

**Oil and Gas Development on Federal Lands
and Sage-Grouse Habitats**

October 2015 to March 2019

Report

Prepared for:

**The Wilderness Society, the National Audubon Society, and
the National Wildlife Federation**

Prepared by:

Grant Gardner, Jason Carlisle, and Chad LeBeau

Western EcoSystems Technology, Inc.
415 West 17th Street, Suite 200
Cheyenne, Wyoming 82001

July 25, 2019



EXECUTIVE SUMMARY

In 2015, the US Fish and Wildlife Service (USFWS) determined that federal and state land use conservation plans reduced threats to greater sage-grouse (sage-grouse) populations that previously warranted protection under the Endangered Species Act. The Bureau of Land Management (BLM) and the US Forest Service developed land resource management plans (RMP) that offered the highest level of protection for sage-grouse in the most important habitats. Between June 7, 2017 and August 4, 2017, a US Department of the Interior Review Team, consisting of the BLM, USFWS, and the US Geological Survey reviewed the policies outlined in the 2015 RMPs and identified provisions to modify the RMPs to be more consistent with individual state plans.

Oil and gas leasing and applications for permit to drill (APD) within sage-grouse habitats have occurred since the implementation of the RMPs but the rate and spatial prioritization was expected to vary based on government administration and BLM policy changes. The purpose of this analysis was to evaluate the number of federal oil and gas leases issued and number of APD issued between 2015 and 2019 that occurred within BLM-designated sage-grouse habitat (General and Priority Habitats). More specifically, our objective was to evaluate the differences in the number and acreage of federal oil and gas leases and number of APDs assigned inside and outside of BLM-designated sage-grouse habitat from October 1, 2015 to March 15, 2019.

Records on oil and gas leases were acquired from BLM's LR2000 database and APD were collected from BLM's Automated Fluid Minerals Support System (AFMSS) database. Public Land Survey System descriptions for each lease and APD were extracted and mapped with BLM-designated sage-grouse habitat. The number of leases issued, associated acreage, the rate of leasing (acres per month), and the rate of APD issued were compared between two time periods (October 1, 2015 to January 31, 2017 and February 1, 2017 to March 15, 2019) and for each designated habitat category in Colorado, Idaho, Montana, Nevada, Oregon, Utah, and Wyoming.

The rate of leasing and associated leased acres per month in all states evaluated was 2.40 times higher during the February 2017 – March 2019 time period compared to the October 2015 – January 2017 time period, respectively. In designated sage-grouse habitat, the rate of leased acres per month in all states was 2.98 times higher during the February 2017 – March 2019 period. The proportion of leased acreage in designated sage-grouse habitat cumulatively increased from 54% of all leases issued during the October 2015 – January 2017 evaluation period to 67% of leases issued during the February 2017 – March 2019 period. More specifically, the proportion of leased acreage within priority habitat (PHMA) increased within each state where leases were issued, and cumulatively rose from 7% to 27% between the two time periods. The rate of APD approval within designated sage-grouse habitat was twice as high in the February 2017 – March 2019 time period than during the October 2015 – January 2017 time period, and the rate of APD approval within PHMA was 6.97 times greater.

Oil and gas leasing on federal lands increased during the study period within all states evaluated. However, the monthly rate of leasing, the proportion of leased acreage, and the monthly rate of APD issued was greater in BLM-designated habitat during the February 2017 – March 2019 time period compared to the October 2015 – January 2017 time period. The relative increase in leasing and permitting activity in BLM-designated sage-grouse habitats could be the result of changes in administrations or BLM policy between the two time periods but this analysis did not consider oil and gas development potential or the current energy demand. In addition, the analysis did not consider previously issued leases and APD or individual state conservation plans all of which could have influenced the rate and spatial extent of leases and APD issued during the evaluation period. Nonetheless, in all states evaluated there was a consistent shift in the proportion of development metrics within non-priority habitat management areas to within PHMA. The development metrics used (leases and APD) do not represent actual impacts to sage-grouse habitats; however, the spatial prioritization and increased rate of leasing and APD observed in this study has the potential to increase degradation and fragmentation of BLM-designated sage-grouse habitats if the leases and permits result in active development.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
INTRODUCTION	1
STUDY AREA.....	2
METHODS.....	3
Issued Oil and Gas Leases.....	3
Applications for Permit to Drill.....	5
RESULTS	6
Issued Oil and Gas Leases.....	6
Applications for Permit to Drill.....	9
DISCUSSION.....	12
REFERENCES	13

LIST OF TABLES

Table 1. Distribution of 2015 BLM sage-grouse habitat designations within the range of greater sage-grouse.	2
Table 2. Rate of acres leased for oil and gas on federal lands that overlap greater sage-grouse habitat during two time periods.	7
Table 3. Proportion of oil and gas leases issued on federal lands that overlap greater sage-grouse habitat during two time periods, by total acreage.	8
Table 4. Rate of approval for applications for permit to drill (APD) per month on federal lands that overlap greater sage-grouse habitat during two time periods.....	10

LIST OF FIGURES

Figure 1. Bureau of Land Management Priority, General, and Additional Habitat Management Areas within the Study Area.	3
Figure 2. Example of hypothetical lease.....	5
Figure 3. Oil and gas leases issued on federal land from October 2015 to March 2019, overlaid with Bureau of Land Management Priority, General, and Additional Habitat Management Areas within the Study Area.	8
Figure 4. Proportion of acreage leased for oil and gas development within each sage-grouse habitat category during two time periods. Data represent leases on federal lands in six Western states: CO, ID, MT, NV, UT, and WY.	9

Figure 5. Approved federal Applications for Permit to Drill (APD) from October 2015 to March 2019, overlaid with Bureau of Land Management Priority, General, and Additional Habitat Management Areas within the Study Area.....11

Figure 6. Proportion of federal Applications for Permit to Drill (APD) approved within each sage-grouse habitat category during two time periods. Data represent leases on federal lands in six Western states: CO, ID, MT, NV, UT, and WY.12

LIST OF APPENDICES

Appendix A. Oil and Gas Lease and APD Summary Figures and Tables, October 2015 – March 2019

Appendix B. State-level Summaries of Oil and Gas Leases, October 2015 – March 2019

INTRODUCTION

The US Fish and Wildlife Service (USFWS) determined in 2010 that listing the greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) under the Endangered Species Act (ESA) was warranted due to habitat loss and fragmentation and inadequacy of regulatory mechanisms that govern activities leading to such habitat loss and fragmentation; however, listing the species was precluded by higher priority listing actions (USFWS 2010). On September 22, 2015, the USFWS determined that protection of the sage-grouse under the ESA was not warranted because the threats identified under the 2010 warranted-but-precluded finding had been significantly reduced due in large part to federal and state land use conservation plans established since 2010 (USFWS 2015). One of those conservation practices was the Records of Decision on 98 land resource management plans (RMP) by the Bureau of Land Management (BLM) and the US Forest Service (USFS) in September 2015 (BLM 2015, USFS 2015). These plans consisted of a layered management approach based on key habitats (BLM-designated sage-grouse habitat) mapped within individual states and included Priority Habitat Management Areas (PHMA, areas where new habitat disturbance was limited or eliminated with some exceptions), General Habitat Management Areas (GHMA, areas that required some special management, but were more flexible), and other various habitat designations (HMA; BLM 2015, USFS 2015). More specifically, PHMA were identified because they contained large, undisturbed expanses of breeding habitat and the highest densities of sage-grouse (BLM 2015).

Between June 7, 2017 and August 4, 2017, a US Department of the Interior Review Team, consisting of the BLM, the USFWS, and the US Geological Survey reviewed the policies outlined in the 2015 RMPs with the stated goal of identifying provisions that could be modified to make the RMPs more consistent with individual state sage-grouse conservation plans (BLM 2019c). On December 27, 2017, the BLM issued Instruction Memorandum 2018-026, which identified a provision to the objective of the 2015 plans to prioritize oil and gas leasing and development outside of sage-grouse habitat management areas. This provision stated "...the BLM does not need to lease and develop outside of [sage-grouse] habitat management areas before considering any leasing and development within [sage-grouse] habitat" (BLM 2017). The RMPs were subsequently revised and amended on March 15, 2019.

Leasing and approved applications for permit to drill (APD) have been issued throughout the range of sage-grouse since the RMPs were first finalized in 2015 and then amended in 2019; however, based on the interpretation of the 2015 RMPs that is reflected in Instruction Memorandum 2018-026, it was expected that the rate of leasing and permitting before and after government administrations and policy changes would vary. In addition, the spatial prioritization of development activity within and outside of sage-grouse habitat was expected to vary between the two time periods. The purpose of this analysis was to evaluate the number of federal oil and gas leases and APD issued between 2015 and 2019 that occurred within BLM-designated sage-grouse habitat. More specifically, our objective was to evaluate the differences in the number and acreage of federal oil and gas leases and number of APD inside and outside of BLM-designated sage-grouse habitat between October 1, 2015 to January 31, 2017 and February 1, 2017 to March

15, 2019 (hereafter referred to as October 2015 to January 2017 and February 2017 to March 2019) which represented changes in government administrations and BLM policies.

STUDY AREA

Sage-grouse GHMA, PHMA, and HMA were developed as a product of the 2015 Record of Decision for Greater Sage-Grouse Approved Resource Management Plan Amendments throughout the Western US. Designated separate from GHMA and PHMA, additional HMA are state-identified areas of moderate to high habitat value, but are not as important as PHMA, often providing connectivity or seasonal relief (BLM 2015). Together, the collective habitat management areas overlapped 11 states and seven sage-grouse management zones. We restricted our analysis to the seven states with the greatest amount of designated sage-grouse habitat management areas on federal lands: Colorado, Idaho, Montana, Nevada, Oregon, Utah, and Wyoming (study area; Figure 1). The largest percentage of habitat management areas occurred in Wyoming (28.56%), followed by Montana (19.94%) and Nevada (19.20%; Table 1).

Table 1. Distribution of 2015 BLM sage-grouse habitat designations within the range of greater sage-grouse.

State	Greater Sage-Grouse Habitat by Designation				% of Total GRSG Habitat
	Acres of PHMA	Acres of GHMA	Acres of Additional HMA	Total Acres of GRSG Habitat	
Colorado	2,086,040	1,311,412	260,865	3,658,317	2.85
Idaho	5,318,642	3,841,616	3,992,498	13,152,755	10.24
Montana	8,326,272	16,890,270	394,280	25,610,822	19.94
Nevada	10,891,769	6,984,855	6,773,956	24,650,580	19.20
Oregon	5,875,489	7,196,428	5	13,071,923	10.18
Utah	4,982,454	1,488,178	37,239	6,507,872	5.07
Wyoming	13,570,827	23,108,646	17	36,679,490	28.56
Study Area Subtotal	51,051,493	60,821,406	11,458,860	123,331,760	96.04
California	485,183	1,029,654	1,032,944	2,547,780	1.98
North Dakota	410,323	215,540	13	625,876	0.49
South Dakota	872,394	1,042,155		1,914,550	1.49
Total	52,819,394	63,108,756	12,491,817	128,419,966	100

PHMA = Priority Habitat Management Area; GHMA = General Habitat Management Area; HMA = Habitat Management Area; GRSG = Greater Sage-Grouse.

Sums may not equal total values shown due to rounding.

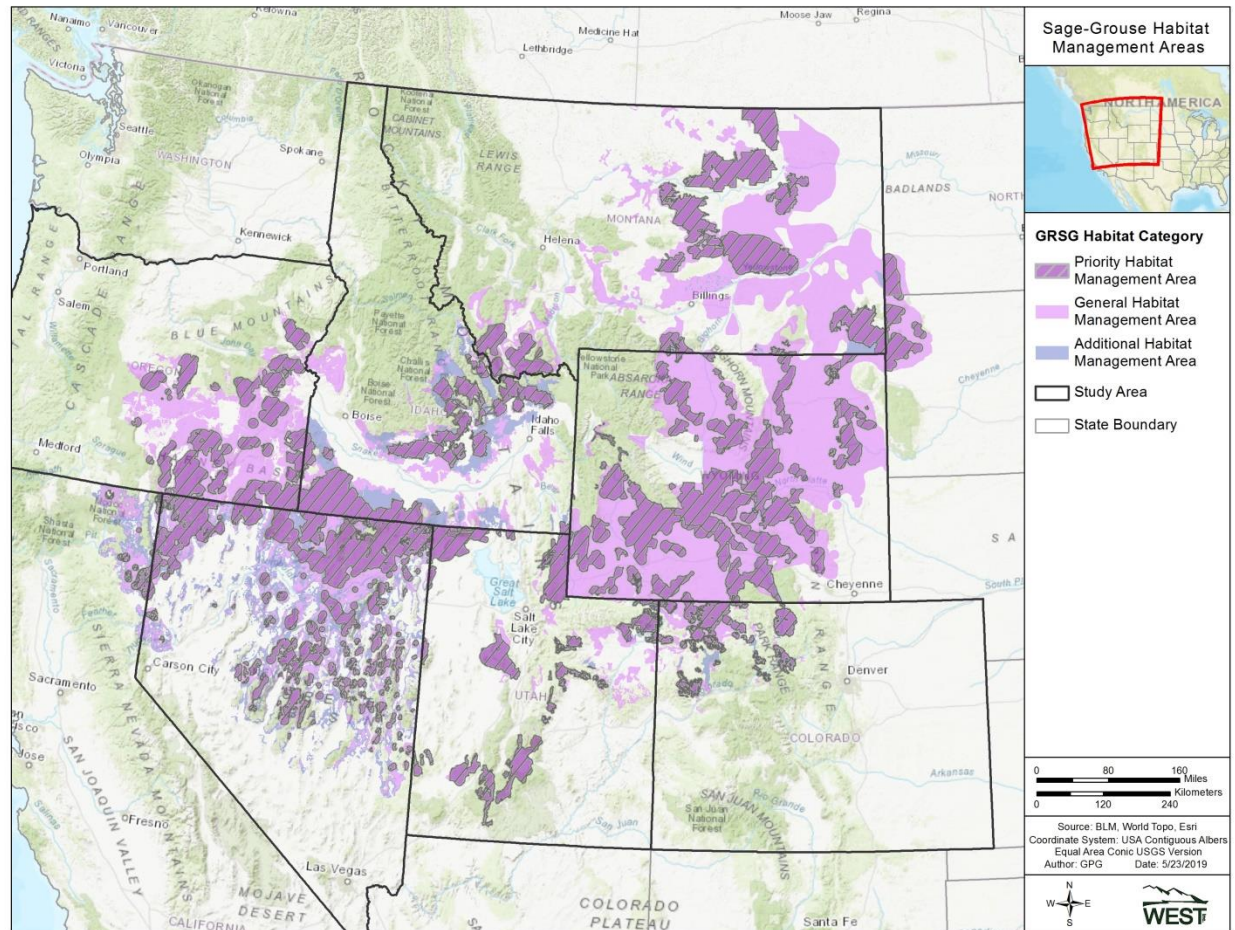


Figure 1. Bureau of Land Management Priority, General, and Additional Habitat Management Areas within the Study Area.

METHODS

Issued Oil and Gas Leases

Records on energy development leases were acquired from the BLM's Legacy Rehost System (LR2000) database. The LR2000 is a searchable database for public reports on BLM land and mineral use authorizations, conveyances, mining claims, withdraws and classifications (BLM 2019b). We queried LR2000 for oil and gas leases issued on federal lands within each of the states of our study area since 2015 (using parameters Action Code = 237 - Lease Issued, Case Group = 31 - OG LEASE, and Commodity Code 459 - Oil & Gas).

We also extracted Public Land Survey System (PLSS) data provided by the BLM for the study area. Using their Median-Township-Range-Section fields, we matched individual lease records from LR2000 with map coordinates, down to the PLSS section level (each PLSS section is one square mile). Each section that intersected a lease was overlaid with the sage-grouse habitat designations to determine whether that portion of the lease was located in BLM-designated sage-

grouse habitat. Each lease portion was identified as located within GHMA, PHMA, or outside of designated habitat; single leases often had portions of area with different habitat distinctions (Figure 2). For analysis purposes, all additional HMA designated habitats were included with GHMA.

Although the LR2000 database provides a list of sections intersected by a single lease, other attributes including acres leased were listed cumulatively over the entire lease. Because the acreage and geometry of leases across individual PLSS sections were not available from the output dataset, we assumed that all sections overlapping a lease contained an equal proportion of the lease's total acreage (Figure 2). Using this method we were able to preserve total acreage and sections intersected while accommodating the fact that some leases overlap multiple categories of sage-grouse habitat.

For each state, the number of leases issued, associated acreage, and the rate of leasing (acres per month) were compared for each designated habitat category between two time periods: October 2015 – January 2017 (16 months) and February 2017 – March 2019 (25.5 months). The relative proportion of leases issued in each state for each habitat type was used to evaluate changes between the two time periods.

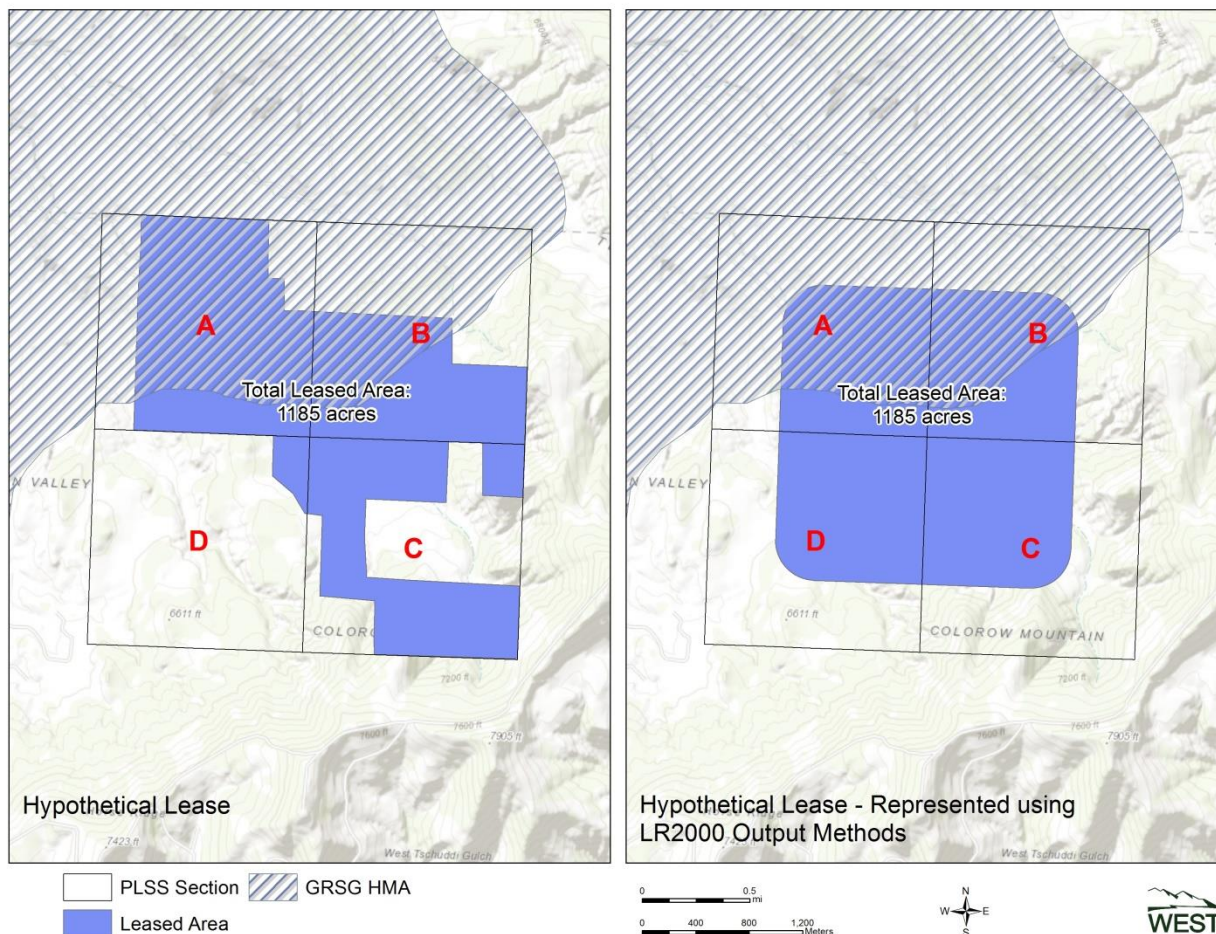


Figure 2. The LR2000 output contains total lease acreage and PLSS sections but not acreage or geometric shape over each section. Because the lease’s true geometry (left panel) could not be determined from the available data, we assumed that lease acreage was divided equally among each of the sections (right panel). This may result in minor differences in partial lease overlap acreage while total lease acreage is preserved. In this example, sections A and B intersected greater sage-grouse (GRSG) habitat management areas (HMA), which meant the lease acreage assigned to sections A and B (50%, or 592.5 acres) was categorized as within HMA, while lease acreage assigned to sections C and D (also 50%, or 592.5 acres) was categorized as outside GRSG habitat.

Applications for Permit to Drill

A table of documented APD records was collected from the BLM’s Automated Fluid Minerals Support System (AFMSS) database (BLM 2019a). AFMSS is used to track oil and gas information on public and tribal land. It contains data concerning lease and agreement ownership, well identification, location and history. Using their Township-Range-Section fields, we matched individual well site records from AFMSS with map coordinates, down to the PLSS section level. Each section that contained a permitted well site was overlaid with the Study Area to determine whether that site was located in BLM-designated sage-grouse habitat. Each well site was identified as located within GHMA, PHMA, or outside of designated habitat. For analysis

purposes, all additional HMA designated habitats were included with GHMA. For each state, the count of federal APDs filed and approved were compared between the same time periods as the leasing analysis (October 2015 – January 2017 and February 2017 – March 2019) and for each designated habitat category.

RESULTS

Issued Oil and Gas Leases

Since 2015, very few leases were issued in Idaho, and no leases were issued in Oregon (Table 2, Figure 3, Appendix A1). When controlling for length of time over which totals were tallied, the number of acres leased per month throughout the study area was 2.40 times higher during the second period than the first, respectively (Table 2, Appendix A2). The monthly rate of leased acres increased 2.04 times in GHMA and 9.71 times in PHMA between the first and second time period (Table 2).

The proportion of leased acreage occurring within each habitat category changed between the time periods. The proportion of issued leased acreage outside of sage-grouse habitat decreased between the evaluation periods in all states where leases were issued except for Wyoming, where few leases were issued outside of sage-grouse habitat (Table 3, Appendix A3). Leases issued in sage-grouse habitat (PHMA and GHMA/Additional HMAs) cumulatively increased from 54% of leases issued during the October 2015 – January 2017 evaluation period to 67% of leases issued during the February 2017 – March 2019 period (Table 3, Figure 4).

During the same evaluation periods, the proportion of issued lease acreage within GHMA increased in each state where leases were issued, except for Wyoming (Table 3, Appendix A3). Across all states, the proportion of issued lease acreage within GHMA decreased from 47% to 40% between the two time periods (Figure 4). The proportion of issued lease acreage within PHMA increased within each state and cumulatively increased from 7% to 27% between the two time periods (Table 3, Figure 4). Wyoming also had the highest increase in proportion of issued lease acreage in PHMA (Table 3, Appendix A3, Appendix B6).

Table 2. Rate of acres leased for oil and gas on federal lands that overlap greater sage-grouse habitat during two time periods.

State	Acres/month leased Outside of GRSB Habitat		Acres/month leased in GHMA/Additional Habitat		Acres/month leased in PHMA		Total Acres/month leased	
	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019
Colorado	7,587	5,473	157	752	3.75	1,189	7,748	7,414
Idaho	588	0	0	0	0	0	588	0
Montana	935	2,136	85	4,923	0	851	1,020	7,910
Nevada	5,811	7,316	3,333	7,605	144	3,213	9,288	18,134
Oregon	0	0	0	0	0	0	0	0
Utah	2,578	14,942	6.90	1,512	46	678	2,630	17,132
Wyoming	218	572	14,758	22,580	2,382	19,071	17,358	42,223
Total	17,717	30,439	18,339	37,372	2,575	25,002	38,632	92,813

Table 3. Proportion of oil and gas leases issued on federal lands that overlap greater sage-grouse habitat during two time periods, by total acreage.

State	Outside of GRSG Habitat		GHMA/Additional Habitat		PHMA	
	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019
Colorado	98%	74%	2%	10%	0.05%	16%
Idaho	100%	-	0%	-	-	-
Montana	92%	27%	8%	62%	-	11%
Nevada	63%	40%	36%	42%	2%	18%
Oregon	-	-	-	-	-	-
Utah	98%	87%	0%	9%	2%	4%
Wyoming	1%	1%	85%	53%	14%	45%
Total	46%	33%	47%	40%	7%	27%

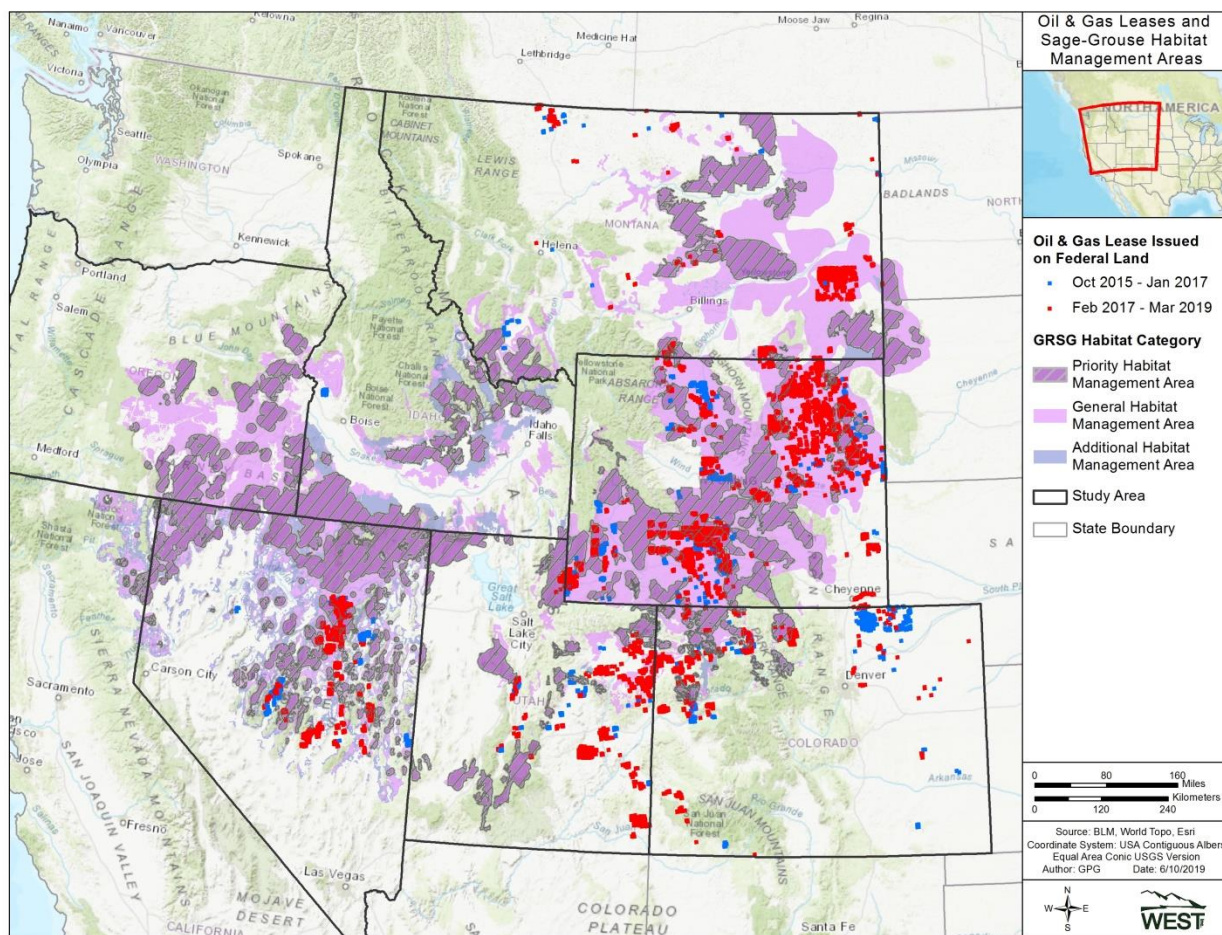


Figure 3. Oil and gas leases issued on federal land from October 2015 to March 2019, overlaid with Bureau of Land Management Priority, General, and Additional Habitat Management Areas within the Study Area.

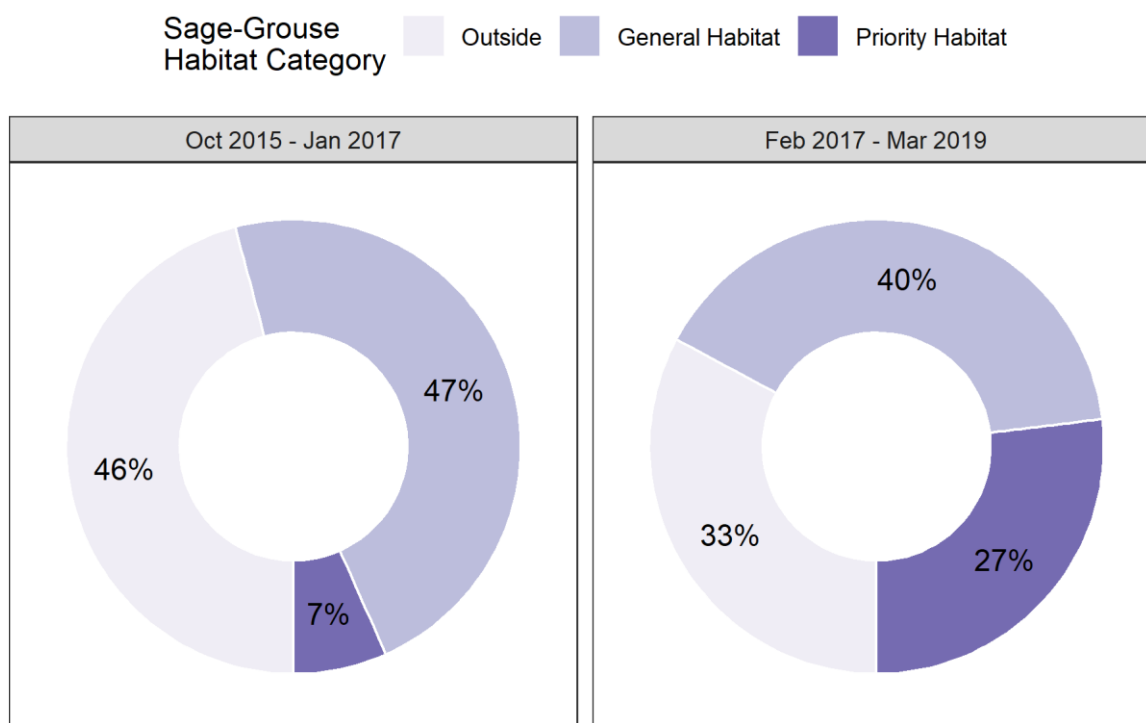


Figure 4. Proportion of acreage leased for oil and gas development within each sage-grouse habitat category during two time periods. Data represent leases on federal lands in six Western states: CO, ID, MT, NV, UT, and WY.

Applications for Permit to Drill

The comparison of APD between the two time periods demonstrated a similar trend to the issued oil and gas leases analysis (Figure 5, Appendix A4). Very few APD were filed in Idaho or Nevada and no APD were approved in Oregon since 2015. The total number of APD approved in all other states increased three-fold between the two evaluation periods (Appendix A4). APD increased in all three habitat categories: PHMA, GHMA, and outside of designated habitat (Appendix A4). Wyoming had the most APD, comprising approximately 67% of all APD over both time periods of which 70% were issued during the February 2017 – March 2019 time period in GHMA.

When corrected for evaluation period length, there was an 87% increase in APD throughout the study area during the second evaluation period compared to the first (Table 4). However, the rate at which APD were approved in designated sage-grouse habitat (PHMA and GHMA/Additional HMAs) cumulatively increased from 66% of APD approved during the October 2015 – January 2017 period to 72% of APD approved during the February 2017 – March 2019 period (Table 4, Figure 6, Appendix A3). The rate of approved APD within GHMA and PHMA increased two and seven times during February 2017 – March 2019 time period compared to the October 2015 – January 2017 time period, respectively (Table 4, Figure 6).

Table 4. Rate of approval for applications for permit to drill (APD) per month on federal lands that overlap greater sage-grouse habitat during two time periods.

State	APD/month Outside of GRSG Habitat		APD/month in GHMA/Additional Habitat		APD/month in PHMA		Total APD/month	
	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019	Oct 2015 – Jan 2017	Feb 2017 – Mar 2019
Colorado	16.94	31.02	0	0	0.13	1.69	17.06	32.71
Idaho	0	0	0.06	0.04	0	0	0.06	0.04
Montana	0.31	0.35	0.06	1.33	0.06	0.12	0.44	1.80
Nevada	0.13	0.08	0.06	0.08	0.06	0.04	0.25	0.20
Oregon	0	0	0	0	0	0	0	0
Utah	8.19	6.55	1.31	2.39	0	0.20	9.5	9.14
Wyoming	0.06	1.88	46.56	88.43	0.88	5.80	47.5	96.12
Total	25.63	39.88	48.06	92.27	1.13	7.84	74.81	140

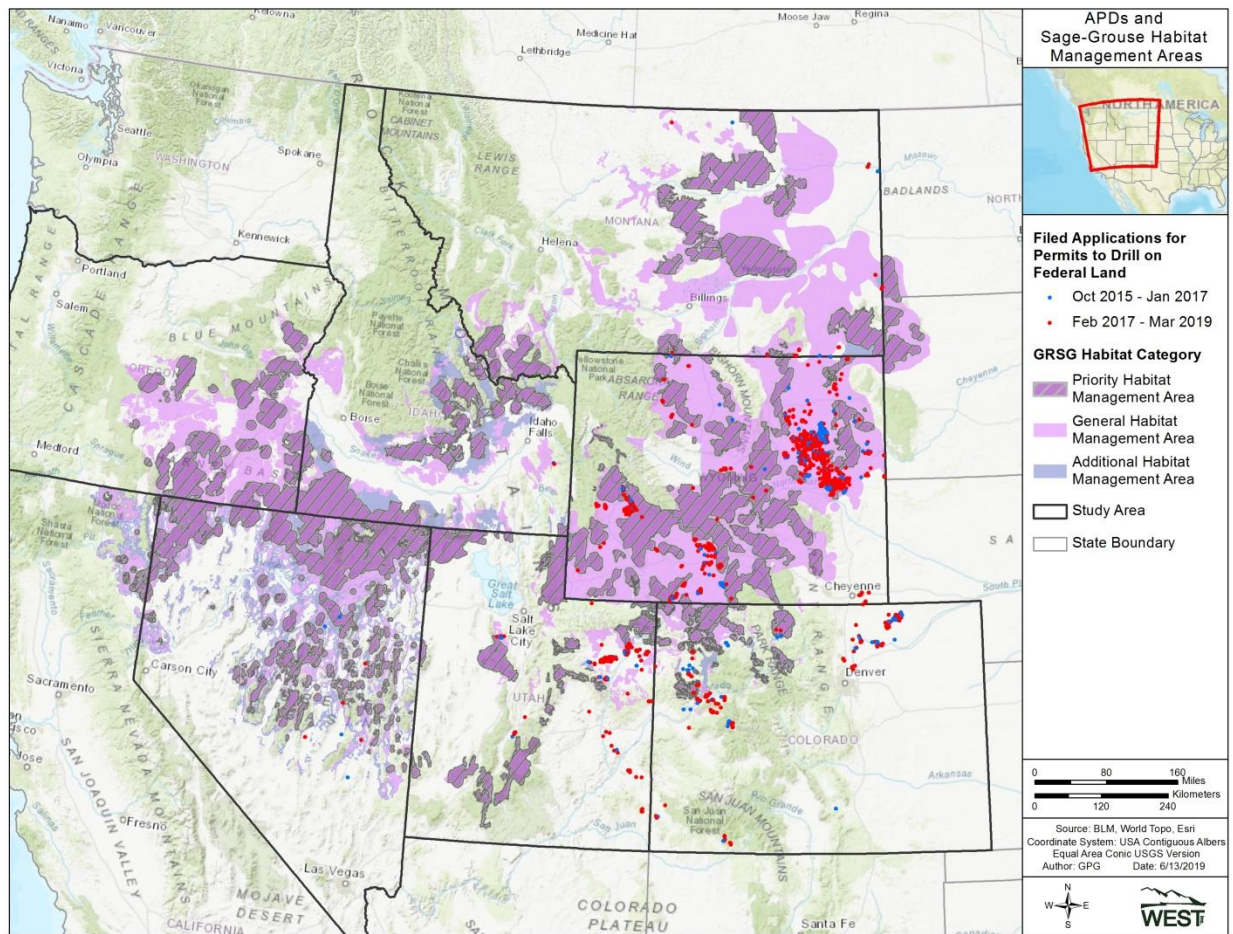


Figure 5. Approved federal Applications for Permit to Drill (APD) from October 2015 to March 2019, overlaid with Bureau of Land Management Priority, General, and Additional Habitat Management Areas within the Study Area.

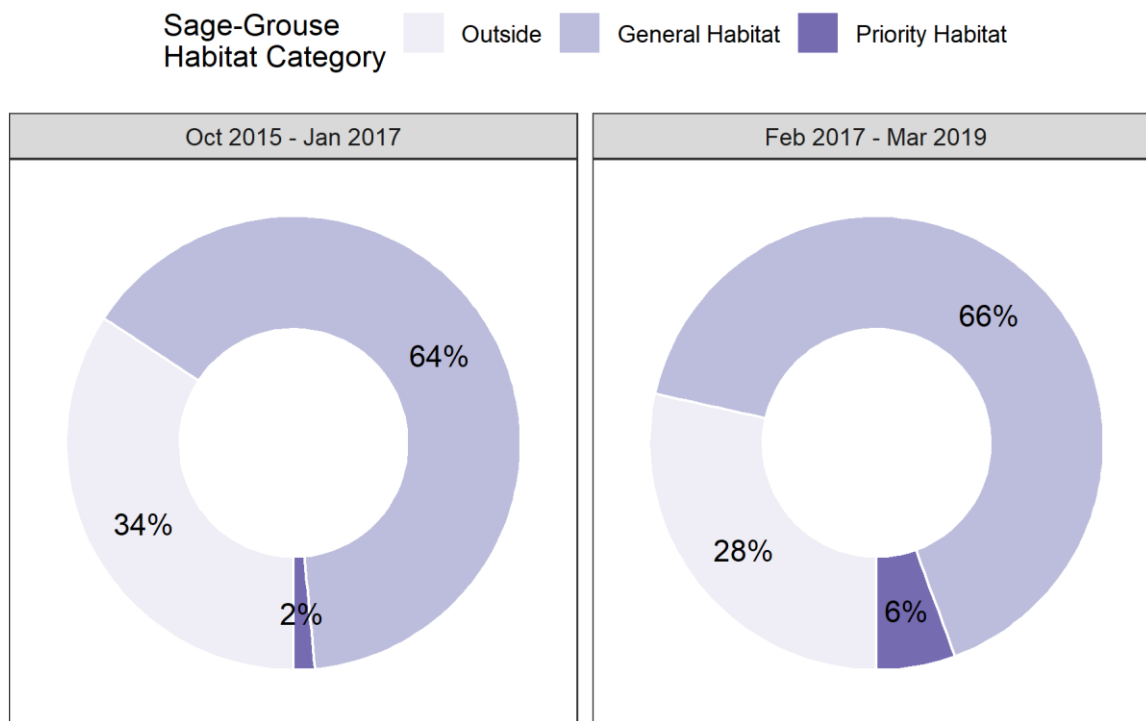


Figure 6. Proportion of federal Applications for Permit to Drill (APD) approved within each sage-grouse habitat category during two time periods. Data represent leases on federal lands in six Western states: CO, ID, MT, NV, UT, and WY.

DISCUSSION

Overall, the rate of oil and gas leasing increased from October 2015 – January 2017 to February 2017 – March 2019 in all states that overlap the range of sage-grouse, except Idaho and Oregon where oil and gas development potential is low (Copeland et al. 2009). A greater proportion of this leasing activity during the February 2017 – March 2019 time-period (67%) occurred in designated sage-grouse habitat compared to the October 2015 – January 2017 time-period (54%). Within sage-grouse habitat, leases issued and associated acreage were highest in GHMA during both time periods. However, the proportion of leases issued in PHMA was four times higher during the February 2017 – March 2019 time period compared to the October 2015 – January 2017 time period. The monthly rate of leasing in PHMA was 9.7 times greater in the later period than it was in the earlier period. This was mainly driven by the large increases associated with Colorado, Montana, Nevada, and Wyoming. These four states collectively contain over 70% of the managed sage-grouse habitat within the US (see Table 1).

The analysis of APD followed a similar trend. While APD increased throughout the study area, a higher proportion of APD during the February 2017 – March 2019 time period were for well sites located in BLM-designated sage-grouse habitat compared to the October 2015 – January 2017

time period. The rate of APD permitting in PHMA was seven times greater in the later period than it was in the early period due to the high number of APD filed within Wyoming and Colorado.

Oil and gas development in Wyoming had a substantial influence on analysis results, due to its geography in relation to both resource development and sage-grouse habitat (Copeland et al. 2009). Of all states within the study area, Wyoming has the most acres of BLM-designated sage-grouse habitat, the most acres of PHMA, and the greatest proportion of its land area covered by designated sage-grouse habitat (58%). Along with this high availability and development potential of federal land, Wyoming also had the most federal leases issued, acres leased, and APD filed of any state throughout both time periods, the vast majority of which occurred in BLM-designated sage-grouse habitat. Despite these differences with other study area states, the shift in proportion of development metrics (leases and APD) to within PHMA during the second evaluation period resembles the same pattern as the other states with higher amounts of federal lands outside sage-grouse habitat (where development is shifting to GHMA as well as PHMA; see Appendix B).

The relative increase in leasing and permitting activity in BLM-designated sage-grouse habitats could be the result of changes in administrations or BLM policy between the two time periods but this analysis did not consider oil and gas development potential or the current energy demand. In addition, the analysis did not consider previously issued leases and APD or individual state conservation plans all of which could have influenced the rate and spatial extent of leases and APD issued during the evaluation period. Nonetheless, in all states evaluated there was a consistent shift in the proportion of development metrics within non-priority habitat management areas to within PHMA. The development metrics used (leases and APD) do not represent actual impacts to sage-grouse habitats; however, the spatial prioritization and increased rate of leasing and APD observed in this study has the potential to increase degradation and fragmentation of BLM-designated sage-grouse habitats if the leases and permits result in active development.

REFERENCES

- Bureau of Land Management (BLM). 2015. Record of Decision and Approved Resource Management Plan Amendments for the Rocky Mountain Region, Including the Greater Sage-Grouse Sub-Regions of Lewistown, North Dakota, Northwest Colorado, Wyoming, and the Approved Resource Management Plans for Billings, Buffalo, Cody, Hiline, Miles City, Pompeys Pillar National Monument, South Dakota, Worland. September 18, 2015. Washington, DC. Available online: https://eplanning.blm.gov/epl-front-office/projects/lup/9506/63299/68541/Rocky_Mountain_Region_ROD_Worland.pdf
- Bureau of Land Management (BLM). 2017. Implementation of Greater Sage-Grouse Resource Management Plan Revisions or Amendments – Oil & Gas Leasing and Development Prioritization Objective. Available online: <https://www.blm.gov/policy/im-2018-026>
- Bureau of Land Management (BLM). 2019a. Automated Fluid Minerals Support System: Approved APDs Report - Federal. US Department of the Interior (USDOI). Accessed June 2019. Available online: <https://reports.blm.gov/report/AFMSS/50/Approved-APDs-Report-Federal>

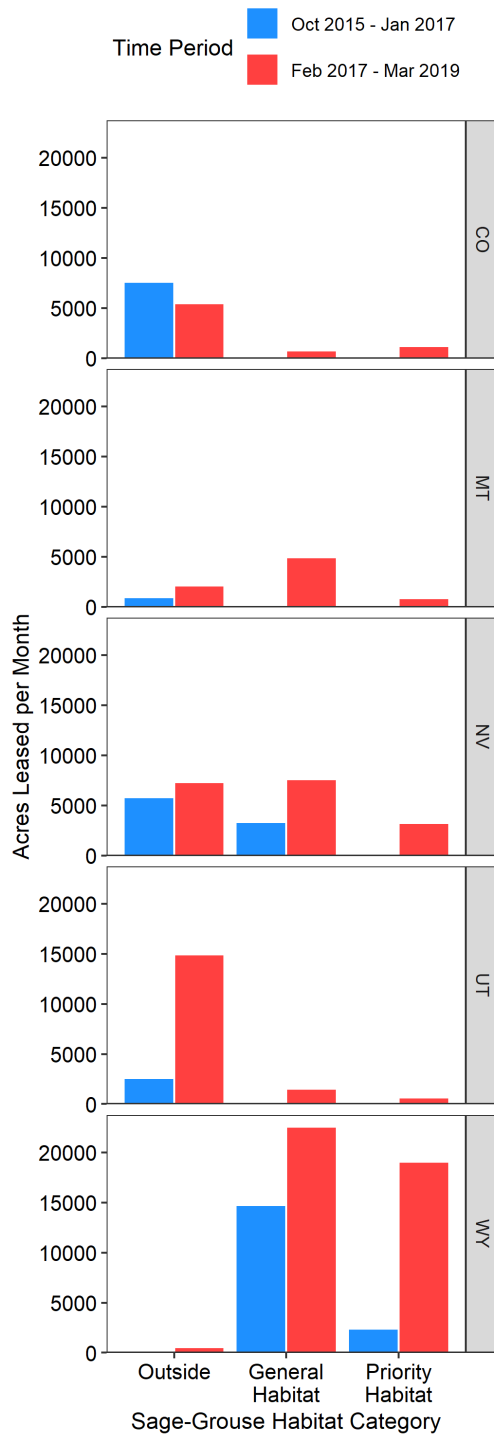
- Bureau of Land Management (BLM). 2019b. Land & Mineral System Reports: LR2000 Reports. US Department of the Interior (USDOI). Accessed May 2019. Available online: <https://reports.blm.gov/reports.cfm?application=LR2000>
- Bureau of Land Management (BLM). 2019c. Wyoming Greater Sage-Grouse: Approved Resource Management Plan Amendment and Record of Decision. US Department of the Interior (USDOI). March 2019. Available online: [https://eplanning.blm.gov/epl-front-office/projects/lup/103347/168776/205593/WY ROD 03142019 signed.pdf](https://eplanning.blm.gov/epl-front-office/projects/lup/103347/168776/205593/WY_ROD_03142019_signed.pdf)
- Copeland, H. E., K. E. Doherty, D. E. Naugle, A. Pocerwicz, and J. M. Kiesecker. 2009. Mapping Oil and Gas Development Potential in the US Intermountain West and Estimating Impacts to Species. PLoS ONE 4(10): e7400. doi: 10.1371/journal.pone.0007400.
- Esri. 2019. World Imagery and Aerial Photos. (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (Esri), producers of ArcGIS software. Redlands, California. Information online: <http://www.arcgis.com/home/webmap/viewer.html?useExisting=1>
- USA Contiguous Lambert Conformal Conic Projection. Conic map projection data. Information online: <http://desktop.arcgis.com/en/arcmap/latest/map/projections/lambert-conformal-conic.htm>
- US Fish and Wildlife Service (USFWS). 2010. Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered. Federal Register 75(55): 13909-14014. Available online at: <https://www.federalregister.gov/documents/2010/03/23/2010-5132/endangered-and-threatened-wildlife-and-plants-12-month-findings-for-petitions-to-list-the-greater>
- US Fish and Wildlife Service (USFWS). 2015. Greater Sage-Grouse 2015 Not Warranted Finding Under the Endangered Species Act. September 2015. Available online: [https://www.fws.gov/greaterSageGrouse/PDFs/GrSG Finding FINAL.pdf](https://www.fws.gov/greaterSageGrouse/PDFs/GrSG_Finding_FINAL.pdf)
- US Forest Service (USFS). 2015. Greater Sage-Grouse Record of Decision for Northwest Colorado and Wyoming, and Land Management Plan Amendments for the Route National Forest, Thunder Basin National Grassland, Bridger-Teton National Forest, and Medicine Bow National Forest. Prepared by the US Department of Agriculture (USDA) Forest Service. September 2015. Available online at: [http://www.fs.usda.gov/Internet/FSE DOCUMENTS/stelprd3855560.pdf](http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3855560.pdf)

**Appendix A. Oil and Gas Lease and APD Summary Figures and Tables,
October 2015 – March 2019**

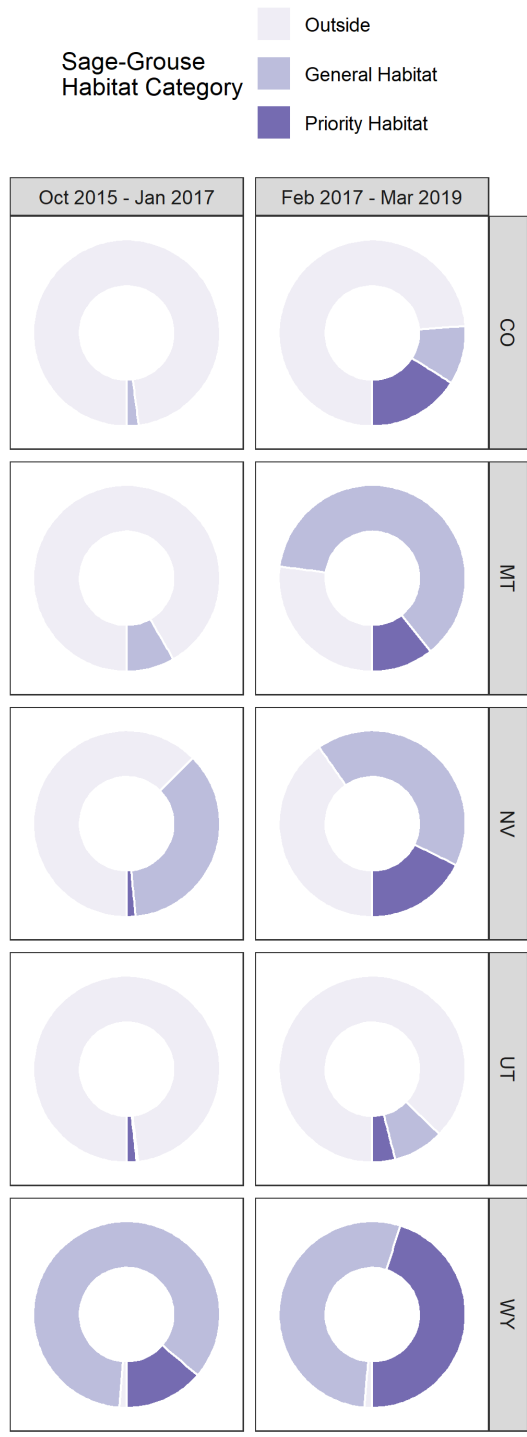
Appendix A1. Count and acreage of oil and gas leases issued on federal lands in study area over two time periods¹.

State	October 2015 – January 2017		February 2017 – March 2019	
	Count	Acreage	Count	Acreage
Colorado	169	123,961	242	189,047
Idaho	8	9,403	0	0
Montana	48	16,326	407	201,705
Nevada	53	148,607	232	462,414
Oregon	0	0	0	0
Utah	33	42,086	314	436,872
Wyoming	238	277,723	1,144	1,076,696
Total	549	618,106	2,339	2,366,734

¹Time periods are of varying length, which may partially describe variation in totals. The second time period (25.5 months) is 1.59 times longer than the first time period (16 months).



Appendix A2. Rate of oil and gas leases issued (acres per month) within each sage-grouse habitat category within each state during two time periods. Only includes leases on federal lands. ID is excluded as the only leases in ID during the study period were outside sage-grouse habitat and during the Oct 2015 - Jan 2017 period.



Appendix A3. Proportion of acreage leased for oil and gas development within each sage-grouse habitat category within each state during two time periods. Only includes leases on federal lands. ID is excluded as the only leases in ID during the study period were outside sage-grouse habitat and during the Oct 2015 - Jan 2017 period.

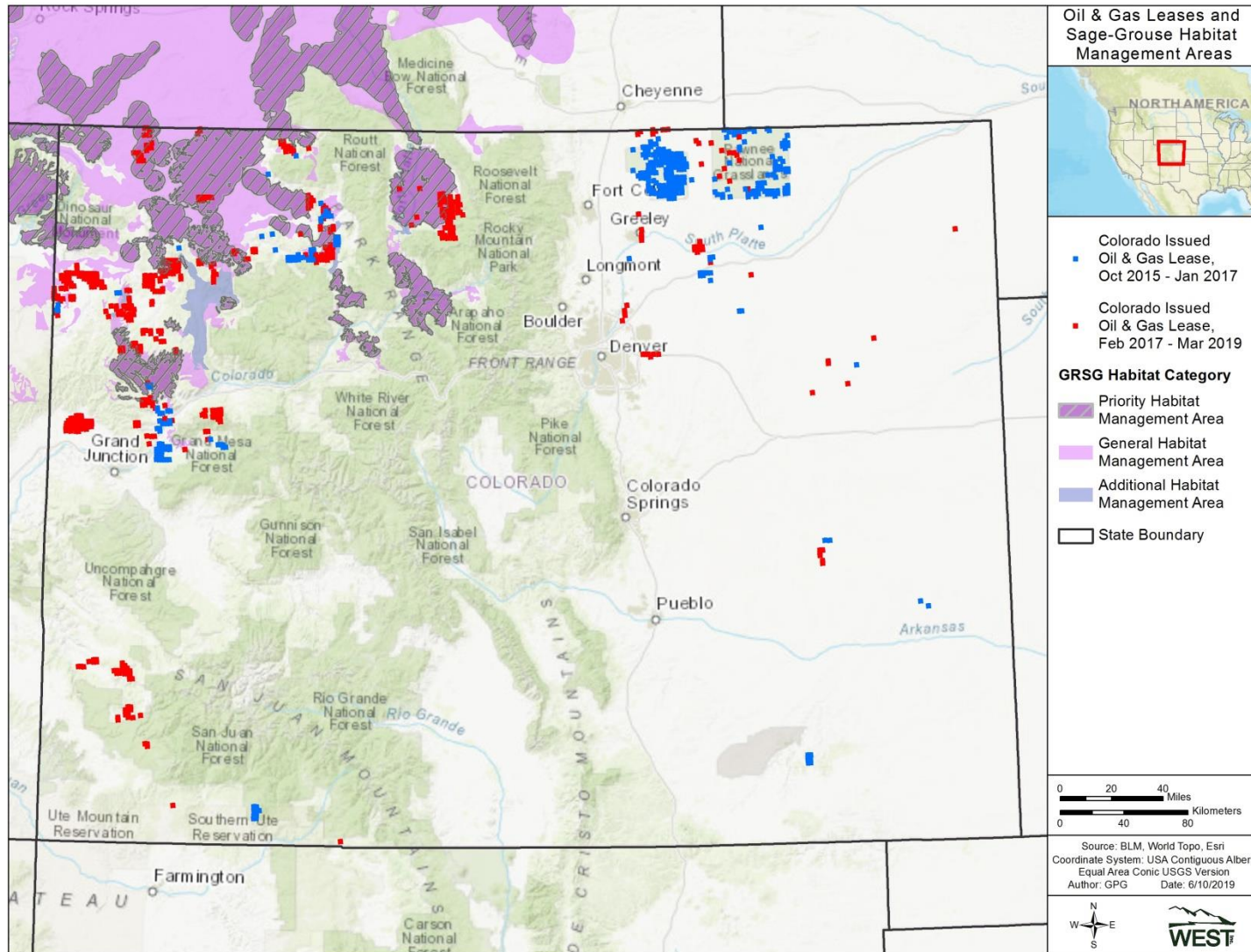
Appendix A4. Count of applications for permit to drill approved for well sites on federal lands that overlap greater sage-grouse habitat during two time periods¹.

State	Outside of GRSG Habitat		GHMA/Additional Habitat		PHMA		Total	
	Oct 2015	Feb 2017	Feb 2017		Oct 2015		Oct 2015	Feb 2017
	- Jan 2017	- Mar 2019	Oct 2015 - Jan 2017	- Mar 2019	- Jan 2017	Feb 2017 - Mar 2019	- Jan 2017	- Mar 2019
Colorado	271	791	0	0	2	43	273	834
Idaho	0	0	1	1	0	0	1	1
Montana	5	9	1	34	1	3	7	46
Nevada	2	2	1	2	1	1	4	5
Oregon	0	0	0	0	0	0	0	0
Utah	131	167	21	61	0	5	152	233
Wyoming	1	48	745	2255	14	148	760	2451
Total	410	1017	769	2353	18	200	1197	3570

¹Time periods are of varying length, which may partially describe variation in totals. The second time period (25.5 months) is 1.59 times longer than the first time period (16 months).

**Appendix B. State-level Summaries of Oil and Gas Leases,
October 2015 – March 2019**

Colorado



Appendix B1. Map of oil and gas leases and greater sage-grouse habitat management areas for Colorado.

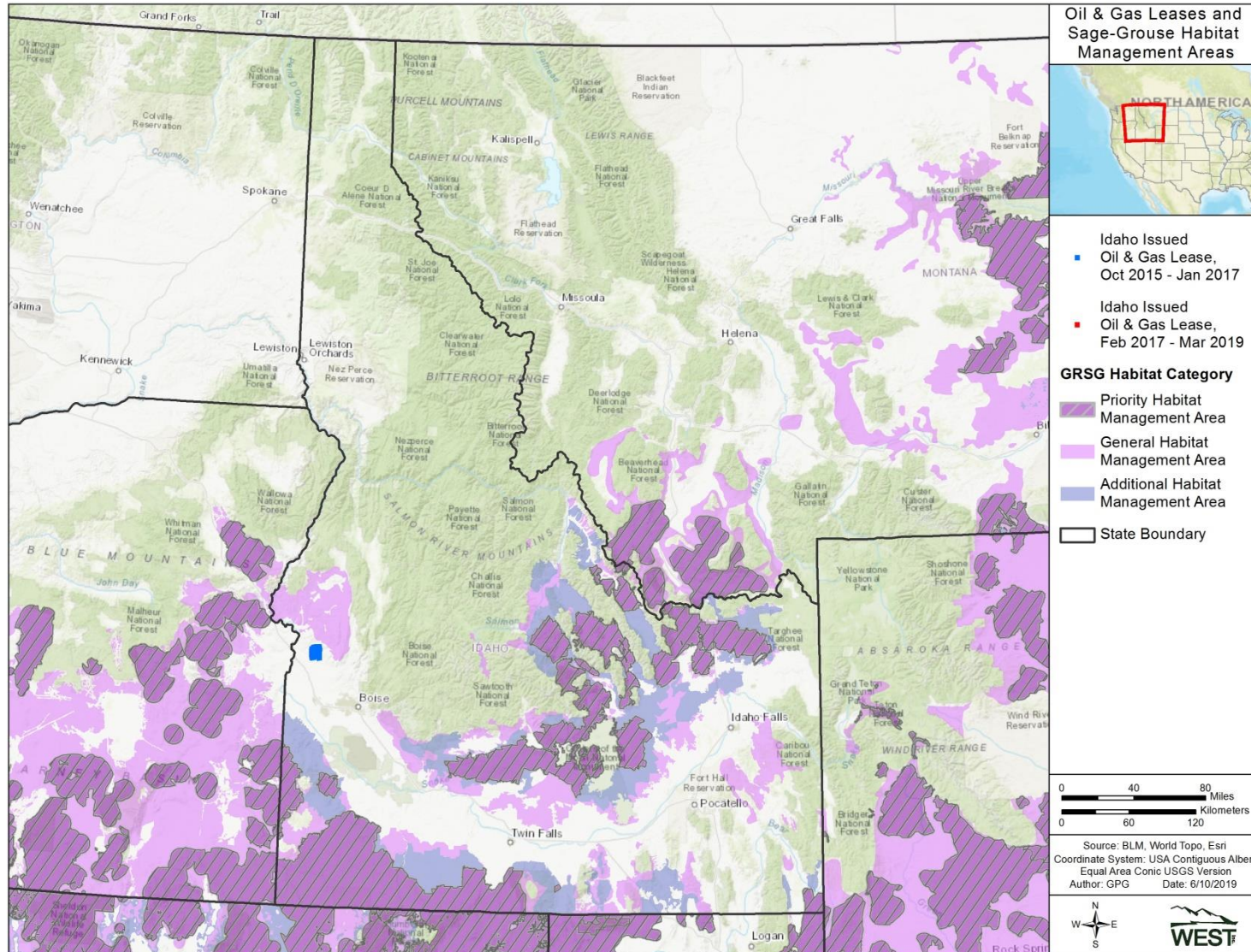
Appendix B1 (continued). Oil and gas leases for Colorado.

Timespan	Outside of GRSG Habitat			GHMA/Additional Habitat			PHMA			Total Count	Total Acreage
	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage		
Oct 2015 - Jan 2017	164	121,394	97.93	4	2,507	2.02	1	60	0.05	169	123,961
Feb 2017 - Mar 2019	174	139,565	73.83	28	19,167	10.14	40	30,316	16.04	248	189,047
Total¹	344	260,959	83.37	32	21,674	6.92	41	30,376	9.70	411	313,008

GRSG = Greater Sage-Grouse; GHMA = General Habitat Management Area; PHMA = Priority Habitat Management Area

¹ Sums may not equal total values shown due to rounding.

Idaho



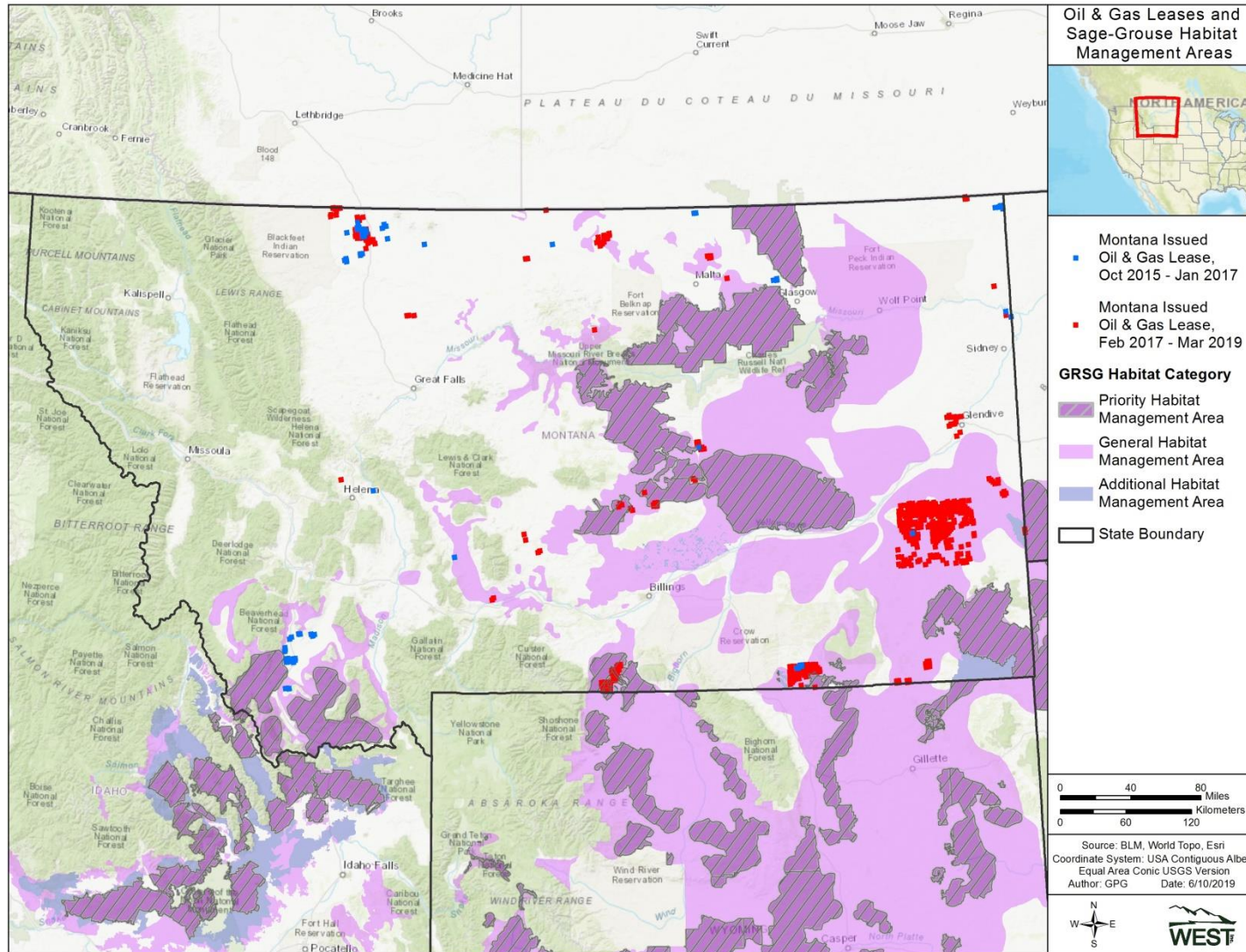
Appendix B2. Map of oil and gas leases and greater sage-grouse habitat management areas for Idaho.

Appendix B2 (continued). Oil and gas leases issued for Idaho.

Timespan	Outside of GRSG Habitat			Total Count	Total Acreage
	Count	Acreage	% of Leased Acreage		
Oct 2015 - Jan 2017	8	9,403	100	8	9,403
Total	8	9,403	100	8	9,403

GRSG = Greater Sage-Grouse

Montana



Appendix B3. Map of oil and gas leases and greater sage-grouse habitat management areas for Montana.

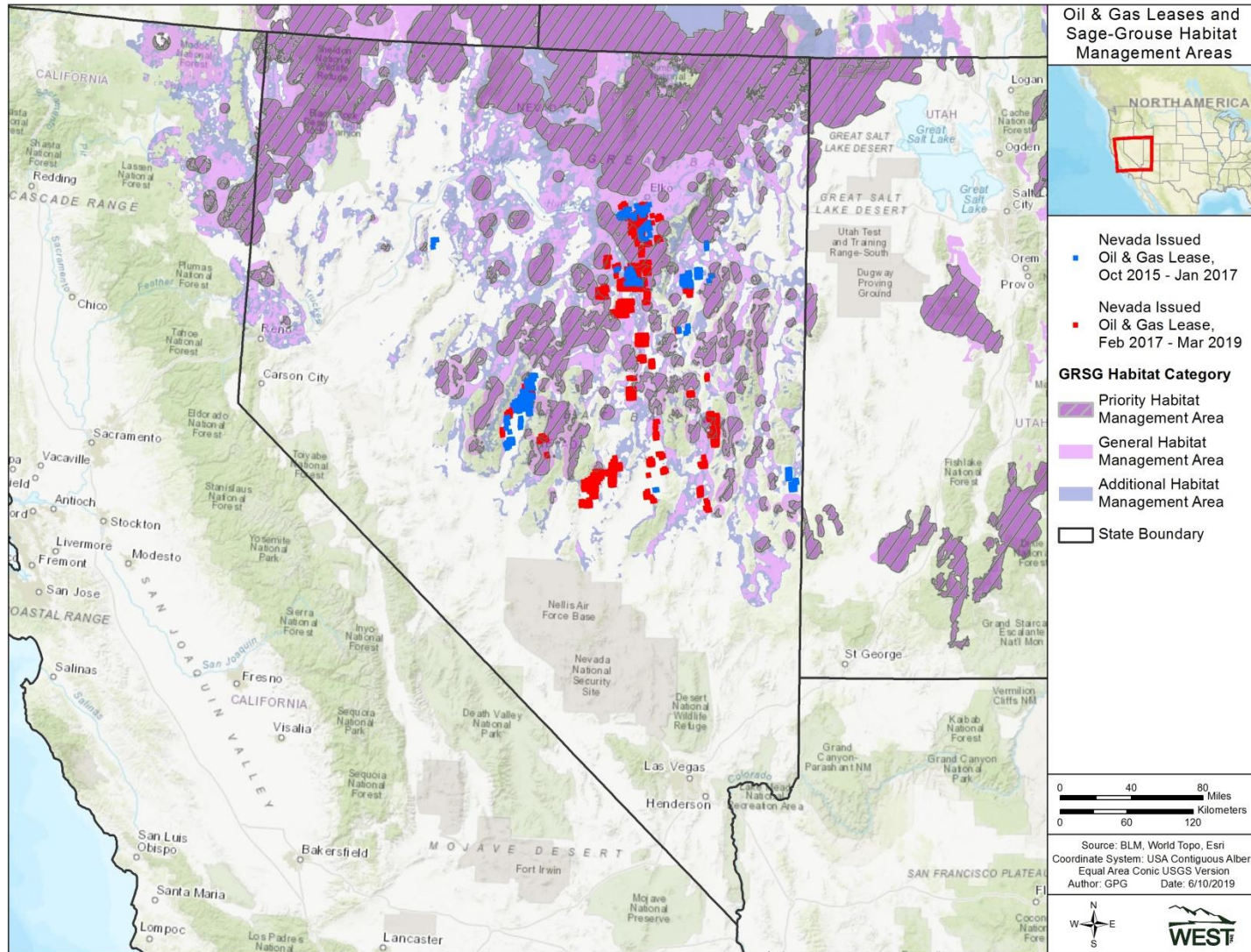
Appendix B3 (continued). Oil and gas leases issued for Montana.

Timespan	Outside of GRSG Habitat			GHMA/Additional Habitat			PHMA			Total Count	Total Acreage
	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage		
Oct 2015 - Jan 2017	46	14,966	91.6	2	1,360	8.33			0	48	16,326
Feb 2017 - Mar 2019	120	54,469	27.00	264	125,530	62.23	23	21,706	10.76	407	201,705
Total¹	166	69,435	31.85	266	126,890	58.20	23	21,706	9.96	455	218,030

GRSG = Greater Sage-Grouse; GHMA = General Habitat Management Area; PHMA = Priority Habitat Management Area

¹ Sums may not equal total values shown due to rounding.

Nevada



Appendix B4. Map of oil and gas leases and greater sage-grouse habitat management areas for Nevada.

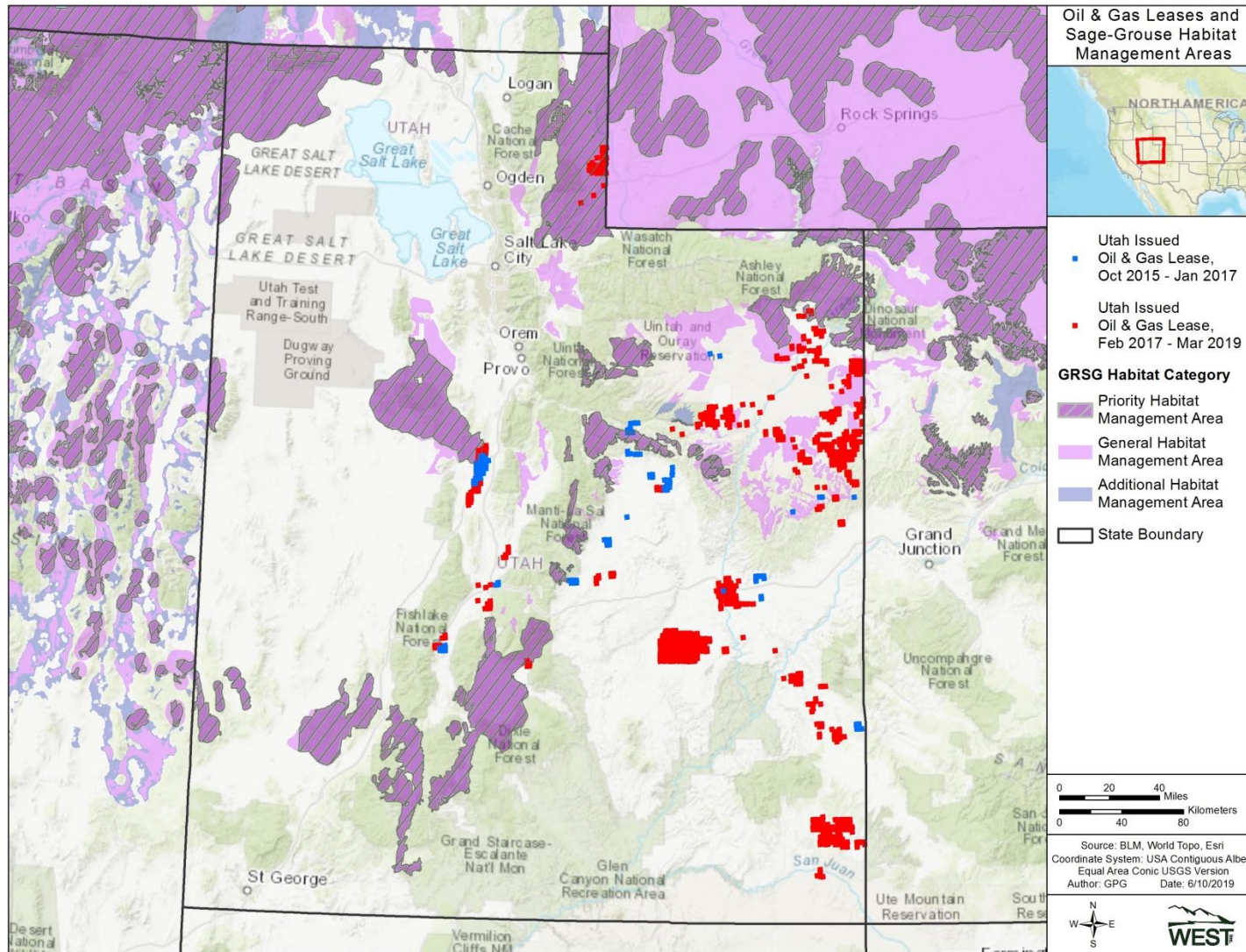
Appendix B4 (continued). Oil and gas leases issued for Nevada.

Timespan	Outside of GRSG Habitat			GHMA/Additional Habitat			PHMA			Total Count	Total Acreage
	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage		
Oct 2015 - Jan 2017	31	92,976	62.56	21	53,326	35.88	1	2,306	1.55	53	148,607
Feb 2017 - Mar 2019	91	186,553	40.34	103	193,930	41.94	38	81,930	17.72	232	462,414
Total¹	122	279,529	45.75	124	247,256	40.47	39	84,236	13.79	285	611,021

GRSG = Greater Sage-Grouse; GHMA = General Habitat Management Area; PHMA = Priority Habitat Management Area

¹ Sums may not equal total values shown due to rounding.

Utah



Appendix B5. Map of oil and gas leases and greater sage-grouse habitat management areas for Utah.

Appendix B5 (continued). Oil and gas leases issued for Utah.

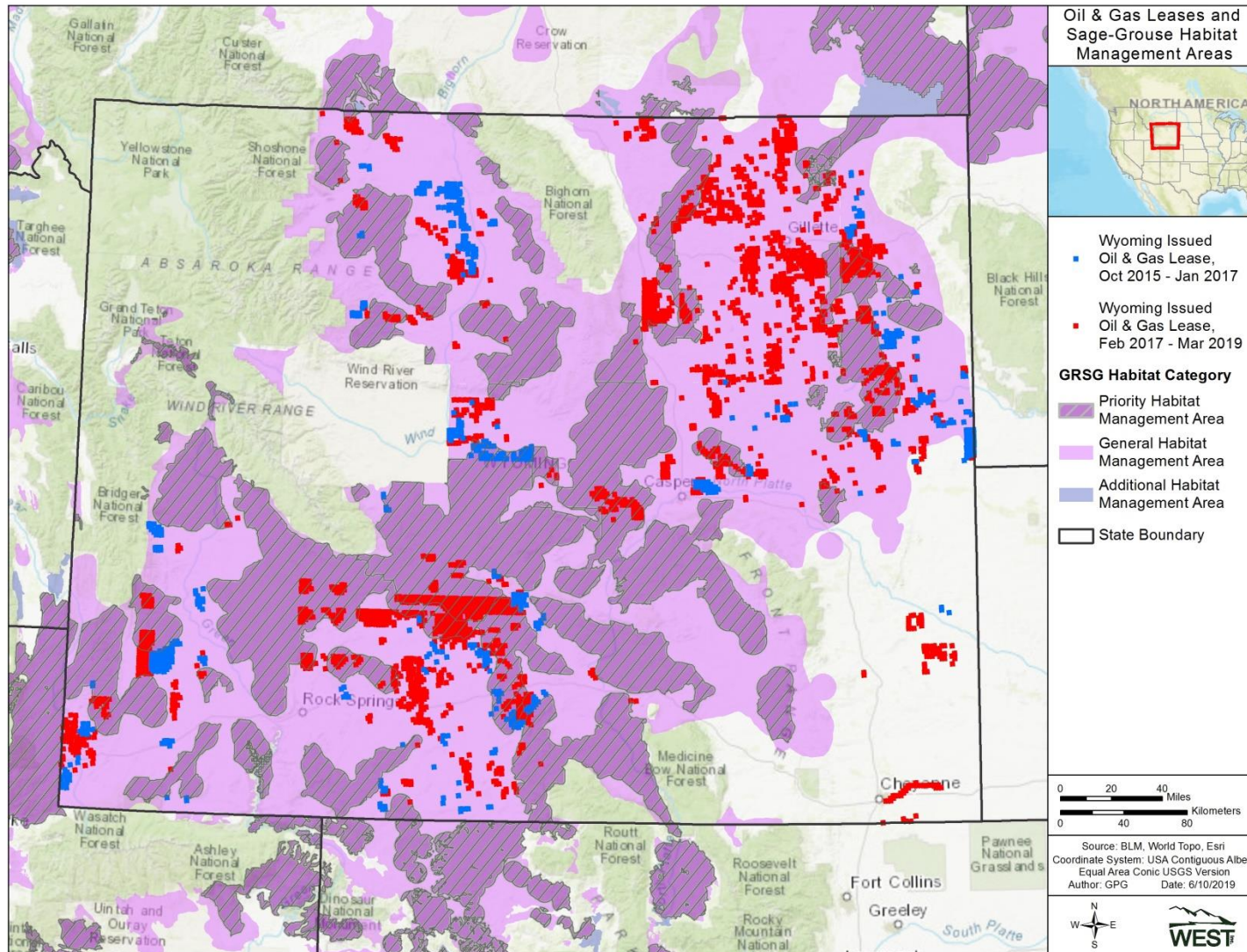
Timespan	Outside of GRSG Habitat			GHMA/Additional Habitat			PHMA			Total Count	Total Acreage
	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage	Count ²	Acreage	% of Leased Acreage		
Oct 2015 - Jan 2017	32	41,246	98.01	1	110	0.26	0	729	1.73	33	42,086
Feb 2017 - Mar 2019	267	381,030	87.22	34	38,555	8.83	13	17,287	3.96	314	436,872
Total¹	299	422,276	88.17	35	38,665	8.07	13	18,016	3.76	347	478,958

GRSG = Greater Sage-Grouse; GHMA = General Habitat Management Area; PHMA = Priority Habitat Management Area

¹ Sums may not equal total values shown due to rounding.

² Partial lease overlap in October 2015 – January 2017.

Wyoming



Appendix B6. Map of oil and gas leases and greater sage-grouse habitat management areas for Wyoming.

Appendix B6 (continued). Oil and gas leases issued for Wyoming.

Timespan	Outside of GRSG Habitat			GHMA/Additional Habitat			PHMA			Total Count	Total Acreage
	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage	Count	Acreage	% of Leased Acreage		
Oct 2015 – Jan 2017	6	3,483	1.25	199	236,123	85.02	33	38,117	13.72	238	277,723
Feb 2017 – Mar 2019	66	14,587	1.35	673	575,801	53.48	404	486,308	45.17	1144	1,076,696
Total¹	72	18,071	1.33	873	811,924	59.95	437	524,425	38.72	1382	1,354,419

GRSG = Greater Sage-Grouse; GHMA = General Habitat Management Area; PHMA = Priority Habitat Management Area

¹ Sums may not equal total values shown due to rounding.