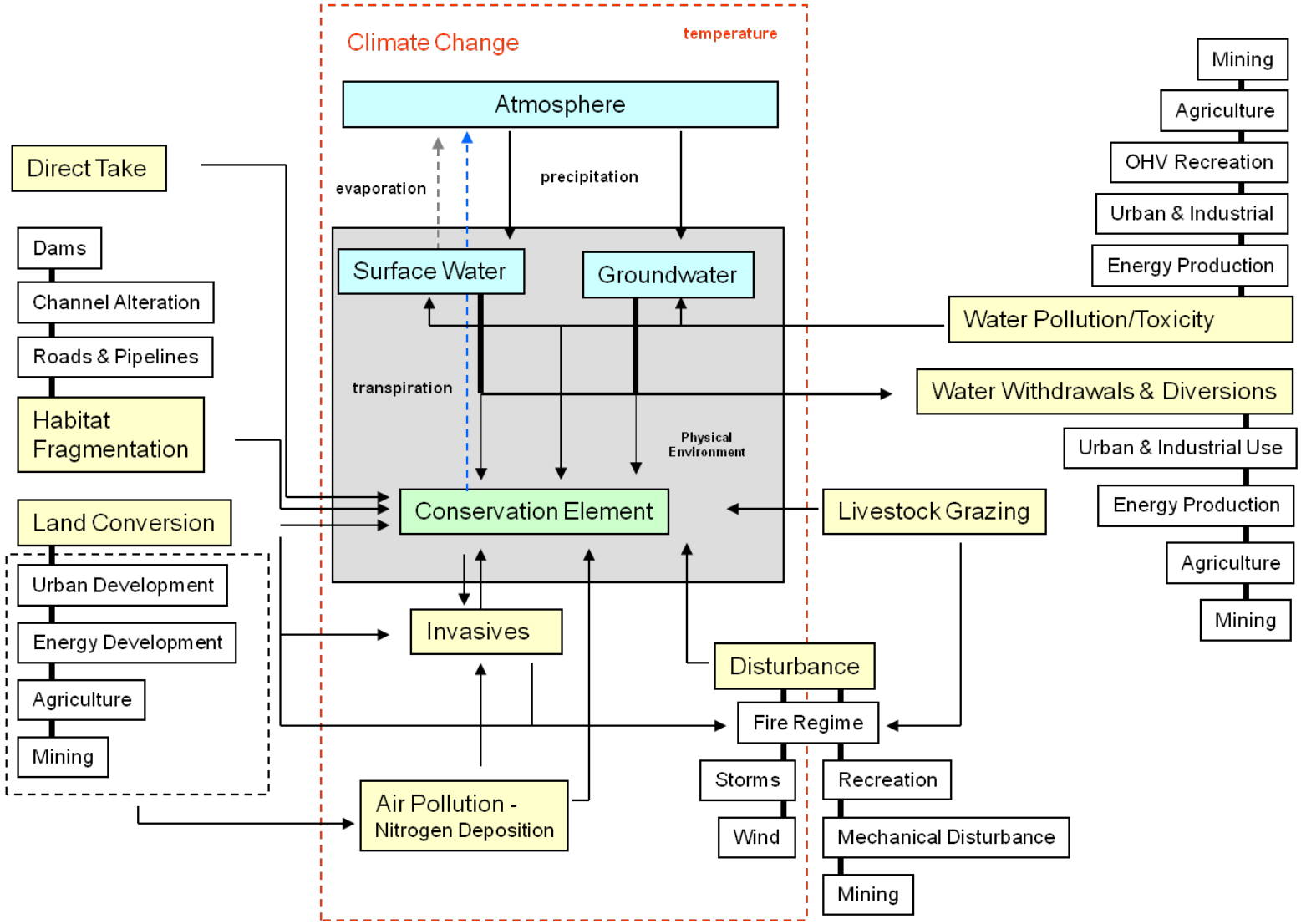
Appendix D – Logic Models

Organization of Appendix D

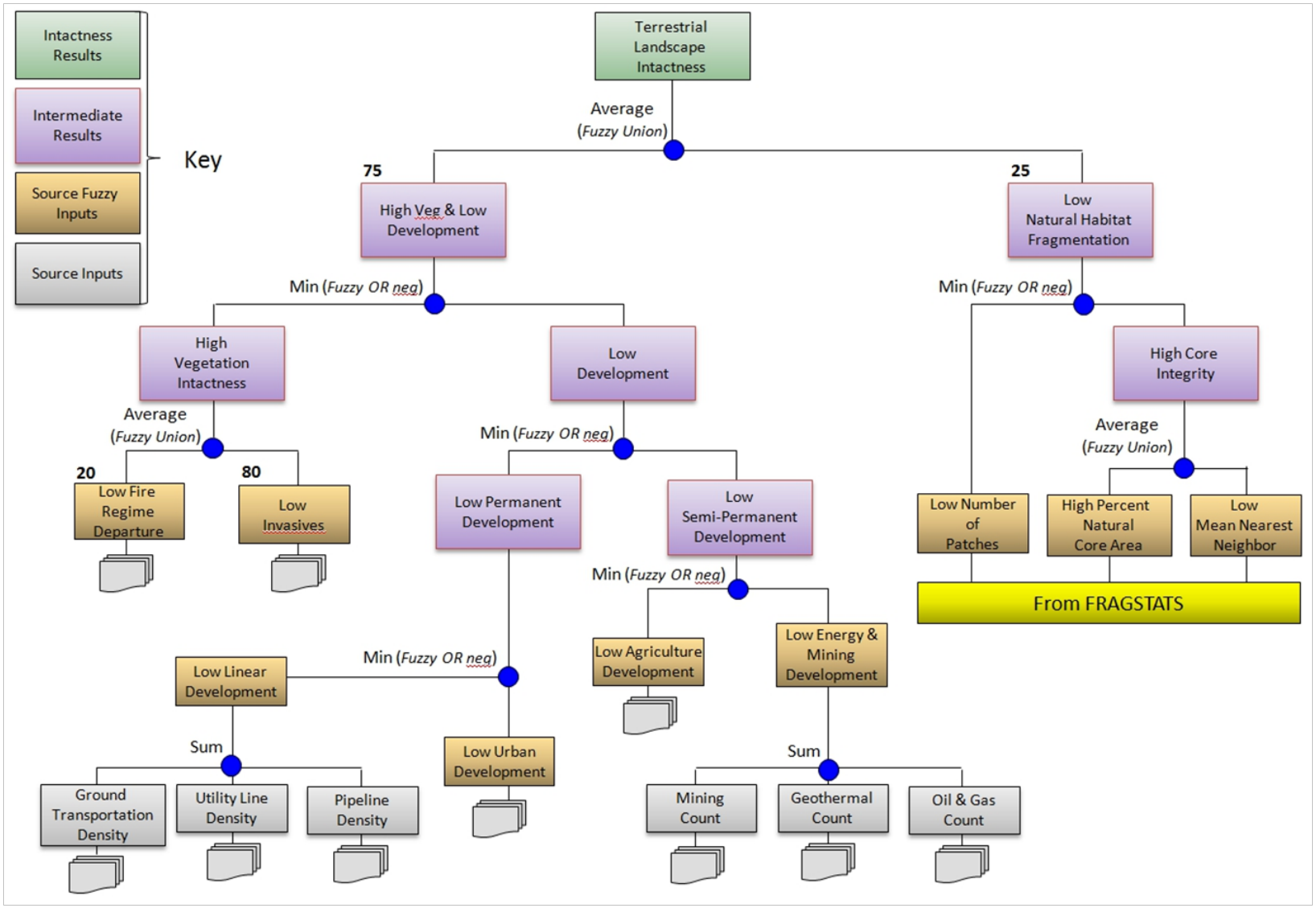
For the Colorado Plateau REA, six issues questions relied on development of more complicated fuzzy logic modeling, including current terrestrial landscape intactness, current aquatic intactness, near-term future (2025) terrestrial landscape intactness, near-term future (2025) aquatic intactness, current development, near-term future (2025) development, maximum (long term) potential energy development, and potential climate change impacts (2060) on conservation elements. All of these models were used to address multiple management questions and they cover different aspects of change agents operating on the landscape. The relationship of the factors modeled above can be viewed as part of a larger, generalized conceptual diagram regarding change agents (conceptual model next page).

For each of the eight models, the logic model is presented first, followed by a table of data sources, an assessment of data quality and overall confidence in the model, and threshold tables. The mapped results are presented in a 4 km X 4 km grid reporting unit and/or 5th level Hydrologic Unit (HUC5), as appropriate for each issue.

Generalized Change Agent Conceptual Diagram



Current Terrestrial Landscape Intactness Logic Model



Data Sources for Current Terrestrial Landscape Intactness

Model Input Label	Data Source	Relative Quality
Ground Transportation Density	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful addition
Utility Line Density	Powerlines in the Western United States (USGS)	Good
Pipeline Density	Pipelines (proprietary, provided by BLM)	Good
Low Urban Development	Impervious Surfaces (NLCD 2006)	Very Good
Low Agriculture Development	LANDFIRE - Existing Vegetation Type (version 1.1)	Very Good
Mining Count	Arizona Mines (Arizona Electronic Atlas)	Good
	Uranium Mines in Arizona (BLM, digitized by CBI)	Good
	Colorado Mines (Colorado Division of Reclamation, Mining and Safety)	Good
	Active Mines and Mineral Processing Plants (USGS)	Good
	New Mexico Mines (New Mexico GIS Resource Program)	Good
	Utah Mines (Automated Geographic Reference Center)	Good
Geothermal Count	Geothermal Wells in Utah (Utah Geological Survey)	Good
	Geothermal Wells in Arizona, Colorado, and New Mexico (Idaho National Engineering and Environmental Laboratory; digitized by CBI)	Good
Oil & Gas Count	Oil & Gas Wells (proprietary, provided by BLM)	Good
Low Fire Regime Departure	Current Fire Regime and Vegetation Departure (see Appendix A MQE3)	Fair
Low Invasives	Current Predicted Distribution of Major Invasive Vegetation Species (see Appendix A MQF1)	Fair
Low Natural Habitat Fragmentation	Natural Vegetation Fragmentation (4KM) (CBI)	Fair-Good

Overall Model Certainty: **High** – biggest weaknesses are lack of detailed invasives data, and additional recreation (OHV) and grazing condition data.

Model output reported using both 4km x 4km grid cells and 5th level HUCs.

Current Terrestrial Landscape Intactness (see threshold explanation, Chapter 3) Thresholds – 4km x 4km grid cells

Item	Data Type	Data Range	True Threshold	False Threshold
Fire Regime	Percent Area	13–98	13[1]	98
Invasive Grasses & Tamarisk	Percent Area	0–88	0[3]	33
Linear Development	Linear Density	0–18	0[1]	2.5
Urban Percent	Percent Area	0–99	0[3]	15
Agriculture Percent	Percent Area	0–90	0[3]	20
Energy & Mining Development	Point Density	0–37	0[2]	1.25
Number of Patches	Number	1–1,455	1[4]	700
Mean Nearest Neighbor	Linear Distance	60–272	60[1]	180
Percent Natural Core Area	Percent Area	0.56–95	100[3]	20

1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 1 Standard Deviation from the mean; 3: Skewed data range = 2 Standard Deviations from the mean; 4: Skewed data range = 2.5 Standard Deviations from the mean

Thresholds – 5th level HUC

Item	Data Type	Data Range	True Threshold	False Threshold
Fire Regime	Percent Area	28–65	13[1]	98
Invasive Grasses & Tamarisk	Percent Area	0–36	0[3]	33
Linear Development	Linear Density	0–6	0[1]	2.5
Urban Percent	Percent Area	0–23	0[3]	15
Agriculture Percent	Percent Area	0–34	0[3]	20
Energy & Mining Development	Point Density	0–13	0[2]	1.25
Number of Patches	Number	45–3,901	1[4]	700
Mean Nearest Neighbor	Linear Distance	60–115	60[1]	180
Percent Natural Core Area	Percent Area	14–86	100[3]	20

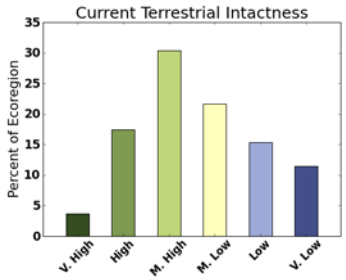
1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 1 Standard Deviation from the mean; 3: Skewed data range = 2 Standard Deviations from the mean; 4: Skewed data range = 2.5 Standard Deviations from the mean

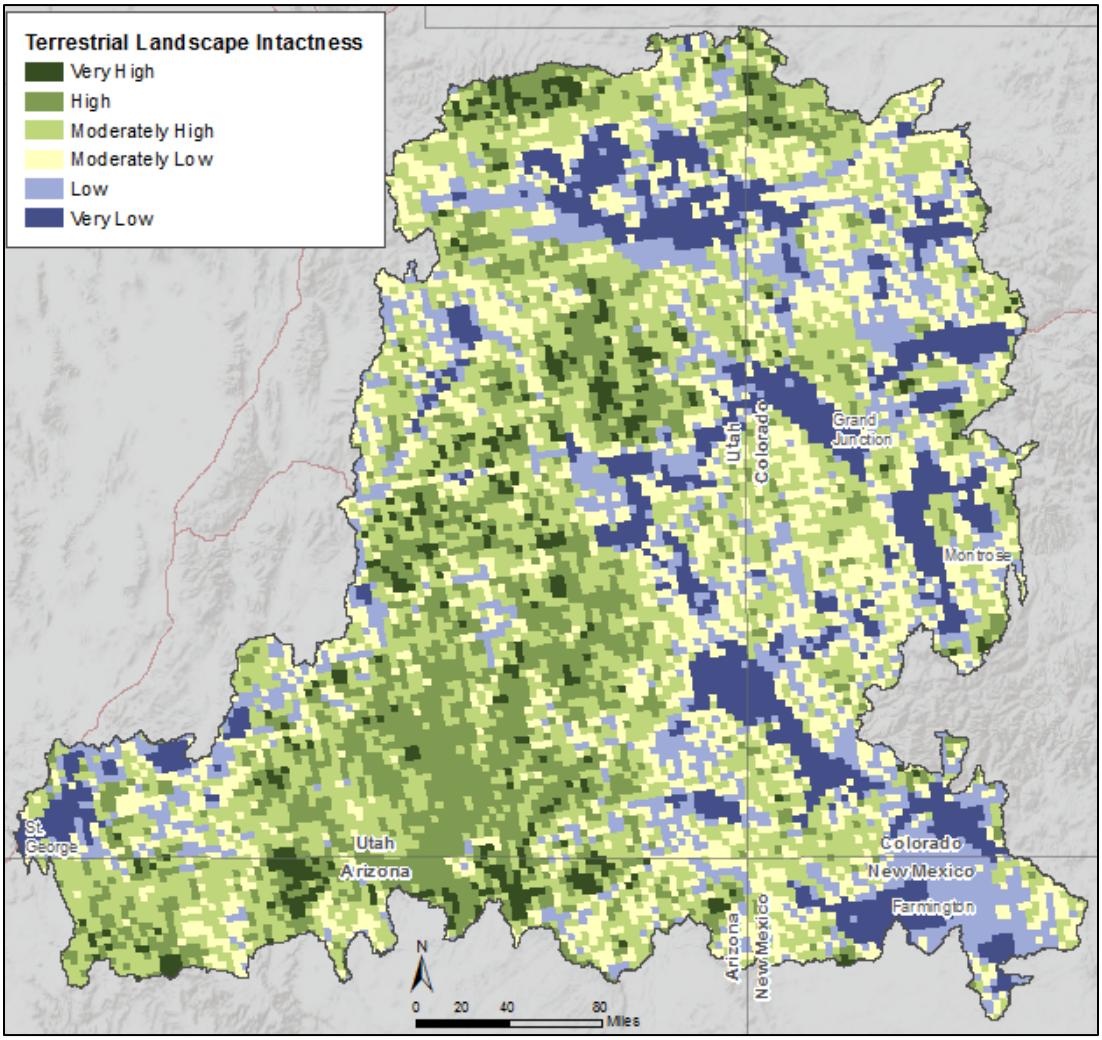
Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

Results for Current Terrestrial Landscape Intactness

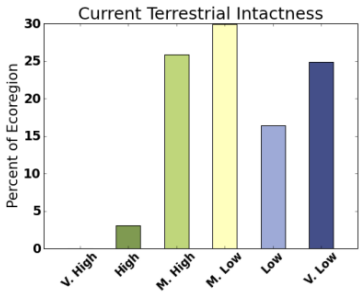
4km x 4km grid cells

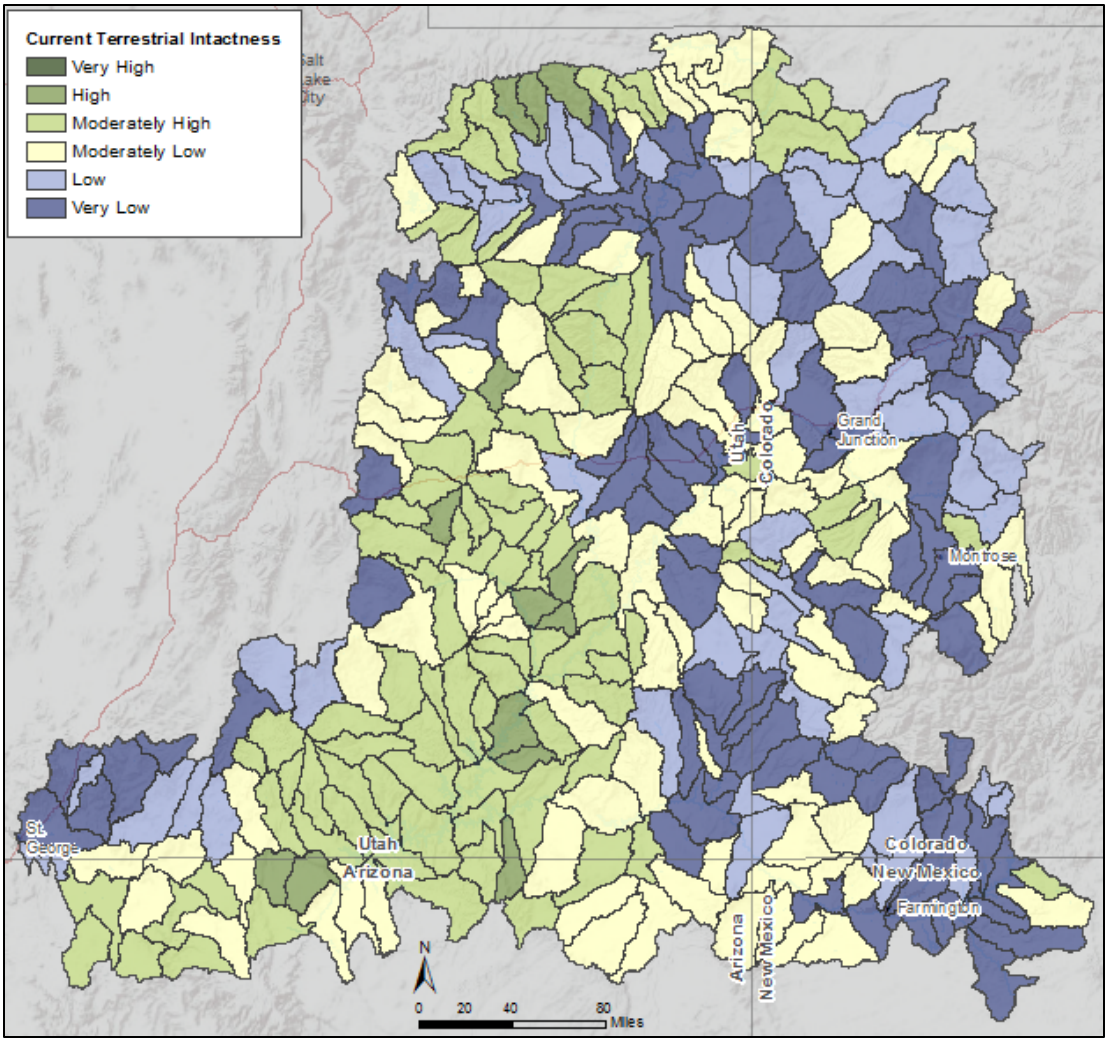




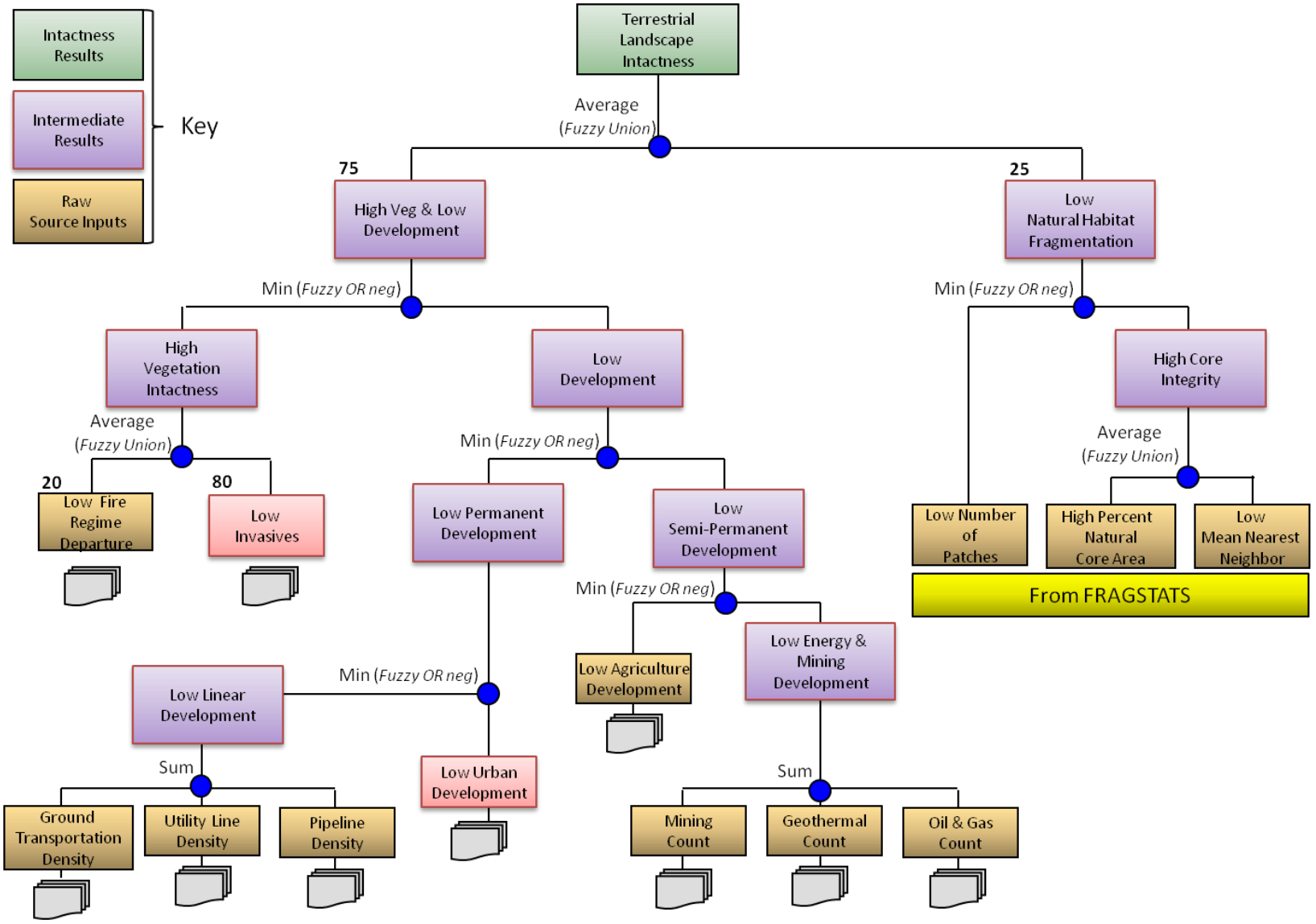
Results for Current Terrestrial Landscape Intactness

5th level HUC





Near-Term Future (2025) Terrestrial Landscape Intactness Logic Model



Data Sources for Near Term Future Terrestrial Landscape Intactness

Model Input Label	Data Source	Relative Quality
Ground Transportation Density	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful addition
Utility Line Density	Powerlines in the Western United States (USGS)	Good
Pipeline Density	Pipelines (proprietary, provided by BLM)	Good
Low Urban Development	Impervious Surfaces (NLCD 2006)	Very Good
	Development Risk, Contiguous US (David Theobald 2010)	Fair-Good
Low Agriculture Development	LANDFIRE - Existing Vegetation Type (version 1.1)	Very Good
Mining Count	Arizona Mines (Arizona Electronic Atlas)	Good
	Uranium Mines in Arizona (BLM, digitized by CBI)	Good
	Colorado Mines (Colorado Division of Reclamation, Mining and Safety)	Good
	Active Mines and Mineral Processing Plants (USGS)	Good
	New Mexico Mines (New Mexico GIS Resource Program)	Good
	Utah Mines (Automated Geographic Reference Center)	Good
Geothermal Count	Geothermal Wells in Utah (Utah Geological Survey)	Good
	Geothermal Wells in Arizona, Colorado, and New Mexico (Idaho National	Good
Oil & Gas Count	Oil & Gas Wells (proprietary, provided by BLM)	Good
Low Fire Regime Departure	Current Fire Regime and Vegetation Departure (see Appendix A MQE3)	Fair
Low Invasives	Near-term Predicted Distribution of Major Invasive Vegetation Species (see	Fair
Low Natural Habitat Fragmentation	Natural Vegetation Fragmentation (4KM) (CBI)	Fair-Good

Overall Model Certainty: **Moderately Low –** In addition to data gaps in Current Intactness model, a number of key datasets could not be projected (e.g. ground transportation density), resulting in a model that significantly under-estimates the near-term impacts.

Model output reported using both 4mk x 4km grid cells and 5th level HUC.
Boxes and accompanying rows shaded in pink indicate new data for near-term intactness.

Near Term Terrestrial Landscape Intactness (see threshold explanation, Chapter 3) Thresholds – 4km x 4km grid cells

Item	Data Type	Data Range	True Threshold	False Threshold
Fire Regime	Percent Area	13–98	13[1]	98
Invasive Grasses & Tamarisk	Percent Area	0–88	0[3]	33
Linear Development	Linear Density	0–18	0[1]	2.5
Urban Percent	Percent Area	0–99	0[3]	15
Agriculture Percent	Percent Area	0–90	0[3]	20
Energy & Mining Development	Number	0–37	0[2]	1.25
Number of Patches	Number	1–1,455	1[4]	700
Mean Nearest Neighbor	Linear Distance	60–272	60[1]	180
Percent Natural Core Area	Percent Area	.56–95	100[3]	20

1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 1 Standard Deviation from the mean; 3: Skewed data range = 2 Standard Deviations from the mean; 4: Skewed data range = 2.5 Standard Deviations from the mean

Thresholds – 5th level HUC

Item	Data Type	Data Range	True Threshold	False Threshold
Fire Regime	Percent Area	28–65	13[1]	98
Invasive Grasses & Tamarisk	Percent Area	0–36	0[3]	33
Linear Development	Linear Density	0–6	0[1]	2.5
Urban Percent	Percent Area	0–23	0[3]	15
Agriculture Percent	Percent Area	0–34	0[3]	20
Energy & Mining Development	Point Density	0–13	0[2]	1.25
Number of Patches	Number	45–3,901	1[4]	700
Mean Nearest Neighbor	Linear Distance	60–115	60[1]	180
Percent Natural Core Area	Percent Area	14–86	100[3]	20

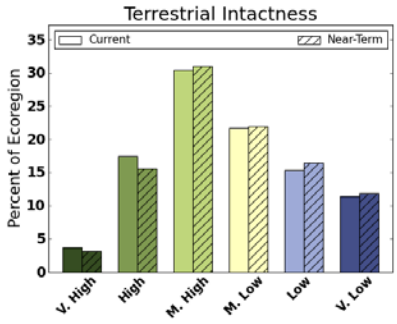
1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 1 Standard Deviation from the mean; 3: Skewed data range = 2 Standard Deviations from the mean; 4: Skewed data range = 2.5 Standard Deviations from the mean

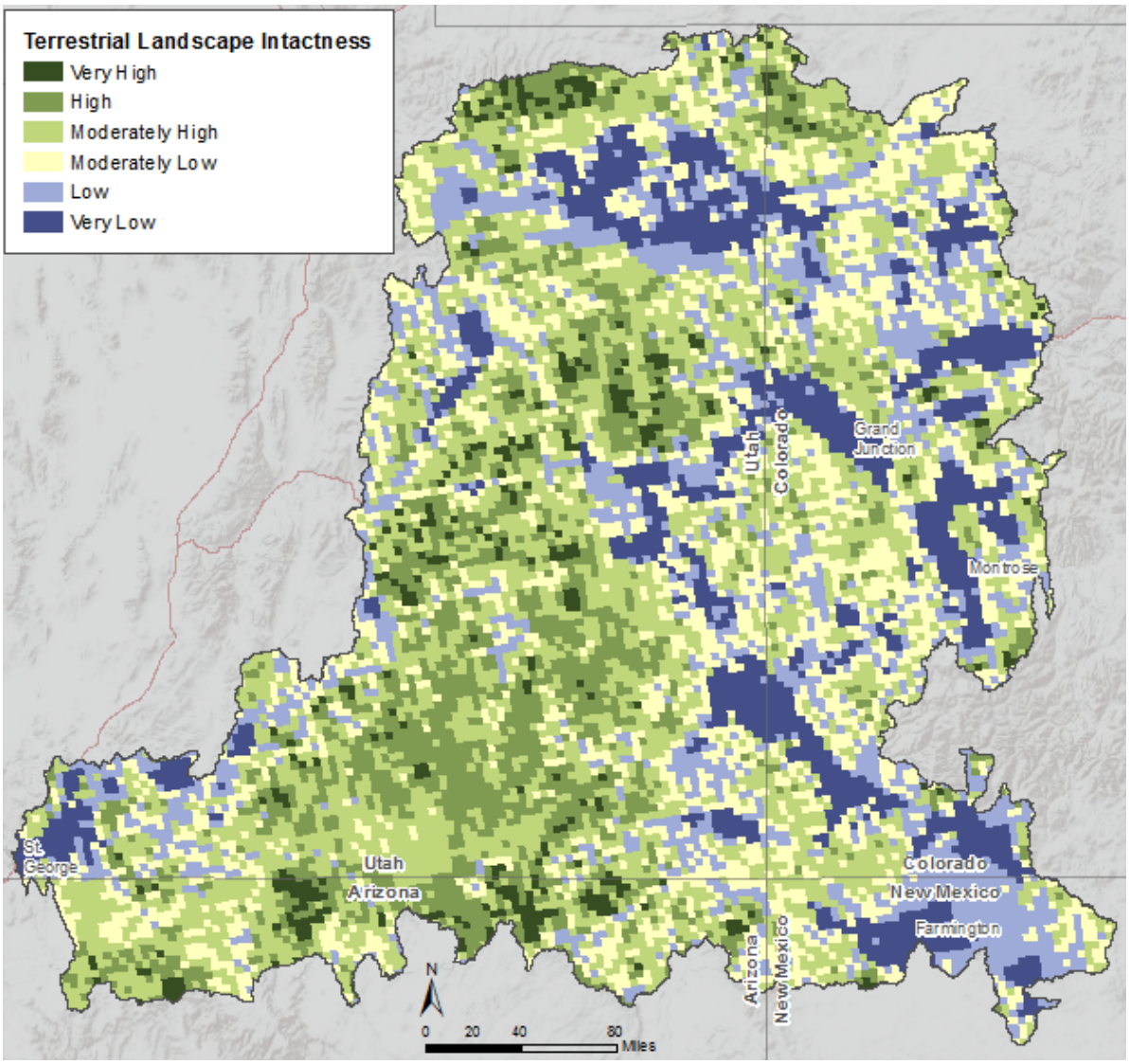
Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

Results for Near Term Future Terrestrial Landscape Intactness

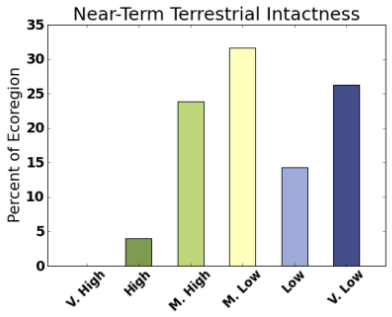
4km x 4km grid cells

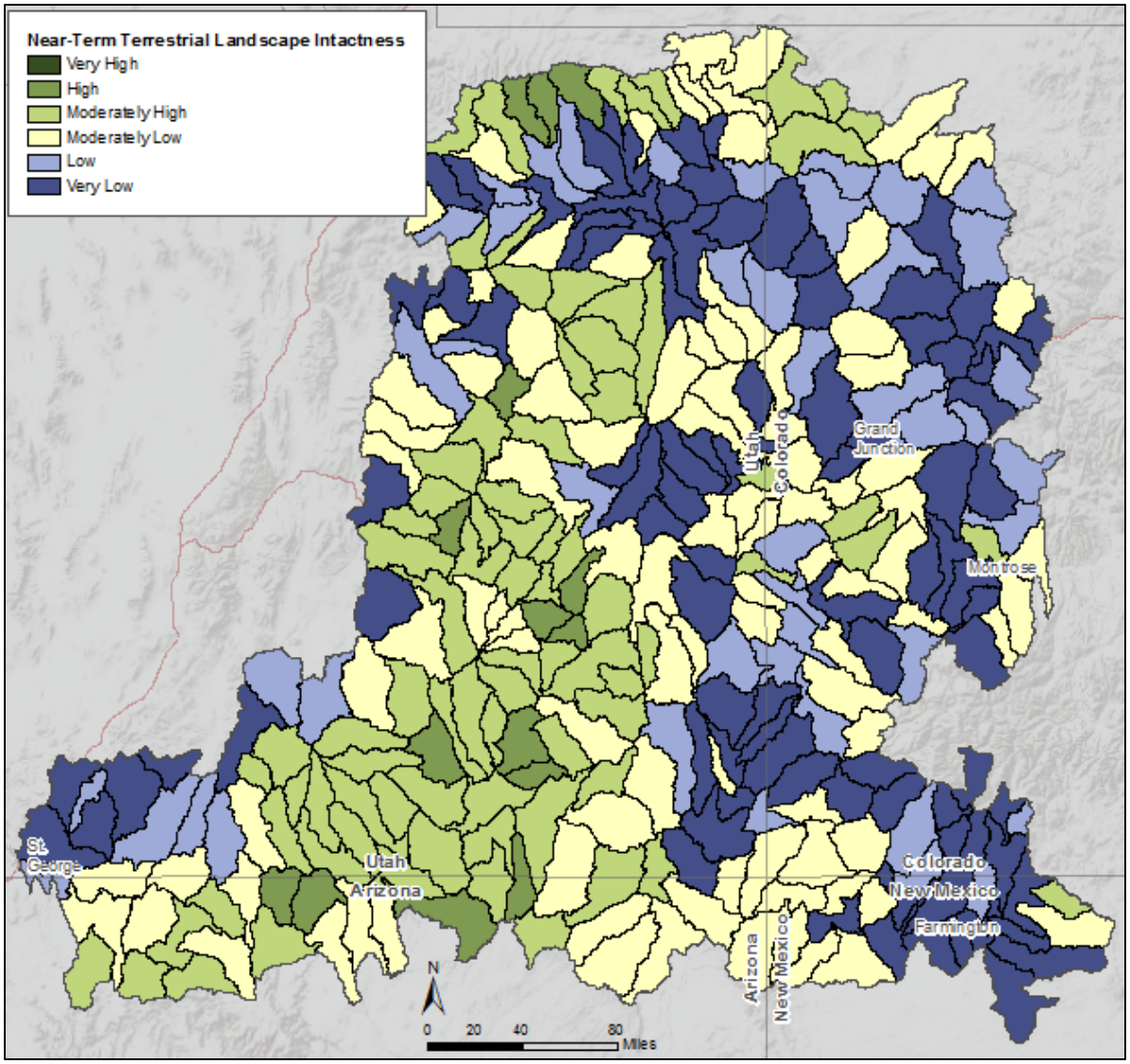




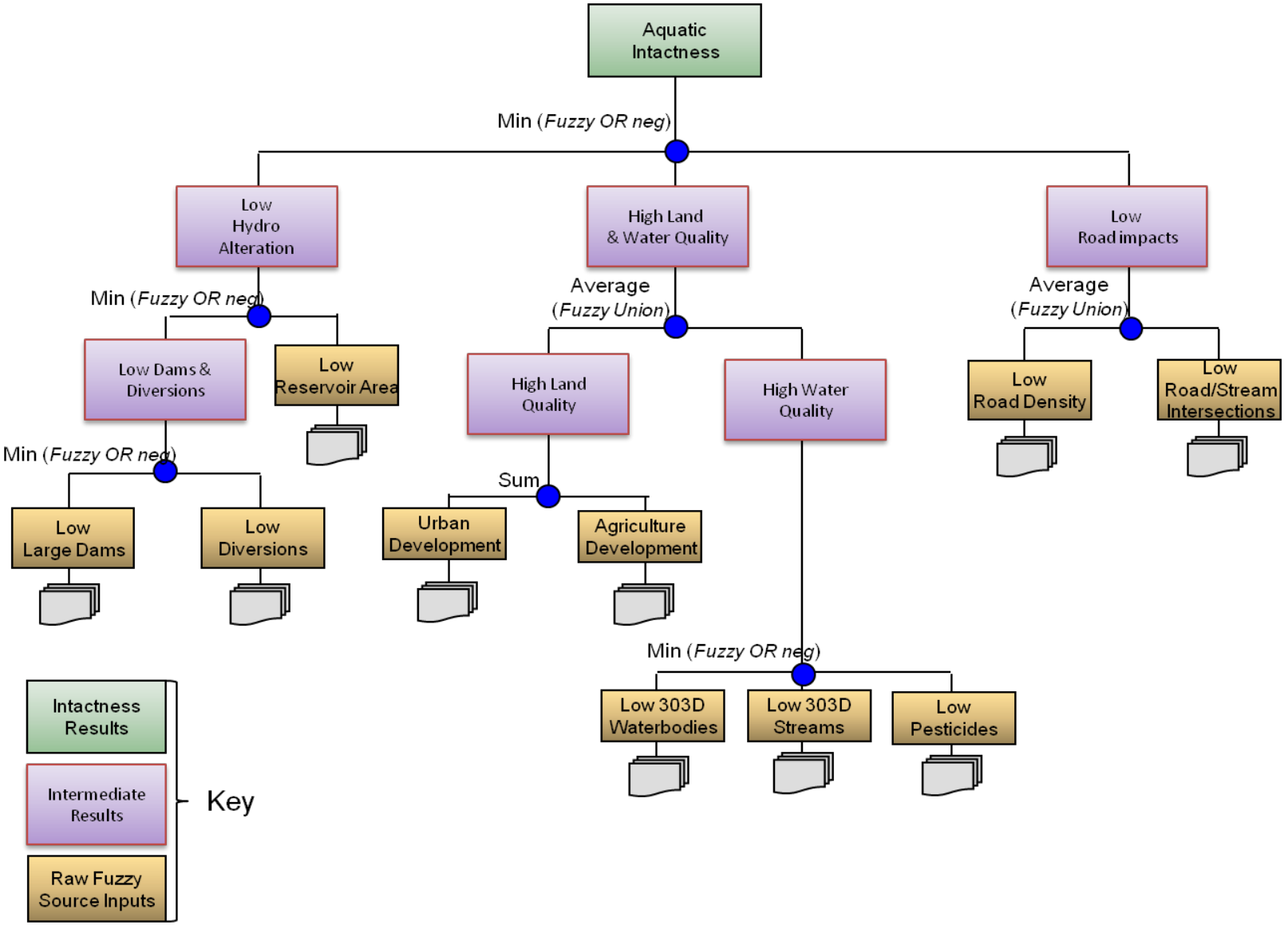
Results for Near Term Future Terrestrial Landscape Intactness

5th level HUC





Current Aquatic Intactness Logic Model



Data Sources for Current Aquatic Intactness

Model Input Label	Data Source	Relative Quality
Low Large Dams	National Inventory of Dams (US Army Corps of Engineers)	Very Good
Low Diversions	Utah Surface Water Diversions (Utah Department of Natural Resources,	Very Good
	Surface Water Rights in Arizona (Arizona Department of Water	Very Good
	Colorado Surface Water Diversions (Colorado Division of Water	Very Good
	New Mexico Surface Water Diversions (New Mexico Water	Very Good
Low Reservoir Area	National Hydrography Dataset (waterbodies) (USGS)	Very Good
Urban Development	Impervious Surfaces (NLCD 2006)	Very Good
Agriculture Development	LANDFIRE - Existing Vegetation Type (version 1.1)	Very Good
Low 303D Waterbodies	EPA Office of Water (OW): 303(d) Listed Impaired Waters (waterbodies	Very Good
Low 303D Streams	EPA Office of Water (OW): 303(d) Listed Impaired Waters (waterbodies	Very Good
Low Pesticides	Agricultural Pesticide Use in the Conterminous United States (USGS)	Very Good
Low Road Density	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful addition
Low Road/Stream Intersections	National Hydrography Dataset (flowlines) (USGS)	Fair-Good – surface type would be useful addition
	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful addition

Overall Model Certainty: Fairly High – BUT a number of potentially valuable datasets were not available that would have improved this model (e.g. grazing density, exotic species, and streamside habitat quality).

Model output reported at 5th level HUC only.

Current Aquatic Intactness (see threshold explanation, Chapter 3)

Thresholds

Item	Data Type	Data Range	True Threshold	False Threshold
Low Large Dams	Point Density	0–0.089	0[1]	0.028
Low Diversions	Point Density	0–8.35	0[1]	1.7
Low Reservoir Area	Percent Area	0–20	0[2]	2
Land Use	Percent Area	0–39	0[3]	20
Low 303D Waterbodies	Percent Area	0–7.62	0[4]	1
Low 303D Streams	Linear Density	0–1.09	0[2]	0.2
Low Pesticides	Weighted Sum	0–0.038	0[5]	0.02
Low Road Density	Linear Density	0–18	0[1]	2.5
Low Road/Stream Intersections	Percent Area	0–0.56	0[2]	0.28

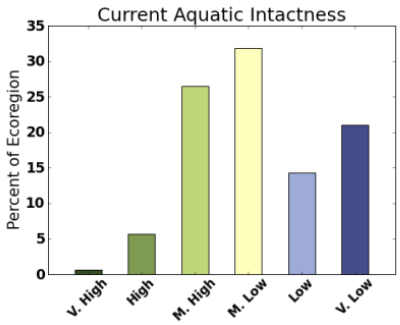
1. Skewed data range: 2 Standard Deviations from the mean; 2. Skewed data range: 1 Standard Deviation from the mean; 3. Skewed data range: 2.5 Standard Deviation from the mean; 4. Skewed data range: 3 Standard Deviations from the mean; 5. Skewed data range: outlier cutoff

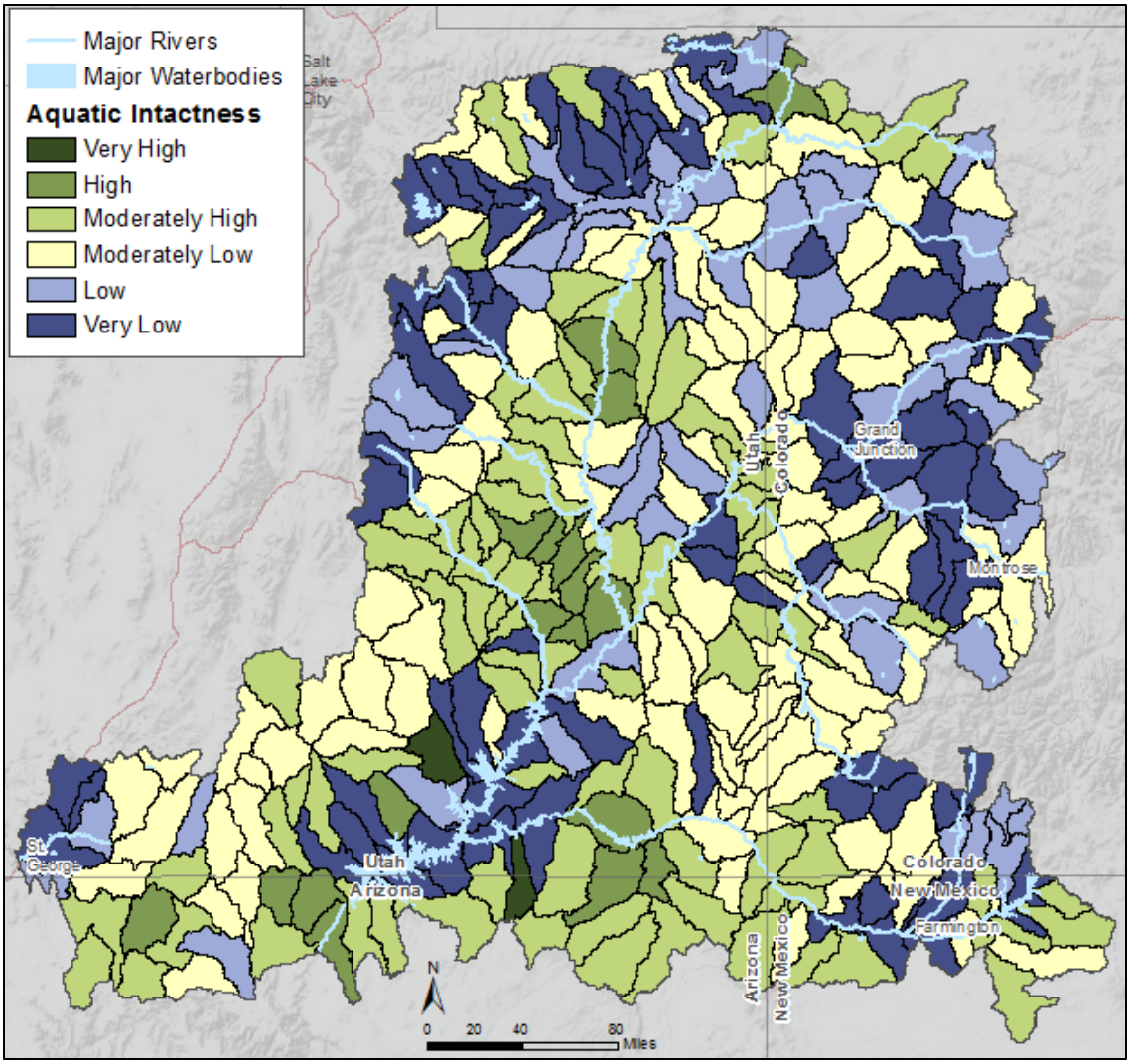
Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

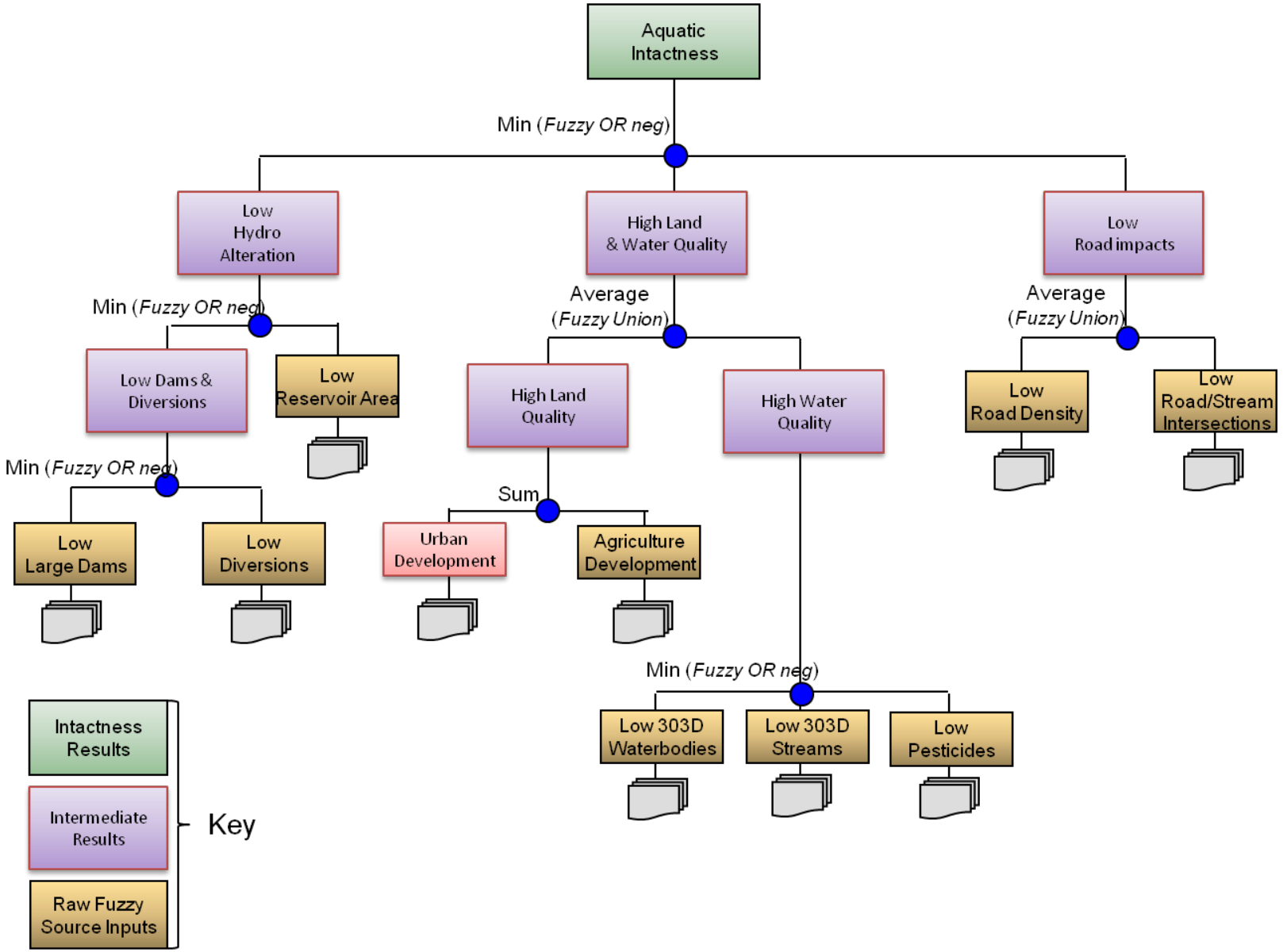
Results for Current Aquatic Intactness

5th level HUC





Near-Term Future (2025) Aquatic Intactness Logic Model



Data Sources for Near Term Future Aquatic Intactness

Model Input Label	Data Source	Relative Quality
Low Large Dams	National Inventory of Dams (US Army Corps of Engineers)	Very Good
Low Diversions	Utah Surface Water Diversions (Utah Department of Natural Resources,	Very Good
	Surface Water Rights in Arizona (Arizona Department of Water	Very Good
	Colorado Surface Water Diversions (Colorado Division of Water	Very Good
	New Mexico Surface Water Diversions (New Mexico Water	Very Good
Low Reservoir Area	National Hydrography Dataset (waterbodies) (USGS)	Very Good
Urban Development	Impervious Surfaces (NLCD 2006)	Very Good
	Development Risk, Contiguous US (David Theobald)	Fair-Good
Agriculture Development	LANDFIRE - Existing Vegetation Type (version 1.1)	Very Good
Low 303D Waterbodies	EPA Office of Water (OW): 303(d) Listed Impaired Waters (waterbodies	Very Good
Low 303D Streams	EPA Office of Water (OW): 303(d) Listed Impaired Waters (waterbodies	Very Good
Low Pesticides	Agricultural Pesticide Use in the Conterminous United States (USGS)	Very Good
Low Road Density	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful addition
Low Road/Stream Intersections	National Hydrography Dataset (flowlines) (USGS)	Fair-Good – surface type would be useful addition
	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful addition

Overall Model Certainty: Moderately Low – A number of key datasets could not be projected (e.g. OHV and ground transportation density, grazing), resulting in a model that significantly under-estimates the near-term impacts.

Model output reported at 5th level HUC only.

Boxes and accompanying rows shaded in pink indicate new data for near-term aquatic intactness.

Near Term Future Aquatic Intactness (see threshold explanation, Chapter 3) Thresholds

Item	Data Type	Data Range	True Threshold	False Threshold
Low Large Dams	Point Density	0–0.089	0[1]	0.028
Low Diversions	Point Density	0–8.35	0[1]	1.7
Low Reservoir Area	Percent Area	0–20	0[2]	2
Land Use	Percent Area	0–39	0[3]	20
Low 303D Waterbodies	Percent Area	0–7.62	0[4]	1
Low 303D Streams	Linear Density	0–1.09	0[2]	0.2
Low Pesticides	Weighted Sum	0–0.038	0[5]	0.02
Low Road Density	Linear Density	0–18	0[1]	2.5
Low Road/Stream Intersections	Percent Area	0–0.56	0[2]	0.28

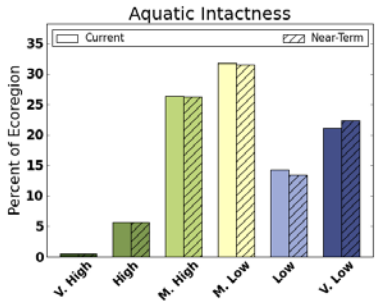
1. Skewed data range: 2 Standard Deviations from the mean; 2. Skewed data range: 1 Standard Deviation from the mean; 3. Skewed data range: 2.5 Standard Deviation from the mean; 4. Skewed data range: 3 Standard Deviations from the mean; 5. Skewed data range: outlier cutoff

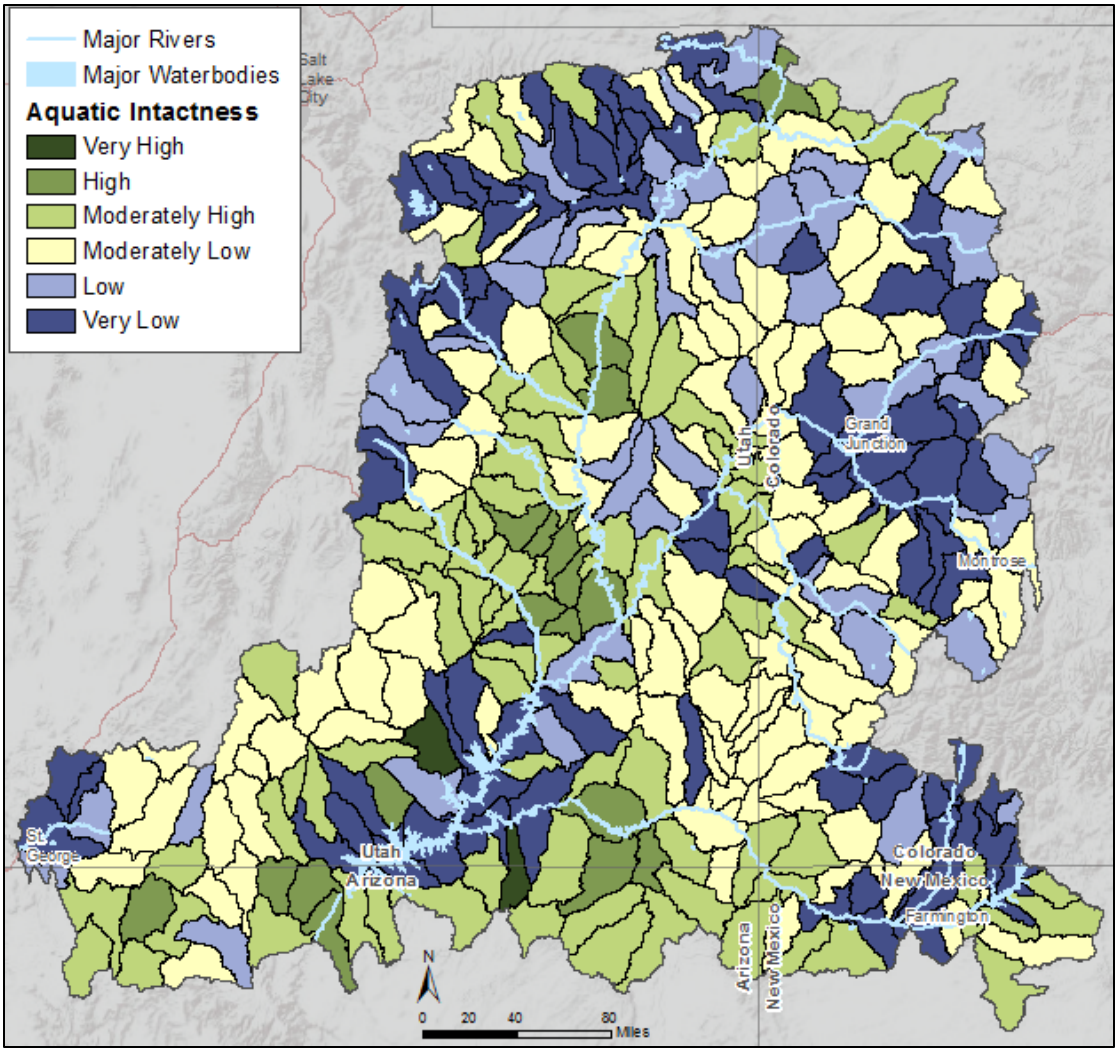
Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

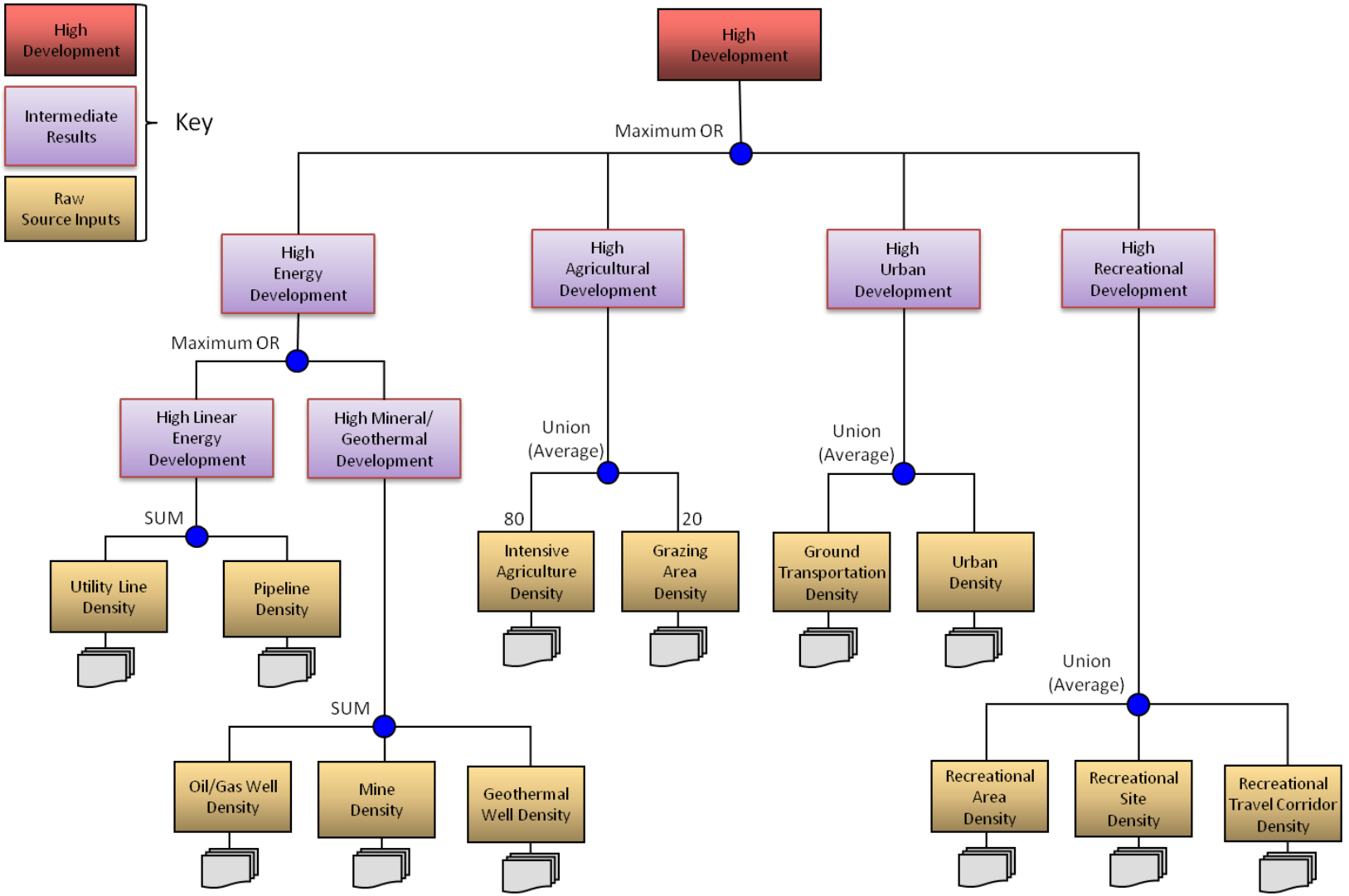
Results for Near Term Future Aquatic Intactness

5th level HUC





Current Development Logic Model



Data Sources for Current Development

Model Input Label	Data Source	Relative Quality
Utility Line Density	Powerlines in the Western United States (USGS)	Good
Pipeline Density	Pipelines (proprietary, provided by BLM)	Good
Oil/Gas Well Density	Oil & Gas Wells (proprietary, provided by BLM)	Good
Mine density	Arizona Mines (Arizona Electronic Atlas)	Good
	Uranium Mines in Arizona (BLM, digitized by CBI)	Good
	Colorado Mines (Colorado Division of Reclamation, Mining and Safety)	Good
	Active Mines and Mineral Processing Plants (USGS)	Good
	New Mexico Mines (New Mexico GIS Resource Program)	Good
	Utah Mines (Automated Geographic Reference Center)	Good
Geothermal Well Density	Geothermal Wells in Utah (Utah Geological Survey)	Good
	Geothermal Wells in Arizona, Colorado, and New Mexico (Idaho	Good
Intensive Agriculture Density	LANDFIRE - Existing Vegetation Type (version 1.1)	Very Good
Grazing Area Density	BLM and USFS Grazing Allotments (MQH4)	Poor-Fair – herd density history or current would be useful
Ground Transportation Density	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful
Urban Density	Impervious Surfaces (NLCD 2006)	Very Good
Recreational Area Density	Land-Based Recreation Areas – areas (MQH1)	Fair-Poor - no standard source; missing data likely
Recreational Site Density	Land-Based Recreation Areas – points (MQH1)	Fair-Poor - no standard source; missing data likely
Recreational Travel Corridor Density	Land-Based Recreation Travel Corridors (MQH2)	Fair-Good

Overall Model Certainty: Fairly High – BUT a number of potentially valuable datasets were not available that would have improved this model (e.g. grazing density, recreation data, OHV data).

Model reported at 4km x 4km grid only.

Current Development Model (see threshold explanation, Chapter 3) Thresholds – 4km x 4km grid cells

Item	Data Type	Data Range	True Threshold	False Threshold
High Linear Energy	Linear Density	0–5.2	0.64	0
High Mineral/Geothermal	Point Density	0–37	4.11	0
Intensive Agriculture Density	Percent Area	0–90	18.5	0
Grazing Density	Percent Area	0–91	91	0
Ground Transportation Density	Linear Density	0–100	4	0
Urban Density	Percent Area	0–99	10	0
Recreational Area Density	Area Density	0–44	1.15	0
Recreational Site Density	Point Density	0–4.6	0.12	0
Recreational Travel Corridor Density	Linear Density	0–16	2.5	0

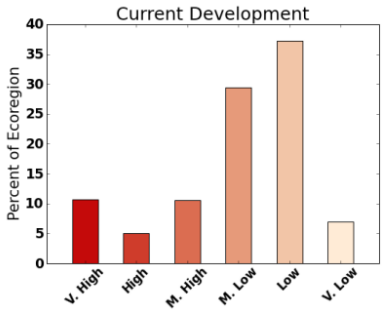
All thresholds based on 2 standard deviations from the mean value for each component.

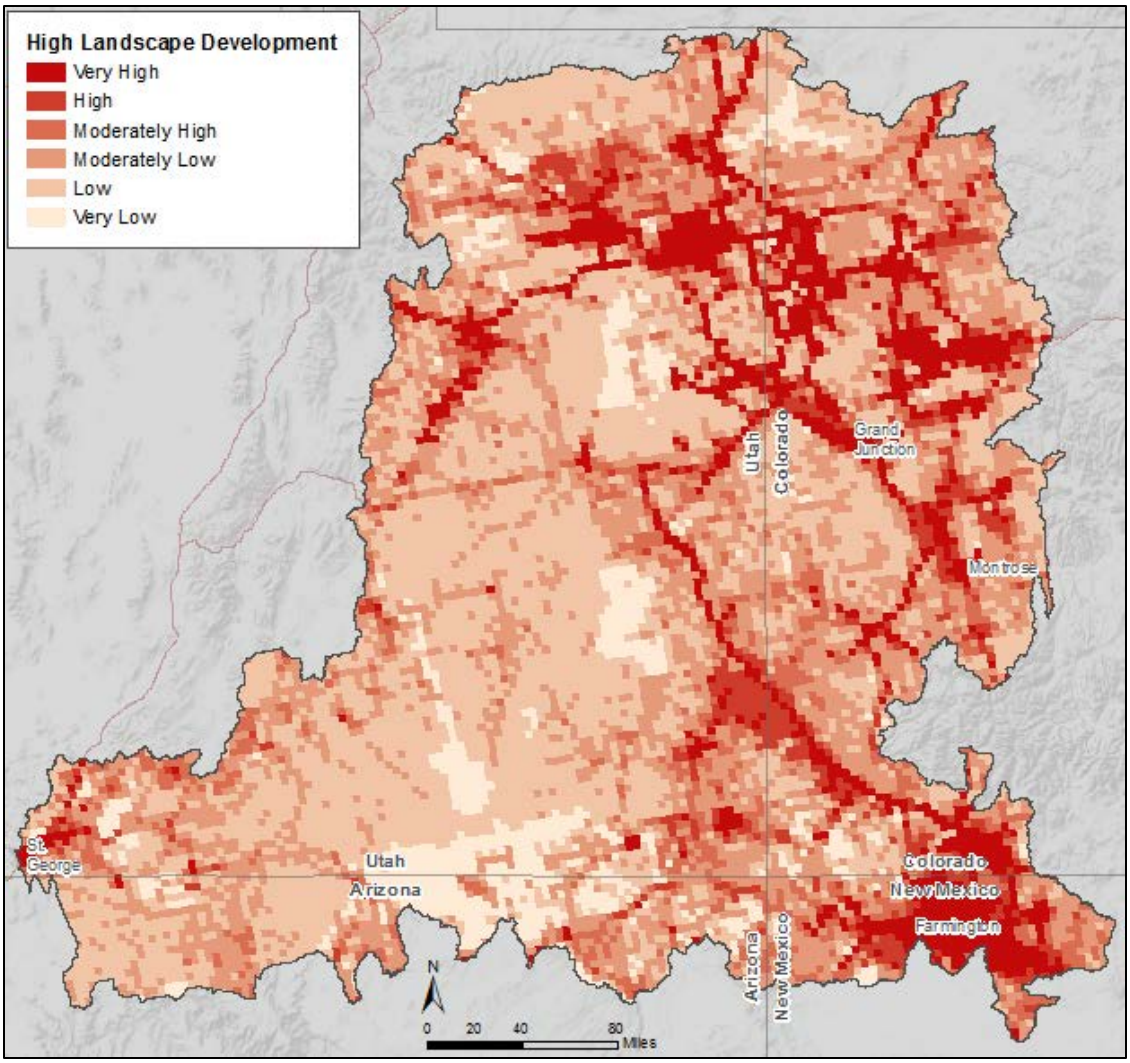
Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

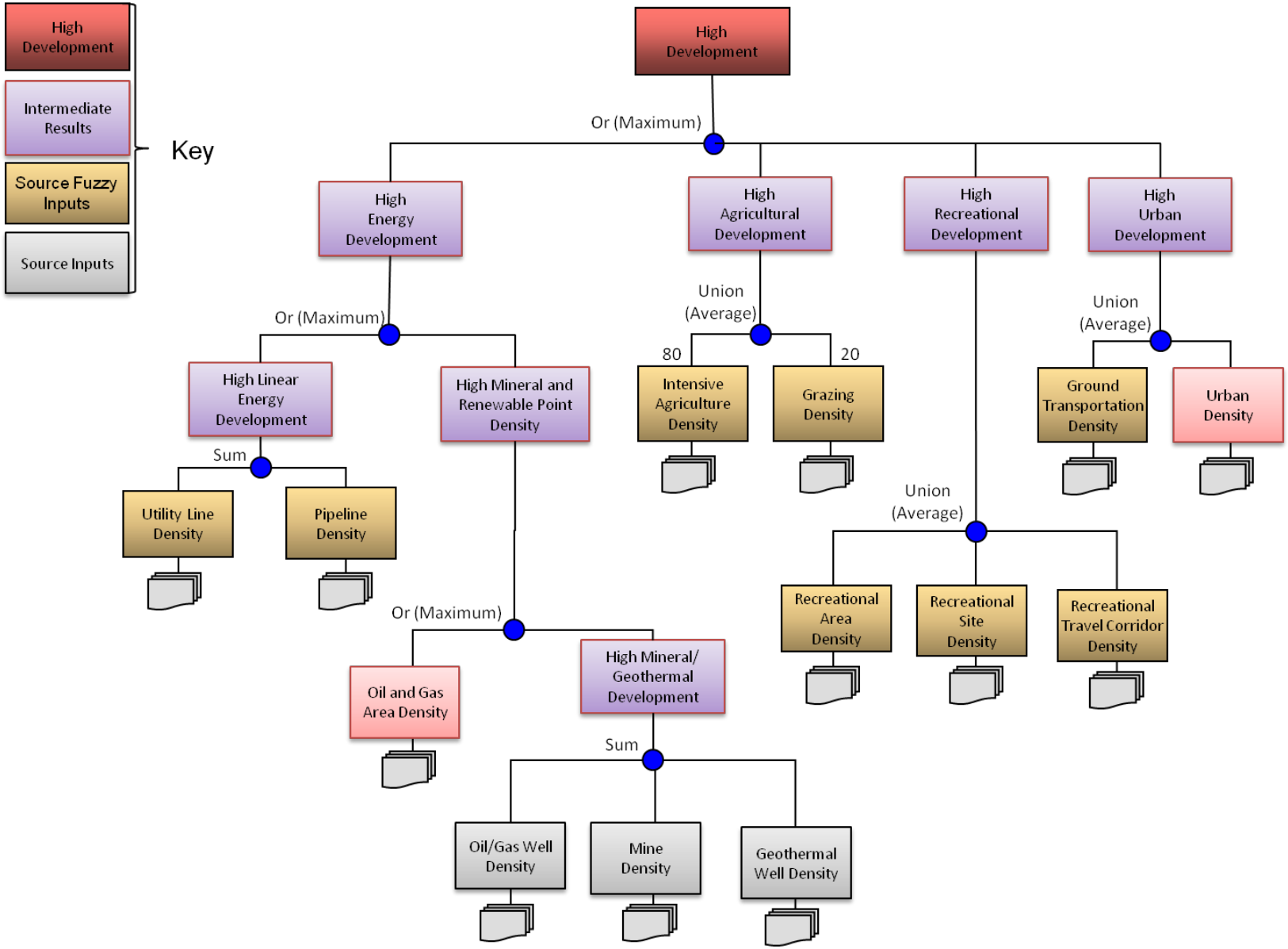
Results for Current Development

4km x 4km grid cells





Near-term Future (2025) Development Logic Model



Data Sources for Near Term Future Development

Model Input Label	Data Source	Relative Quality
Utility Line Density	Powerlines in the Western United States (USGS)	Good
Pipeline Density	Pipelines (proprietary, provided by BLM)	Good
Oil/Gas Well Density	Oil & Gas Wells (proprietary, provided by BLM)	Good
	Intermountain West Oil and Gas Potential-Anticipated Oil Wells	Good
Mine density	Arizona Mines (Arizona Electronic Atlas)	Good
	Uranium Mines in Arizona (BLM, digitized by CBI)	Good
	Colorado Mines (Colorado Division of Reclamation, Mining and Safety)	Good
	Active Mines and Mineral Processing Plants (USGS)	Good
	New Mexico Mines (New Mexico GIS Resource Program)	Good
	Utah Mines (Automated Geographic Reference Center)	Good
Geothermal Well Density	Geothermal Wells in Utah (Utah Geological Survey)	Good
	Geothermal Wells in Arizona, Colorado, and New Mexico (Idaho	Good
Intensive Agriculture Density	LANDFIRE - Existing Vegetation Type (version 1.1)	Very Good
Grazing Area Density	BLM and USFS Grazing Allotments (MQH4)	Poor-Fair – herd density history or current would be useful
Ground Transportation Density	BLM Ground Transportation Linear Features	Fair-Good – surface type would be useful
Urban Density	Impervious Surfaces (NLCD 2006)	Very Good
	Development Risk, Contiguous US (David Theobald)	Fair-Good
Recreational Area Density	Land-Based Recreation Areas – areas (MQH1)	Fair-Poor - no standard source; missing data likely
Recreational Site Density	Land-Based Recreation Areas – points (MQH1)	Fair-Poor - no standard source; missing data likely
Recreational Travel Corridor Density	Land-Based Recreation Travel Corridors (MQH2)	Fair-Good

Overall Model Certainty: Moderately Low – A number of key datasets could not be projected (e.g. ground transportation density, future grazing density, future recreation), resulting in a model that significantly under-estimates the near-term impacts.

Model output reported at 4km x 4km grid

Near Term Future Development Model (see threshold explanation, Chapter 3) Thresholds

Item	Data Type	Data Range	True Threshold	False Threshold
High Linear Energy	Linear Density	0–5.2	0.64	0
High Oil/Mineral/Geothermal	Point Density	0–37	4.11	0
High Oil/Gas Polygons	Percent Area	0–100	7.35	0
Intensive Agriculture Density	Percent Area	0–90	18.5	0
Grazing Density	Percent Area	0–91	91	0
Ground Transportation Density	Linear Density	0–100	4	0
Urban Density	Percent Area	0–99	10	0
Recreational Area Density	Area Density	0–44	1.15	0
Recreational Site Density	Point Density	0–4.6	0.12	0
Recreational Travel Corridor Density	Linear Density	0–16	2.5	0

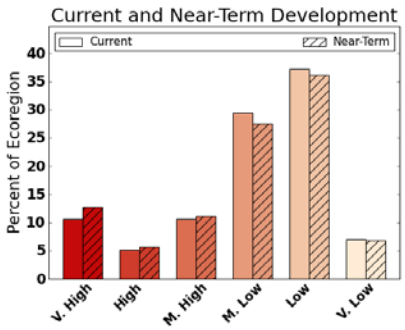
All thresholds based on 2 standard deviations from the mean value for each component.

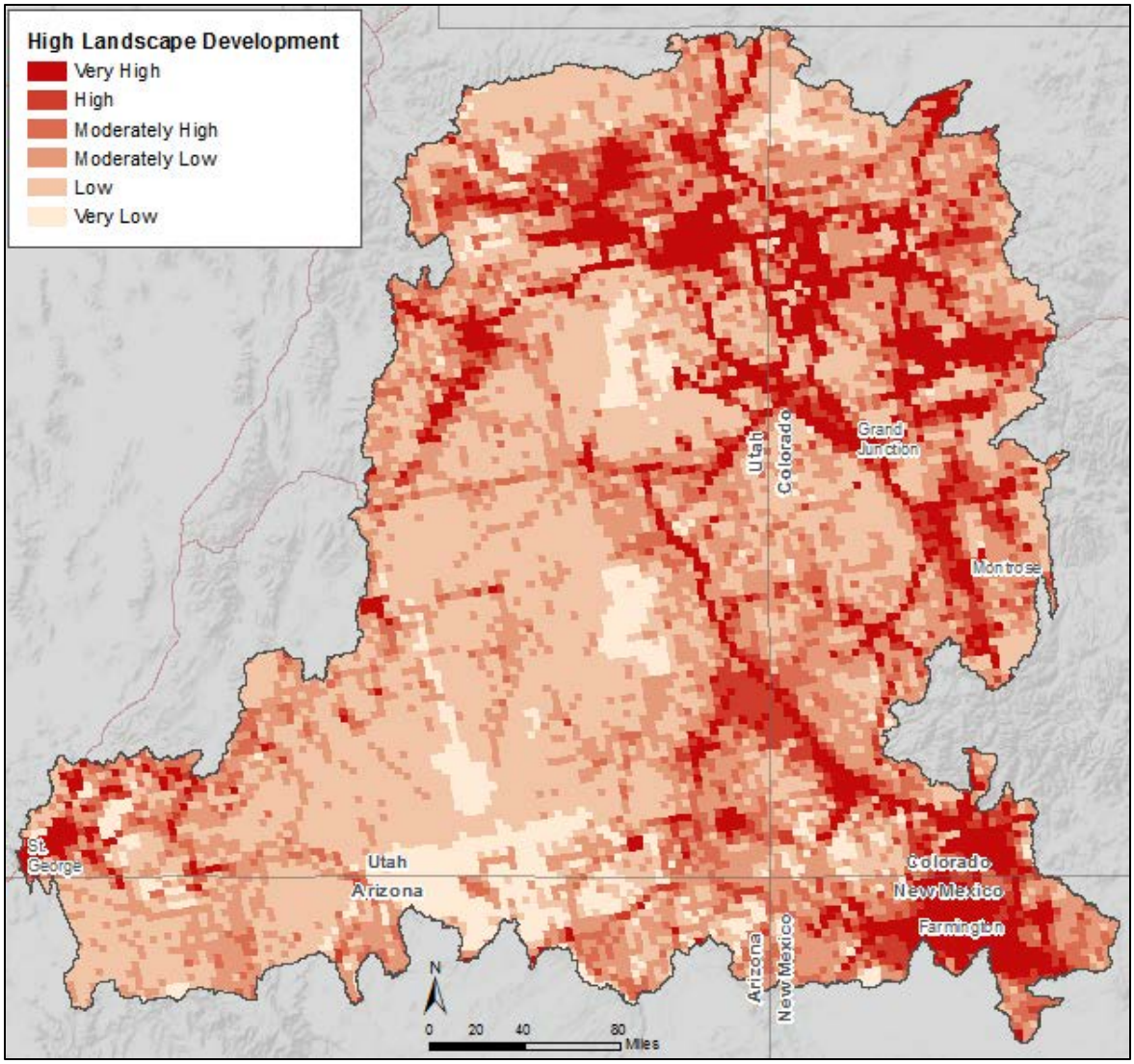
Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

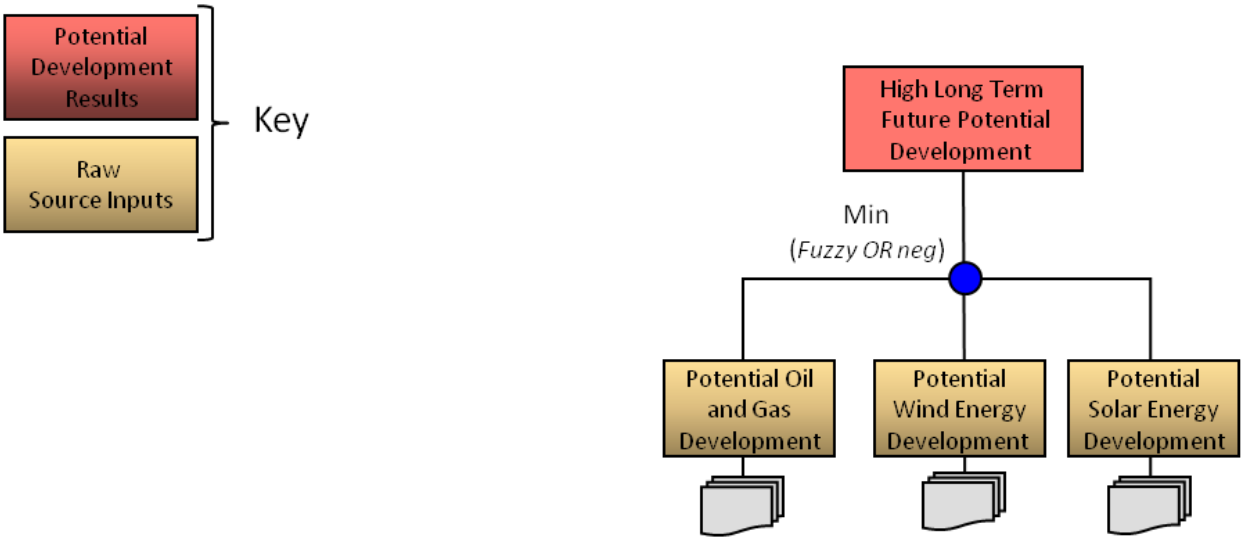
Results for Near Term Future (2025) Development

4km x 4km grid cells





Maximum (Long Term) Potential Energy Development Logic Model



Data Sources for Maximum Potential Energy Development

Model Input Label	Data Source	Relative Quality
Potential Oil and Gas Development	Allowable Leasing Footprints For Tar Sand Extraction in Special Tar Sands Areas of Utah (PEIS Alternative B) (BLM)	Very Good
	Allowable Leasing Footprints for Oil Shale Extraction in Colorado (PEIS Alternative B) (BLM)	Very Good
	Allowable Leasing Footprints for Oil Shale Extraction in Utah (PEIS Alternative B) (BLM)	Very Good
	BLM Colorado Oil and Gas Lease Stipulations	Very Good
	BLM New Mexico Oil and Gas Leases	Very Good
	BLM Utah Oil and Gas Leases	Very Good
	Oil and Gas Fields (US Depts of the Interior, Agriculture & Energy)	Good
	Intermountain West Oil and Gas Potential (Copeland et al. 2009)	Good
Potential Wind Energy Development	Wind Power Density (W/m2) at 50 Meters Above Ground Level	Good
	Utah BLM Wind Energy Priority Areas	Good
Potential Solar Energy Development	Average Solar Resource Potential (filtered to less than 1% slope)	Good

Removed protected areas using PAD-US (CBI Edition) v 1.1 – GAP codes 1&2

Overall Model Certainty: Fairly High – BUT this is just POTENTIAL energy. Not all of these areas are likely to be developed.

Model reported for 4km x 4km grid cells only.

Maximum (Long Term) Potential Energy Development Model (see threshold explanation, Chapter 3)

Thresholds – 4km x 4km grid cells

Item	Data Type	Data Range	True Threshold	False Threshold
Oil and Gas	Percent Area	0–100	0	100
Solar	Percent Area	0–100	0	100
Wind	Percent Area	0–100	0	100

Thresholds – 5th level HUC

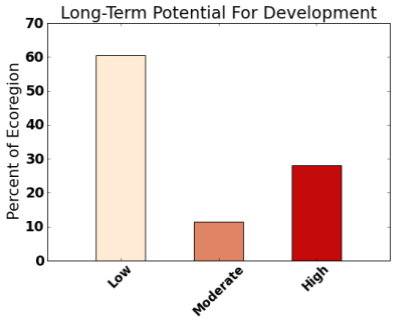
Item	Data Type	Data Range	True Threshold	False Threshold
Oil and Gas	Percent Area	0–100	0	100
Solar	Percent Area	0–27	0	27
Wind	Percent Area	0–78	0	78

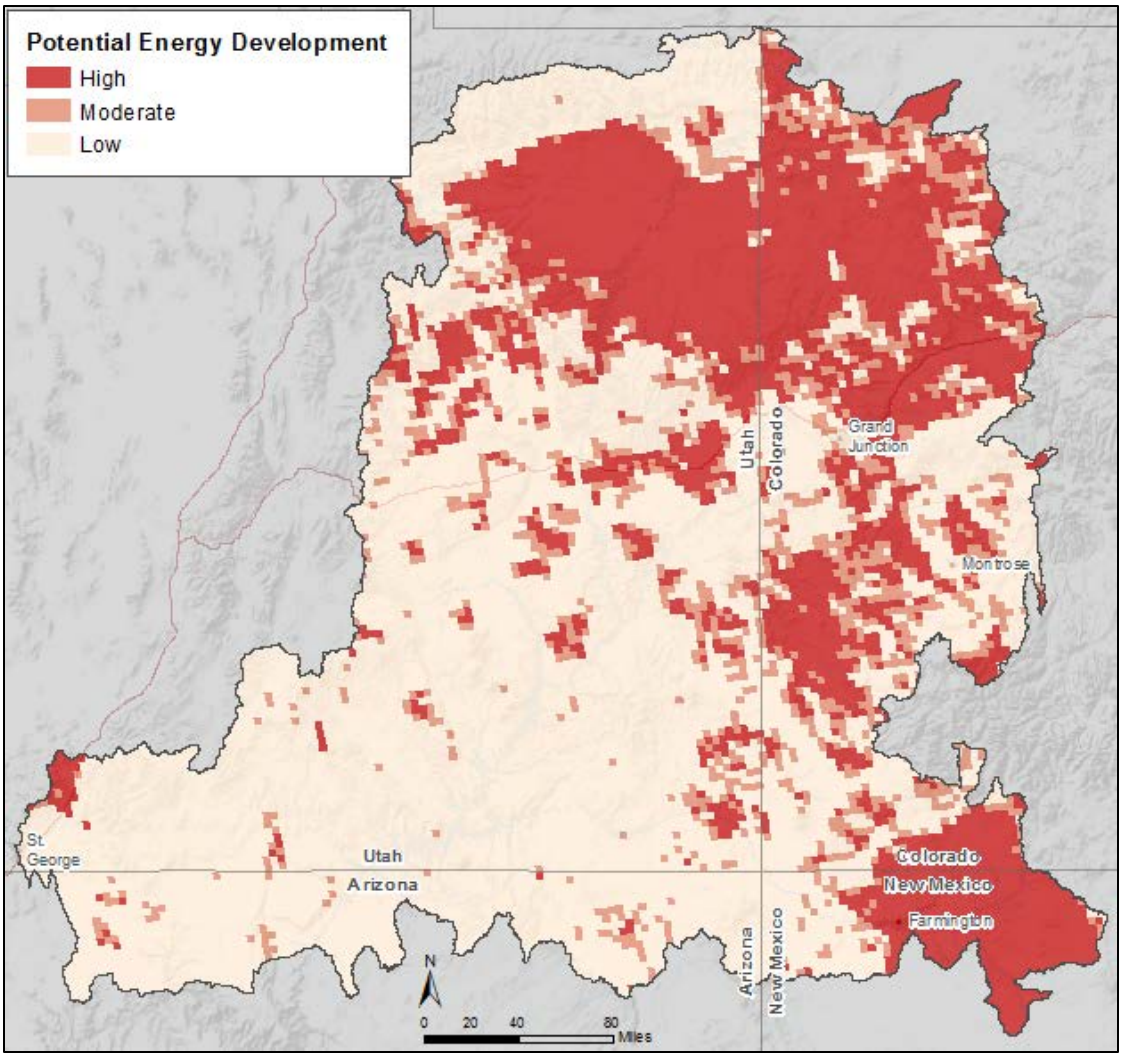
Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
0.333 to 1.0	High
--0.333 to 0.333	Medium
-0.333 to -1.0	Low

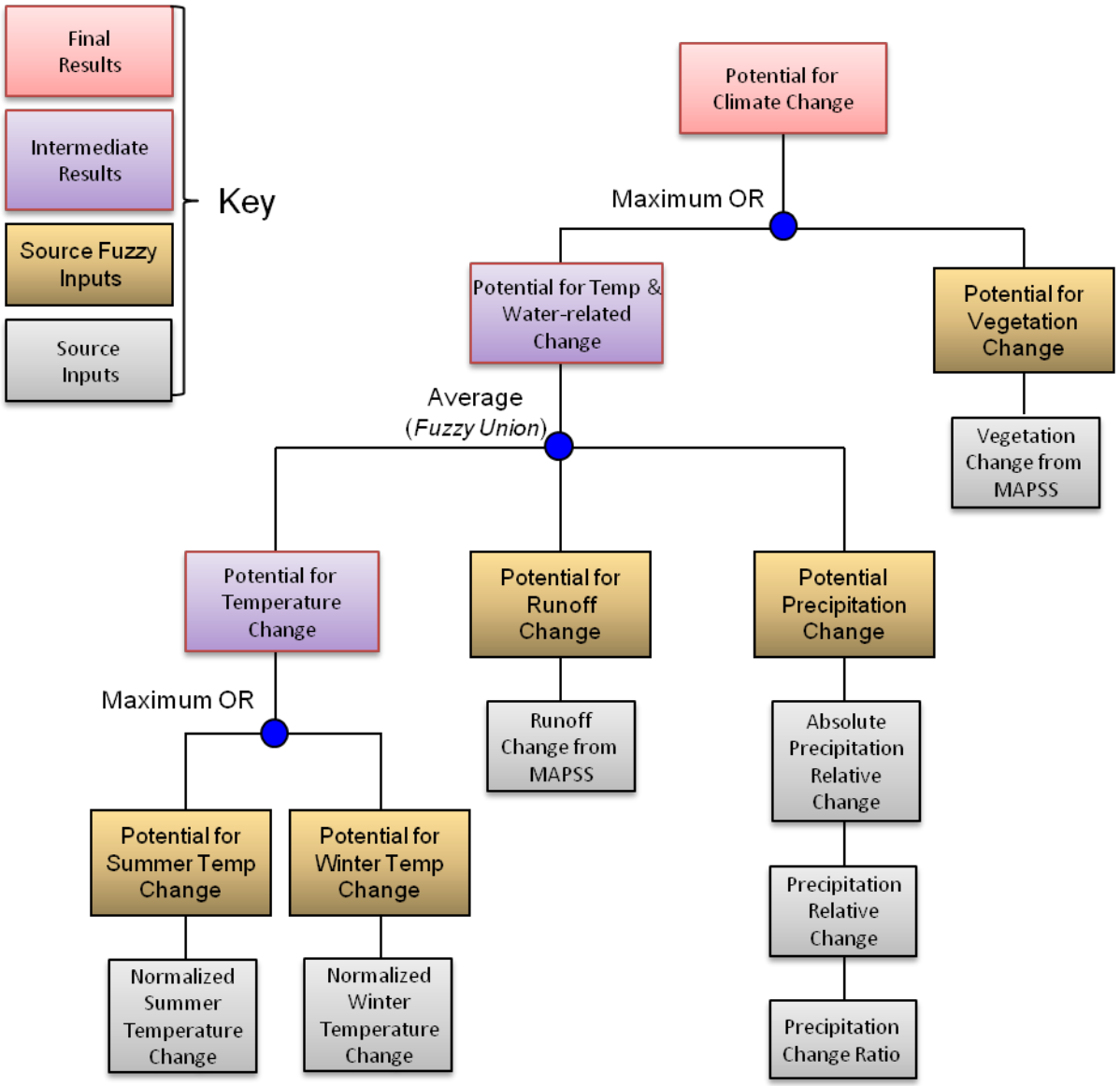
Results for Maximum (Long Term) Potential Energy Development

4km x 4km grid cells





Potential Climate Change Impacts



Data Sources for Potential Climate Change Impacts

Model Input Label	Data Source	Relative Quality
Potential for Summer Temp Change	RegCM3 ECHAM5	Fair
Potential for Winter Temp Change	RegCM3 ECHAM5	Fair
Potential for Runoff	MAPSS model output	Fair
Potential Precipitation Change	RegCM3 ECHAM5	Fair
Potential for Vegetation Change	MAPSS model output	Fair

Overall Model Certainty: Moderately Low – The climate change data are the best available and the basic trends and general patterns posses fairly high certainty; however, there is inherent uncertainty as discussed in the text that cautions over-interpretation, especially as it applies to site-specific scales.

Model output reported at 4km x 4km grid cells only.

Potential Climate Change Impacts Model (see threshold explanation, Chapter 3) Thresholds – 4km x 4km grid cells

Item	Data Type	Data Range	True Threshold	False Threshold
Potential for Summer Temp Change	See Below	1.14–3.74	3.74	1.14
Potential for Winter Temp Change	See Below	0.47–1.44	1.44	0.47
Potential for Runoff	Percent Change	0–10	2[1]	0
Potential Precipitation Change	See Below	0–2.16	2.16	0
Potential for Vegetation Change	Percent Area	0–100	100	0

1. Tail cutoff

Thresholds – 5th level HUC

Item	Data Type	Data Range	True Threshold	False Threshold
Potential for Summer Temp Change	See Below	1.59–3.26	3.26	1.59
Potential for Winter Temp Change	See Below	0.51–1.33	1.33	0.51
Potential for Runoff	Percent Change	0.63–8.17	2[1]	0
Potential Precipitation Change	See Below	0.34–1.94	1.94	0.34
Potential for Vegetation Change	Percent Area	0–100	100	0

1. Tail cutoff

For temperature, potential for change calculated by RegCM3 (ECHAM5) 2045–2060 TEMP – PRISM TEMP/SD PRISM TEMP; values are unit-less

For precipitation, potential for change calculated by RegCM3 (ECHAM5) 2045–2060 PRECIP – PRISM PRECIP/PRISM PRECIP/SD PRISM PRECIP; values are unit-less

Intactness Value Ranges and Legend Descriptions

Intactness Value	Legend
-1.00 to -0.66	Very Low
-0.66 to -0.22	Moderately Low
-0.22 to 0.22	Moderate
0.22 to 0.66	Moderately High
0.66 to 1.00	Very High

Results for Potential Climate Change Impacts

4 km x 4 km grid cells