

Lincoln County Nevada

Biomass Supply Update



**Project Report
March 2016**

1.1 INTRODUCTION

In 2010, The Beck Group (BECK) completed a biomass heat and power feasibility study for Lincoln County, Nevada and A-Power Energy Generation Systems. Part of that effort included estimating the acres and volume of Pinyon-Juniper (P-J) biomass to be found in the region surrounding the Lincoln County Power District's Pony Springs and Prince substations. However, due to time limitations and other factors, a relatively small portion of the potential supply area located east of the Utah and Nevada state boundary was excluded from the 2010 study.

Because of continued interest in utilizing P-J biomass, Lincoln County wants to revisit the 2010 study to update the biomass supply estimate to include the full area within a 50 mile radius of the Pony Springs and Prince substations (i.e., include the area within 50 miles that lies east of the Utah Nevada state border) respectively. The following sections describe the methodology used to complete the update and the results of the effort.

1.2 SUPPLY ESTIMATE METHODOLOGY

BECK subcontracted with Resource Concepts, Inc. of Carson City, Nevada to use Geographic Information Systems technology to identify the number of acres of P-J biomass within a 50-mile radius each of the Prince and Pony Springs substations. The procedure for completing this process involved collecting various ground cover vegetation data layers from the U.S. Geological Service and the appropriate Bureau of Land Management Offices in Nevada and Utah. The total acres of P-J in the data was then screened to exclude land: designated as Wilderness, a Wilderness Study Area, that had been burned by wildfire between 1981 and 2013, and lands with greater than 30 percent slope. In addition, the area contained within a 50 mile radius from the Prince and Pony Springs substations was divided into sub-zones by 10 mile increments.

All of the preceding methods resulted in an estimate of the accessible acres of P-J forest within a 50 mile radius respectively of the two substations. The next step in the analysis was to estimate the volume of P-J in bone dry tons contained on those acres. The estimate was developed by first allocating a given percentage of the available acres to three different P-J forest types: Phase 1, Phase 2, and Phase 3. The phase classification categories refer to the density of P-J vegetation per acre, with Phase 1 being the least dense and Phase 3 being the most dense. According to regional land managers interviewed as part of the original study, it is estimated that 25 percent of the P-J acres are Phase I, 50 percent are Phase II, and 25 percent are Phase III.

According to the *Guide for Quantifying Fuels in the Sagebrush Steppe and Juniper Woodlands of the Great Basin*, published by the Sagebrush Steppe Treatment Evaluation Project, Phase I P-J type contains an average total of 3.5 bone dry tons of biomass per acre and, when thinned, would yield an average of 2.6 bone dry tons per acre. Phase II P-J type contains an average total of 10.2 bone dry tons per acre and would yield an average of 5.1 bone dry tons per acre when thinned. Finally, Phase III P-J type contains an average total of 23.0 bone dry tons per acre and would yield an average of 17.3 bone dry tons per acre when thinned.

LINCOLN COUNTY NEVADA – UPDATED BIOMASS SUPPLY ESTIMATE

The thinning yield for each phase were applied to the acres in each phase to estimate the accessible supply of P-J in bone dry tons in the two supply areas (Prince and Pony Springs).

1.3 RESULTS – PRINCE SUBSTATION

The preceding methodology was applied to the region surrounding the Prince Substation of the Lincoln County Power District. The estimated accessible acres of P-J are shown in **Table 1**. The estimate is shown for Nevada and Utah separately and when the two states' regions are combined. As the table illustrates, a total of nearly 1 million acres of accessible P-J is located within the 50 mile radius. Of that amount, a little over half is situated less than 30 miles from the Prince Substation.

Table 1 – Prince Substation Estimated Acres of P-J by Phase Type

Nevada	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	8,500	17,100	8,500	34,100	34,100
11 to 20 miles	30,700	61,400	30,700	122,800	156,900
21 to 30 miles	82,200	164,400	82,200	328,800	485,700
31 to 40 miles	49,600	99,300	49,600	198,500	684,200
41 to 50 miles	9,500	19,000	9,500	38,000	722,200
Total	180,500	361,200	180,500	722,200	
Utah	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	-	-	-	-	-
11 to 20 miles	-	-	-	-	-
21 to 30 miles	9,800	19,700	9,800	39,300	39,300
31 to 40 miles	20,100	40,200	20,100	80,400	119,700
41 to 50 miles	37,000	74,000	37,000	148,000	267,700
Total	66,900	133,900	66,900	267,700	
Nevada & Utah	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	8,500	17,100	8,500	34,100	34,100
11 to 20 miles	30,700	61,400	30,700	122,800	156,900
21 to 30 miles	92,000	184,100	92,000	368,100	525,000
31 to 40 miles	69,700	139,500	69,700	278,900	803,900
41 to 50 miles	46,500	93,000	46,500	186,000	989,900
Total	247,400	495,100	247,400	989,900	

LINCOLN COUNTY NEVADA – UPDATED BIOMASS SUPPLY ESTIMATE

Table 2 displays the estimated bone dry tons of accessible P-J that would result from thinning the Phase I, Phase II, and Phase III acres within a 50 mile radius of the Prince Substation. As the table displays, an estimated 7.44 million bone dry tons of accessible P-J biomass is available within the supply area. Of that amount, a little over half is located less than 30 miles from the Prince Substation.

Table 2 – Prince Substation Estimated Bone Dry Tons of Accessible P-J

Zone	Nevada acres in zone	Phase I BDT's	Phase II BDT's	Phase III BDT's	In Zone Total BDT's	Cumulative Total BDT's
0 – 10	34,100	22,100	87,200	147,100	256,400	256,400
11 – 20	122,800	79,800	313,100	531,100	924,000	1,180,400
21 – 30	328,700	213,700	838,400	1,422,100	2,474,200	3,654,600
31 – 40	198,500	129,000	506,400	858,100	1,493,500	5,148,100
41 – 50	38,000	24,700	96,900	164,400	286,000	5,434,100
	Total	469,300	1,842,000	3,122,800	5,434,100	
Zone	Utah acres in zone	Phase I BDT's	Phase II BDT's	Phase III BDT's	In Zone Total BDT's	Cumulative Total BDT's
0 – 10	-	-	-	-	-	-
11 – 20	-	-	-	-	-	-
21 – 30	39,300	25,500	100,500	169,500	295,500	295,500
31 – 40	80,300	52,300	205,000	347,700	605,000	900,500
41 – 50	147,900	96,200	377,400	640,100	1,113,700	2,014,200
	Total	174,000	682,900	1,157,300	2,014,200	
Zone	Nevada & Utah acres in zone	Phase I BDT's	Phase II BDT's	Phase III BDT's	In Zone Total BDT's	Cumulative Total BDT's
0 – 10	34,100	22,100	87,200	147,100	256,400	256,400
11 – 20	122,800	79,800	313,100	531,100	924,000	1,180,400
21 – 30	368,000	239,200	938,900	1,591,600	2,769,700	3,950,100
31 – 40	278,800	181,300	711,400	1,205,800	2,098,500	6,048,600
41 – 50	185,900	120,900	474,300	804,500	1,399,700	7,448,300
	Total	643,300	2,524,900	4,280,100	7,448,300	

LINCOLN COUNTY NEVADA – UPDATED BIOMASS SUPPLY ESTIMATE

1.4 RESULTS – PONY SPRINGS SUBSTATION

The estimated accessible acres of P-J surrounding the Pony Springs Substation are shown in **Table 3**. The estimate is shown for both Nevada and Utah separately as well as when the two regions are combined. As the table illustrates, a total of a little over 900,000 acres of accessible P-J is available within the 50 mile radius. Of that amount, a little over 40 percent is located less than 30 miles from the Pony Springs Substation.

Table 3 – Pony Springs Substation Estimated Acres of P-J by Phase Type

Nevada	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	18,500	37,000	18,500	74,000	74,000
11 to 20 miles	42,400	84,800	42,400	169,600	243,600
21 to 30 miles	30,500	61,000	30,500	122,000	365,600
31 to 40 miles	28,700	57,400	28,700	114,800	480,400
41 to 50 miles	39,900	79,800	39,900	159,600	640,000
Total	160,000	320,000	160,000	640,000	
Utah	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	-	-	-	-	-
11 to 20 miles	-	-	-	-	-
21 to 30 miles	1,100	2,200	1,100	4,400	4,400
31 to 40 miles	35,400	70,800	35,400	141,600	146,000
41 to 50 miles	31,000	62,100	31,000	124,100	270,100
Total	67,500	135,100	67,500	270,100	
Nevada & Utah	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	18,500	37,000	18,500	74,000	74,000
11 to 20 miles	42,400	84,800	42,400	169,600	243,600
21 to 30 miles	31,600	63,200	31,600	126,400	370,000
31 to 40 miles	64,100	128,200	64,100	256,400	626,400
41 to 50 miles	70,900	141,900	70,900	283,700	910,100
Total	227,500	455,100	227,500	910,100	

LINCOLN COUNTY NEVADA – UPDATED BIOMASS SUPPLY ESTIMATE

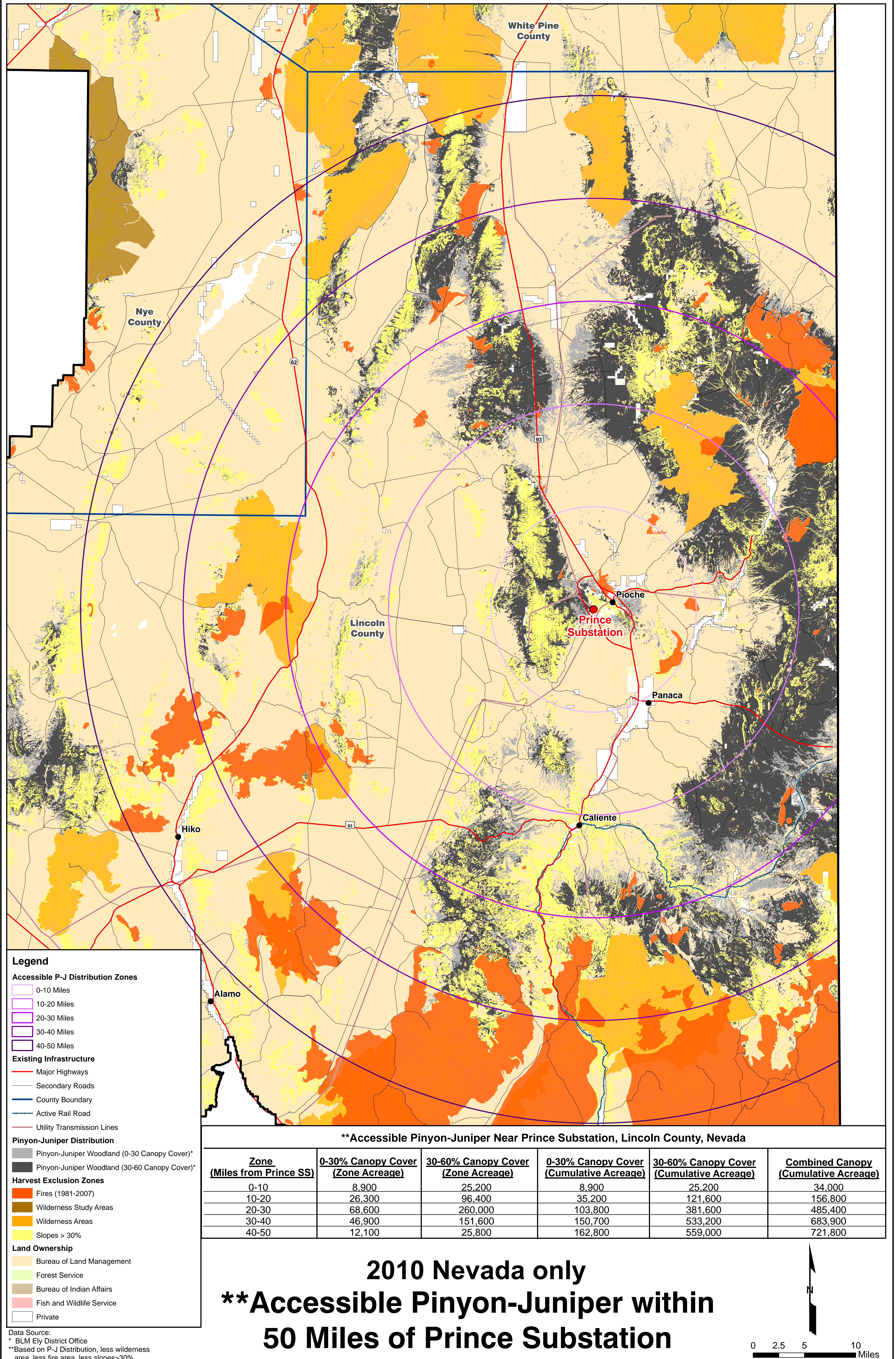
Table 4 displays the estimated bone dry tons of accessible P-J that would result from thinning the Phase I, Phase II, and Phase III acres within a 50 mile radius of the Pony Springs Substation. As shown in the table, there is an estimated 6.85 million bone dry tons of accessible P-J biomass within the supply area. This is roughly 600,000 bone dry tons lower than the Prince Substation estimate. In addition, for Pony Springs, about 41 percent is located less than 30 miles from the Pony Springs Substation, while the Prince Substation has a little over half of its volume located less than 30 miles from the substation. Thus, not only is a greater proportion of the biomass closer to the substation at Prince, the volume within 30 miles of Prince is greater than Pony Springs by about 1.2 million tons.

Table 2 – Pony Springs Substation Estimated Bone Dry Tons of Accessible P-J

Zone	Nevada acres in zone	Phase I BDT's	Phase II BDT's	Phase III BDT's	In Zone Total BDT's	Cumulative Total BDT's
0 – 10	73,900	48,100	188,700	320,100	556,900	556,900
11 – 20	169,500	110,200	432,500	733,500	1,276,200	1,833,100
21 – 30	122,000	79,300	311,100	527,700	918,100	2,751,200
31 – 40	114,800	74,600	292,700	496,500	863,800	3,615,000
41 – 50	159,600	103,700	407,000	690,300	1,201,000	4,816,000
	Total	415,900	1,632,000	2,768,100	4,816,000	
Zone	Utah acres in zone	Phase I BDT's	Phase II BDT's	Phase III BDT's	In Zone Total BDT's	Cumulative Total BDT's
0 – 10	-	-	-	-	-	-
11 – 20	-	-	-	-	-	-
21 – 30	4,400	2,900	11,200	19,000	33,100	33,100
31 – 40	141,500	92,000	361,100	612,400	1,065,500	1,098,600
41 – 50	124,100	80,600	316,700	536,300	933,600	2,032,200
	Total	175,500	689,000	1,167,700	2,032,200	
Zone	Nevada & Utah acres in zone	Phase I BDT's	Phase II BDT's	Phase III BDT's	In Zone Total BDT's	Cumulative Total BDT's
0 – 10	73,900	48,100	188,700	320,100	556,900	556,900
11 – 20	169,500	110,200	432,500	733,500	1,276,200	1,833,100
21 – 30	126,400	82,200	322,300	546,700	951,200	2,784,300
31 – 40	256,300	166,600	653,800	1,108,900	1,929,300	4,713,600
41 – 50	283,700	184,300	723,700	1,226,600	2,134,600	6,848,200
	Total	591,400	2,321,000	3,935,800	6,848,200	

1.5 APPENDICES - MAPS

The following pages are maps of the Pony Springs and Prince substations. The maps display the location of areas of P-J and areas excluded because of wildfire, Wilderness, etc. In addition, the maps show tables of the estimated acres of P-J within various zones. Please note that the map acreage totals may not exactly match the estimates in the preceding tables because of rounding. Finally, note that there are four maps – two each for Prince and Pony Springs. They include the original maps developed in 2010 that only cover Nevada and the updated maps developed in 2016 that include the data from Utah.



Legend

Accessible P-J Distribution Zones

0-10 Miles

10-20 Miles

20-30 Miles

30-40 Miles

40-50 Miles

Existing Infrastructure

Major Highways

Secondary Roads

County Boundary

Active Rail Road

Utility Transmission Lines

Pinyon-Juniper Distribution

Pinyon-Juniper Woodland (0-30 Canopy Cover)*

Pinyon-Juniper Woodland (30-60 Canopy Cover)*

Harvest Exclusion Zones

Fires (1981-2007)

Wilderness Study Areas

Wilderness Areas

Slopes > 30%

Land Ownership

Bureau of Land Management

Forest Service

Bureau of Indian Affairs

Fish and Wildlife Service

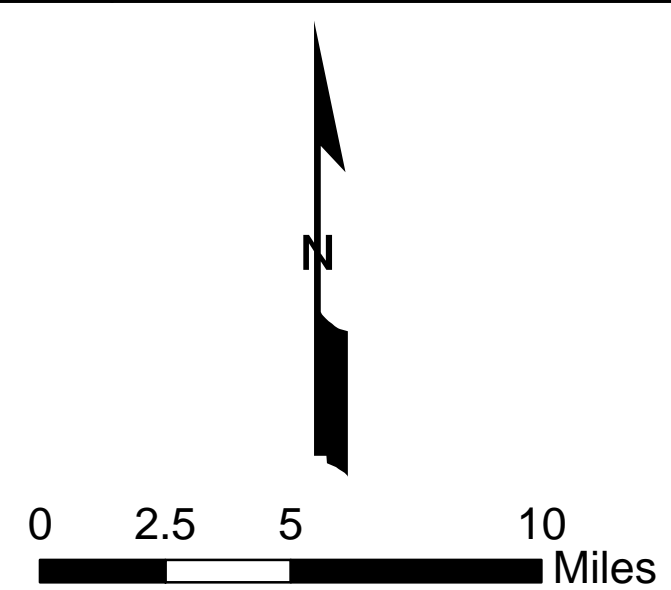
Private

**Accessible Pinyon-Juniper Near Prince Substation, Lincoln County, Nevada					
Zone (Miles from Prince SS)	0-30% Canopy Cover (Zone Acreage)	30-60% Canopy Cover (Zone Acreage)	0-30% Canopy Cover (Cumulative Acreage)	30-60% Canopy Cover (Cumulative Acreage)	Combined Canopy (Cumulative Acreage)
0-10	8,900	25,200	8,900	25,200	34,000
10-20	26,300	96,400	35,200	121,600	156,800
20-30	68,600	260,000	103,800	381,600	485,400
30-40	46,900	151,600	150,700	533,200	683,900
40-50	12,100	25,800	162,800	559,000	721,800

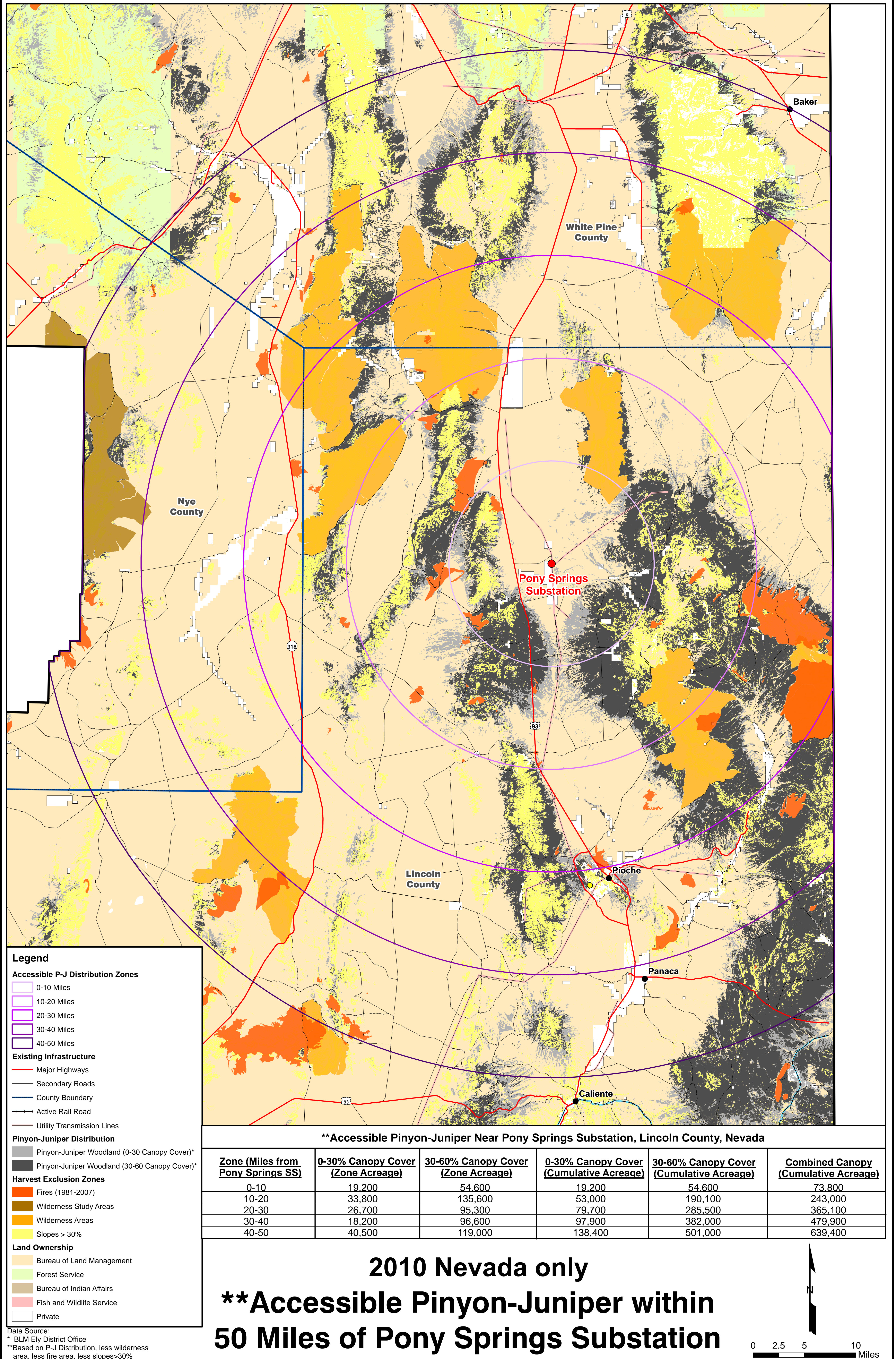
2010 Nevada only

**Accessible Pinyon-Juniper within

50 Miles of Prince Substation



Data Source:
* BLM Ely District Office
**Based on P-J Distribution, less wilderness
area, less fire area, less slopes>30%



Legend

Accessible P-J Distribution Zones

- 0-10 Miles
- 10-20 Miles
- 20-30 Miles
- 30-40 Miles
- 40-50 Miles

Existing Infrastructure

- Major Highways
- Secondary Roads
- County Boundary
- Active Rail Road
- Utility Transmission Lines

Pinyon-Juniper Distribution

- Pinyon-Juniper Woodland (0-30 Canopy Cover)*
- Pinyon-Juniper Woodland (30-60 Canopy Cover)*

Harvest Exclusion Zones

- Fires (1981-2007)
- Wilderness Study Areas
- Wilderness Areas
- Slopes > 30%

Land Ownership

- Bureau of Land Management
- Forest Service
- Bureau of Indian Affairs
- Fish and Wildlife Service
- Private

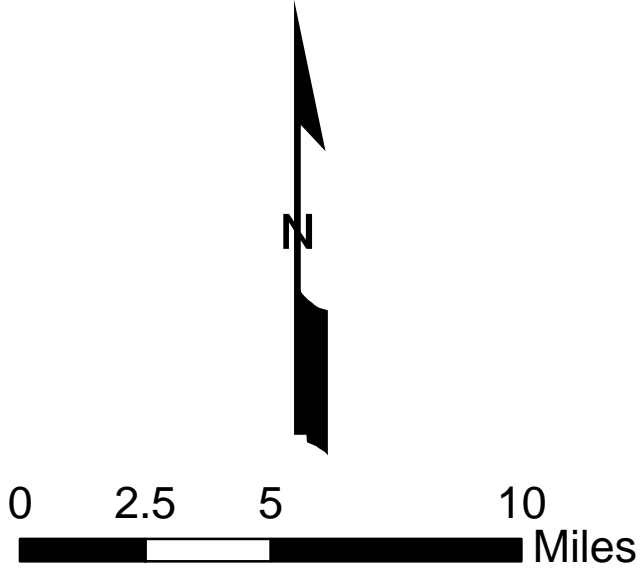
Data Source:
* BLM Ely District Office
**Based on P-J Distribution, less wilderness area, less fire area, less slopes>30%

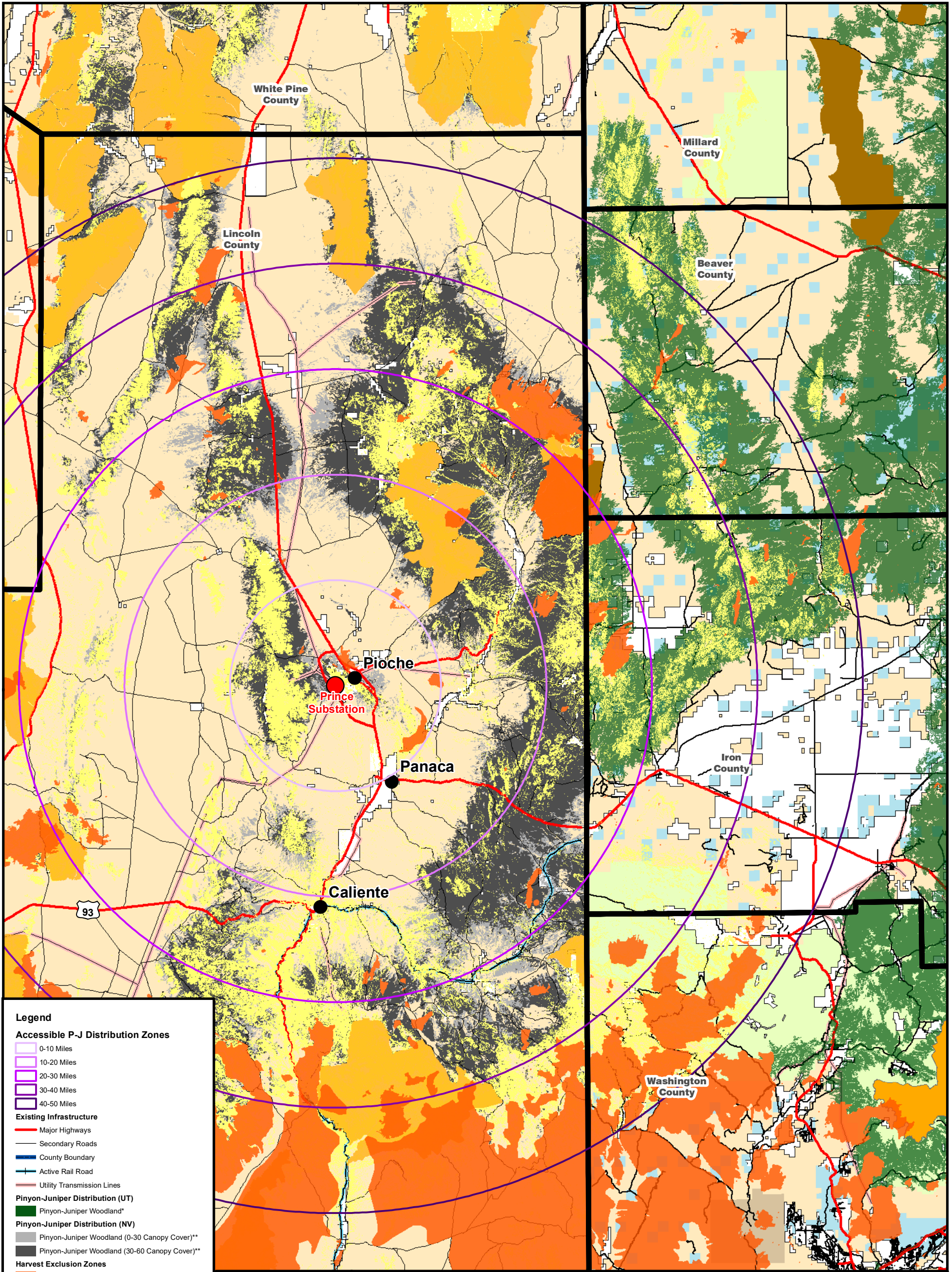
**** Accessible Pinyon-Juniper Near Pony Springs Substation, Lincoln County, Nevada**

<u>Zone (Miles from Pony Springs SS)</u>	<u>0-30% Canopy Cover (Zone Acreage)</u>	<u>30-60% Canopy Cover (Zone Acreage)</u>	<u>0-30% Canopy Cover (Cumulative Acreage)</u>	<u>30-60% Canopy Cover (Cumulative Acreage)</u>	<u>Combined Canopy (Cumulative Acreage)</u>
0-10	19,200	54,600	19,200	54,600	73,800
10-20	33,800	135,600	53,000	190,100	243,000
20-30	26,700	95,300	79,700	285,500	365,100
30-40	18,200	96,600	97,900	382,000	479,900
40-50	40,500	119,000	138,400	501,000	639,400

2010 Nevada only

**** Accessible Pinyon-Juniper within 50 Miles of Pony Springs Substation**





Legend

Accessible P-J Distribution Zones

- 0-10 Miles
- 10-20 Miles
- 20-30 Miles
- 30-40 Miles
- 40-50 Miles

Existing Infrastructure

- Major Highways
- Secondary Roads
- County Boundary
- Active Rail Road
- Utility Transmission Lines

Pinyon-Juniper Distribution (UT)

- Pinyon-Juniper Woodland*

Pinyon-Juniper Distribution (NV)

- Pinyon-Juniper Woodland (0-30 Canopy Cover)**
- Pinyon-Juniper Woodland (30-60 Canopy Cover)**

Harvest Exclusion Zones

- Fires (1981-2013)
- Wilderness Study Areas
- Wilderness Areas
- Slopes > 30%

Land Ownership

- Bureau of Land Management
- Forest Service
- Bureau of Indian Affairs
- Fish and Wildlife Service
- State Land
- Private

**Accessible Pinyon-Juniper in Utah Near Prince Substation, Lincoln County, Nevada				
Zone (Miles from Prince SS)	Accessible PJ *** (Zone Acres, Utah only)	Accessible PJ *** (Cumulative Acres, Utah only)	Total Accessible** PJ in Nevada (Cumulative Acres)	Total Accessible PJ in NV & UT (Cumulative Acres)
0 - 10	0	0	34,000	34,000
10 - 20	0	0	156,800	156,800
20 - 30	39,300	39,300	485,400	524,700
30 - 40	80,300	119,600	683,900	803,500
40 - 50	147,900	267,500	721,800	989,300

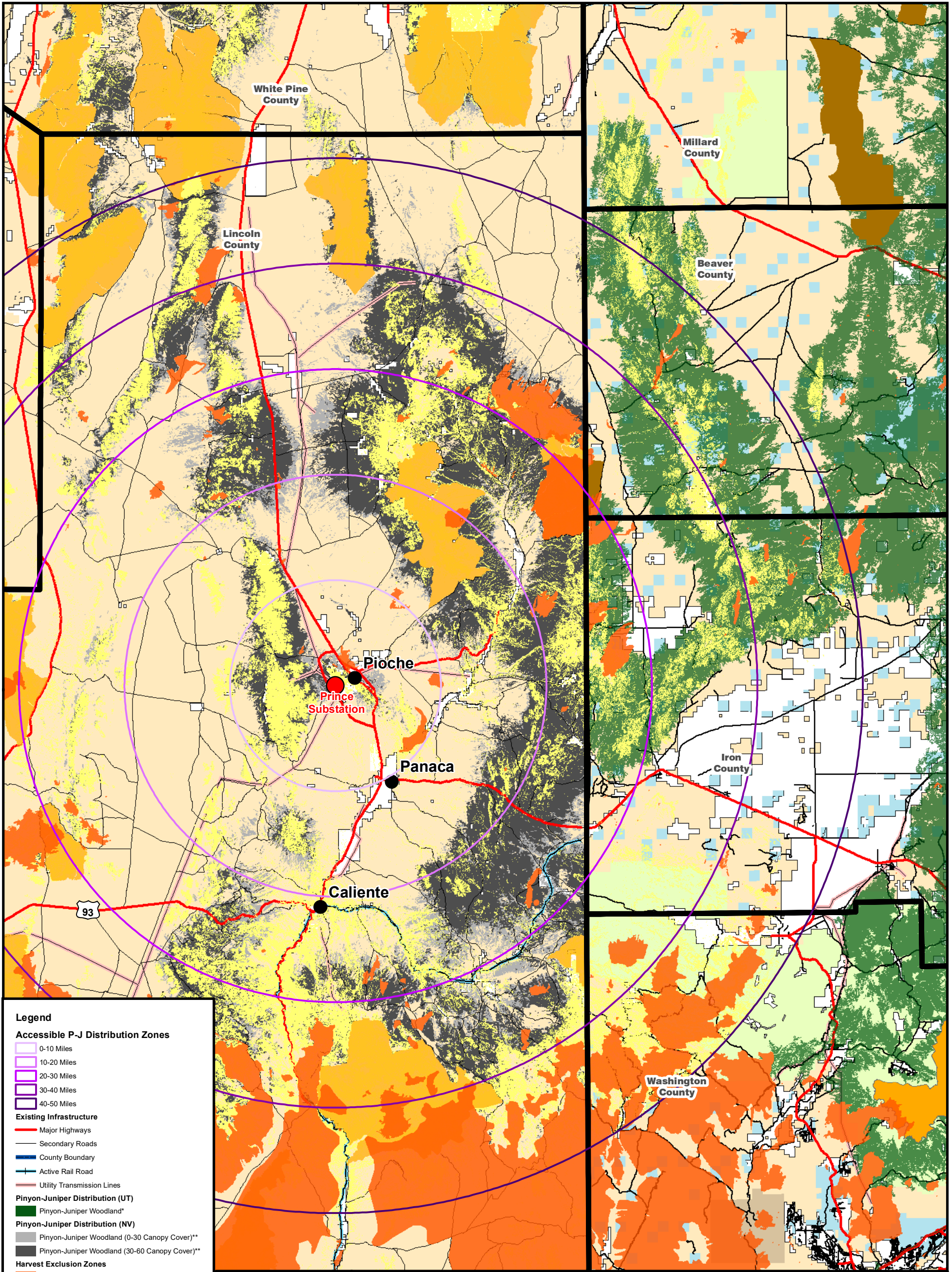
2016 Utah

***Accessible Pinyon-Juniper in Utah within 50 Miles of Prince Substation

02.5510

Miles

Data Source:
* USGS SW ReGAP
** BLM Ely District Office
***Based on NV P-J Distribution, less wilderness area, less fire area, less slopes>30%
***Based on UT PJ Distribution, less fires (1981-2013), Wilderness Study Areas, Wilderness Areas, and slopes >30%



Legend

Accessible P-J Distribution Zones

- 0-10 Miles
- 10-20 Miles
- 20-30 Miles
- 30-40 Miles
- 40-50 Miles

Existing Infrastructure

- Major Highways
- Secondary Roads
- County Boundary
- Active Rail Road
- Utility Transmission Lines

Pinyon-Juniper Distribution (UT)

- Pinyon-Juniper Woodland*

Pinyon-Juniper Distribution (NV)

- Pinyon-Juniper Woodland (0-30 Canopy Cover)**
- Pinyon-Juniper Woodland (30-60 Canopy Cover)**

Harvest Exclusion Zones

- Fires (1981-2013)
- Wilderness Study Areas
- Wilderness Areas
- Slopes > 30%

Land Ownership

- Bureau of Land Management
- Forest Service
- Bureau of Indian Affairs
- Fish and Wildlife Service
- State Land
- Private

**Accessible Pinyon-Juniper in Utah Near Prince Substation, Lincoln County, Nevada				
Zone (Miles from Prince SS)	Accessible PJ *** (Zone Acres, Utah only)	Accessible PJ *** (Cumulative Acres, Utah only)	Total Accessible** PJ in Nevada (Cumulative Acres)	Total Accessible PJ in NV & UT (Cumulative Acres)
0 - 10	0	0	34,000	34,000
10 - 20	0	0	156,800	156,800
20 - 30	39,300	39,300	485,400	524,700
30 - 40	80,300	119,600	683,900	803,500
40 - 50	147,900	267,500	721,800	989,300

2016 Utah

***Accessible Pinyon-Juniper in Utah within 50 Miles of Prince Substation

02.5510

Miles

3/16/2016

Data Source:
* USGS SW ReGAP
** BLM Ely District Office
***Based on NV P-J Distribution, less wilderness area, less fire area, less slopes>30%
***Based on UT PJ Distribution, less fires (1981-2013), Wilderness Study Areas, Wilderness Areas, and slopes >30%