

FEEDSTOCK SECURITY: THE PINYON-JUNIPER OPTION IN LINCOLN COUNTY, NEVADA



April 2016

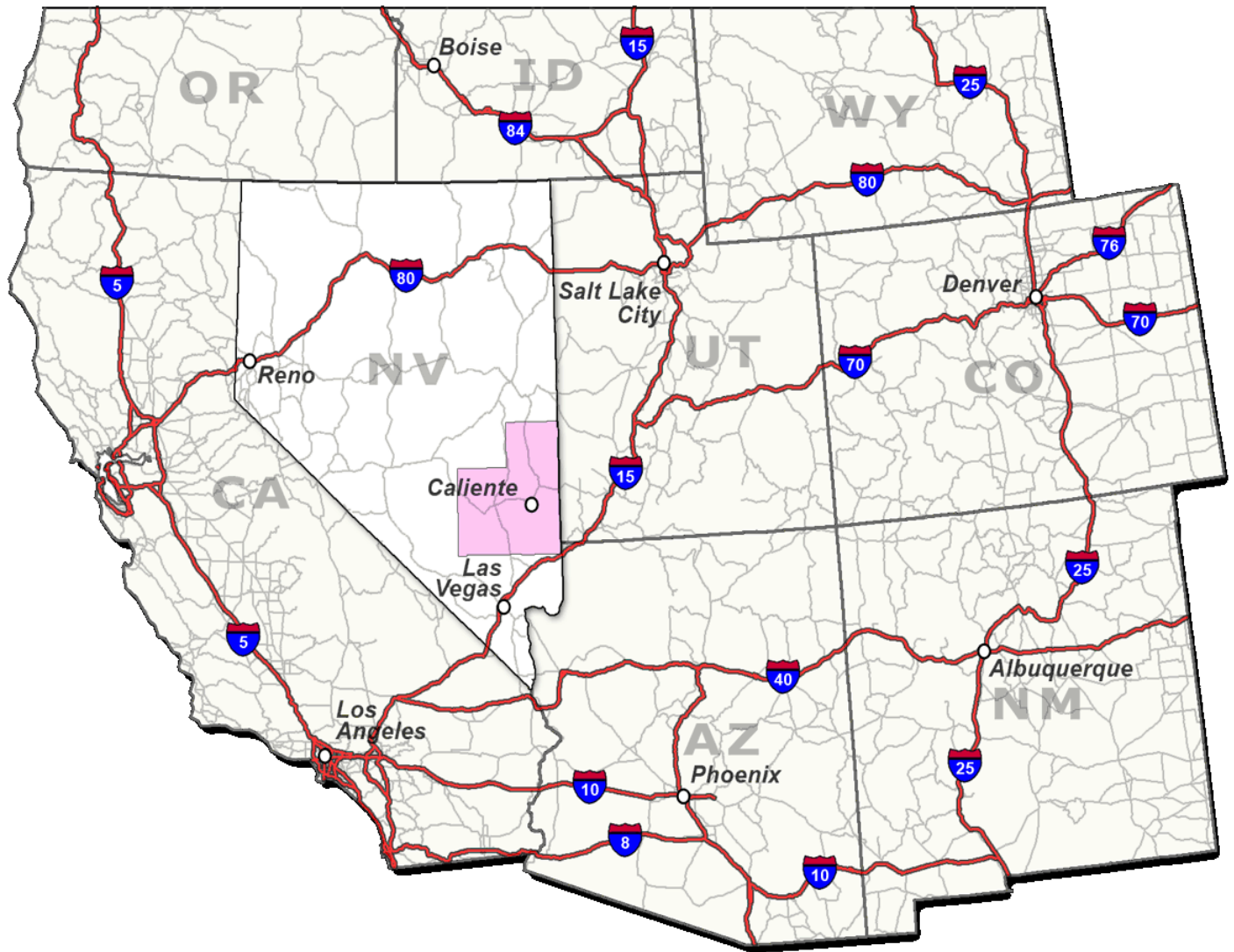
**Lincoln County Regional Development Authority
Lincoln County, Nevada**

Nevada/Western States Rail Routes



to/from Caliente, NV (approx. miles)	
Las Vegas, NV	135
Los Angeles, CA	441
Denver, CO (Southern Route)	754
Denver, CO (Northern Route)	961

Nevada/Western States Highway Routes



to/from Caliente, NV (miles)	
Las Vegas, NV	159
Salt Lake City, UT	338
Los Angeles, CA	428
Reno, NV	443
Phoenix, AZ	446
Sacramento, CA	561
San Francisco, CA	647
Denver, CO	662
Albuquerque, NM	725

Pinyon-Juniper Woodland Types

Phase I Foreground

Phase II Midground

Phase III Background



Current vs Desired Range of Conditions for the Pinyon-Juniper Vegetation Type within the Ely BLM District

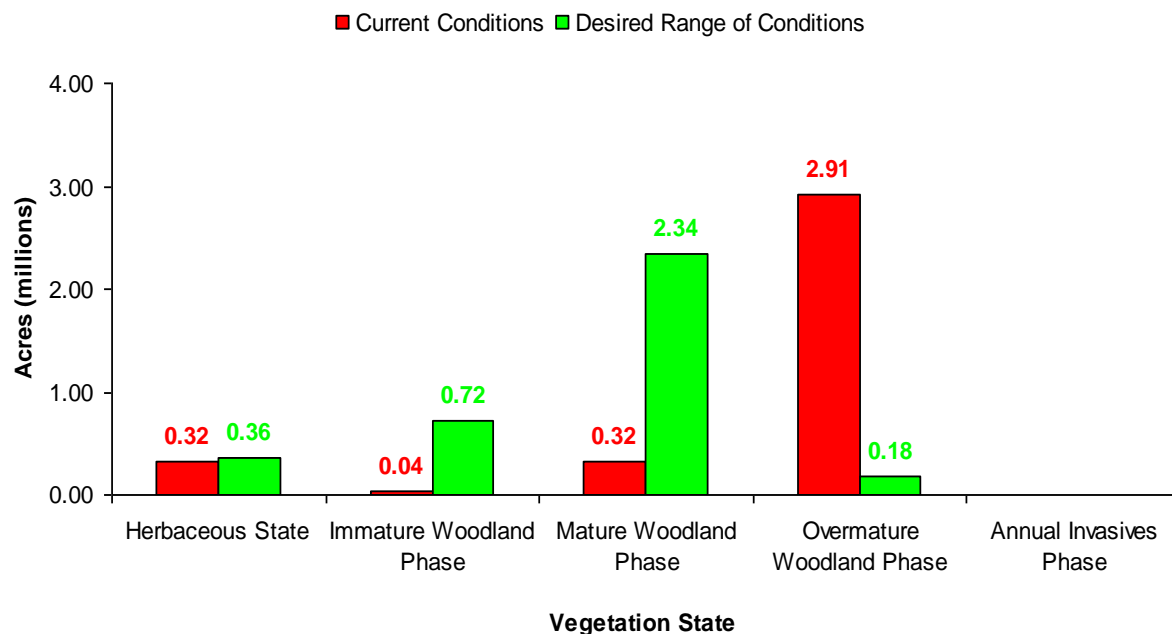


Chart developed based on information from Tables 3.5-2 and 3.5-3 from the Final Ely District EIS (Current State) and Table 2 from the Approved Resource Management Plan (Desired State).

Bureau of Land Management Landscape Restoration Objectives in Eastern Nevada and Western Utah

Phase I Landscape Restoration Projects

- Encroachment Control
- Sage Grouse Habitat Preservation

Phase II and III Landscape Restoration Projects

- Catastrophic Wildfire Hazard Reduction
- Watershed Health
- Deer and Elk Habitat Enhancement
- Increased Biodiversity
- Pine Nut Production

Equipment Utilized in Pinyon-Juniper Thinning

Southern Utah Biomass Demonstration Days

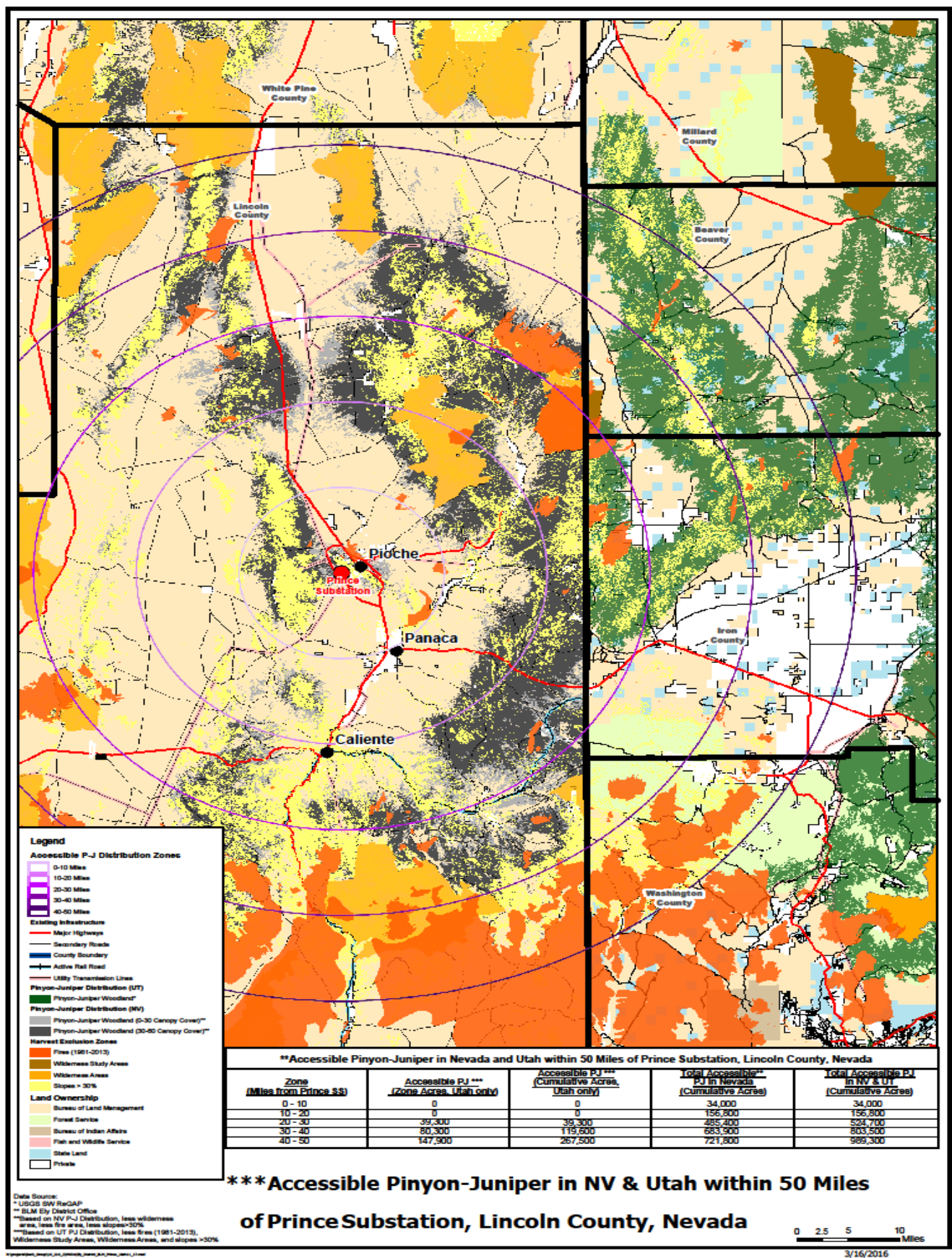
June 2-4, 2011, Beaver, Utah



**PONSSE COMBINATION
HARVESTER/FORWARDER**



FECON RTC 2500



Source: The Beck Group, *Lincoln County, Nevada Biomass Supply Update*, prepared for the Lincoln County Regional Development Authority, Portland, Oregon, March 2016.

Accessible Pinyon-Juniper Woodland within 50 Miles of Prince Substation In Central Lincoln County, Nevada 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	

Source: The Beck Group, *Lincoln County, Nevada Biomass Supply Update*, prepared for the Lincoln County Regional Development Authority, Portland, Oregon, March 2016.

Estimated Bone Dry Tons of Accessible Pinyon-Juniper Biomass within 50 Miles of Prince Substation in Central Lincoln County, Nevada by Phase Type

Distance from Prince Substation (miles)	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	
Distance from Prince Substation (miles)	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	
Distance from Prince Substation (miles)	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	

Source: The Beck Group, *Lincoln County, Nevada Biomass Supply Update*, prepared for the Lincoln County Regional Development Authority, Portland, Oregon, March 2016.

Idaho National Laboratory Analyses of Lincoln County, Nevada Derived Juniper Biomass Samples

Pedigree

Institution: Lincoln County Regional Development Authority
Location: West side of Panaca Summit off of NV State Route 319
Sample Preparation: 30.00 Commercial DR Rapid-Feed Chipper

Harvested: 2016
Received at INL: January 2016
Document Prepared 4/6/16

Proximate, Ultimate & Calorimetry

Table 1. Proximate, ultimate, and calorific values for Phase II Juniper (Biomass Library GUID: 031c749d-b618-43c3-bd9a-2fb52d2aac89; reported on a dry basis)

Proximate ^a			Ultimate ^b					Calorimetry ^c	
%Volatile	%Ash	%Fixed Carbon	%Hydrogen	%Carbon	%Nitrogen	%Oxygen	%Sulfur	HHV	LHV
79.70	2.89	17.41	6.30	53.12	0.60	37.04	0.05	9517	8068

Footnotes: See Table 2 below.

Table 2. Proximate, ultimate, and calorific values for Phase III Juniper (Biomass Library GUID: 00af89ac-084c-4f74-8d40-1202f6c0d352; reported on a dry basis)

Proximate ^a			Ultimate ^b					Calorimetry ^c	
%Volatile	%Ash	%Fixed Carbon	%Hydrogen	%Carbon	%Nitrogen	%Oxygen	%Sulfur	HHV	LHV
78.04	2.85	19.11	6.07	52.05	0.51	38.47	0.05	9129	7720

^aProximate analysis was done according to ASTM D 5142-09

^bUltimate analysis was conducted using a modified ASTM D5373-10 method (Flour and Plant Tissue Method) that uses a slightly different burn profile. Elemental sulfur content was determined using ASTM D4239-10, and oxygen content was determined by difference

^cHeating values (HHV, LHV) were determined with a calorimeter using ASTM D5865-10

Elemental Ash

Table 3. Elemental ash composition^a of Phase II Juniper (Biomass Library GUID: 2d4191c1-2483-7543-826a-7171833ae6f6)

%Al as Al ₂ O ₃	%Ca as CaO	%Fe as Fe ₂ O ₃	%K as K ₂ O	%Mg as MgO	%Mn as MnO	%Na as Na ₂ O	%P as P ₂ O ₅	%Si as SiO ₂	%Ti as TiO ₂	%S as SO ₃
1.46	58.55	0.63	11.00	5.85	0.07	0.27	4.93	7.11	0.08	3.96

^aDetermined as described in ASTM standards D3174, D3682 and D6349. Total ash was 3.06% (held at 750°C for 8 hours).

Table 4. Elemental ash composition^a of Phase III Juniper (Biomass Library GUID: e04e08c7-3b7a-5c47-ad20-0c9a6ef8328c)

%Al as Al ₂ O ₃	%Ca as CaO	%Fe as Fe ₂ O ₃	%K as K ₂ O	%Mg as MgO	%Mn as MnO	%Na as Na ₂ O	%P as P ₂ O ₅	%Si as SiO ₂	%Ti as TiO ₂	%S as SO ₃
1.33	63.50	0.63	10.77	4.33	0.10	0.24	4.28	6.21	0.07	3.79

^aDetermined as described in ASTM standards D3174, D3682 and D6349. Total ash was 3.18% (held at 750°C for 8 hours).

Composition

Table 5. *Chemical composition^a of phase II juniper (2D4191C1-2483-7543-826A-7171833AE6F6)*

%Structural Ash	%Extractable Inorganics	%Water Extractives Others	%EtOH Extractives
3.11	0.81	12.08	11.53
%Lignin	%Glucan	%Xylan	%Galactan
30.98	20.11	5.37	3.47
%Arabinan + Mannan	%Acetate	%Total	
6.55	0.85	94.87	

^aDetermined using NREL “Summative Mass Closure” LAP (NREL/TP-510-48087)

Table 6. *Chemical composition^a of phase III juniper (E04E08C7-3B7A-5C47-AD20-0C9A6EF8328C)*

%Structural Ash	%Extractable Inorganics	%Water Extractives Others	%EtOH Extractives
3.37	1.16	9.67	6.63
%Lignin	%Glucan	%Xylan	%Galactan
35.13	22.94	5.65	3.72
%Arabinan + Mannan	%Acetate	%Total	
6.84	0.98	96.07	

^aDetermined using NREL “Summative Mass Closure” LAP (NREL/TP-510-48087)

Idaho National Laboratory Analyses of Lincoln County, Nevada Derived Pinyon Biomass Samples

Pedigree

Institution: Lincoln County Regional Development Authority
Location: West side of Panaca Summit off of NV State Route 319
Sample Preparation: 30.00 Commercial DR Rapid-Feed Chipper

Harvested: 2016
Received at INL: January 2016
Document Prepared 4/6/16

Proximate, Ultimate & Calorimetry

Table 1. Proximate, ultimate, and calorific values for Phase II Pinyon Pine (Biomass Library GUID: 08a5c880-4853-48e8-bea6-26f37b55e1ba; reported on a dry basis)

Proximate ^a			Ultimate ^b					Calorimetry ^c	
%Volatile	%Ash	%Fixed Carbon	%Hydrogen	%Carbon	%Nitrogen	%Oxygen	%Sulfur	HHV	LHV
79.26	1.90	18.84	6.28	52.49	0.58	38.70	0.04	9268	7819

Footnotes: See Table 2.

Table 2. Proximate, ultimate, and calorific values for Phase III Pinyon Pine (Biomass Library GUID: 55341a91-8891-43dd-bf8b-729e2b92ec6d; reported on a dry basis)

Proximate ^a			Ultimate ^b					Calorimetry ^c	
%Volatile	%Ash	%Fixed Carbon	%Hydrogen	%Carbon	%Nitrogen	%Oxygen	%Sulfur	HHV	LHV
79.64	1.85	18.52	6.27	52.70	0.52	38.63	0.04	9355	7901

^aProximate analysis was done according to ASTM D 5142-09

^bUltimate analysis was conducted using a modified ASTM D5373-10 method (Flour and Plant Tissue Method) that uses a slightly different burn profile. Elemental sulfur content was determined using ASTM D4239-10, and oxygen content was determined by difference

^cHeating values (HHV, LHV) were determined with a calorimeter using ASTM D5865-10

Elemental Ash

Table 3. Elemental ash composition^a of Phase II Juniper (Biomass Library GUID: 2fd580ca-a85b-bb41-af49-2af1f4f92e03)

%Al as Al ₂ O ₃	%Ca as CaO	%Fe as Fe ₂ O ₃	%K as K ₂ O	%Mg as MgO	%Mn as MnO	%Na as Na ₂ O	%P as P ₂ O ₅	%Si as SiO ₂	%Ti as TiO ₂	%S as SO ₃
1.61	46.05	1.09	19.64	9.59	0.21	0.22	7.75	6.28	0.08	4.21

^aDetermined as described in ASTM standards D3174, D3682 and D6349. Total ash was 2.00% (held at 750°C for 8 hours).

Table 4. Elemental ash composition^a of Phase III Juniper (Biomass Library GUID: 5092a3e1-f73b-f24b-b6d8-fe84b35a25fb)

%Al as Al ₂ O ₃	%Ca as CaO	%Fe as Fe ₂ O ₃	%K as K ₂ O	%Mg as MgO	%Mn as MnO	%Na as Na ₂ O	%P as P ₂ O ₅	%Si as SiO ₂	%Ti as TiO ₂	%S as SO ₃
1.49	44.63	1.20	20.12	8.06	0.17	0.30	7.20	5.74	0.08	4.48

^aDetermined as described in ASTM standards D3174, D3682 and D6349. Total ash was 1.89% (held at 750°C for 8 hours).

Composition

Table 5. *Chemical composition^a of phase II pinyon pine (2FD580CA-A85B-BB41-AF49-2AF1F4F92E03)*

%Structural Ash	%Extractable Inorganics	%Water Extractives Others	%EtOH Extractives
1.48	0.95	11.36	9.60
%Lignin	%Glucan	%Xylan	%Galactan
31.66	22.57	5.38	3.62
%Arabinan + Mannan	%Acetate	%Total	
9.12	0.61	96.35	

^aDetermined using NREL “Summative Mass Closure” LAP (NREL/TP-510-48087)

Table 6. *Chemical composition^a of phase III pinyon pine (5092A3E1-F73B-F24B-B6D8-FE84B35A25FB)*

%Structural Ash	%Extractable Inorganics	%Water Extractives Others	%EtOH Extractives
1.40	1.00	12.24	10.53
%Lignin	%Glucan	%Xylan	%Galactan
29.95	22.03	5.22	3.59
%Arabinan + Mannan	%Acetate	%Total	
10.13	0.79	96.87	

^aDetermined using NREL “Summative Mass Closure” LAP (NREL/TP-510-48087)

For questions regarding biomass material or the INL analytical data presented above please contact Amber Hoover at amber.hoover@inl.gov or 208-526-5992.

Why Consider Pinyon-Juniper Feedstock Derived from the Lincoln County, Nevada Area?

- **Nearly 1 Million Acres of Accessible Woodland Administered Primarily by One Land Owner**
 - United States Department of Interior, Bureau of Land Management
- **Approved Agency Plans and National Environmental Policy Act (NEPA) Compliance**
 - BLM's Ely Resource Management Plan – 2.9 million acres Requiring Thinning
 - Numerous Thinning Project Specific Plans and Environmental Assessments
 - Completed by BLM Ely District and BLM Cedar City District Staff and Ready for Implementation – in excess of 350,000 acres
 - Under Development by BLM Ely District and BLM Cedar City District Staff – 250,000 acres
- **BLM and USFS Paying \$100 (Phase I) to \$400 Per Acre (Phases II and III) for Contract Thinning**
- **BLM Authorized to Enter Into 10-Year Renewable Stewardship Contracts or Agreements Providing Feedstock Security**
- **Mainline Union Pacific Railroad Terminating at Port of Los Angeles Serves Area**

Credits

Cover Photo, Doug Page

Page 1 Photo – Scott Bell

Page 2 – Both Photos – Doug Page

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