acreage where the estimated canopy cover of that weed species exceeds 20%.

Acreage for weed presence is reported in Table 5; weed-impacted acreages are reported in Table 6 for each county in Wyoming.

Suitable habitat for each weed species (except Palmer amaranth) is estimated as modeled by the USGS Invasive Species Habitat Tool, INHABIT (USGS n.d.; Young et al. 2020), which includes three levels of potential weed distribution: precautionary (more inclusive), balanced (moderate estimate), and targeted (more restrictive).[1] In this report, we use the moderate "balanced" model to estimate potential economic impacts on suitable habitat. For the remainder of this report, "suitable habitat" refers to area defined by the INHABIT moderate model with the following exception. Table 7 reports total county area and area estimated for suitable weed habitat acreage for individual species across the state.

Note that because Palmer amaranth does not currently have suitable habitat modeled by INHABIT, we used a different approach to estimate its potential suitable habitat in Wyoming. After consulting with several weed scientists, we considered all cultivated cropland (Dewitz and USGS 2021) to be suitable habitat for Palmer amaranth.

Each of the 10 weeds selected for economic impact estimation can be classified by its association with a particular agricultural land category or categories, as reported in Table 8.

1 Targeted estimates use more stringent criteria for ecological characteristics, relative to the balanced model, predicting where each species may be able to exist; precautionary acreage uses a somewhat less stringent criteria than the balanced model and is more inclusive of potential sites, leading to a more liberal estimate of suitable acres.

Table 2. Area (acres) related to agricultural production by Wyoming county

Wyoming county	Rangeland	Pasture & hay	Cropland	Non-ag	Total
Albany	2,244,026 (81%)	32,775 (1%)	0	480,796 (17%)	**2,757,597 (100%)**
Big Horn	1,535,911 (76%)	21,845 (1%)	116,501 (6%)	347,040 (17%)	**2,021,297 (100%)**
Campbell	2,827,012 (92%)	76,042 (2%)	20,093 (1%)	152,892 (5%)	**3,076,038 (100%)**
Carbon	4,179,963 (82%)	91,406 (2%)	949 (<1%)	824,618 (16%)	**5,096,936 (100%)**
Converse	2,443,335 (90%)	15,066 (1%)	22,647 (1%)	248,586 (9%)	**2,729,634 (100%)**
Crook	1,291,123 (70%)	96,219 (5%)	39,192 (2%)	407,295 (22%)	**1,833,829 (100%)**
Fremont	4,782,381 (81%)	81,450 (1%)	71,620 (1%)	994,614 (17%)	**5,930,065 (100%)**
Goshen	1,168,675 (82%)	17,052 (1%)	184,632 (13%)	58,225 (4%)	**1,428,583 (100%)**
Hot Springs	1,156,832 (90%)	10,680 (1%)	6,011 (<1%)	110,571 (9%)	**1,284,094 (100%)**
Johnson	2,199,091 (82%)	25,662 (1%)	14,771 (1%)	432,214 (16%)	**2,671,738 (100%)**
Laramie	1,367,574 (80%)	13,460 (1%)	246,270 (14%)	92,721 (5%)	**1,720,025 (100%)**
Lincoln	1,812,968 (69%)	42,644 (2%)	45,256 (2%)	719,686 (27%)	**2,620,554 (100%)**
Natrona	3,223,706 (94%)	14,234 (<1%)	13,831 (<1%)	188,647 (5%)	**3,440,418 (100%)**
Niobrara	1,563,821 (93%)	24,438 (1%)	27,873 (2%)	65,752 (4%)	**1,681,883 (100%)**
Park	2,973,942 (67%)	33,865 (1%)	92,893 (2%)	1,356,992 (30%)	**4,457,692 (100%)**
Platte	1,120,583 (83%)	32,692 (2%)	78,572 (6%)	119,090 (9%)	**1,350,937 (100%)**
Sheridan	1,150,186 (71%)	38,127 (2%)	34,226 (2%)	394,383 (24%)	**1,616,922 (100%)**
Sublette	2,253,986 (71%)	113,180 (4%)	288 (<1%)	791,360 (25%)	**3,158,813 (100%)**
Sweetwater	6,310,401 (94%	12,287 (<1%)	12,135 (<1%)	379,511 (6%)	**6,714,333 (100%)**
Teton	1,166,723 (43%)	6,261 (<1%)	3,235 (<1%)	1,522,822 (56%)	**2,699,041 (100%)**
Uinta	1,024,563 (77%)	76,944 (6%)	1,632 (<1%)	233,269 (17%)	**1,336,407 (100%)**
Washakie	1,271,902 (89%)	10,005 (1%)	39,545 (3%)	113,874 (8%)	**1,435,326 (100%)**
Weston	1,369,101 (89%)	22,780 (1%)	15,225 (1%)	128,906 (8%)	**1,536,012 (100%)**

Sources: Agricultural Land cover classifications are selected or aggregated from the 2019 National Land Cover Database;
Total county area from U.S. Census Bureau;
Area by land use category = land cover proportion × total acres by county.

Agricultural land type classifications for each weed were determined by weed science collaborators based on economic significance. Cheatgrass, medusahead, and ventenata mainly impact Wyoming rangelands used for livestock grazing; hoary cress has potential economic impacts on all agricultural land types; leafy spurge, per ennial pepperweed, Russian knapweed, and yellow starthistle infestations have potential economic loss on rangeland and pasture and hay land types; Palmer amaranth is considered a risk to economic loss on cultivated cropland; and Russian olive has potential for economic loss on pasture and hay lands.

AGRICULTURAL VALUE REDUCED BY WEED INFESTATION

In agricultural areas, weeds compete for resources such as water, light, and nutrients, resulting in interference that reduces production values. In order to estimate the direct loss in agricultural value due to each weed species, annual cash rent (Table 3) for relevant agricultural land types (Table 8) is multiplied by

1. a percent loss on agricultural land type acreage where the weed is reported as "present";
2. a loss estimate on acreage reported as "impacted" (canopy cover of that weed exceeds 20% of each acre);
3. and an average of present and impacted loss estimates on "suitable habitat" acreages.

Loss estimates reported in Table 9 are collected from literature describing agricultural impacts (livestock forage reduction) from infestation. These impacts were interpreted based on biomass reduction resulting from different levels of infestation on relevant agricultural land types for each weed, as interpreted by weed scientist collaborators on this report. Agricultural loss estimates are used statewide.

The highest economic loss estimates on areas where weeds are reported as present are for Palmer amaranth (70%) and medusahead (65%), followed by cheatgrass, Russian knapweed, and ventenata (40%); Russian olive (35%); hoary cress and perennial pepperweed (15%); and leafy spurge (10%). On impacted areas, defined as infestation of more than 20% canopy cover, Palmer amaranth and medusahead again have the highest loss estimates (100% and 95%, respectively); cheatgrass, Russian knapweed, ventenata, hoary cress, and perennial pepperweed each are estimated at 80% loss; Russian olive at 75%; yellow starthistle at 60%; and leafy spurge at 50%. Again, the percentage of potential loss on suitable habitat is estimated as an average of present and impacted percentages.

TOTAL ECONOMIC ACTIVITY AT RISK

Cash rents on agricultural lands, which we used to estimate the direct economic value reduced by weed infestations, enter county and state economies as household income. Households in turn spend a portion of this income

Table 3. Annual per-acre agricultural production values associated with agricultural land cover categories

Wyoming county	2021 Annual cash rent ($/acre)[1]		
	Rangeland[2]	Pasture & hay[2]	Cultivated cropland[3]
Albany	$3.10	$3.10	$13.00*
Big Horn	$12.50	$12.50	$13.00*
Campbell	$4.00	$4.00	$13.00*
Carbon	$3.20	$3.20	$13.00*
Converse	$3.10	$3.10	$13.00*
Crook	$6.40	$6.40	$12.50
Fremont	$4.90	$4.90	$15.00
Goshen	$6.20	$6.20	$15.00
Hot Springs	$4.90	$4.90	$13.00*
Johnson	$3.80	$3.80	$13.00*
Laramie	$7.10	$7.10	$29.00
Lincoln	$8.00	$8.00	$24.00
Natrona	$2.80	$2.80	$13.00*
Niobrara	$5.60	$5.60	$13.00*
Park	$3.80*	$3.80*	$30.00
Platte	$4.50	$4.50	$12.00
Sheridan	$7.50	$7.50	$13.00*
Sublette	$6.40	$6.40	$13.00*
Sweetwater	$2.50	$2.50	$13.00*
Teton	$3.80*	$3.80*	$13.00*
Uinta	$6.00	$6.00	$13.00*
Washakie	$3.80*	$3.80*	$13.00*
Weston	$4.60	$4.60	$13.00*
Other counties	$3.80	$3.80	$13.00
Statewide	$4.80	$4.80	$17.50

Sources:
[1] Annual cash rent expense reported by the National Agricultural Statistical Service (NASS) 2021
[2] RENT, CASH, PASTURELAND - EXPENSE, MEASURED IN $ / ACRE
[3] RENT, CASH, CROPLAND, NON-IRRIGATED - EXPENSE, MEASURED IN $ / ACRE
* Non-disclosed county value replaced by "Other Counties" value.

Table 4. Baseline estimated annual agricultural values by agricultural land cover category for Wyoming counties

Wyoming county	Rangeland	Pasture & hay	Cultivated cropland	Total
Albany	$6,956,480	$101,602	$0	**$7,058,082**
Big Horn	$19,198,889	$273,065	$1,514,509	**$20,986,463**
Campbell	$11,308,047	$304,166	$261,209	**$11,873,422**
Carbon	$13,375,882	$292,500	$12,335	**$13,680,717**
Converse	$7,574,338	$46,706	$294,410	**$7,915,454**
Crook	$8,263,187	$615,803	$489,905	**$9,368,895**
Fremont	$23,433,667	$399,106	$1,074,296	**$24,907,069**
Goshen	$7,245,782	$105,721	$2,769,474	**$10,120,978**
Hot Springs	$5,668,477	$52,331	$78,144	**$5,798,953**
Johnson	$8,356,546	$97,514	$192,025	**$8,646,085**
Laramie	$9,709,774	$95,563	$7,141,842	**$16,947,179**
Lincoln	$14,503,745	$341,151	$1,086,134	**$15,931,031**
Natrona	$9,026,378	$39,855	$179,799	**$9,246,032**
Niobrara	$8,757,395	$136,851	$362,351	**$9,256,598**
Park	$11,300,980	$128,689	$2,786,776	**$14,216,444**
Platte	$5,042,626	$147,113	$942,862	**$6,132,600**
Sheridan	$8,626,397	$285,949	$444,937	**$9,357,283**
Sublette	$14,425,508	$724,350	$3,741	**$15,153,599**
Sweetwater	$15,776,002	$30,717	$157,755	**$15,964,474**
Teton	$4,433,548	$23,791	$42,060	**$4,499,398**
Uinta	$6,147,378	$461,663	$21,215	**$6,630,256**
Washakie	$4,833,228	$38,021	$514,086	**$5,385,335**
Weston	$6,297,866	$104,789	$197,925	**$6,600,580**
Wyoming total	**$230,262,119**	**$4,847,015**	**$20,567,792**	**$255,676,926**

Source: National Land Cover Database (2019) land cover acres related to agricultural production × National Agricultural Statistics Service annual cash rent (2021) for pasture (used for Rangeland and Pasture & hay) or non-irrigated cropland (used for Cultivated cropland).

on goods and services in the local economy, a portion of which is spent locally by the businesses who receive them, and so on. Economic impact analysis aims at quantifying this "ripple effect"—or the portion of each dollar spent by households in the local economy on goods and services.

Lost household income resulting from direct economic loss due to weed infestation has quantifiable ripple effects across the state economy. That is, using the initial direct loss in reduced cash rents, we can estimate secondary losses as a portion of household income that would otherwise have been re-spent locally. In this way, lost income contributes to total economic activity at risk, which includes direct loss plus employment, labor income, value added, and output from foregone household spending, described below.

Economic impact analysis is modeled in IMPLAN using the latest (2021) data. IMPLAN is software that provides economic impact data and modeling to estimate impacts arising from a policy change or event, in this case weed infestation. Agricultural values reduced by each weed are modeled as a "household income event" within the Wyoming economy. Wyoming median household income (in 2021 dollars) was $65,204 (USCB 2022); therefore, we used the household income specification of $50,000 to $70,000 as the relevant IMPLAN parameter.

Following standard economic impact analysis terminology, for this analysis:

Direct Loss is defined as cash agricultural land rent reduced by reduced forage production or crop yield estimated

Table 5. Presence acreage[1] for 10 selected weeds

Wyoming county	Total area (acres)[2]	Cheatgrass	Hoary cress / whitetop	Leafy spurge	Medusa -head	Palmer amaranth	Perennial pepperweed	Russian knapweed	Russian olive	Ventenata	Yellow starthistle
Albany	2,735,360	80,000	10,000	1,250	0	0	20,000	8,000	500	500	0
Big Horn	2,007,680	577,405	42,839	13	0	0	6,243	32,583	36,422	0	0
Campbell	3,070,080	2,000,000	3,000	70,000	0	0	0	10,000	1,000	80,000	0
Carbon	5,054,080	475,000	32,620	157,000	0	0	4,706	9,857	5,500	0	0
Converse	2,723,200	1,000,000	500	1,500	5	0	1,000	5,000	500	20	0
Crook	1,829,760	50,000	5,000	250,000	0	0	0	500	1,000	5	0
Fremont	5,877,120	229,000	50,500	26,000	0	1	15,000	50,500	15,000	0	0
Goshen	1,424,000	500,000	2,000	3,000	0	50	2,000	200	10,000	0	0
Hot Springs	1,282,560	321,064	6,644	10	0	0	20	62,592	3,995	0	0
Johnson	2,666,240	900,000	300	10,000	0	0	1	2,000	3,000	80	0
Laramie	1,719,040	170,000	100	17,000	0	0	500	500	0	0	0
Lincoln	2,604,160	1,800,000	10,000	10,000	0	0	50,000	8,000	10	0	0
Natrona	3,417,600	2,000,000	2,500	1,000	0	0	3,000	2,500	500	0	0
Niobrara	1,680,640	900,000	50	40,000	0	0	10	500	150	0	0
Park	4,443,520	1,700,000	375,000	6,500	0	0	10	90,000	45,000	0	0
Platte	1,334,400	900,000	50	8,000	0	0	10	50	5,000	0	0
Sheridan	1,614,720	900,000	11,000	122,286	5,800	0	50	75	42,000	290,000	0
Sublette	3,124,480	85,000	200	844	0	0	3,500	167	0	0	0
Sweetwater	6,672,640	20,000	10,000	600	0	0	40,000	5,000	100	0	0
Teton	2,565,120	7,282	276	214	0	0	149	39	2	0	0
Uinta	1,332,480	24,000	4,000	300	0	0	5,000	500	450	0	1
Washakie	1,433,600	750,000	2,000	5	0	0	200	2,000	5,000	0	0
Weston	1,534,720	50,000	7,000	15,000	0	0	0	5,000	20	0	0
Statewide	**62,147,200**	**15,438,751**	**575,579**	**740,522**	**5,805**	**51**	**151,399**	**295,563**	**175,149**	**370,605**	**1**

Sources: [1]Estimated acreage of weed presence reported by Wyoming Weed and Pest supervisors, 2021–2022.
[2] Total county area from U.S. Census Bureau.

for each weed, modeled as a reduction in landowners' household income.

Induced Employment Loss represents the number of job years (including part-time, and seasonal jobs adjusted to full-time year-round work) that would potentially be supported by household spending as a result of foregone rent.

Induced Labor Income Loss is foregone employee compensation and proprietor income associated with household spending as a result of rent lost from weed infestation.

Value Added is analogous to Gross Domestic Product for the Wyoming economy—this Gross State Product includes labor income, taxes on production and imports, and other property income. ***Induced Value Added Loss*** modeled for losses from weed competition is a specific foregone value generated from reduced household spending as a result of rent reduction.

Output of an industry adds together value created through labor and capital (***Value Added***) plus the cost of goods and services purchased from other industries (***Intermediate Inputs***).

Induced Output Loss is the total lost value, or amount foregone by industries as a result of the reduction in household spending from reduced agricultural land cash rent (Clouse 2022).

Total economic value at risk for Wyoming, including these component parts, is estimated for each listed weed in individual species summaries, and in statewide results below.

Table 6. Impacted acreage[1] for 10 selected weeds

Wyoming county	Total area (acres)[2]	Cheatgrass	Hoary cress / whitetop	Leafy spurge	Medusa -head	Palmer amaranth	Perennial pepperweed	Russian knapweed	Russian olive	Ventenata	Yellow starthistle
Albany	2,735,360	40,000	5,000	800	0	0	15,000	6,000	100	200	0
Big Horn	2,007,680	333,760	38,000	0	0	0	2,164	26,175	36,261	0	0
Campbell	3,070,080	1,000,000	1,000	20,000	0	0	0	5,000	100	20,000	0
Carbon	5,054,080	285,000	16,310	31,000	0	0	680	7,393	4,000	0	0
Converse	2,723,200	400,000	100	500	0	0	200	1,000	100	5	0
Crook	1,829,760	2,500	500	40,000	0	0	0	100	0	0	0
Fremont	5,877,120	15,000	5,000	2,600	0	0	300	10,100	750	0	0
Goshen	1,424,000	50,000	100	150	0	0	50	15	300	0	0
Hot Springs	1,282,560	160,532	2,214	1	0	0	5	31,296	2,663	0	0
Johnson	2,666,240	500,000	150	2,500	0	0	0	1,500	2,000	0	0
Laramie	1,719,040	170,000	50	17,000	0	0	250	250	0	0	0
Lincoln	2,604,160	200,000	3,000	2,000	0	0	5,000	3,000	5	0	0
Natrona	3,417,600	500,000	1,500	200	0	0	1,500	1,000	400	0	0
Niobrara	1,680,640	450,000	0	20,000	0	0	0	30	40	0	0
Park	4,443,520	100,000	15,000	200	0	0	1	10,000	10,000	0	0
Platte	1,334,400	800,000	10	4,000	0	0	1	5	20	0	0
Sheridan	1,614,720	400,000	2,000	32,000	1,800	0	0	0	16,000	110,000	0
Sublette	3,124,480	5,000	50	168	0	0	700	16	0	0	0
Sweetwater	6,672,640	10,000	0	0	0	0	30,000	2,500	0	0	0
Teton	2,565,120	5,000	61	81	0	0	16	3	0	0	0
Uinta	1,332,480	16,000	2,500	200	0	0	2,000	150	100	0	0
Washakie	1,433,600	500,000	1,000	0	0	0	30	1,000	3,000	0	0
Weston	1,534,720	5,000	2,000	5,000	0	0	0	200	2	0	0
Statewide	**62,147,200**	**5,947,792**	**95,545**	**178,400**	**1,800**	**0**	**57,897**	**106,733**	**75,841**	**130,205**	**0**

Sources: [1]Estimated acreage of weed-impacted area reported by Wyoming Weed and Pest supervisors, 2021–2022.
[2] Total county area from U.S. Census Bureau.

RESULTS

STATEWIDE DIRECT AND POTENTIAL ECONOMIC LOSSES

Statewide agricultural value reduced by weed infestations observed in 2022, and potential loss estimated on potential habitat, are reported in Table 10. Note that because the loss estimate analyses do not account for overlapping losses from multiple weeds on the same acreage, summing loss estimates over two or more individual weed species is not appropriate.

Considering both direct and potential impacts to agriculture from reduced rents on agricultural land in Wyoming, cheatgrass has the highest loss estimates statewide with $32 million in direct loss on observed acres and $110 million in potential loss from infestation on suitable habitat. Cheatgrass infestation resulted in a 13% reduction in agricultural value across Wyoming in 2021. If cheatgrass were to spread to all potential habitat in the state this loss would grow to a 43% reduction from estimated agricultural value without cheatgrass. Potential future impacts for cheatgrass are notably high in Fremont, Sweetwater, and Big Horn counties; and for ventenata in Big Horn County (Table 10).

Ventenata, another cool-season grass species that is invasive to Wyoming's rangelands, has the second-highest statewide estimates for direct impacts to agricultural value,

Table 7. Suitable weed habitat acreage[1] for 10 selected weeds by Wyoming county

Wyoming county	Total area (acres)[2]	Cheatgrass	Hoary cress / whitetop	Leafy spurge	Medusa -head	Palmer amaranth[3]	Perennial pepperweed	Russian knapweed	Russian olive	Ventenata	Yellow starthistle
Albany	2,735,360	2,405,824	1,546,264	85,696	23,228	0	459,621	1,169,251	2,181,614	430,333	1,031
Big Horn	2,007,680	1,627,049	1,522,860	163,415	57,979	116,501	1,051,438	1,440,868	1,539,590	46,469	259
Campbell	3,070,080	2,994,697	2,256,587	347,783	56,149	20,093	367,875	2,104,955	3,057,868	2,307,355	144
Carbon	5,054,080	4,257,820	3,756,976	79,075	29,808	949	1,328,182	3,388,285	2,886,742	181,943	235
Converse	2,723,200	2,593,795	2,049,865	116,917	69,997	22,647	477,228	2,231,472	2,569,388	1,218,301	376
Crook	1,829,760	1,225,475	899,130	124,416	2,899	39,192	276,119	506,383	1,557,141	853,266	0
Fremont	5,877,120	4,611,421	4,129,378	256,821	28,136	71,620	1,890,992	3,904,062	4,007,400	63,483	101
Goshen	1,424,000	1,198,451	1,063,733	257,430	1,259	184,632	420,901	1,316,025	1,385,635	153,541	700
Hot Springs	1,282,560	1,164,546	1,061,896	21,320	112,093	6,011	406,238	974,408	1,145,908	135,502	1,560
Johnson	2,666,240	2,289,214	1,777,728	92,990	49,236	14,771	468,395	1,721,276	2,066,181	869,340	187
Laramie	1,719,040	1,584,504	1,331,179	673,487	4,169	246,270	228,543	1,053,720	1,712,650	729,784	639
Lincoln	2,604,160	1,488,303	1,355,469	136,034	0	45,256	641,653	1,091,238	654,155	86,316	0
Natrona	3,417,600	3,355,635	2,963,400	123,630	90,529	13,831	990,017	2,964,553	2,761,685	305,883	3,734
Niobrara	1,680,640	1,549,547	1,267,550	25,794	228	27,873	321,200	1,449,732	1,675,039	952,572	0
Park	4,443,520	2,071,768	1,497,897	229,155	117,709	92,893	682,232	1,316,228	1,689,094	508,600	4,794
Platte	1,334,400	1,255,984	1,173,978	238,922	78,041	78,572	318,859	1,267,739	1,328,842	688,021	2,276
Sheridan	1,614,720	945,632	1,066,066	245,650	31,138	34,226	365,798	897,073	1,197,426	911,333	0
Sublette	3,124,480	2,100,109	1,565,692	56,314	0	288	1,041,168	1,301,304	43,588	4,589	0
Sweetwater	6,672,640	6,645,545	6,058,401	96,919	12,212	12,135	3,932,114	6,157,226	1,481,711	739	0
Teton	2,565,120	206,163	129,413	73,785	0	3,235	33,512	6,321	53,552	11,210	0
Uinta	1,332,480	1,155,030	1,178,804	165,474	0	1,632	583,829	1,072,434	1,086,927	228,807	0
Washakie	1,433,600	1,360,062	1,250,594	59,784	41,625	39,545	594,048	1,144,371	1,230,492	65,254	316
Weston	1,534,720	1,357,167	1,025,968	58,311	729	15,225	309,319	1,043,131	1,424,222	657,024	0
Statewide	**62,147,200**	**49,443,739**	**41,928,829**	**3,729,122**	**807,165**	**1,087,396**	**17,189,278**	**39,522,056**	**38,736,849**	**11,409,665**	**16,351**

Sources: [1]Moderate "balanced" weed habitat estimates modeled by USGS INHABIT, 2022.
[2] Total county area from U.S. Census Bureau.
[3]All NLCD-defined cultivated cropland is considered as suitable habitat for Palmer amaranth.

with $1 million in estimated loss from reduced cash rent on rangelands on observed areas in 2021.

In terms of potential loss on suitable habitat, Russian knapweed and hoary cress are next in line to cheatgrass with $90 and $83 million—35% and 32% of non-impacted value—respectively. See individual species summaries for a complete set of county loss estimates.

While other listed weed species have annual statewide direct loss estimates under $1 million, equating to less than 1% of non-impacted agricultural values statewide, local impacts are relatively high. Hoary cress has an estimated direct loss of $323,000 in Big Horn County and $210,000 in Park County, each accounting for 1.5% of annual non-impacted agricultural value respectively. Leafy spurge has $199,000 in direct losses in Crook County and $138,000 in Sheridan County (2.1% and 1.5% respectively). Russian knapweed has direct loss estimates of $226,000 (1.1%) in Big Horn County and $167,000 (2.9%) in Hot Springs County. (See below for complete county loss estimates by species.)

Relatively high county-level potential future loss estimates (assuming infestation on all suitable habitat) are notable in the following Wyoming counties for having loss estimates over $1 million, 10% of non-impacted agricultural value, or both: hoary cress in Fremont County ($8.2 million, 33%), Big

Horn County ($7.5 million, 36%), Sweetwater County ($6.8 million, 43%), and every other Wyoming county except for Teton; leafy spurge in Laramie County ($1.2 million, 6.8%), perennial pepperweed in Big Horn County ($4.8 million, 23%), Sweetwater County ($4.4 million, 28%), Fremont County ($3.6 million, 14%), and eight other counties; and Russian knapweed in Fremont County ($9.4 million, 38%), Sweetwater County ($8.7 million, 54%), and, like hoary cress, every other Wyoming county except for Teton County. County-level potential loss estimates are reported in species summaries below.

TOTAL STATEWIDE ECONOMIC ACTIVITY AT RISK

What secondary impacts ripple across the Wyoming economy as a result of agricultural value reduced by weed infestations? Modeled as a reduction in cash rent on agricultural land, these economic losses reduce landowners' household income. The resulting reduction in induced (household-to-business) spending from these foregone rents can be measured in induced employment, labor income, value added, and output losses reported in Table 11. (See the "Total Economic Activity at Risk" section above for definitions of these economic terms.)

Across the Wyoming economy, cheatgrass infestation resulted in the highest reduced value of agricultural cash rents in 2021, translating to a $32.1 million direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including 149 annual jobs, $6.6 million in labor income, $13.0 million in value added, and $24.1 million in output. Lost agricultural rents from observed 2021 ventenata infestation ($1.0 million) resulted in foregone household spending that would have supported 5 full-time annual jobs with $205,000 in labor income, $408,000 in value added, and $754,000 in induced output (Table 11).

SUMMARY OF INDIVIDUAL SPECIES

For each of 10 invasive Wyoming weeds identified for this study, we provide a short description of the species, county-level distribution map of observed presence, and our estimates of direct economic impacts to Wyoming agriculture as well as total economic activity at risk.

Table 8. Agricultural land types impacted by infestation of 10 selected weeds

Invasive weed	Rangeland	Pasture & hay	Cultivated cropland
Cheatgrass	X		
Hoary cress / whitetop	X	X	X
Leafy spurge	X	X	
Medusahead	X		
Palmer amaranth			X
Perennial pepperweed	X	X	
Russian knapweed	X	X	
Russian olive		X	
Ventenata	X		
Yellow starthistle	X	X	

Table 9. Agricultural rent loss estimates on acreage reported as present, impacted (20% or greater incidence), and suitable habitat for 10 invasive weed species in Wyoming.

Invasive weed[1]	Loss on area where present	Loss on area impacted	Potential loss on suitable habitat[2]
Cheatgrass	40%	80%	60%
Hoary cress / whitetop	15%	80%	48%
Leafy spurge	10%	50%	30%
Medusahead	65%	95%	80%
Palmer amaranth	70%	100%	85%
Perennial pepperweed	15%	80%	48%
Russian knapweed	40%	80%	60%
Russian olive	35%	75%	55%
Ventenata	40%	80%	60%
Yellow starthistle	20%	60%	40%

Notes:
[1] Refer to species-specific accounts later in the report for details on the derivation of these loss estimates.
[2] Potential loss on suitable habitat is estimated as the average between loss on area where present and impacted.

Table 10. Statewide direct and potential agricultural loss estimates (% of non-impacted agricultural value)1 from 10 invasive weed species in Wyoming

Invasive weed	Estimated loss on present and impacted area[2]	Potential loss on suitable habitat[3]
Cheatgrass / downy brome (*Bromus tectorum*)	$32,060,597 (13%)	$109,841,084 (43%)
Hoary cress / whitetop (*Lepidium draba*)	$726,615 (<1%)	$82,737,008 (32%)
Leafy spurge (*Euphorbia esula*)	$577,303 (<1%)	$5,042,826 (2%)
Medusahead (*Taeniatherum caput-medusae*)	$23,003 (<1%)	$2,446,034 (1%)
Palmer amaranth (*Amaranthus palmeri*)	$68 (<1%)	$1,411,938 (<1%)
Perennial pepperweed (*Lepidium latifolium* L.)	$190,643 (<1%)	$31,690,566 (12%)
Russian knapweed (*Acroptilon repens*)	$715,510 (<1%)	$89,986,377 (35%)
Russian olive (*Elaeagnus angustifolia*)	$9,495 (<1%)	$1,701,662 (1%)
Ventenata (*Ventenata dubia*)	$1,001,491 (<1%)	$27,087,402 (11%)
Yellow starthistle (*Centaurea solstitialis*)	$0 (0%)	$21,799 (<1%)

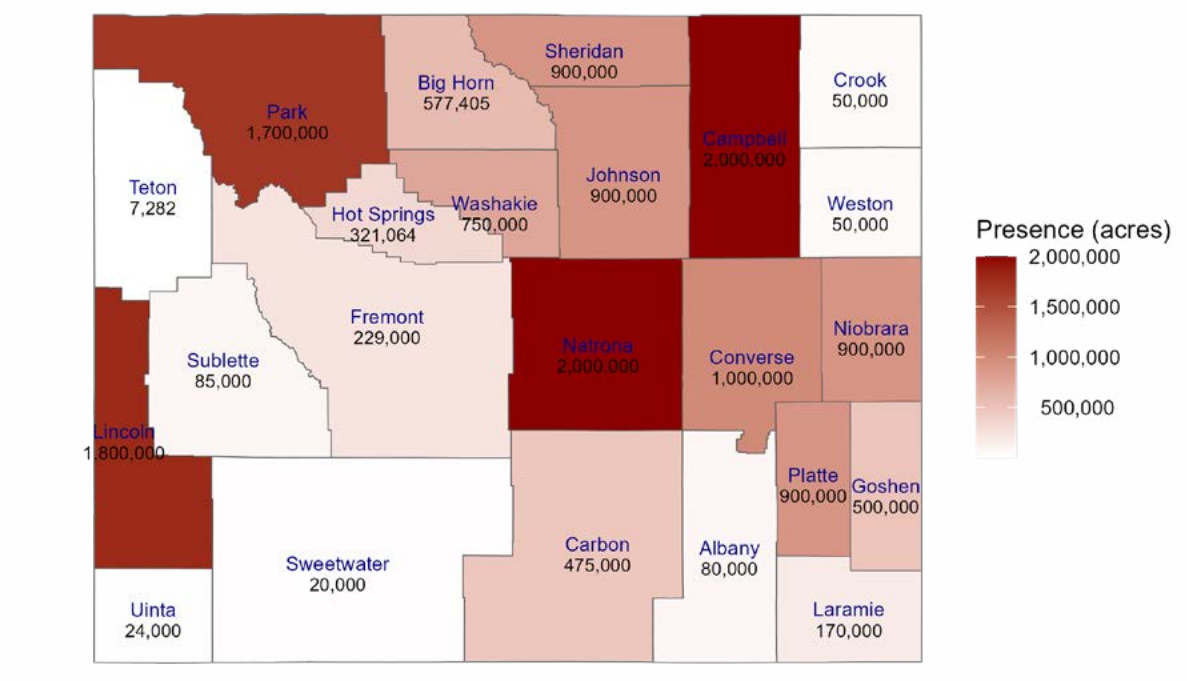
Notes:
[1] Loss estimate / (all agricultural land area × respective annual cash rent value).
[2] Weed area reported as present or impacted by Wyoming Weed and Pest supervisors in 2021–2022 × relevant agricultural land type proportion × respective annual cash rent value × relevant present or impacted loss estimate.
[3] Suitable habitat area × agricultural land type proportion × respective annual cash rent value × present or impacted loss estimate.

Table 11. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from 10 invasive weed species, 2021

Invasive weed	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Cheatgrass	$32,060,597	149	$6,556,448	$13,048,265	$24,149,188
Hoary cress / whitetop	$726,615	3	$148,594	$295,723	$547,312
Leafy spurge	$577,303	3	$118,059	$234,955	$434,845
Medusahead	$23,003	0	$4,704	$9,362	$17,327
Palmer amaranth	$68	0	$14	$28	$51
Perennial pepperweed	$190,643	1	$38,987	$77,589	$143,599
Russian knapweed	$715,510	3	$146,323	$291,204	$538,948
Russian olive	$9,495	0	$1,942	$3,864	$7,152
Ventenata	$1,001,491	5	$204,807	$407,594	$754,359
Yellow starthistle	$0	0	$0	$0	$0

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1] Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2] Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3] Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4] Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported by household spending in the Wyoming economy if weed infestation were avoided.
[5] The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 3. County-level cheatgrass / downy brome (*Bromus tectorum*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021–2022.



CHEATGRASS / DOWNY BROME (*BROMUS TECTORUM*)

SPECIES DESCRIPTION

Cheatgrass (*Bromus tectorum*), also known as downy brome, is a tufted, cool-season annual bunchgrass that easily displaces native grasses. Suitable habitat includes degraded or disturbed sites in meadows, grassland, woodland, and riparian communities, generally below 8,500 feet (White 2014). Cheatgrass reduces forage quality, alters wildfire regimes, impacts species diversity, and reduces wildlife habitat (Mealor et al. 2013).

DISTRIBUTION IN WYOMING

On a county level, cheatgrass distribution across Wyoming is concentrated in Campbell, Natrona, and Park counties, as well as much of north-central Wyoming. Statewide, cheatgrass is reported as present on 15.4 million acres (Table 5, Figure 3). Of the acreage where cheatgrass is present, 5.9 million acres (39%) is reported as impacted, that is, accounting for 20% or more of vegetative cover (Table 6).

Suitable cheatgrass habitat is estimated at 49.4 million acres across Wyoming, with significant potential for losses in Sweetwater, Fremont, and Carbon counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Cheatgrass infestations are widespread and primarily impact agricultural production on non-irrigated rangelands in Wyoming. Direct economic loss to agricultural value due to cheatgrass is estimated as a 40% reduction in annual cash rent for rangeland (Table 3 and Table 8) on acres with reported presence and 80% on impacted areas (Table 9), where cheatgrass cover exceeds 20% of canopy cover. Potential loss on suitable cheatgrass habitat (Table 7) is estimated with 60% loss (Table 9). County non-impacted agricultural values and loss estimates from cheatgrass infestation are reported in Table 12.

Campbell, Lincoln, and Big Horn counties have the highest estimated direct economic impacts to agriculture, with $4.4, $3.6, and $3.5 million in lost annual cash rent on rangelands due to cheatgrass infestation, respectively. Losses in Sheridan, Natrona, and Platte counties are estimated at just under $3 million each. Total loss to agriculture in Wyoming is estimated at $30 million (Table 12).

As a percentage of total non-impacted agricultural value, Platte County has the highest loss due to cheatgrass (41%), followed by Campbell (37%) and Washakie (31%) counties. Statewide, cheatgrass infestation reduced total agricultural value by 12.5% (Table 12).

Potential loss from cheatgrass infestation on suitable habitat is greatest in Fremont County, with over $10.9 million in potential lost agricultural rent; statewide potential annual loss is estimated at nearly $110 million (Table 12).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, cheatgrass infestation reduced the value of agricultural cash rents by an estimated $32.1 million in 2021 (Table 12). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including 149 annual jobs, $6.6 million in labor income, $13.0 million in value added, and $24.1 million in output (Table 13).

Cheatgrass. Photo by Beth Fowers.

Table 12. Agricultural value and estimated loss from infestation by cheatgrass / downy brome (*Bromus tectorum*) by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$121,088	1.7%	$3,641,446
Big Horn	$20,986,463	$3,461,808	16.5%	$9,272,522
Campbell	$11,873,422	$4,411,408	37.2%	$6,605,414
Carbon	$13,680,717	$797,787	5.8%	$6,704,274
Converse	$7,915,454	$1,220,936	15.4%	$4,318,442
Crook	$9,368,895	$94,625	1.0%	$3,313,175
Fremont	$24,907,069	$385,683	1.5%	$10,933,692
Goshen	$10,120,978	$1,115,841	11.0%	$3,647,130
Hot Springs	$5,798,953	$850,379	14.7%	$3,084,447
Johnson	$8,646,085	$1,751,544	20.3%	$4,296,062
Laramie	$16,947,179	$767,739	4.5%	$5,366,845
Lincoln	$15,931,031	$3,564,289	22.4%	$4,942,307
Natrona	$9,246,032	$2,623,629	28.4%	$5,282,364
Niobrara	$9,256,598	$1,770,346	19.1%	$4,841,001
Park	$14,216,444	$1,825,318	12.8%	$3,151,363
Platte	$6,132,600	$2,538,228	41.4%	$2,812,918
Sheridan	$9,357,283	$2,774,238	29.6%	$3,027,009
Sublette	$15,153,599	$146,136	1.0%	$5,754,403
Sweetwater	$15,964,474	$28,195	0.2%	$9,368,626
Teton	$4,499,398	$8,070	0.2%	$203,191
Uinta	$6,630,256	$29,440	0.4%	$3,187,833
Washakie	$5,385,335	$1,683,669	31.3%	$2,747,873
Weston	$6,600,580	$90,203	1.4%	$3,338,746
State total	**$255,676,926**	**$32,060,597**	**12.5%**	**$109,841,084**

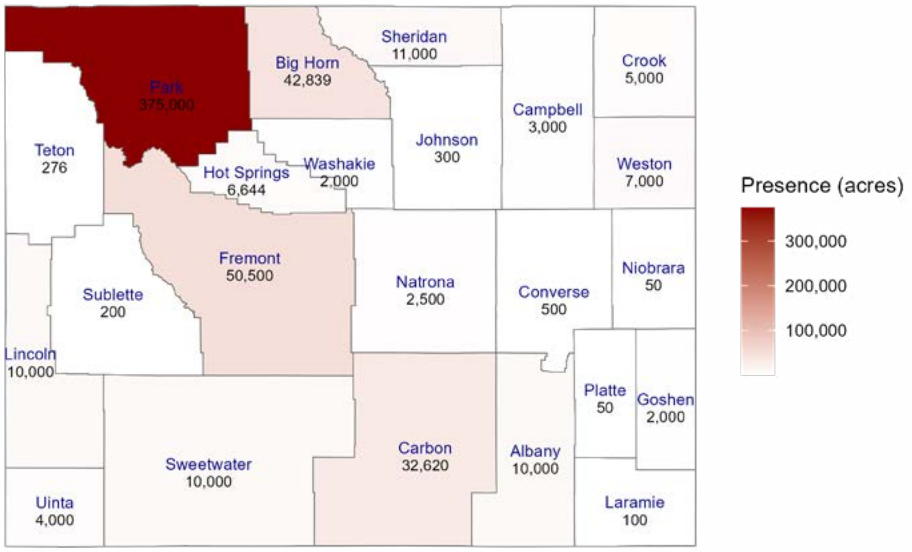
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.4 and 0.8 representing 40% and 80% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.6 representing 60% loss, reported in Table 9).

Table 13. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from cheatgrass

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$32,060,597				
Induced (household spending)		149	$6,556,448	$13,048,265	$24,149,188z

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1] Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2] Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3] Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4] Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5] The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 4. County-level hoary cress / whitetop (Lepidium draba) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



HOARY CRESS / WHITETOP (*LEPIDIUM DRABA*)

SPECIES DESCRIPTION

Hoary cress (*Lepidium draba*), also known as whitetop and heart-podded hoary cress, is an annual or perennial herb in the Mustard family with early spring flowers (Whitson et al. 2009). Hoary cress can spread rapidly via seeds, root stock, and creeping roots or rhizomes. Seeds spread by wind and are distributed through livestock manure and agricultural machinery; root fragments can be dispersed though irrigation and tillage (Francis and Warwick 2008). Hoary cress is generally considered a serious weed of numerous economic crops, including corn, small grains, and sugar beets (Weyl 2018), as well as pasture, hay, and forage grasses (Francis and Warwick 2008). It also has potential palatability and toxicity issues for livestock grazing (Wilson, Davison, and Smith 2006).

DISTRIBUTION IN WYOMING

Across Wyoming counties, hoary cress presence is concentrated in Park County, with moderate acreages in Fremont, Carbon, and Big Horn counties, and some reported presence in all other counties. Statewide, hoary cress is reported as present on 575,579 acres; of that, 95,545 acres (17%) is reported as impacted, that is, accounting for over 20% of vegetative cover (Figure 4; Table 6).

Suitable hoary cress habitat is estimated at 41.9 million acres across Wyoming with significant potential for losses in Sweetwater, Fremont, Carbon, and Natrona counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Hoary cress is found in a wide range of habitats and is associated with rangeland, pasture and hay land, and cultivated crops. Direct economic loss to agricultural value from hoary cress infestation is estimated as a 15% reduction in relevant annual cash rent (reported in Table 3) associated with all agricultural land types (Table 8) on acres with reported presence and 80% reduction on impacted areas (Table 9), where hoary cress cover exceeds 20% of canopy cover. Potential loss on suitable hoary cress habitat (7) is estimated using a 48% loss (Table 9). County non-impacted agricultural values and loss estimates from hoary cress infestation are reported in Table 14.

The highest direct economic impacts to agriculture from hoary cress are estimated in Big Horn and Park counties, at $323,170 and $210,487 in lost rents on all agricultural land types, respectively; for all other counties, direct losses are under $70,000 each. Statewide, losses from hoary cress in 2021 are estimated to be $726,615 (Table 15).

Losses from hoary cress in both Big Horn and Park counties are 1.5% of total non-impacted agricultural value; statewide, hoary cress infestation reduced total agricultural value by less than 1% (Table 13).

Potential loss from hoary cress infestation on suitable habitat in Wyoming is greatest in Fremont County ($8.2 million), Big Horn County ($7.5 million), Sweetwater County ($6.8 million), and Laramie County ($6.2 million). Statewide, potential annual loss on all suitable habitat is estimated at $82.7 million. (Table 13).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, hoary cress infestation reduced the value of agricultural cash rents by an estimated $727,000 in 2021 (Table 14). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including 3 annual jobs, $149,000 in labor income, $296,000 in value added, and $547,000 in output (Table 15).

Hoary cress / whitetop.
Photo by Tom Whitson.

Table 14. Agricultural value and estimated loss from hoary cress / whitetop (*Lepidium draba*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$12,158	0.2%	$1,879,893
Big Horn	$20,928,213	$323,170	1.5%	$7,510,395
Campbell	$11,692,585	$4,246	0.0%	$4,137,423
Carbon	$13,671,418	$64,543	0.5%	$4,789,958
Converse	$7,691,249	$406	0.0%	$2,823,516
Crook	$9,129,822	$5,492	0.1%	$2,181,954
Fremont	$24,183,709	$45,466	0.2%	$8,238,373
Goshen	$8,496,220	$2,586	0.0%	$3,579,671
Hot Springs	$5,750,263	$11,000	0.2%	$2,277,866
Johnson	$8,510,190	$461	0.0%	$2,732,654
Laramie	$11,553,857	$468	0.0%	$6,230,069
Lincoln	$15,206,941	$11,733	0.1%	$3,914,119
Natrona	$9,104,959	$661	0.0%	$3,782,928
Niobrara	$9,050,336	$41	0.0%	$3,313,708
Park	$11,782,660	$210,487	1.5%	$2,269,115
Platte	$5,543,312	$64	0.0%	$2,531,414
Sheridan	$9,169,040	$17,072	0.2%	$2,930,477
Sublette	$15,151,700	$300	0.0%	$3,567,729
Sweetwater	$15,837,056	$3,567	0.0%	$6,842,319
Teton	$4,469,633	$135	0.0%	$102,475
Uinta	$6,618,833	$5,085	0.1%	$2,777,964
Washakie	$5,021,520	$3,564	0.1%	$2,228,805
Weston	$6,472,690	$3,910	0.1%	$2,094,184
State total	**$251,684,701**	**$726,615**	**0.3%**	**$82,737,008**

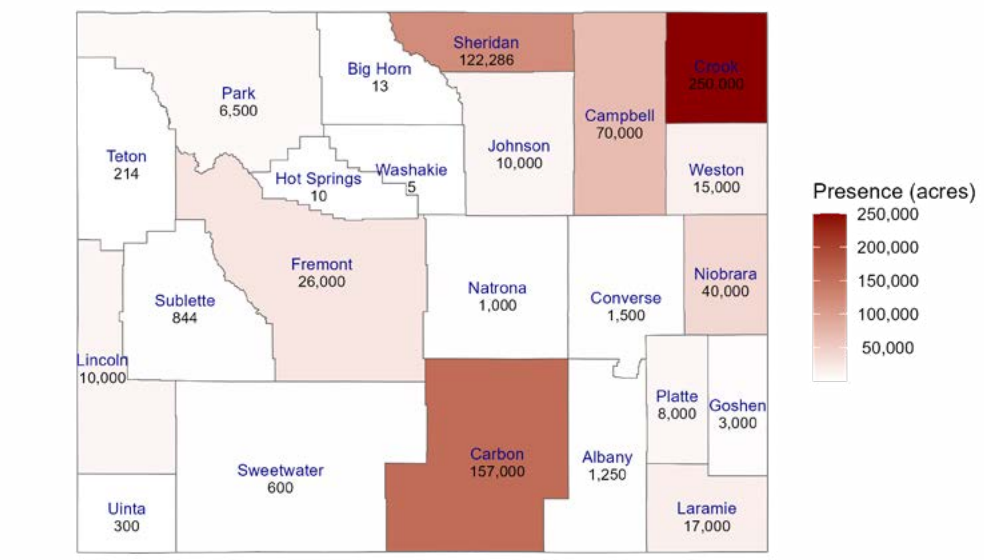
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.15 and 0.8 representing 15% and 80% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.48 representing 48% loss, reported in Table 9).

Table 15. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from hoary cress / whitetop (*Lepidium draba*) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$726,615				
Induced (household spending)		3	$148,594	$295,723	$547,312

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1]Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2]Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3]Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4]Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5]The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 5. County-level leafy spurge (*Euphorbia esula*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



LEAFY SPURGE (*EUPHORBIA ESULA*)

SPECIES DESCRIPTION

Leafy spurge (*Euphorbia esula*) is a creeping perennial forb with deep spreading roots that can regenerate even after the plant has been pulled, cut, or burned. Its seed capsules can shoot seeds up to 20 feet (MDA 2023). Leafy spurge invades prairies, pastures, and other open areas, displacing native vegetation (Whitson et al. 2009).

Cattle will avoid moderate to high densities of leafy spurge (Lym and Kirby 1987) and infestations result in reduced availability of quality forage (USFS 2014). Leafy spurge has been modeled with an estimate of around 1.25% in loss to grazing lands per 1% infestation (Leitch et al. 1996). On rangeland, leafy spurge has been found to reduce livestock carrying capacity up to 75% (50% yield reduction in rangeland production and 25% loss in utilization from unpalatable leafy spurge mixed with existing grass) (Reilly and Kaufman 1979).

It may be interesting to note that sheep and goat grazing can be effective in reducing leafy spurge on infested rangeland: leafy spurge can comprise between 22% to 66% of the diet of goats when targeted (Seefeldt, Taylor, and Van Vleet 2007; Kirby, Hanson, and Sieg 1994).

DISTRIBUTION IN WYOMING

Notable leafy spurge presence is reported in Crook, Carbon, and Sheridan counties, with some presence in all Wyoming counties, totaling 740,522 acres statewide (Table 5, Figure 5). Of this presence area, 178,400 acres (24%) is reported as impacted (leafy spurge comprises more than 20% of vegetative cover)(Table 6).

Suitable leafy spurge habitat is estimated to be 3.7 million acres across Wyoming, with notable potential for losses in Laramie county (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Direct economic loss to agricultural value from leafy spurge infestation is estimated as a 10% reduction in annual cash rent for rangeland and pasture and hay (Table 3 and Table 8) on acres with reported presence and 50% on impacted areas (Table 9), where leafy spurge exceeds 20% of canopy cover. Potential loss on suitable habitat (Table 7) is estimated using a 30% reduction in cash rent (Table 9). County non-impacted agricultural values and loss estimates from leafy spurge are reported in Table 16.

Crook and Sheridan counties have the highest loss estimates from leafy spurge infestation, with $198,513 and $137,956 in reduced agricultural value, respectively. These two counties make up the majority of statewide loss, estimated at $572,413 (Table 16).

Likewise, as a proportion of non-impacted value, Crook and Sheridan counties are the most heavily impacted by leafy spurge (2.1% and 1.5% of non-impacted value, respectively). Statewide, leafy spurge infestation reduced total agricultural value by less than 1% (Table 16).

However, potential loss to agriculture on land with suitable leafy spurge habitat in Wyoming is notably high in Laramie County, where an estimated $1.2 million is at risk. Statewide, potential loss from leafy spurge is just over $5 million (Table 16).

TOTAL ECONOMIC ACTIVITY AT RISK

Leafy spurge reduced agricultural cash rents by an estimated $577,000 across the Wyoming economy in 2021 (Table 16). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including 3 annual jobs, $118,000 in labor income, $235,000 value added, and $435,000 in state output (Table 17).

Leafy spurge. Photo by Beth Fowers.

Table 16. Agricultural value and estimated loss from leafy spurge (*Euphorbia esula*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$1,139	0.0%	$65,802
Big Horn	$20,928,213	$13	0.0%	$472,272
Campbell	$11,692,585	$56,626	0.5%	$393,870
Carbon	$13,671,418	$75,355	0.6%	$63,616
Converse	$7,691,249	$419	0.0%	$97,928
Crook	$9,129,822	$198,513	2.1%	$180,718
Fremont	$24,183,709	$12,017	0.1%	$309,647
Goshen	$8,496,220	$1,853	0.0%	$397,421
Hot Springs	$5,750,263	$6	0.0%	$28,495
Johnson	$8,510,190	$6,329	0.1%	$88,273
Laramie	$11,553,857	$48,456	0.3%	$1,151,803
Lincoln	$15,206,941	$5,665	0.0%	$231,181
Natrona	$9,104,959	$382	0.0%	$97,737
Niobrara	$9,050,336	$13,221	0.1%	$40,922
Park	$11,782,660	$1,872	0.0%	$176,268
Platte	$5,543,312	$9,220	0.2%	$275,352
Sheridan	$9,169,040	$137,956	1.5%	$406,201
Sublette	$15,151,700	$564	0.0%	$81,026
Sweetwater	$15,837,056	$141	0.0%	$68,449
Teton	$4,469,633	$89	0.0%	$36,556
Uinta	$6,618,833	$173	0.0%	$245,499
Washakie	$5,021,520	$2	0.0%	$60,869
Weston	$6,472,690	$7,295	0.1%	$72,918
State total	**$251,684,701**	**$572,413**	**0.2%**	**$5,042,826**

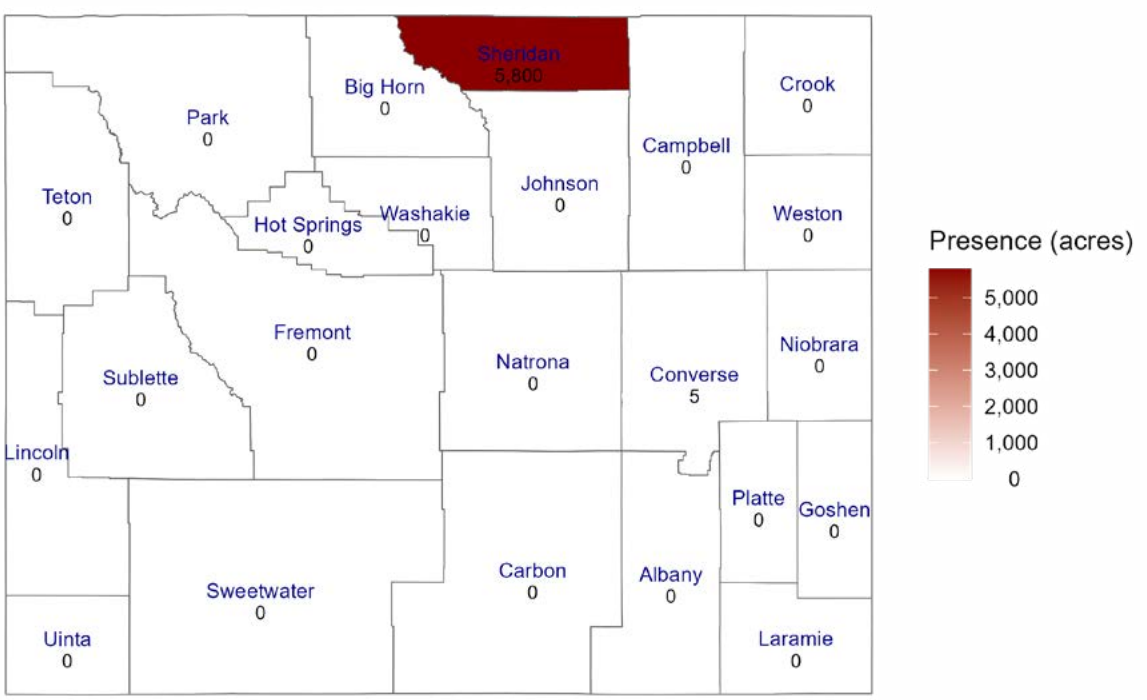
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.1 and 0.5 representing 10% and 50% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.3 representing 30% loss, reported in Table 9).

Table 17. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from leafy spurge (*Euphorbia esula*) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$577,303				
Induced (household spending)		3	$118,059	$234,955	$434,845

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1]Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2]Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3]Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4]Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5]The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 6. County-level medusahead wildrye (*Taeniatherum caput-medusae*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



MEDUSAHEAD WILDRYE (*TAENIATHERUM CAPUT-MEDUSAE*)

SPECIES DESCRIPTION

Medusahead (*Taeniatherum caput-medusae*), also known as medusahead wildrye, is an invasive winter annual grass that reduces plant diversity and alters ecosystem function, reducing carrying capacities for both livestock and wildlife (Whitson et al. 2009). Medusahead typically colonizes disturbed sites, and may be a higher management concern compared to cheatgrass because of its year-round lack of grazing preference, fast growth, and its ability to replace more palatable annual grasses in some areas (Stannard, Ogle, and St. John 2010). Like cheatgrass, medusahead is a fire-adapted species that threatens western rangelands (Bateman et al. 2020).

DISTRIBUTION IN WYOMING

Nearly all medusahead presence observed by Wyoming Weed and Pest personnel in 2021–2022 (5,800 of 5,805 acres statewide) was in Sheridan County, in north-central Wyoming (Table 5; Figure 6). Of this statewide presence, 1,800 acres (31%) are impacted (medusahead comprises more than 20% of vegetative cover)(Table 6).

While presence as of 2021–2022 was limited, Wyoming has potential for medusahead infestation: suitable habitat is estimated at 807,165 acres across Wyoming, notably in Park, Hot Springs, and Natrona counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Medusahead is primarily associated with rangeland agricultural land cover in Wyoming. Direct economic loss to agricultural value due to medusahead is estimated as a 65% reduction in annual cash rent for rangeland (Table 3 and Table 8) on acres with reported presence and 95% on impacted areas (Table 9), where medusahead cover exceeds 20% of canopy cover. Potential loss on suitable medusahead habitat (Table 7) is calculated using an 80% loss estimate (Table 9). County non-impacted agricultural values and loss estimates from medusahead infestation are reported in Table 18.

Nearly all lost agricultural value from medusahead infestation is in Sheridan County, with $22,994 (Table 18) accounting for less than 1% of that county's non-impacted agricultural value; $23,003 statewide (Table 18).

Potential loss from medusahead on suitable habitat across Wyoming rangelands is more substantial. Top counties in terms of potential loss are Big Horn County ($441,000) and Hot Springs County ($396,000), with a statewide total loss estimate of $2.4 million (Table 18).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, medusahead infestation reduced the value of agricultural cash rents by an estimated $23,000 in 2021 (Table 18). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including less than 1 annual job, $5,000 in labor income, $9,000 in value added, and $17,000 in output (Table 19).

Medusahead wildrye. Photo by Beth Fowers.

Table 18. Agricultural value and estimated loss from medusahead wildrye (*Taeniatherum caput-medusae*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$0	0%	$46,877
Big Horn	$20,928,213	$0	0%	$440,562
Campbell	$11,692,585	$0	0%	$165,131
Carbon	$13,671,418	$0	0%	$62,580
Converse	$7,691,249	$9	0%	$155,385
Crook	$9,129,822	$0	0%	$10,450
Fremont	$24,183,709	$0	0%	$88,947
Goshen	$8,496,220	$0	0%	$5,109
Hot Springs	$5,750,263	$0	0%	$395,857
Johnson	$8,510,190	$0	0%	$123,199
Laramie	$11,553,857	$0	0%	$18,828
Lincoln	$15,206,941	$0	0%	$0
Natrona	$9,104,959	$0	0%	$190,012
Niobrara	$9,050,336	$0	0%	$950
Park	$11,782,660	$0	0%	$238,729
Platte	$5,543,312	$0	0%	$233,042
Sheridan	$9,169,040	$22,994	0.2%	$132,899
Sublette	$15,151,700	$0	0%	$0
Sweetwater	$15,837,056	$0	0%	$22,955
Teton	$4,469,633	$0	0%	$0
Uinta	$6,618,833	$0	0%	$0
Washakie	$5,021,520	$0	0%	$112,132
Weston	$6,472,690	$0	0%	$2,391
State total	**$251,684,701**	**$23,003**	**<0.0%**	**$2,446,034**

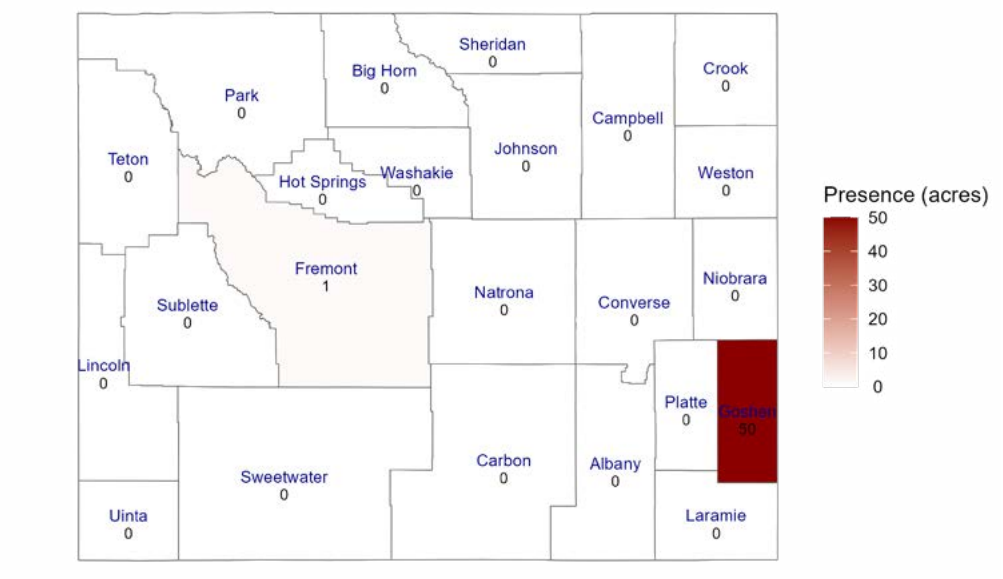
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.65 and 0.95 representing 65% and 95% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.8 representing 80% loss, reported in Table 9).

Table 19. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from medusahead wildrye (*Taeniatherum caput-medusae*) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$23,003				
Induced (household spending)		<1	$4,704	$9,362	$17,327

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1] Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2] Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3] Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4] Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5] The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 7. County-level Palmer amaranth (*Amaranthus palmeri*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



PALMER AMARANTH (*AMARANTHUS PALMERI*)

SPECIES DESCRIPTION

Palmer amaranth (*Amaranthus palmeri*) is a fast-growing broadleaf weed that is also known as Palmer's pigweed. Infestation leads to significant crop damage, with reported yield losses of up to 91% in corn and 79% in soybeans. Palmer amaranth can also be toxic to animals (NRCS 2017).

Palmer amaranth is associated with agricultural areas of cultivated cropland, with potential for losses for several crops grown in Wyoming, notably corn, soybeans, dry edible beans, and sugar beets. Amaranthus species are a current and emerging threat in Wyoming (Coles et al. 2024). Palmer amaranth is aggressive and has evolved resistance to glyphosate herbicides (Coles et al. 2024). A comparative analysis with redroot pigweed (*Amaranthus retroflexus*) using estimated potential future impacts in Wyoming suggests greater expected yield loss in sugar beet and dry bean crops and worse herbicide efficacy from Palmer amaranth infestation (Kniss 2022).

DISTRIBUTION IN WYOMING

Fifty acres of Palmer amaranth presence were reported in Goshen County plus one acre in Fremont County for a statewide total of 51 acres in 2021–2022 (Table 5, Figure 7). Of this area, none was reported as impacted (where more than 20% of land cover is infested)(Table 6).

All 1.1 million acres of NLCD-defined cultivated cropland in Wyoming is considered suitable habitat for Palmer amaranth, with significant acreages in Laramie and Goshen counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Palmer amaranth is considered a threat to all Wyoming cropland (Table 8). Direct economic loss to agricultural value is estimated as a 70% reduction in annual cash rent for cropland (Table 3) on acres where Palmer amaranth is reported as present and 100% on impacted acres (Table 9), where Palmer amaranth exceeds 20% of canopy cover. Potential loss on suitable habitat in Wyoming (Table 7) is estimated using an 85% reduction in rent (Table 9). County non-impacted agricultural values and loss estimates from Palmer amaranth infestation are reported in Table 20.

Nearly all of Wyoming's reduction in agricultural value in 2021 occurred in Goshen County, where 50 acres of reported presence resulted in an estimated $68 in lost rent (less than 1% of the county's non-impacted agricultural value) (Table 20).

More substantial potential loss to agricultural value from Palmer amaranth on suitable habitat is greatest in Laramie County ($869,000), followed by Goshen County ($304,000). Across all Wyoming counties, potential loss is estimated at $1.4 million, or 0.6% of the state's non-impacted agricultural value (Table 20).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, Palmer amaranth infestation reduced the value of agricultural cash rents by just $68 in 2021 (Table 20). This translates to a direct reduction in landowners' household income; related induced losses from foregone household-to-business spending are negligible (Table 21).

Palmer Amaranth. Photo by Andrew Kniss.

Table 20. Agricultural value and estimated loss from Palmer amaranth (*Amaranthus palmeri*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$0	0%	$0
Big Horn	$20,928,213	$0	0%	$74,197
Campbell	$11,692,585	$0	0%	$1,450
Carbon	$13,671,418	$0	0%	$2
Converse	$7,691,249	$0	0%	$2,076
Crook	$9,129,822	$0	0%	$8,900
Fremont	$24,183,709	$0	0%	$11,028
Goshen	$8,496,220	$68	<0.0%	$304,240
Hot Springs	$5,750,263	$0	0%	$311
Johnson	$8,510,190	$0	0%	$902
Laramie	$11,553,857	$0	0%	$869,174
Lincoln	$15,206,941	$0	0%	$15,943
Natrona	$9,104,959	$0	0%	$614
Niobrara	$9,050,336	$0	0%	$5,104
Park	$11,782,660	$0	0%	$49,362
Platte	$5,543,312	$0	0%	$46,612
Sheridan	$9,169,040	$0	0%	$8,005
Sublette	$15,151,700	$0	0%	$0
Sweetwater	$15,837,056	$0	0%	$242
Teton	$4,469,633	$0	0%	$43
Uinta	$6,618,833	$0	0%	$22
Washakie	$5,021,520	$0	0%	$12,039
Weston	$6,472,690	$0	0%	$1,668
State total	**$251,684,701**	**$68**	**<0.0%**	**$1,411,938**

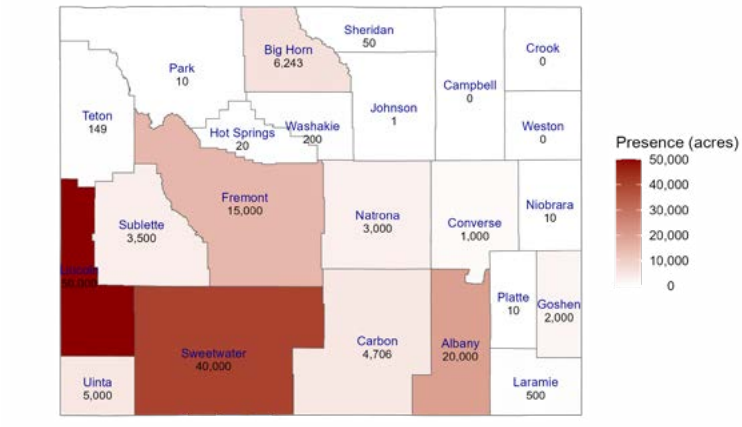
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.7 and 1.0 representing 70% and 100% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] NLCD-defined cultivated cropland area × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.85 representing 85% loss, reported in Table 9).

Table 21. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from Palmer amaranth (*Amaranthus palmeri*) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$68				
Induced (household spending)		<1	$14	$28	$51

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1]Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2]Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3]Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4]Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5]The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 8. County-level perennial pepperweed (*Lepidium latifolium* L.) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



PERENNIAL PEPPERWEED (*LEPIDIUM LATIFOLIUM* L.)

SPECIES DESCRIPTION

Perennial pepperweed (*Lepidium latifolium* L.)—also known as broadleaved pepperweed, broad-leaved pepper-grass, and a number of other common names—is a creeping perennial in the Mustard (Brassicaceae) family that invades pasture as well as disturbed and riparian areas (Whitson et al. 2009). The weed has been observed displacing 5% of meadow and 10% of upland grass and shrub vegetation (Francis and Warwick 2008; Young, Turner, and James 1995). Range and pastureland are degraded by perennial pepperweed's relatively low nutritional quality and digestibility, reducing carrying capacity (Eiswerth et al. 2005); if left un-mowed, dead perennial pepperwood stems can deter grazing (Young, Turner, and James 1995). Further, accumulating litter layers can inhibit other plants and create a monoculture (Renz and DiTomaso 1998). Eiswerth et al. (2005) found that perennial pepperweed can reduce the carrying capacity of grazing lands. They estimate that on land used for pasture and hay, the cumulative benefits exceed cumulative control costs for this weed after 4 to 5 years. As with most mustard and all *Lepidium* species, perennial pepperweed can be toxic to livestock in large quantities (Mackenzie 2004).

DISTRIBUTION IN WYOMING

Perennial pepperweed in Wyoming is concentrated in Sweetwater County, with significant acreages in Albany, Fremont, and Carbon counties (Figure 8). Statewide, reported 2021–2022 presence covered 151,399 acres (Table 5); 57,897 acres of this area (38%), was classified as impacted (observed as more than 20% of vegetative cover)(Table 6).

Suitable perennial pepperweed habitat is estimated at 17.2 million acres across Wyoming with significant potential for losses in Sweetwater and Fremont counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Perennial pepperweed is mainly associated with rangeland and pasture and hay agricultural land types in Wyoming (Table 8). Direct economic loss from perennial pepperweed infestation is estimated as a 15% reduction in annual cash rent for these land types (Table 3) on acres reported as present and 80% on areas reported as impacted (Table 9), where perennial pepperweed exceeds 20% of canopy cover. Potential loss on suitable habitat in Wyoming (Table 7) is estimated using a 48% reduction in rent (Table 9). County non-impacted agricultural values and loss estimates from perennial pepperweed are reported in Table 22.

Perennial pepperweed has the highest direct impacts in Sweetwater County, with an estimated $60,000 in lost agricultural value. Other counties with relatively high impacts include Lincoln County ($40,000), Albany County ($33,000) and Big Horn County ($23,000). Statewide, direct agricultural value lost due to perennial pepperweed totaled $190,643 in 2021 (Table 22. Loss estimates account for less than 1% in any county and statewide (Table 22).

Potential impacts from perennial pepperweed on suitable habitat across the state includes nine Wyoming counties with loss estimates of over $1 million, each of which could see agricultural rent reduced by over 10% of non-impacted values. These nine counties are Big Horn ($4.8 million, 23% loss), Sweetwater ($4.4 million, 28% loss), Fremont ($3.6 million, 14% loss), Sublette ($2.4 million, 16% loss), Lincoln ($1.7 million, 11% loss), Carbon ($1.7 million, 12% loss), Uinta ($1.4 million, 21% loss), Natrona ($1.2 million, 13% loss), and Goshen ($1.0 million, 10% loss). Total potential statewide loss is $31.7 million (Table 22).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, perennial pepperweed infestation reduced the value of agricultural cash rents by an estimated $191,000 in 2021 (Table 22). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including 1 annual job, $39,000 in labor income, $78,000 in value added, and $144,000 in output (Table 23).

Perennial pepperweed. Photo by Tom Whitson.

Table 22. Agricultural value and estimated loss from perennial pepperweed (*Lepidium latifolium* L.) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$32,634	0.5%	$558,791
Big Horn	$20,928,213	$22,572	0.1%	$4,811,237
Campbell	$11,692,585	$0	0%	$659,656
Carbon	$13,671,418	$3,078	0.0%	$1,691,839
Converse	$7,691,249	$558	0.0%	$632,892
Crook	$9,129,822	$0	0%	$635,031
Fremont	$24,183,709	$9,826	0.0%	$3,609,927
Goshen	$8,496,220	$1,711	0.0%	$1,028,831
Hot Springs	$5,750,263	$28	0.0%	$859,676
Johnson	$8,510,190	$0	0%	$704,008
Laramie	$11,553,857	$1,354	<0.0%	$618,856
Lincoln	$15,206,941	$39,597	<0.0%	$1,726,545
Natrona	$9,104,959	$1,120	0.0%	$1,239,230
Niobrara	$9,050,336	$8	<0.0%	$806,831
Park	$11,782,660	$6	<0.0%	$830,901
Platte	$5,543,312	$8	<0.0%	$581,839
Sheridan	$9,169,040	$41	<0.0%	$957,719
Sublette	$15,151,700	$9,688	0.1%	$2,371,915
Sweetwater	$15,837,056	$60,031	0.4%	$4,397,021
Teton	$4,469,633	$54	<0.0%	$26,288
Uinta	$6,618,833	$8,160	0.1%	$1,371,446
Washakie	$5,021,520	$168	<0.0%	$957,646
Weston	$6,472,690	$0	0%	$612,443
State total	**$251,684,701**	**$190,643**	**0.1%**	**$31,690,566**

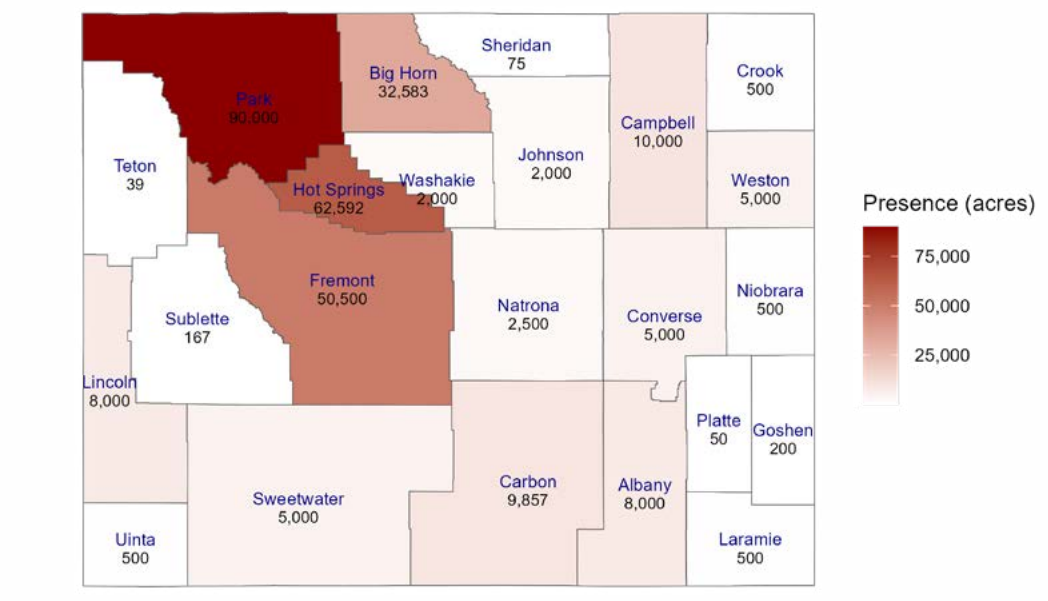
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.15 and 0.8 representing 15% and 80% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.48 representing 48% loss, reported in Table 9).

Table 23. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from perennial pepperweed (*Lepidium latifolium* L.) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$190,643				
Induced (household spending)		1	$38,987	$77,589	$143,599

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1]Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2]Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3]Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4]Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5]The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 9. County-level Russian knapweed (*Acroptilon repens*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



RUSSIAN KNAPWEED (*ACROPTILON REPENS*)

SPECIES DESCRIPTION

Russian knapweed (*Acroptilon repens*) is a non-native creeping herbaceous perennial with pink or purple thistle-like flowers, distinguished by brown or black spreading rhizomes (USFS 2015). It is capable of reproducing seed but primarily propagates from vegetative root buds (Beck 2013). In the western U.S., Russian knapweed is found along roadsides and fence lines as well as on rangeland, pasture, and riparian corridors. Dense stands of Russian knapweed reduce livestock and wildlife forage availability; moreover, it is toxic to livestock, especially to horses (USFS 2015).

DISTRIBUTION IN WYOMING

Russian knapweed was observed and reported by Wyoming Weed and Pest supervisors as present on 295,563 acres in 2021–2022 (Table 5), 36% or 106,733 acres of which was classified as impacted (observed as more than 20% of vegetative cover (Table 6). A swath of northwest-north-central Wyoming has relatively high Russian knapweed presence, including 90,000 acres in Park County, 62,592 acres in Hot Springs, 50,500 acres in Fremont, and 32,583 acres in Big Horn (Table 5, Figure 9).

Suitable Russian knapweed habitat is estimated at 39.5 million acres across Wyoming, with significant potential for losses in Sweetwater County as well as Fremont, Carbon, and Natrona counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

In Wyoming, Russian knapweed is associated with rangeland and pasture and hay agricultural land cover (Table 8). Direct economic loss to agricultural value from Russian knapweed in Wyoming is estimated as a 40% reduction in annual cash rent associated with these land types (Table 3) on areas with reported presence and 80% on impacted areas (Table 9), where Russian knapweed exceeds 20% of canopy cover. Potential loss on suitable Russian knapweed habitat (Table 7) is calculated using a 60% loss estimate (Table 9). County non-impacted agricultural values and loss estimates from Russian knapweed are reported in Table 24.

Big Horn, Hot Springs, and Park counties have the highest estimated direct impacts to agriculture from Russian knapweed infestation, with $226,000, $167,000, and $102,000 in lost annual cash rent in 2021, respectively. Statewide, lost value totaled $715,510 (Table 24). Loss estimates from Russian knapweed are 2.9 % of non-impacted agricultural value in Hot Springs County, 1.1% in Big Horn County, and less than 1% in all other counties as well as statewide (Table 24).

Potential losses from Russian knapweed on suitable habitat across Wyoming total $90 million, including $9.4 million in Fremont County, $8.7 million in Sweetwater County, and $8.3 million in Big Horn County (Table 24).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, Russian knapweed infestation reduced the value of agricultural cash rents by an estimated $716,000 in 2021 (Table 24). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including 3 annual jobs, $146,000 in labor income, $291,000 in value added, and $539,000 in output (Table 25).

Russian knapweed. Photo by Beth Fowers.

Table 24. Agricultural value and estimated loss from Russian knapweed (*Acroptilon repens*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$14,333	0.2%	$1,795,622
Big Horn	$20,928,213	$226,416	1.1%	$8,328,272
Campbell	$11,692,585	$22,650	0.2%	$4,767,793
Carbon	$13,671,418	$31,927	0.2%	$5,451,790
Converse	$7,691,249	$6,701	0.1%	$3,738,115
Crook	$9,129,822	$1,162	0.0%	$1,471,076
Fremont	$24,183,709	$97,420	0.4%	$9,414,193
Goshen	$8,496,220	$443	0.0%	$4,063,366
Hot Springs	$5,750,263	$167,313	2.9%	$2,604,669
Johnson	$8,510,190	$4,430	0.1%	$3,267,934
Laramie	$11,553,857	$1,710	0.0%	$3,604,162
Lincoln	$15,206,941	$11,783	0.1%	$3,708,983
Natrona	$9,104,959	$3,689	0.0%	$4,687,337
Niobrara	$9,050,336	$1,121	0.0%	$4,599,942
Park	$11,782,660	$102,561	0.7%	$2,024,911
Platte	$5,543,312	$85	0.0%	$2,922,076
Sheridan	$9,169,040	$165	0.0%	$2,966,757
Sublette	$15,151,700	$482	0.0%	$3,744,679
Sweetwater	$15,837,056	$7,063	0.0%	$8,697,114
Teton	$4,469,633	$28	0.0%	$6,263
Uinta	$6,618,833	$1,286	0.0%	$3,182,155
Washakie	$5,021,520	$4,073	0.1%	$2,330,278
Weston	$6,472,690	$8,670	0.1%	$2,608,889
State total	**$251,684,701**	**$715,510**	**0.3%**	**$89,986,377**

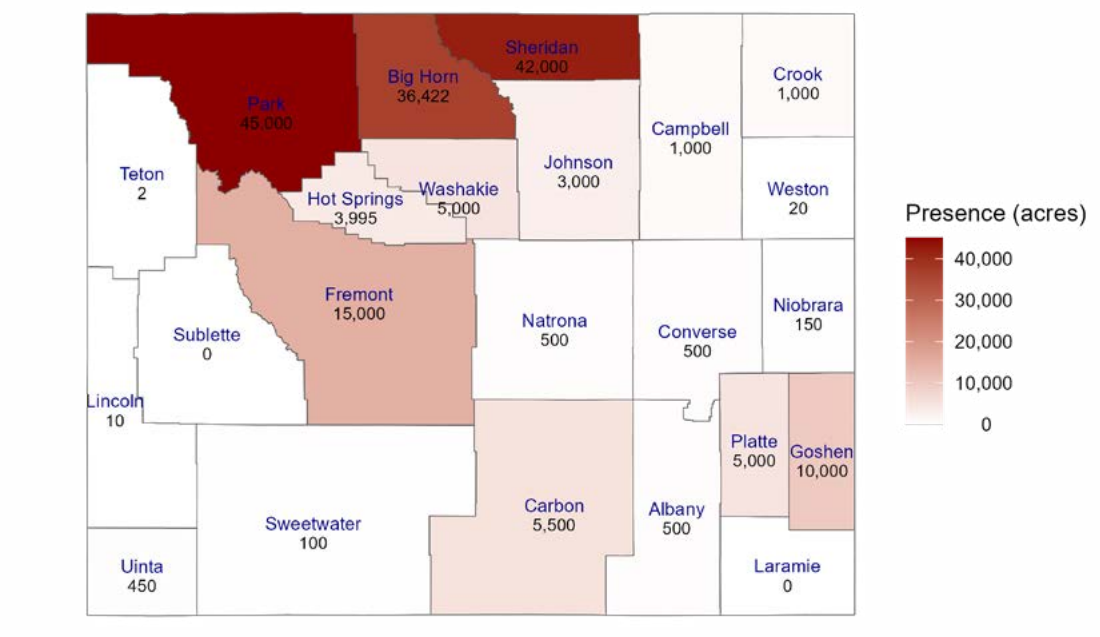
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.4 and 0.8 representing 40% and 80% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.6 representing 60% loss, reported in Table 9).

Table 25. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from Russian knapweed (*Acroptilon repens*) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$715,510				
Induced (household spending)		3	$146,323	$291,204	$538,948

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1] Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2] Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3] Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4] Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5] The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 10. County-level Russian olive (*Elaeagnus angustifolia*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



RUSSIAN OLIVE (*ELAEAGNUS ANGUSTIFOLIA*)

SPECIES DESCRIPTION

Russian olive (*Elaeagnus angustifolia* L.) is a tall shrub or small tree, native to Eurasia and introduced to North America in the early 1900s as a shelterbelt tree. It is now widespread and self-sustaining in riparian areas in the western U.S., where it can replace native cottonwood and willows (Weyl and Pasiecznik 2018). Russian olive can be invasive in irrigated pasture and hay land, interfering with irrigation systems (Pokorny, Mangold, and Noack 2020).

DISTRIBUTION IN WYOMING

Russian olive presence was reported in Wyoming on 175,149 acres in 2021–2022 (Table 5), 75,841 acres (43%) of which was classified as impacted (accounting for more than 20% of vegetative cover (Table 6). Across the state, Park, Sheridan, and Big Horn counties have the highest reported acreages, with moderate areas in Fremont and Goshen counties (Table 5, Figure 10).

Suitable Russian olive habitat is estimated at 38.7 million acres across Wyoming, with notable potential for losses in Fremont and Campbell counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Russian olive is associated with pasture and hay agricultural land cover, often adjacent to riparian areas (Table 8). Direct economic loss from Russian olive infestation is estimated as a 35% reduction in annual cash rent on pasture and hay acres (Table 3 and Table 8) with reported presence and 75% on impacted areas (Table 9), where Russian olive exceeds 20% of canopy cover. Potential loss on suitable habitat (Table 7) is estimated using a 55% reduction in cash rent (Table 9). County non-impacted agricultural values and loss estimates from Russian olive are reported in Table 26.

Big Horn and Sheridan counties have the highest estimated agricultural losses from Russian olive, with $4,000 each; statewide losses are $9,495 (Table 26). No county exceeded 1% of non-impacted agricultural value impacted by Russian olive (Table 26).

Potential losses due to Russian olive on suitable habitat across Wyoming total $1.7 million. The largest potential impacts to agricultural value are in Crook and Uinta counties (Table 26).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, Russian olive infestation reduced the value of agricultural cash rents by an estimated $9,000 in 2021 (Table 26). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including less than 1 annual job, $2,000 in labor income, $4,000 in value added, and $7,000 in output for the state (Table 27).

Russian olive. Photo by Beth Fowers.

Table 26. Agricultural value and estimated loss from Russian olive (*Elaeagnus angustifolia*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$8	0.0%	$44,209
Big Horn	$20,928,213	$3,682	0.0%	$114,394
Campbell	$11,692,585	$39	0.0%	$166,303
Carbon	$13,671,418	$202	0.0%	$91,114
Converse	$7,691,249	$4	0.0%	$24,180
Crook	$9,129,822	$118	0.0%	$287,590
Fremont	$24,183,709	$374	0.0%	$148,339
Goshen	$8,496,220	$268	0.0%	$56,399
Hot Springs	$5,750,263	$100	0.0%	$25,685
Johnson	$8,510,190	$68	0.0%	$41,477
Laramie	$11,553,857	$0	0%	$52,334
Lincoln	$15,206,941	$1	0%	$46,838
Natrona	$9,104,959	$3	0.0%	$17,596
Niobrara	$9,050,336	$6	0.0%	$74,962
Park	$11,782,660	$570	0.0%	$26,819
Platte	$5,543,312	$191	0.0%	$79,589
Sheridan	$9,169,040	$3,731	0.0%	$116,469
Sublette	$15,151,700	$0	0%	$5,497
Sweetwater	$15,837,056	$0	0%	$3,728
Teton	$4,469,633	$0	0%	$260
Uinta	$6,618,833	$53	0.0%	$206,514
Washakie	$5,021,520	$78	0.0%	$17,927
Weston	$6,472,690	$1	0.0%	$53,439
State total	**$251,684,701**	**$9,495**	**<0.0%**	**$1,701,662**

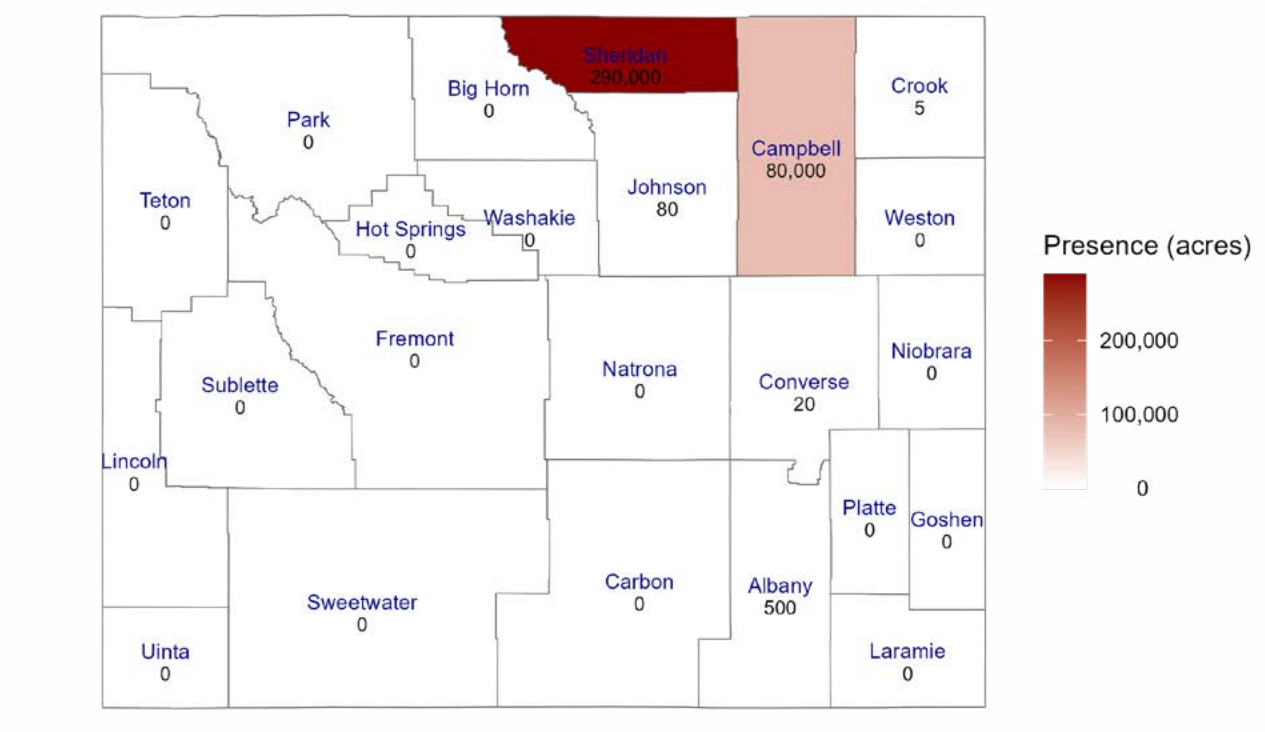
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.35 and 0.75 representing 35% and 75% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.55 representing 55% loss, reported in Table 9).

Table 27. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from Russian olive (*Elaeagnus angustifolia*) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$9,495				
Induced (household spending)		<1	$1,942	$3,864	$7,152

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1] Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2] Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3] Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4] Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5] The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 11. County-level ventenata (*Ventenata dubia*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



VENTENATA (*VENTENATA DUBIA*)

SPECIES DESCRIPTION

Ventenata (*Ventenata dubia*), also known as African wiregrass, is a non-native cool-season grass species, considered invasive in western North America as it displaces more palatable, nutritious native species and desirable introduced grasses. Ventenata can be invasive in both annual- and perennial-dominated grasslands, including sagebrush-steppe communities (Prather 2015). Ventenata has recently spread to the Great Plains and threatens forage on Wyoming rangelands, with disturbed areas more susceptible to invasion (Hart 2022).

DISTRIBUTION IN WYOMING

Observed occurrences of ventenata in Wyoming are concentrated in Sheridan and Campbell counties with 370,605 acres of ventenata presence reported statewide (Table 5, Figure 11), 35%, or 130,205 acres, of which is classified as impacted (Table 6).

Suitable ventenata habitat is estimated at 11.4 million acres across Wyoming. The highest potential loss area from ventenata is in Campbell County (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

In Wyoming, ventenata is mainly associated with rangeland agricultural land cover (Table 8). Direct economic loss to agricultural value due to ventenata is estimated as a 40% reduction in annual cash rent for rangeland acres (Table 3 and Table 8) with reported presence and 80% on impacted areas (Table 9), where ventenata exceeds 20% of canopy cover. Potential loss on suitable ventenata habitat (Table 7) is calculated using a 60% loss estimate (Table 9). County non-impacted agricultural values and loss estimates from ventenata infestation are reported in Table 28.

Following observed acres, nearly all lost agricultural value is in Sheridan County ($853,612), followed by Campbell County ($147,047); all other counties have negligible or no loss (Table 28). Loss estimates account for 9.1% and 1.2% of non-impacted agricultural value in Sheridan and Campbell counties, respectively, and less than 1% in other counties and statewide (Table 28).

The top county in terms of agricultural value at risk related to ventenata on suitable habitat is Campbell County with $5.1 million in potential loss. Five other counties (Niobrara, Sheridan, Laramie, Crook, and Converse) have over $2 million in potential losses on suitable ventenata habitat. Total potential statewide loss is $27 million. (Table 28).

TOTAL ECONOMIC ACTIVITY AT RISK

Across the Wyoming economy, ventenata infestation reduced the value of agricultural cash rents by an estimated $1 million in 2021 (Table 28). This translates to a direct reduction in landowners' household income as well as related induced losses from foregone household-to-business spending, including 5 annual jobs, $205,000 in labor income, $408,000 in value added, and $754,000 in output in the state economy (Table 29).

Ventenata. Photo by Beth Fowers.

Table 28. Agricultural value and estimated loss from ventenata (*Ventenata dubia*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$706	0.0%	$651,350
Big Horn	$20,928,213	$0	0%	$264,826
Campbell	$11,692,585	$147,047	1.2%	$5,089,342
Carbon	$13,671,418	$0	0%	$286,484
Converse	$7,691,249	$17	0.0%	$2,028,365
Crook	$9,129,822	$9	0.0%	$2,306,877
Fremont	$24,183,709	$0	0%	$150,518
Goshen	$8,496,220	$0	0%	$467,256
Hot Springs	$5,750,263	$0	0%	$358,894
Johnson	$8,510,190	$100	0.0%	$1,631,450
Laramie	$11,553,857	$0	0%	$2,471,838
Lincoln	$15,206,941	$0	0%	$286,635
Natrona	$9,104,959	$0	0%	$481,514
Niobrara	$9,050,336	$0	0%	$2,975,968
Park	$11,782,660	$0	0%	$773,631
Platte	$5,543,312	$0	0%	$1,540,901
Sheridan	$9,169,040	$853,612	9.1%	$2,917,217
Sublette	$15,151,700	$0	0%	$12,574
Sweetwater	$15,837,056	$0	0%	$1,042
Teton	$4,469,633	$0	0%	$11,048
Uinta	$6,618,833	$0	0%	$631,497
Washakie	$5,021,520	$0	0%	$131,839
Weston	$6,472,690	$0	0%	$1,616,335
State total	**$251,684,701**	**$1,001,491**	**0.4%**	**$27,087,402**

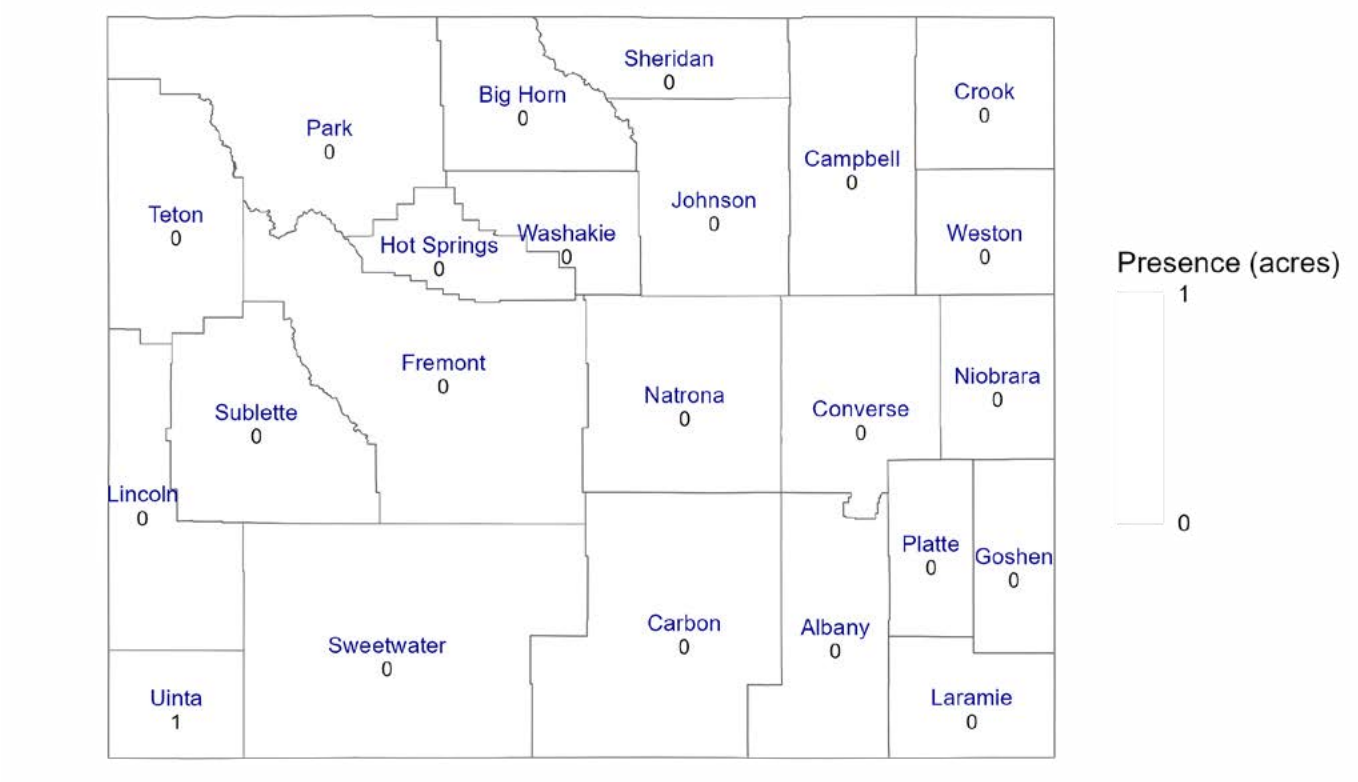
Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.4 and 0.8 representing 40% and 80% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.6 representing 60% loss, reported in Table 9).

Table 29. Direct loss in agricultural value and related induced economic activity at risk in Wyoming from ventenata (*Ventenata dubia*) infestation, 2021

	Direct Loss[1]	Induced Employment Loss[2]	Induced Labor Income Loss[3]	Induced Value Added Loss[4]	Induced Output Loss[5]
Impact (loss value)	$1,001,491				
Induced (household spending)		5	$204,807	$407,594	$754,359

Source: IMPLAN model, 2021 data, $2023.
Notes:
[1] Lost agricultural value, estimated above as a reduction in cash rent on weed-infested agricultural land.
[2] Number of job years potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[3] Employee compensation and proprietor income potentially supported from household spending in the Wyoming economy if direct agricultural value loss from weed infestation were avoided.
[4] Value Added is analogous to Gross Domestic Product, and includes labor income, taxes on production and income, and other property income. Loss is Value Added potentially supported from household spending in the Wyoming economy if weed infestation were avoided.
[5] The total value of production (Value Added plus Intermediate Inputs) potentially supported from household spending in the Wyoming economy if weed infestation were avoided.

Figure 12. County-level yellow starthistle (*Centaurea solstitialis*) presence distribution estimated by Wyoming Weed and Pest supervisors in 2021.



YELLOW STARTHISTLE (*CENTAUREA SOLSTITIALIS*)

SPECIES DESCRIPTION

Yellow starthistle (*Centaurea solstitialis*) is a tap-rooted annual forb in the sunflower (Asteraceae) family (Whitson et al. 2009). This weed spreads through high rates of seed production and seedbanks that can remain in the soil for 10 years (DiTomaso, Kyser, and Pitcairn 2006). Yellow starthistle can cause serious damage to both rangeland and improved pasture (Eagle et al. 2007), reducing carrying capacity from 10 to 50% (DiTomaso, Kyser, and Pitcairn 2006). The weed can also contaminate dried hay and can be toxic to horses (DiTomaso, Kyser, and Pitcairn 2006).

DISTRIBUTION IN WYOMING

Yellow starthistle had one acre reported of presence and none impacted Wyoming in 2021–2022 (Table 5, Figure 12).

Suitable yellow starthistle habitat is estimated at just 16,351 acres across Wyoming, mainly in Park, Natrona, and Platte counties (Table 7).

DIRECT ECONOMIC IMPACT TO WYOMING AGRICULTURE

Yellow starthistle is associated with rangeland and pasture and hay agricultural land cover (Table 8). Direct economic loss is estimated as a 20% reduction in annual cash rent for rangeland and pasture and hay (Table 3, Table 8) on acres with reported presence and 60% on impacted areas (Table 9), where yellow starthistle exceeds 20% of canopy cover. Potential loss on suitable habitat (Table 7) is estimated using a 40% reduction in cash rent (Table 9). County non-impacted agricultural values and loss estimates from yellow starthistle infestation are reported in Table 30.

With only a single reported acre of presence, yellow starthistle infestation did not reduce agricultural value in Wyoming in 2021–2022. Fourteen Wyoming counties with suitable yellow starthistle habitat had potential loss. These potential reductions in agricultural rents statewide are estimated at $22,000, with the highest impacts in Park, Natrona, and Platte counties (Table 30).

TOTAL ECONOMIC ACTIVITY AT RISK

With virtually no present yellow starthistle presence reported for 2021–2022, the value of agricultural cash rents was not reduced and there were no related induced losses from foregone household-to-business spending in Wyoming.

Yellow starthistle. Photo by Tom Whitson.

Table 30. Agricultural value and estimated loss from yellow starthistle (*Centaurea solstitialis*) infestation by Wyoming county

Wyoming county	Total non-impacted agricultural value[1] ($/year)	Loss to agricultural value[2] ($/year)	Percent of total agricultural value lost[3]	Potential loss on suitable habitat[4] ($/year)
Albany	$7,058,082	$0	0%	$1,056
Big Horn	$20,928,213	$0	0%	$998
Campbell	$11,692,585	$0	0%	$217
Carbon	$13,671,418	$0	0%	$252
Converse	$7,691,249	$0	0%	$420
Crook	$9,129,822	$0	0%	$0
Fremont	$24,183,709	$0	0%	$162
Goshen	$8,496,220	$0	0%	$1,441
Hot Springs	$5,750,263	$0	0%	$2,780
Johnson	$8,510,190	$0	0%	$237
Laramie	$11,553,857	$0	0%	$1,457
Lincoln	$15,206,941	$0	0%	$0
Natrona	$9,104,959	$0	0%	$3,936
Niobrara	$9,050,336	$0	0%	$0
Park	$11,782,660	$0	0%	$4,917
Platte	$5,543,312	$0	0%	$3,497
Sheridan	$9,169,040	$0	0%	$0
Sublette	$15,151,700	$0	0%	$0
Sweetwater	$15,837,056	$0	0%	$0
Teton	$4,469,633	$0	0%	$0
Uinta	$6,618,833	$1	0%	$0
Washakie	$5,021,520	$0	0%	$429
Weston	$6,472,690	$1	0%	$0
State total	**$251,684,701**	**$0**	**0%**	**$21,799**

Notes:
[1] Total area × proportion of each agricultural land category × its respective annual cash rent value.
[2] Weed area reported as present and impacted by Wyoming Weed and Pest supervisors in 2021–2022 × each agricultural land category proportion × respective annual cash rent value × respective biomass reduction estimates (0.2 and 0.6 representing 20% and 60% loss, respectively).
[3] Annual loss to agricultural value / Total non-impacted agricultural value.
[4] USGS INHABIT suitable habitat acreage × each agricultural land type proportion × respective annual cash rent value × respective biomass reduction estimate (0.4 representing 40% loss, reported in Table 9).

IMPLICATIONS

Invasive species have substantial economic impacts in Wyoming, as we have demonstrated. Among the species presented, cheatgrass currently has the largest impact on the statewide economy. This species was responsible for $28.7 million in losses in 2022. In comparison, ventenata, the second most economically damaging species, caused just over $1 million in losses in 2022. While these numbers may seem relatively small compared to the total economy of the state, they only reflect one level of impact (loss, primarily, of grazing cash rent) that is relatively low in value compared to other ecosystem goods and services. As such, these impact numbers may be very conservative estimates of actual impacts to the state. However, by focusing on agricultural value at risk, this analysis provides valuable information about the impacts of weed infestation across the state to aid in prioritizing species for control and providing a basis for comparison over time.

This report serves as a pilot study, setting out sound methods to estimate the economic impacts of 10 weeds with diverse growth habits, habitat requirements, and potential threats to Wyoming agriculture. Any such estimates are only as good as the area and distribution measures that inform them. The methods used to estimate agricultural value lost to infestation from each selected weed species are a simple reduction in agricultural cash rent for relevant land types (cropland versus pasture and hay or rangeland). Further economic impact analyses serve to illustrate lost value from other types of ecosystem goods and services at risk to impacts from terrestrial invasive plants.

Our results provide a basis to compare costs from lost agricultural value across a subset of invasive species and counties, as well as for ongoing comparisons over time. By including an assessment of potential losses if each species were allowed to spread into all currently suitable habitat, we can estimate the potential proactive reduction in such impacts. While there is much uncertainty regarding habitat suitability, suitable habitat used in this report provides a current best estimate of potential impacts if the weeds were left to spread unchecked.

We must interpret results presented here with appropriate caution. Current impact estimates are based solely upon the acreage estimates from each county Weed and Pest Control District. District personnel are the local experts regarding invasive weeds and are likely the best source for such estimates. However, it is nearly impossible to estimate acreage infested with absolute certainty. Until technology allows us to accurately map weed distribution to the finest scale at very large acreages, local expert knowledge is the best alternative.

Readers must also keep in mind the relationship between realized losses and potential losses due to expansion. It may be tempting to focus on a high-loss species such as cheatgrass in lieu of currently low-loss species (e.g., medusahead). Many of the low-loss species in this analysis are new or not yet widely established in the state, so we may not fully know their impacts. Additionally, preventing further spread of species with very limited range in Wyoming is a higher-leverage approach than waiting for them to have broad-reaching impacts before implementing a strategic management approach.

These estimates should be considered when planning for invasive plant management—especially when taking regional or statewide approaches. However, the estimates presented here may be considered conservative since we did not include impacts to other ecosystem goods and services such as recreation, wildfire reduction, and wildlife habitat. Non-market ecosystem goods and services can be substantial and even overshadow market goods and services (Epanchin-Niell 2017; Holmes et al. 2009; Rosenberger et al. 2012). Future work should explore additional impacts beyond direct losses to agricultural production capacity.

FURTHER WORK

Work such as that presented in this analysis is limited by lack of empirical data on distribution and severity of weed species across the state. Collection, curation, and sharing of such data in a way that is useful for analyses like this and for decision-makers will strengthen our ability to assess impacts and plan strategically for the future. Additionally, we need more information on the direct losses to other ecosystem goods and services caused by terrestrial invasive weeds. Although general concepts and anecdotal information are commonly seen, it is difficult to find examples of direct impacts across a suite of weed species in our region. Some examples that may be considered for opportunities to improve estimates for future efforts may include the following.

PUBLIC VERSUS PRIVATE RANGELAND SPATIAL AREAS AND VALUES

Available spatial Bureau of Land Management grazing allotment (DOI 2022), U.S. Forest Service Range Management Unit (USFS 2022a), and state and county grazing lease (WOSLI 2020a) data, paired with public grazing lease rates (e.g., BLM 2022b; USFS 2022b; WOSLI 2020b), could be used to more accurately estimate agricultural values on public lands.

PARCEL-LEVEL PRIVATE AGRICULTURAL LAND AREA AND USE

Likewise, Wyoming land parcel polygons (State of Wyoming 2022) and parcel-level county assessment data available from the Wyoming Department of Revenue (WDOR 2022) could be used to better define agricultural land tax status, as well as agricultural production quality and land values associated with spatial locations.

IRRIGATED VERSUS NON-IRRIGATED CROPLAND

Irrigated versus non-irrigated croplands could also be paired with relevant cash rent value. Several spatial datasets defining irrigated cropland are available, including the

U.S. Geological Survey's MODIS dataset (USGS 2019) and Wyoming State Climate Office Water Resources Data System irrigated lands map (WWDO 2007). These data could be paired with NASS-reported cash land rents on irrigated and non-irrigated croplands by Wyoming county (e.g., NASS 2017) and reported as a weighted value (= [irrigated crop rent × proportion irrigated] + [non-irrigated cropland rent × 1 - proportion irrigated]).

IMPROVED SUITABLE HABITAT ESTIMATES

Identifying irrigation status allows for other additional specificity for individual species; for example, cheatgrass impacts could be specified on non-irrigated croplands and Russian olive on irrigated cropland as well as pasture and hay land. Spatial data from more rigorous recent modeling of Russian olive habitat is available from Perry, Jarnevich, and Shafroth (2022). A more focused review of literature for other species might uncover additional sources for suitable habitat estimates.

IMPACTS TO SPECIFIC CROPS

Recent (2021) spatial data for specific crops is available using the USDA Cropland Data Layer (NASS 2022). NASS also reports county-level crop production values. Furthermore, the Weed Science Society of America yield loss committee publishes the economic impact of weed competition in different crops every few years, including crops relevant to Wyoming, such as corn, dry beans, sugar beets, and wheat (WSSA 2023). Combining these at the county level with Wyoming Weed and Pest weed presence and impact observations could be used for more crop-specific loss estimates. Examples of specific crop impacts from weeds identified for analysis in Wyoming include cheatgrass losses associated with winter wheat (Blackshaw and Hamman 1998), winter rye, and other dryland crops (Blackshaw 1993; Schillinger et al. 2006); Palmer amaranth with corn (Massinga et al. 2001), soybeans (Klingaman and Oliver 1994), dry edible beans (Miranda et al. 2022), and sugar beets (Beiermann et al. 2021); and hoary cress infesting corn, small grains, and sugar beets (Weyl 2018).

VALUING LOSSES AND COSTS TO ECOSYSTEM SERVICES

Analysis of the economic impacts related to weed infestation on recreation, ecosystem services, wildfire, wildlife habitat, or similar observations (e.g., Eiswerth et al. 2009, Brunson and Tanaka 2011), is an obvious extension to this pilot study that focuses solely on losses related to agricultural value. Study areas expanded to include non-agricultural wildland areas could capture additional lost economic value. The economic value of wildlife, recreation, and other ecosystem services has also been applied to western rangelands (Maher et al. 2021), though not in Wyoming. Examples of invasive weeds leading to lost ecosystem services value might include medusahead infestation that reduces diversity in native sagebrush habitat or cheatgrass infestation related to degraded wildlife forage that has a potential to reduce hunting tags available in certain areas (WGFD 2022).

Wildfire suppression costs and benefits impacted by invasive weeds such as cheatgrass may shift Wyoming wildfire regimes (Taylor et al. 2013). This shift can directly impact homes and human lives, but also has indirect effects such as air quality impacts and increased wildfire suppression costs (Jaffe et al. 2020).

FURTHER ECONOMIC IMPACT ANALYSIS

Further economic impact analysis could expand IMPLAN modeling to translate loss and potential loss in agricultural value into potential indirect loss from infestation on suitable habitat.

TOTAL AGGREGATE COST

Summing indirect economic loss estimates over multiple weeds in a given area, for example to calculate the total loss in agricultural value from all selected invasive species in a given county or statewide, requires a process that accounts for the possibility that multiple weeds may be impacting the same observed or suitable area. Developing a total aggregate cost method that accounts for potential overlapping species and species-specific agricultural land types could be valuable as part of further analysis.

REFERENCES

BACKGROUND AND JUSTIFICATION

Office of the Wyoming Governor (OWG). 2020. Final Report: Governor's Invasive Species Initiative, October 2020. https://wyoweed.org/wp-content/uploads/2024/04/GISIFinalReportOct2020-1.pdf

METHODS

Clouse, C. 2022. IMPLAN Support. Examining results and interpreting direct, indirect, and induced effects. https://support.implan.com/hc/en-us/articles/360038799153-Examining-Results-Interpreting-Direct-Indirect-and-Induced-Effects.

Dewitz, J., and US Geological Survey (USGS). 2021, National Land Cover Database (NLCD) 2019 Products (ver. 2.0, June 2021): US Geological Survey data release. https://www.sciencebase.gov/catalog/item/5f21cef582cef313ed940043.

IMPLAN. 2021. IMPLAN, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078, www.IMPLAN.com.

National Agricultural Statistical Service (NASS). 2021a. Quick Stats: 2021 Survey, Wyoming Counties, Rent, Cash, Pastureland - Expense measured in $/Acre. https://quickstats.nass.usda.gov/results/ADCE9A39-4AC4-34FA-8227-302B1CBFEFC9.

National Agricultural Statistical Service (NASS). 2021b. Quick Stats: 2021 Survey, Wyoming Counties, Rent, Cash, Cropland, Non-irrigated - Expense measured in $/Acre. https://quickstats.nass.usda.gov/results/65B1C19E-D2BC-39EB-9F5B-5BE45B5B196C.

US Census Bureau (USCB). 2022. American Community Survey, selected economic characteristics, median household income (dollars), 2021. https://data.census.gov/table?q=DP03&g=0400000US56.

US Geological Survey (USGS). n.d. Invasive Species Habitat Tool (INHABIT). https://gis.usgs.gov/inhabit/.

Young, N.E., C.S. Jarnevich, H.R. Sofaer, I. Pearse, J. Sullivan, P. Engelstad, et al. 2020. A modeling workflow that balances automation and human intervention to inform invasive plant management decisions at multiple spatial scales. *PLoS ONE* 15(3): e0229253. https://doi.org/10.1371/journal.pone.0229253.

RESULTS

Cheatgrass / downy brome

Mealor, B.A., R.D. Mealor, W.K. Kelley, D.L. Bergman, et al. 2013. Cheatgrass management handbook: Managing an invasive annual grass in the Rocky Mountain Region. University of Wyoming Extension, Laramie, WY, and Colorado State University Extension, Fort Collins, CO. https://www.wyoextension.org/publications/Search_Details.php?pubid=1837&pub=B-1246.

White, M. 2014. Invasive plants and weeds of the National Forests and Grasslands in the Southwestern Region, Second Edition. USDA Forest Service Southwestern Region Apache-Sitgreaves National Forests. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3802006.pdf.

Hoary cress / whitetop

Francis, A. and S.I. Warwick. 2008. The biology of Canadian weeds. 3. *Lepidium draba* L., *L. chalepense* L., *L. appelianum* Al-Shehbaz (updated). *Canadian Journal of Plant Science* 88(2). https://cdnsciencepub.com/doi/10.4141/CJPS07100.

Weyl, P. 2018. *Lepidium draba* (hoary cress) Datasheet. CABI Compendium Digital Library. https://doi.org/10.1079/cabicompendium.10621.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2009. Weeds of the West 10th Edition. https://www.wyoextension.org/publications/Search_Details.php?pubid=696

Wilson, L., J. Davison, and E. Smith. 2006. "Grazing and Browsing Guidelines for Invasive Rangeland Weeds," Chapter 15 in *Targeted Grazing: A Natural Approach to Vegetation Management and Landscape Enhancement,* edited by K. Launchbaugh. American Sheep Industry Association. Centennial, CO: Cottrell Printing. https://www.webpages.uidaho.edu/rx-grazing/Handbook/Chapter_15_Targeted_Grazing.pdf.

Leafy spurge

Kirby, D.R., T.P. Hanson, and C.H. Sieg. 1997. Diets of Angora Goats Grazing Leafy Spurge (*Euphorbia esula*)-Infested Rangeland. *Weed Technology* 11(4):734-738. https://www.jstor.org/stable/3988767#metadata_info_tab_contents.

Leitch, J.A., F.L. Leistritz, and D.A. Bangsund. 1996. Economic effect of leafy spurge in the Upper Great Plans: Methods, models, and results. *Impact Assessment* 14(4):419-433. https://doi.org/10.1080/07349165.1996.9725915.

Lym, R.G., and D.R. Kirby. 1987. Cattle foraging behavior in leafy spurge (*Euphorbia esula*)-infested rangeland. *Weed Technology* 1(4): 314-318. https://www.jstor.org/stable/3987009#metadata_info_tab_contents.

Minnesota Department of Agriculture (MDA). 2023. Pest Management. Weed Control. Noxious List. Leafy Spurge. https://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/noxiouslist/leafyspurge.

Reilly, W., and K.R. Kaufman. 1979. The social and economic impact of leafy spurge in Montana. Pages 21-24 in *Proceedings: Leafy spurge symposium*. ND State University Cooperative Extension Service, unnumbered publication. https://library.ndsu.edu/ir/bitstream/handle/10365/3623/1954RE79.PDF?sequence=1.

Seefeldt, S.S., J.B. Taylor, and S. Van Vleet. 2007. Reducing *Euphorbia esula* with a combination of sheep grazing and imazapic. *Journal of Arid Environments* 69(3):432-440. https://www.sciencedirect.com/science/article/pii/S014019630600351X.

US Forest Service (USFS). 2014. Field Guide for Managing Leafy Spurge in the Southwest. USFS Southwest Region. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410117.pdf.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2009. Weeds of the West 10th Edition. https://www.wyoextension.org/publications/Search_Details.php?pubid=696

Medusahead wildrye

Stannard, M.E., D.O. Ogle, and L. St. John. 2010. Plant guide for medusahead (*Taenitherum caput-medusae*).Published August, 2010. USDA Natural Resources Conservation Service. https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_taca8.pdf.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2009. Weeds of the West 10th Edition. https://www.wyoextension.org/publications/Search_Details.php?pubid=696

Palmer amaranth

Coles, D.J., K.C. Brock, and A.R. Kniss. 2024. Palmer amaranth: A new threat to Wyoming's agriculture. B-1396. University of Wyoming Extension, Laramie, WY. https://www.wyoextension.org/publications/Search_Details.php?pubid=2127&pub=B-1396.

Kniss, Andrew. 2022. Palmer Amaranth in Wyoming: Legitimate threat to agriculture, or just another pigweed? University of Wyoming, Weed Science. Available on request from the author: AKniss@uwyo.edu.

USDA Natural Resources Conservation Service (NRCS). 2017. Palmer Amaranth Factsheet. USDA Natural Resources Conservation Service. https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/archived-fact-sheets/palmer_amaranth_nrcs_national_factsheet.pdf.

Perennial pepperweed

Eiswerth, M.E., L. Singletary, J.R. Zimmerman, and W.S. Johnson. 2005. Dynamic Benefit–Cost Analysis for Controlling Perennial Pepperweed (*Lepidium latifolium*): A Case Study. *Weed Technology* 19(2):237-243. https://doi.org/10.1614/WT-04-136R.

Francis, A. and S.I. Warwick. 2008. The biology of Canadian weeds. 3. *Lepidium draba* L., *L. chalepense* L., *L. appelianum* Al-Shehbaz (updated). *Canadian Journal of Plant Science* 88(2). https://cdnsciencepub.com/doi/10.4141/CJPS07100.

Mackenzie, A. 2004. "The Plants: How to Remove Bay Area Weeds," Chapter 6 in *The Weed Workers' Handbook*, The Watershed Project, California Invasive Plant Council. https://www.cal-ipc.org/resources/library/publications/wwh/.

Renz, M.J. and J.M. DiTomaso. 1998. The effectiveness of mowing and herbicides to control perennial pepperweed (*Lepidium latifolium*) in rangeland and roadside habitats. Proceedings from the 1998 California Weed Science Conference 50, 178. https://www.cwss.org/wp-content/uploads/2018/04/CWSS1998_178.pdf.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2009. Weeds of the West 10th Edition. https://www.wyoextension.org/publications/Search_Details.php?pubid=696

Young, J.A., C.E. Turner, and L.F James. 1995. Perennial pepperweed. *Rangelands* 17(4):121-123. https://repository.arizona.edu/handle/10150/639060.

Russian knapweed

Beck, K.G. 2013. Russian knapweed factsheet. Colorado State University Extension, Fort Collins, CO. https://extension.colostate.edu/topic-areas/natural-resources/russian-knapweed-3-111/.

US Forest Service (USFS). 2015. Field guide for managing Russian knapweed in the Southwest. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410125.pdf.

Russian olive

Pokorny, M., J. Mangold, and R. Noack. 2020. Plant Guide for Russian olive (*Elaeagnus angustifolia* L.). USDA-Natural Resources Conservation Service, Bridger Plant Materials Center, Bridger, MT 59014. https://plantsorig.sc.egov.usda.gov/plantguide/pdf/pg_elan.pdf.

Weyl, P. and N. Pasiecznik. 2018. *Elaeagnus angustifolia* (Russian olive). CABI Compendium, Digital Library Datasheet. https://doi.org/10.1079/cabicompendium.20717.

Ventenata

Hart, Marshall, T., Ventenata in the Northern Mixed Prairie: Forage recovery, drought considerations, and the economics of its removal, Ph.D., Department of Plant Sciences, May 2022. https://www.proquest.com/docview/2674014320?pq-origsite=gscholar&fromopenview=true.

Prather, T. 2015. *Ventenata dubia* (North Africa grass). CABI Compendium, Digital Library Datasheet. https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.117772.

Yellow starthistle

DiTomaso, J.M., G.B. Kyser, and M.J. Pitcairn. 2006. Yellow starthistle management guide. Cal-IPC Publication 2006-03. California Invasive Plant Council: Berkeley, CA. https://www.cal-ipc.org/docs/ip/management/pdf/YSTMgmtweb.pdf.

Eagle, A.J., M.E. Eiswerth, W.S. Johnson, S.E. Schoenig, and G.C. van Kooten. 2007. Costs and losses imposed on California ranchers by yellow starthistle. *Rangeland Ecology and Management* 60(4):369-377. https://doi.org/10.2111/1551-5028(2007)60[369:CALIOC]2.0.CO;2.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2009. Weeds of the West 10th Edition. https://www.wyoextension.org/publications/Search_Details.php?pubid=696

FURTHER WORK

Beiermann, C.W., C.F. Creech, S.Z. Knezevic, A.J. Jhala, R. Harveson, and N.C. Lawrence. 2021. Response of Palmer amaranth (*Amaranthus palmeri S. Watson*) and sugarbeet to desmedipham and phenmedipham. *Weed Technology* 35(3):440-448. https://doi.org/10.1017/wet.2021.1

Blackshaw, R.E. 1993. Downy brome (*Bromus tectorum*) Interference in winter rye (*Secale cereale*). *Weed Science* 41(4): 557-562. https://doi.org/10.1017/S0043174500076311

Blackshaw, R.E., and W.M. Hamman. 1998. Control of downy brome (*Bromus tectorum*) in winter wheat (*Triticum aestivum*) with MON 37500. *Weed Technology* 12(3):421-425. https://www.jstor.org/stable/3988928#metadata_info_tab_contents.

Brunson, M.W., and J. Tanaka. 2011. Economic and social impacts of wildfires and invasive plants in American deserts: Lessons from the Great Basin. *Rangeland Ecology and Management* 64(5):463-470. https://doi.org/10.2111/REM-D-10-00032.1.

Eiswerth, M.E., T.D. Darden, W.S. Johnson, J. Agapoff, and T. Harris. 2005. Input–output modeling, outdoor recreation, and the economic impacts of weeds. *Weed Science* 53:130-137. https://doi.org/10.1614/WS-04-022R.

Jaffe, D.A., S.M. O'Neill, N.K. Larkin, A.L. Holder, D.L. Peterson, J.E. Halofsky, and A.G. Rappold. 2020. Wildfire and prescribed burning impacts on air quality in the United States. Journal of the Air and Waste Management Association 70(6):583-615. https://doi.org/10.1080/10962247.2020.1749731.

Klingaman, T.E. and L.R. Oliver. 1994. Palmer Amaranth (*Amaranthus palmeri*) interference in soybeans (*Glycine max*). *Weed Science* 42(4): 523-527. https://doi.org/10.1017/S0043174500076888.

Maher, A.T., N.E.Q. Ashwell, K.A. Maczko, D.T. Taylor, J.A. Tanaka, and M.C. Reeves. 2021. An economic valuation of federal and private grazing land ecosystem services supported by beef cattle ranching in the United States. *Translational Animal Science* 5(3):1-15. https://doi.org/10.1093/tas/txab054.

Massinga, R.A., R.S. Currie, M.J. Horak, and J. Boyer Jr. 2001. Interference of Palmer amaranth in corn. *Weed Science* 49(2):202-208. https://doi.org/10.1614/0043-1745(2001)049[0202:IOPAIC]2.0.CO;2.

Miranda, J.W.A., A.J. Jhala, J. Bradshaw, and N.C. Lawrence. 2022. Palmer amaranth (*Amaranthus palmeri*) interference and seed production in dry edible bean. *Weed Technology* 35(6):995-1006. https://doi.org/10.1017/wet.2021.101.

National Agricultural Statistics Service (NASS). 2017. 2017 Census of Agriculture, Cropland, harvested acres, by Wyoming county. https://quickstats.nass.usda.gov/results/EE8A821A-1175-3595-A8B5-8DBE0F1.

National Agricultural Statistics Service (NASS). 2022. 2021 Cropland Data Layer. https://www.nass.usda.gov/Research_and_Science/Cropland/Release/index.php.

Perry, L.G., C.S Jarnevich, and P.B Shafroth. 2022. Occurrence data and models for woody riparian native and invasive plant species in the conterminous western USA: US Geological Survey data release. https://doi.org/10.5066/P9LIB2TF.

Schillinger, W.F., R.I. Papendick, S.O. Guy, P.E. Rasmussen, and C. Van Kessel. 2006. "Dryland Cropping in the Western United States," Chapter 11 in *Dryland Agriculture*, Vol. 23, 2nd Ed, edited by G.A. Peterson, P.W. Unger, and W.A. Payne. https://doi.org/10.2134/agronmonogr23.2ed.c11.

State of Wyoming. 2022. Wyoming Statewide Parcel Viewer. https://lands.wyo.gov/trust-land-management/surface-leasing/grazing-agricultural-leases.

Taylor, M.H., K. Rollins, M. Kobayashi, and R.J. Tausch. 2013. The economics of fuel management: Wildfire, invasive plants, and the dynamics of sagebrush rangelands in the western United States. *Journal of Environmental Management* 126(15):157-173. https://doi.org/10.1016/j.jenvman.2013.03.044.

US Department of Interior (DOI). 2022b. BLM Natl Grazing Allotment Polygons. https://gbp-blm-egis.hub.arcgis.com/datasets/blm-natl-grazing-allotment-polygons/explore?location=39.832257%2C-111.703184%2C6.09.

US Forest Service (USFS). 2022b. FSGeodata Clearinghouse. Download National Datasets. Range: Allotment. Range Management Unit feature class. https://data.fs.usda.gov/geodata/edw/datasets.php.

US Geological Survey (USGS). 2019. MlrAD Irrigation Frequency Map. https://wyo-prop-div.wyo.gov/assessment-data-download.

Weed Science Society of America (WSSA). 2023. Crop loss publications. https://old.wssa.net/wssa/weed/croploss-2.

Weyl, P. 2018. CABI Compendium datasheet. *Lepidium draba* (hoary cress). https://doi.org/10.1079/cabicompendium.10621.

Wyoming Department of Revenue (WDOR). 2022. Wyoming CAMA Data Download. https://wyo-prop-div.wyo.gov/assessment-data-download.

Wyoming Game and Fish Department (WGFD) 2022. Hunters: 2022 Wyoming hunt forecast available. https://wgfd.wyo.gov/News/Hunters-2022-Wyomng-hunt-forecast-available.

Wyoming Office of State Lands and Investments (WOSLI). 2020a. Land and Lease Map Viewer. https://gis2.statelands.wyo.gov/portal/apps/webappviewer/index.html?id=b8051ebac03744f7835331ae8afc01e5.

Wyoming Office of State Lands and Investments (WOSLI). 2020b. Grazing and Agricultural Leases. Maps and Records. Grazing and Agricultural Leases. https://lands.wyo.gov/trust-land-management/surface-leasing/grazing-agricultural-leases.

Wyoming Water Development Office. 2007. Wyoming State Water Plan. GIS Products. Irrigated Lands polygon dataset. https://waterplan.state.wy.us/plan/statewide/2007/gis/Irrigated_Land.html.

USDA

This work is supported by McIntire-Stennis research funds, project accession no. 7001691, from the U.S. Department of Agriculture's National Institute of Food and Agriculture.

Additional support from the Wyoming Weed and Pest Council and the Joe and Arlene Watt Foundation.

Issued in furtherance of extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Mandy Marney, Director, University of Wyoming Extension, College of Agriculture, Life Sciences and Natural Resources, University of Wyoming Extension, University of Wyoming, Laramie, Wyoming 82071.

B-1398
Publish Month & Year

Weed and Pest Declared List (By County) 2025

Defined by Wyoming Statutes:

W.S. 11-5-102(a)(vii) ""Declared pest" means any animal or insect which the board and the Wyoming weed and pest council have found, either by virtue of its direct effect, or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district;"

W.S. 11-5-102(a)(viii) ""Declared weed" means any plant which the board and the Wyoming weed and pest council have found, either by virtue of its direct effect, or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district;"

W.S. 11-5-105(a)(vi) "Participate in programs for the control of declared weeds and declared pests not included on the designated list. Such programs do not qualify for cost-sharing from the department."

Procedures Defined by Wyoming Rules and Regulations:

Chapter 42. Board of Agriculture – Weed and Pest Rules and Regulations

Section 4. Declared Pest and Declared Weed Program Participation Under W.S. 11-5-105(b)(vi).

Albany County

Downy brome	*Bromus tectorum* L.
Geyer larkspur	*Delphinium geyeri* Greene
Locoweed	Oxytropis spp.
Mosquito	Culicidae spp.

Big Horn County

Babysbreath	*Gypsophila paniculata* L.
Common crupina	*Crupina vulgaris* Cass.
Common teasel	*Dipsacus fullonum* L.
Wooly distaff thistle	*Carthamus lanatus* L.
Field dodder	*Cuscuta pentagona* Engelm.
Goatsrue	*Galega officinalis* L.
Gorse	*Ulex europaeus* L.
Iberian starthistle	*Centaurea iberica* Trev. ex Spreng.
Italian thistle	*Carduus pycnocephalus* L.
Japanese knotweed	*Reynoutria japonica* Houtt.
Meadow knapweed	*Centaurea pratensis* Thuill.
Orange hawkweed	*Hieracium aurantiacum* L.
Poison hemlock	*Conium maculatum* L.
Puncturevine	*Tribulus terrestris* L.
Purple starthistle	*Centaurea calcitrapa* L.
Redstem filaree	*Erodium cicutarium* (L.) L'Her. ex Ait.
Rush skeletonweed	*Chondrilla juncea* L.
Scentless chamomile	*Tripleurospermum inodorum* (L.) Sch. Bip.
Scotch broom	*Cytisus scoparius* (L.) Link
Squarrose knapweed	*Centaurea virgata* Lam.
Swainsonpea	*Sphaerophysa salsula* (Pallas) DC.
Sulfur cinquefoil	*Potentilla recta* L.
Syrian beancaper	*Zygophyllum fabago* L.
Tansy ragwort	*Senecio jacobaea* L.
Yellowdevil hawkweed	*Hieracium x floribundum* Wimmer & Grab. (pro sp.)
Venice mallow	*Hibiscus trionum* L.
Vipers bugloss	*Echium vulgare* L.

Campbell County

Buffalobur	*Solanum rostratum* Dunal
Bulbous bluegrass	*Poa bulbosa* L.
Common cocklebur	*Xanthium strumarium* L.
Jointed goatgrass	*Aegilops cylindrica* Host.
Mosquito	*Culex tarsalis*
Poison hemlock	*Conium maculatum* L.
Sulfur cinquefoil	*Potentilla recta* L.

Carbon County

Absinthe wormwood	Artemisia absinthium L.
Babysbreath	*Gypsophila paniculata*
Downy brome	*Bromus tectorum* L.
Common cocklebur	*Xanthium strumarium* L.
Geyer larkspur	*Delphinium geyeri* Greene
Halogeton	*Halogeton glomeratus* (M. Bieb.) C.A. Mey.
Mosquito	Culicidae spp.
Sulfur cinquefoil	*Potentilla recta* L.
Wyeth's lupine	*Lupinus wyethii* S. Watson.

Converse County

Absinth wormwood	*Artemisia absinthium* L.
Alfalfa weevil	*Hypera postica* Gyllenhal
Babysbreath	*Gypsophila paniculata* L.
Bull thistle	*Cirsium vulgare* (Savi) Ten.
Buffalobur	*Solanum rostratum* Dunal
Bur buttercup	*Ceratocephala testiculata* (Crantz) Roth
Chicory	*Cichorium intybus* L.
Common cocklebur	*Xanthium strumarium* L.
Common crupina	*Crupina vulgaris* Cass.
Common sunflower	*Helianthus annuus* L.
Common teasel	*Dipsacus fullonum* L.
Curly dock	*Rumex crispus* L.
Curlycup gumweed	*Grindelia squarrosa* (Pursh) Dunal
Damesrocket	*Hesperis matronalis* L.
Downy brome	*Bromus tectorum* L.
Geyer larkspur	*Delphinium geyeri* Greene
Goatsrue	*Galega officinalis* L.
Gorse	*Ulex europaeus* L.
Halogeton	*Halogeton glomeratus* (M. Bieb.) C.A. Mey.
Iberian starthistle	*Centaurea iberica* Trev. ex Spreng.
Italian thistle	*Carduus pycnocephalus* L.
Jointed goatgrass	*Aegilops cylindrica* Host.
Meadow knapweed	*Centaurea pratensis* Thuill.
Mosquito	Culicidae spp..
Blue mustard	*Chorispora tenella* (Pall.) DC.
Northern pocket gopher	*Thomomys talpoides*
Orange hawkweed	*Hieracium aurantiacum* L.
Poison hemlock	*Conium maculatum* L.
Puncturevine	*Tribulus terrestris* L.
Purple starthistle	*Centaurea calcitrapa* L.
Redstem filaree	*Erodium cicutarium* (L.) L'Her.ex Ait
Rush skeletonweed	*Chondrilla juncea* L.
Field sandbur	*Cenchrus spinifex* Cav.
Scentless chamomile	*Tripleurospermum inodorum* (L.) Sch. Bip.
Scotch broom	*Cytisus scoparius* (L.) Link
Squarrose knapweed	*Centaurea virgata* Lam.
Sulfur cinquefoil	*Potentilla recta* L.
Syrian beancaper	*Zygophyllum fabago* L.
Tansy ragwort	*Senecio jacobaea* L.
Wavyleaf thistle	*Cirsium undulatum* (Nutt.) Spreng.
Western sticktight	*Lappula occidentalis* (S. Wats.) Greene
Wild licorice	*Glycyrrhiza lepidota* Pursh
Yellowdevil hawkweed	*Hieracium x floribundum* Wimmer & Grab. (pro sp.)

Crook County

Buffalobur	*Solanum rostratum* Dunal
Bull thistle	*Cirsium vulgare* (Savi) Ten.
Common cocklebur	*Xanthium strumarium* L.
Great Plains yucca	*Yucca glauca* Nutt.
Plains pocket gopher	*Geomys bursarius* (Shaw)
Sulphur cinquefoil	*Potentilla recta* L.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Weed and Pest Declared List (By County) 2025

Uniting with Wyoming Weed and Pest Control Districts, Wyoming Department of Agriculture, University of Wyoming

Fremont County

Absinth wormwood	*Artemisia absinthium* L.
Babysbreath	*Gypsophila paniculate* L.
Downy brome	*Bromus tectorum* L.
Damesrocket	*Hesperis matronalis* L.
Northern pocket gopher	*Thomomys talpoides*
Puncturevine	*Tribulus terrestris* L.
Swainsonpea	*Sphaerophysa salsula* (Pall.) DC.
Sulphur cinquefoil	*Potentilla recta* L.
Tall buttercup	*Ranunculus acris* L.

Goshen County

Downy brome	*Bromus tectorum* L.
Horseweed	*Erigeron canadensis* L.
Mosquito	Culicidae spp.
Palmer amaranth	*Amaranthus palmeri* S. Watson
Plains pocket gopher	*Geomys bursarius*
Puncturevine	*Tribulus terrestris* L.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Hot Springs County

Bull thistle	*Cirsium vulgare* (Savi) Ten.
Common cocklebur	*Xanthium strumarium* L.
Curlycup gumweed	*Grindelia squarrosa* (Pursh) Dunal
Downy brome	*Bromus tectorum* L.
Duncecap larkspur	Delphinium occidentale S. Watson
Geyer larkspur	*Delphinium geyeri* Greene
Mosquito	Culicidae spp.
Puncturevine	*Tribulus terrestris* L.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Johnson County

Buffalobur	*Solanum rostratum* Dunal
Common cocklebur	*Xanthium strumarium* L.
Curly dock	*Rumex crispus* L.
Curlycup gumweed	*Grindelia squarrosa* (Pursh) Dunal
Downy brome	*Bromus tectorum* L.
Duncecap larkspur	*Delphinium occidentale* S. Watson
Hoary alyssum	*Berteroa incana* (L.) DC.
Mosquito	Culicidae spp.
Moth Mullein	*Verbascum blattaria* L.
Orange hawkweed	*Hieracium aurantiacum* L.
Puncturevine	*Tribulus terrestris* L.
Rocky Mountain beeplant	*Cleome serrulate* Pursh
Varroa mites	*Varroa destructor*
Wild licorice	*Glycyrrhiza lepidota* Pursh

Laramie County

Downy brome	*Bromus tectorum* L.
Hairy false goldenaster	*Heterotheca villosa* (Pursh) Shinners
Geyer larkspur	*Delphinium geyeri* Greene
Jointed goatgrass	*Aegilops cylindrica* Host.
Locoweed	Oxytropis spp.
Plains pricklypear	*Opuntia polyacantha* Haw.
Plains pocket gopher	*Geomys bursarius* (Shaw)
Puncturevine	*Tribulus terrestris* L.
Field sandbur	*Cenchrus spinifex* Cav.
Vipers bugloss	*Echium vulgare* L.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Lincoln County

Alfalfa weevil	*Hypera postica* Gyllenhal
Bull thistle	*Cirsium vulgare* (Savi) Ten.
Common Reed	*Phragmites australis* (Cav.) Trin. ex Steud.
Curlycup gumweed	*Grindelia squarrosa* (Pursh) Dunal
Downy brome	*Bromus tectorum* L.
Mosquito	Culicidae spp.
Invasive phragmites	*Phragmites australis* (Cav.) Trin. ex Steud.
Plains pocket gopher	*Geomys bursarius* (Shaw)
Poison hemlock	*Conium maculatum* L.
Poplar borer	*Saperda calcarata*
Scentless chamomile	*Tripleurospermum inodorum* (L.) Sch. Bip.
Western waterhemlock	*Cicuta douglasii* (DC.) J.M. Coult. & Rose
Wild oat	*Avena fatua* L.

Natrona County

Babysbreath	*Gypsophila paniculata*
Buffalobur	*Solanum rostratum* Dunal
Bulbous bluegrass	*Poa bulbosa* L.
Downy brome	*Bromus tectorum* L.
Common cocklebur	*Xanthium strumarium* L.
Curlycup gumweed	*Grindelia squarrosa* (Pursh) Dunal
Curly dock	*Rumex crispus* L.
Cutleaf vipergrass	*Scorzonera laciniata* L.
Damesrocket	*Hesperis matronalis* L.
Foxtail barley	*Hordeum jubatum* L.
Halogeton	*Halogeton glomeratus* (M. Bieb.) C.A. Mey.
Mosquito	Culicidae spp.
Northern pocket gopher	*Thomomys talpoides*
Puncturevine	*Tribulus terrestris* L.
Western salsify	*Tragopogon dubious* Scop.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Niobrara County

Buffalobur	*Solanum rostratum* Dunal
Deptford pink	*Dianthus armeria* L.
Douglas fir tussock moth	*Orgyia pseudotsugata* (McDunnough)
Hoary alyssum	*Berteroa incana* (L.) DC.
Horseweed	*Erigeron canadensis* L.
Plains pocket gopher	*Geomys bursarius* (Shaw)
Showy milkweed	*Asclepias speciosa* Torr.
Sulphur cinquefoil	*Potentilla recta* L.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Park County

Babysbreath	*Gypsophila paniculata*
Blue mustard	*Chorispora tenella* (Pall.) DC.
Bull thistle	*Cirsium vulgare* (Savi) Ten.
Chicory	*Cichorium intybus* L.
Damesrocket	*Hesperis matronalis* L.
Duncecap larkspur	*Delphinium occidentale* S. Watson
Emerald Ash Borer	*Agrilus planipennis*
Geyer larkspur	*Delphinium geyeri* Greene
Hoary alyssum	*Berteroa incana* (L.) DC.
Lanceleaf sage	*Salvia reflexa* Hornem.
Redstem filaree	*Erodium cicutarium* (L.) L'Her. Ex Ait.
Showy milkweed	*Asclepias speciosa* Torr.
Sulphur cinquefoil	*Potentilla recta* L.
White campion	*Silene latifolia* Poir.
Wild four-o'clock	*Mirabilis nyctaginea* (Michx.) Macmill.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Platte County

Alfalfa weevil	*Hypera postica* Gyllenhal
Black fly	Simuliidae spp.
Buffalobur	*Solanum rostratum* Dunal
Bull thistle	*Cirsium vulgare* (Savi) Ten.
Downy brome	*Bromus tectorum* L.
Chicory	*Cichorium intybus* L.
Common cocklebur	*Xanthium strumarium* L.
Common sunflower	*Helianthus annuus* L.
Curlycup gumweed	*Grindelia squarrosa* (Pursh) Dunal
Curly dock	*Rumex crispus* L.
Geyer larkspur	*Delphinium geyeri* Greene
Great plains yucca	*Yucca glauca* Nutt.
Jointed goatgrass	*Aegilops cylindrical* Host.
Mosquito	Culicidae spp.
Plains pricklypear	*Opuntia polyacantha* Haw.
Pocket Gophers	*Geomys* and *Thomomys spp.*
Poison hemlock	*Conium maculatum* L.
Puncturevine	*Tribulus terrestris* L.
Silky crazyweed	*Oxytropis sericea* (Nutt.)
Western salsify	*Tragopogon dubious* Scop.
Western waterhemlock	*Cicuta douglasii* (DC.) J.M. Coult. & Rose
Wild licorice	*Glycyrrhiza lepidota* Pursh
Wyeth's lupine	*Lupinus wyethii* S. Watson.

Weed and Pest Declared List (By County) 2025

Uniting with Wyoming Weed and Pest Control Districts, Wyoming Department of Agriculture, University of Wyoming

Sheridan County

Alfalfa weevil	*Hypera postica* Gyllenhal
Buffalobur	*Solanum rostratum* Dunal
Common cocklebur	*Xanthium strumarium* L.
Common teasel	*Dipsacus fullonum* L.
Curly dock	*Rumex crispus* L.
Downy brome	*Bromus tectorum* L.
Japanese beetle	*Popillia japonica*
Japanese Brome	Bromus japonicus
Mosquito	Culicidae spp.
Plains pocket gopher	*Geomys bursarius* (Shaw)
Poison hemlock	*Conium maculatum* L.
Puncturevine	*Tribulus terrestris* L.
Sulphur cinquefoil	*Potentilla recta* L.
Western waterhemlock	*Cicuta douglasii*
Wild licorice	*Glycyrrhiza lepidota* Pursh
Varroa mites	*Varroa destructor*

Sublette County

Austrian fieldcress	*Rorippa austriaca* (Crantz) Besser
Babysbreath	*Gypsophila paniculata*
Bluebutton	*Knautia arvensis* (L.) Coult.
Bulbous bluegrass	*Poa bulbosa* L.
Bull thistle	*Cirsium vulgare* (Savi) Ten
Common teasel	*Dipsacus fullonum* L.
Damesrocket	*Hesperis matronalis* L.
Downy brome	*Bromus tectorum* L.
Hoary alyssum	*Berteroa incana* (L.) DC.
Scentless chamomile	*Tripleurospermum inodorum* (L.) Sch. Bip.
Sulphur cinquefoil	*Potentilla recta* L.
Tentiform leafminer	*Phyllonorycter blancardella*
Western waterhemlock	*Cicuta douglasii* (DC.) J.M. Coult. & Rose
White pine weevil	*Pissodes strobi*
White satin moth	*Leucoma salicis L.*

Sweetwater County

Army cutworm	*Euxos auxilliarius*
Black fly	*Simulium vittatum* Zetterstedt
Bull thistle	*Cirsium vulgare* (Savi) Ten.
Common reed	*Phragmites australis* (Cav.) Trin. ex Steud.
Curlycup gumweed	*Grindelia squarrosa* (Pursh) Dunal
Curly dock	*Rumex crispus* L.
Downy brome	*Bromus tectorum* L.
Foxtail barley	*Hordeum jubatum* L.
Yellow bedstraw	*Galium verum* L.
Mosquito	Culicidae spp.
Mountain thermopsis	*Thermopsis montana* Nutt.
Northern pocket gopher	*Thomomys talpoides*
Poplar bud gall mite	*Eriophes parapopuli* Keifer
Showy milkweed	*Asclepias speciosa* Torr.
Wild licorice	*Glycyrrhiza lepidota* Pursh
Wild oat	*Avena fatua* L.

Teton County

Absinth wormwood	*Artemisia absinthium* L.
Austrian fieldcress	*Rorippa austriaca* (Crantz) Besser
Babysbreath	*Gypsophila paniculata*
Bittersweet nightshade	*Solanum dulcamara* L.
Bluebuttons	*Knautia arvensis* (L.) Coult.
Bohemian knotweed	*Reynoutria bohemica* Chrtek & Chrtkov
Bulbous bluegrass	*Poa bulbosa* L.
Bull thistle	*Cirsium vulgare* (Savi) Ten.
Downy brome	*Bromus tectorum* L.
Chicory	*Cichorium intybus* L.
Common reed	*Phragmites australis* (Cav.) Trin. ex Steud.
Common teasel	*Dipsacus fullonum* L.
Curlyleaf pondweed	*Potamogeton crispus* L.
Cypress spurge	*Euphorbia cyparissias* L.
Damesrocket	*Hesperis matronalis* L.
Eurasian watermilfoil	*Myriophyllum spicatum* L.
Garlic mustard	*Alliaria petiolate* (M. Bieb.) Cavara & Grande
Hard tick	*Ixodidae spp.*
Himalayan knotweed	*Koenigia polystachya* (Wall. ex Meisn.) T. M. Schust. & Reveal
Hoary alyssum	*Berteroa incana* (L.) DC.
Japanese knotweed	*Reynoutria japonica* Houtt.
Meadow knapweed	*Centaurea pratensis* Thuill.
Mosquito	Culicidae spp.

Teton County (cont.)

Moth mullein	*Verbascum blattaria* L.
Myrtle spurge	*Euphorbia myrsinites* L.
Orange hawkweed	*Hieracium aurantiacum* L.
Poison hemlock	*Conium maculatum* L.
Puncturevine	*Tribulus terrestris* L.
Rush skeltonweed	*Chondrilla juncea* L.
Sakalin knotweed	*Fallopia sachalinensis (F. Schmidt) Nakai*
Scentless chamomile	*Tripleurospermum inodorum* (L.) Sch. Bip.
Squarrose knapweed	*Centaurea virgata* Lam.
Sulfur cinquefoil	*Potentilla recta* L.
Tall buttercup	*Ranunculus acris* L.
Yellow chamomile	*Anthemis tinctorial* L.
Yellowdevil hawkweed	*Hieracium x floribundum* Wimmer & Grab. (pro sp.)
Yellowflag iris	*Iris pseudacorus* L.
Waterhyacinth	*Eichhornia crassipes* (Mart.) Solms
Waterlettuce	*Pistia stratiotes* L.

Uinta County

Alfalfa weevil	*Hypera postica* Gyllenhal
Common reed	*Phragmites australis* (Cav.) Trin. ex Steud.
Downy brome	*Bromus tectorum* L.
Mosquito	Culicidae spp.
Round-leaved thermopsis	*Thermopsis rhombifolia* Nutt.
Sulphur cinquefoil	*Potentilla recta* L.
Vipers bugloss	*Echium vulgare* L.

Washakie County

Absinth wormwood	*Artemisia absinthium* L.
Downy brome	*Bromus tectorum* L.
Common crupina	*Crupina vulgaris* Cass.
Common teasel	*Dipsacus fullonum* L.
Duncecap Larkspur	*Delphinium occidentale* S. Watson
Field sandbur	*Cenchrus incertus* Cav.
Iberian starthistle	*Centaurea iberica* Trev. ex Spreng.
Italian thistle	*Carduus pycnocephalus* L.
Meadow knapweed	*Centaurea pratensis* Thuill.
Mosquito	Culicidae spp.
Orange hawkweed	*Hieracium aurantiacum* L.
Puncturevine	*Tribulus terrestris* L.
Purple starthistle	*Centaurea calcitrapa* L.
Rush skeltonweed	*Chondrilla juncea* L.
Scentless chamomile	*Tripleurospermum inodorum* (L.) Sch. Bip.
Scotch broom	*Cytisus scoparius* (L.) Link
Squarrose knapweed	*Centaurea virgata* Lam.
Sulfur cinquefoil	*Potentilla recta* L.
Swainsonpea	*Sphaerophysa salsula* (Pallas) DC.
Tansy ragwort	*Senecio jacobaea* L.
Venice mallow	*Hibiscus trionum* L.
Wild licorice	*Glycyrrhiza lepidota* Pursh
Woolly distaff thistle	*Carthamus lanatus* L.
Yellowdevil hawkweed	*Hieracium x floribundum* Wimmer & Grab. (pro sp.)

Weston County

Black medic	*Medicago lupulina* L.
Blue mustard	*Chorispora tenella* (Pall.) DC.
Broom snakeweed	*Gutierrezia sarothrae* (Pursh) Britton & Rusby
Downy brome	*Bromus tectorum* L.
Common purslane	*Portulaca oleracea* L.
Curly dock	*Rumex crispus* L.
Puncturevine	*Tribulus terrestris* L.
Sulfur cinquefoil	*Potentilla recta* L.
Wild licorice	*Glycyrrhiza lepidota* Pursh

Wyoming DEPARTMENT OF Agriculture

WYOMING WEED AND PEST COUNCIL
The Wheel of Weed and Pest Control
Uniting with
Wyoming Weed and Pest Control Districts
Wyoming Department of Agriculture
University of Wyoming

WYOMING WEED & PEST CONTROL ACT
STATE DESIGNATED WEEDS AND PESTS

NOTE: W.S. 11-5-105(a)(i) – "The district board shall: Implement and pursue an effective program for the control of designated weed s and pests;"

Designated Noxious Weeds W.S. 11-5-102 (a)(xi)

(1) Field bindweed (Convolvulus arvensis L.)
(2) Canada thistle (Cirsium arvense L.)
(3) Leafy spurge (Euphorbia esula L.)
(4) Perennial sowthistle (Sonchus arvensis L.)
(5) Quackgrass (Agropyron repens (L.) Beauv.)
(6) Hoary cress (whitetop) (Cardaria draba and Cardaria pubescens (L.) Desv.)
(7) Perennial pepperweed (giant whitetop) (Lepidium latifolium L.)
(8) Ox-eye daisy (Chrysanthemum leucanthemum L.)
(9) Skeletonleaf bursage (Franseria discolor Nutt.)
(10) Russian knapweed (Centaurea repens L.)
(11) Yellow toadflax (Linaria vulgaris L.)
(12) Dalmatian toadflax (Linaria dalmatica (L.) Mill.)
(13) Scotch thistle (Onopordum acanthium L.)
(14) Musk thistle (Carduus nutans L.)
(15) Common burdock (Arctium minus (Hill) Bernh.)
(16) Plumeless thistle (Carduus acanthoides L.)
(17) Dyers woad (Isatis tinctoria L.)
(18) Houndstongue (Cynoglossum officinale L.)
(19) Spotted knapweed (Centaurea maculosa Lam.)
(20) Diffuse knapweed (Centaurea diffusa Lam.)
(21) Purple loosestrife (Lythrum salicaria L.)
(22) Saltcedar (Tamarix spp.)
(23) Common St. Johnswort (Hypericum perforatum)
(24) Common Tansy (Tanacetum vulgare)
(25) Russian olive (Elaeagnus angustifolia)
(26) Black Henbane (Hyoscyamus Niger L.)
(27) Common Mullein (Verbascum thapsus L.)
(28) Yellow starthistle (Centaurea solstitialis L.)
(29) Ventenata (Ventenata dubia (Leers) Coss.)
(30) Medusahead rye (Taeniatherum caput-medusae (L.) Nevski)
(31) Palmer amaranth (Amaranthus palmeri S. Watson)

Designated Pests W.S. 11-5-102 (a)(xii)

(1) Grasshoppers
(2) Mormon crickets
(3) Prairie dogs
(4) Ground squirrels
(5) Mountain pine beetle
(6) Beet Leafhopper