

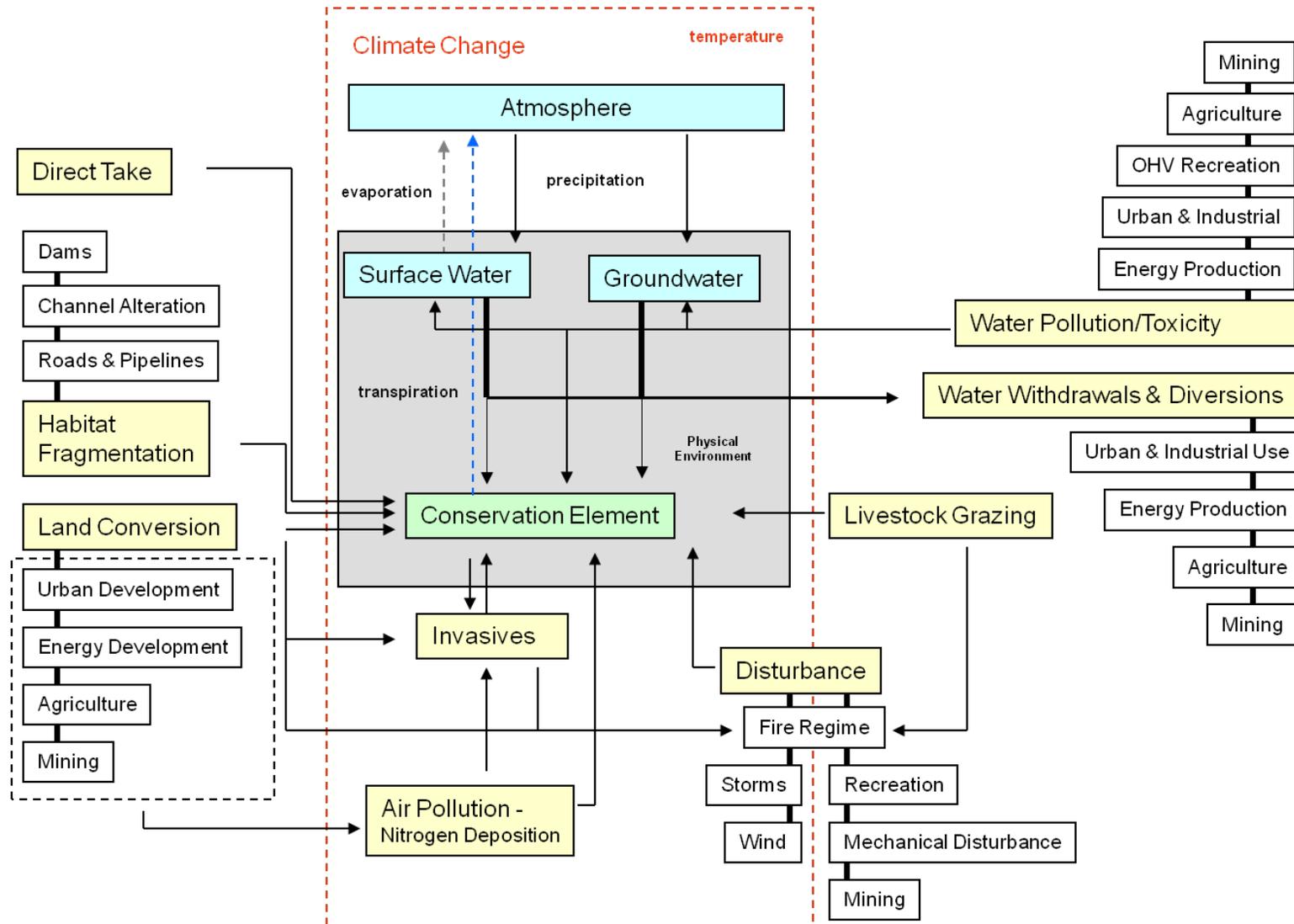
## Appendix E – Logic Models

### Organization of Appendix E

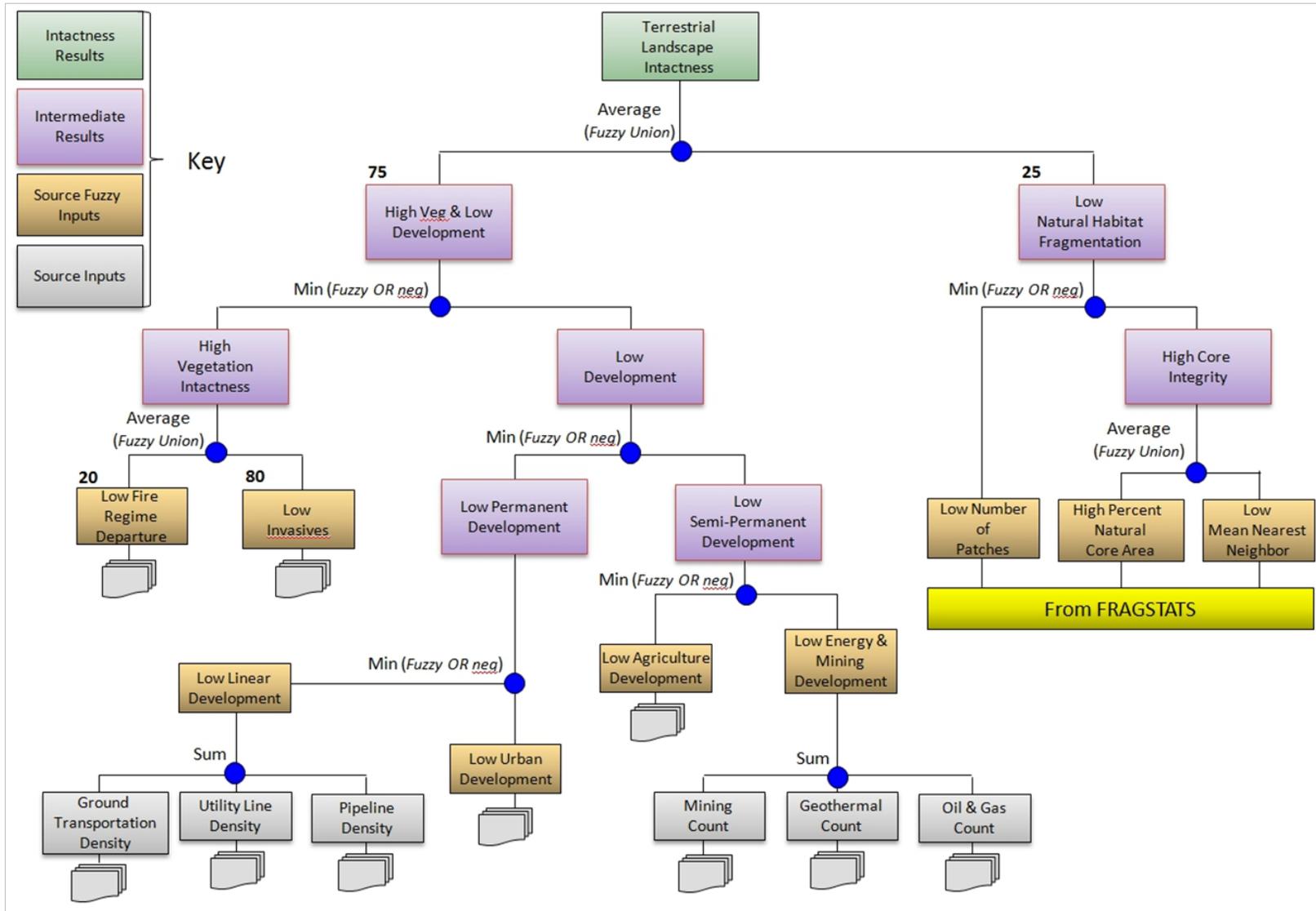
For the Sonoran Desert REA, six issues questions relied on development of more complicated fuzzy logic modeling, including current terrestrial landscape intactness, current aquatic intactness, near-term future (2025) terrestrial landscape intactness, near-term future (2025) aquatic intactness, current 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 5<sup>th</sup> 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
	Active Mineral Operations (USGS)	Good
	California Mines (California Department of Conservation, Office)	Good
Geothermal Count	Geothermal Wells in California (State of California, Department of)	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	Fair
Low Natural Habitat Fragmentation	Natural Vegetation Fragmentation (4KM) (CBI)	Fair-Good

**Overall Model Certainty: High** – biggest weakness is lack of more detailed invasives data. Additional recreation data and grazing condition data would also improve the model.

**Model output reported using both 4mk x 4km grid cells and 5<sup>th</sup> level HUC.**

## 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	7–100	7 <sup>1</sup>	100
Invasive Grasses & Tamarisk	Percent Area	0–100	0 <sup>1</sup>	100
Linear Development	Linear Density	0–75	0 <sup>2</sup>	2.5
Urban Percent	Percent Area	0–100	0 <sup>3</sup>	15
Agriculture Percent	Percent Area	0–97	0 <sup>3</sup>	20
Energy & Mining Development	Number	0–10	0 <sup>1</sup>	2.5
Number of Patches	Number	1–2,868	1 <sup>4</sup>	700
Mean Nearest Neighbor	Linear Distance	60–1,897	60 <sup>5</sup>	180
Percent Natural Core Area	Percent Area	0–97	97 <sup>3</sup>	20

1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 0.5 Standard Deviation from the mean; 3: Skewed data range = 1 Standard Deviation from the mean; 4: Skewed data range = 2 Standard Deviations from the mean; 5: Skewed data range = 2.5 Standard Deviations from the mean

## Thresholds – 5<sup>th</sup> level HUC

Item	Data Type	Data Range	True Threshold	False Threshold
Fire Regime	Percent Area	8–73	8 <sup>1</sup>	73
Invasive Grasses & Tamarisk	Percent Area	0–91	0 <sup>1</sup>	91
Linear Development	Linear Density	0–9	0 <sup>2</sup>	2.5
Urban Percent	Percent Area	0–51	0 <sup>3</sup>	15
Agriculture Percent	Percent Area	0–81	0 <sup>3</sup>	20
Energy & Mining Development	Number	0–1.98	0 <sup>1</sup>	1.98
Number of Patches	Number	1–7,056	1 <sup>1</sup>	700
Mean Nearest Neighbor	Linear Distance	60–229	60 <sup>1</sup>	180
Percent Natural Core Area	Percent Area	0–93	93 <sup>2</sup>	20

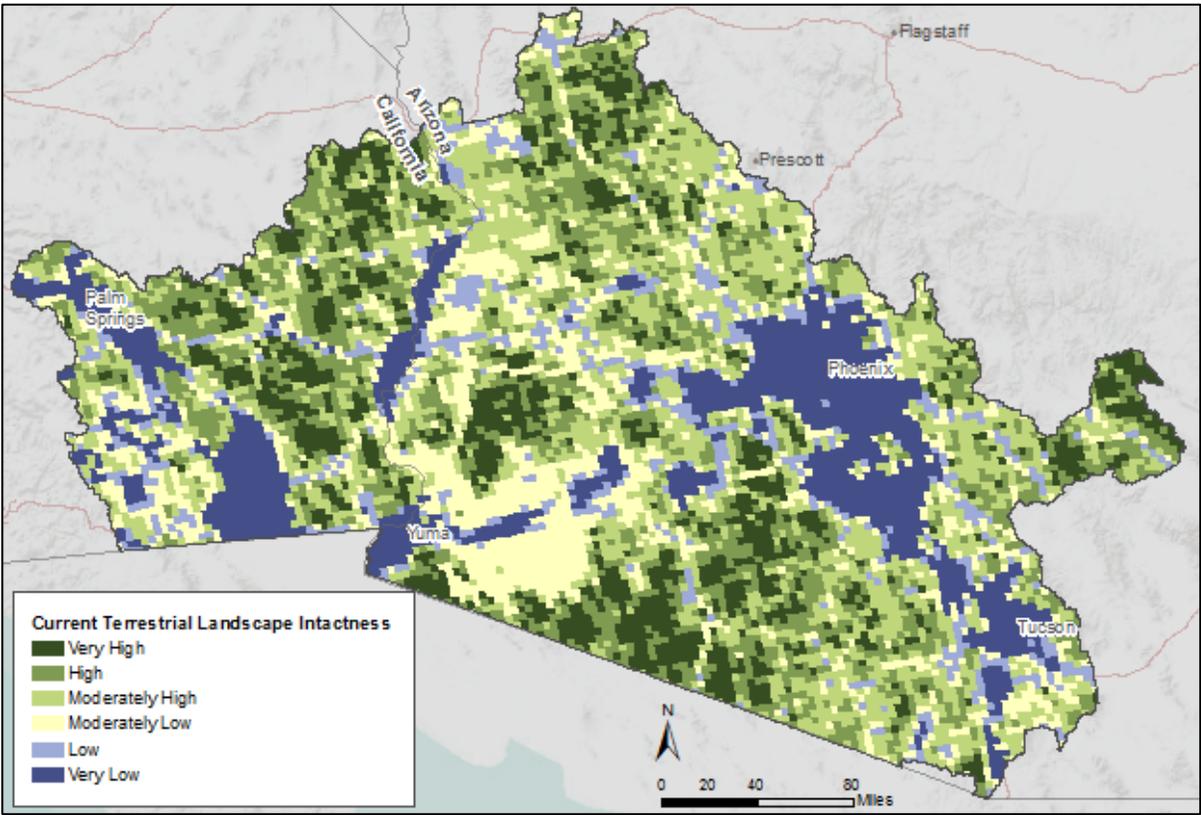
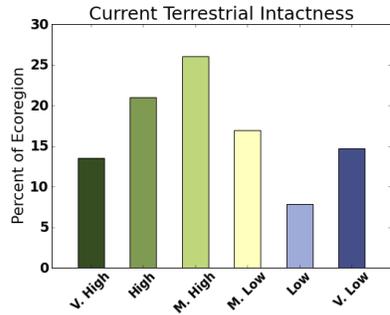
1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 2 Standard Deviations from the mean; 3: Skewed data range = 1.5 Standard Deviations from the mean

## 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

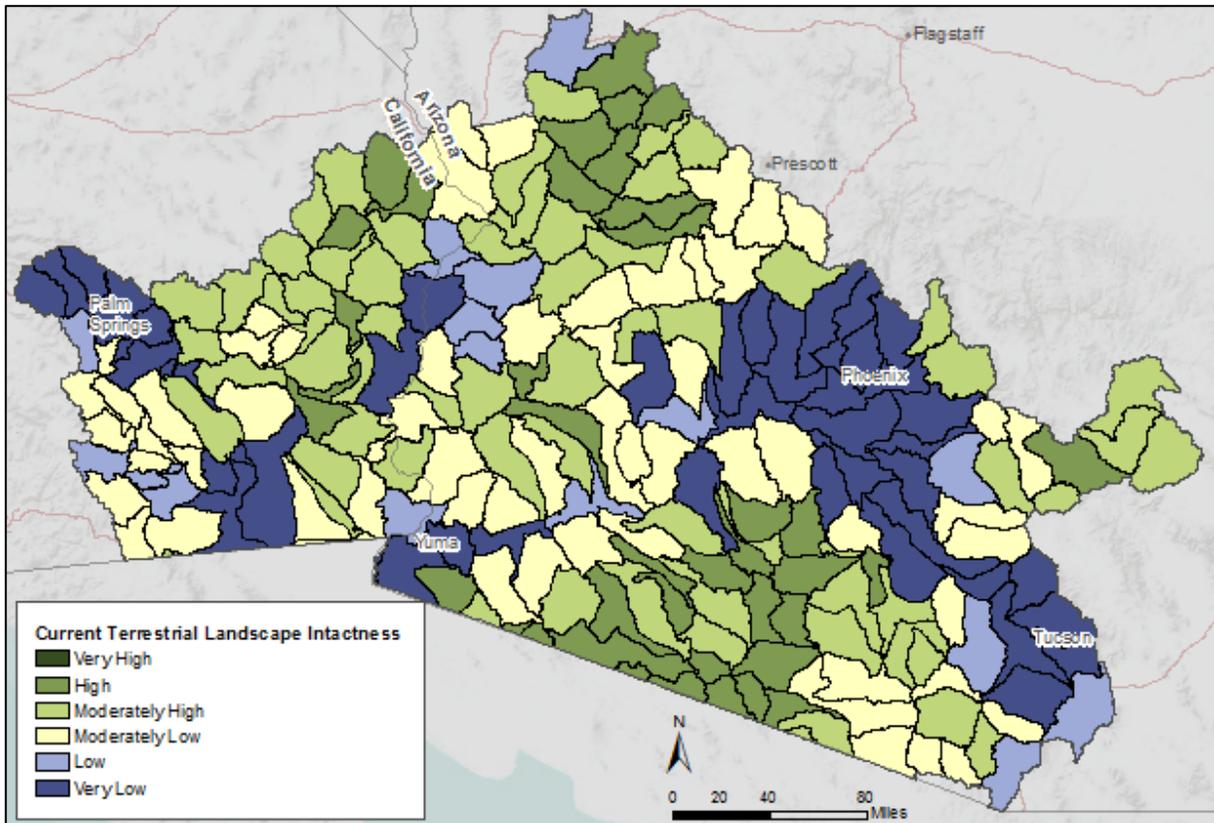
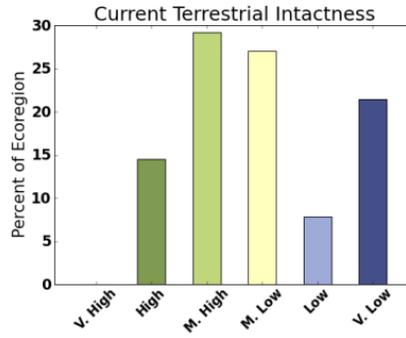
# Results for Current Terrestrial Landscape Intactness

4km x 4km grid cells

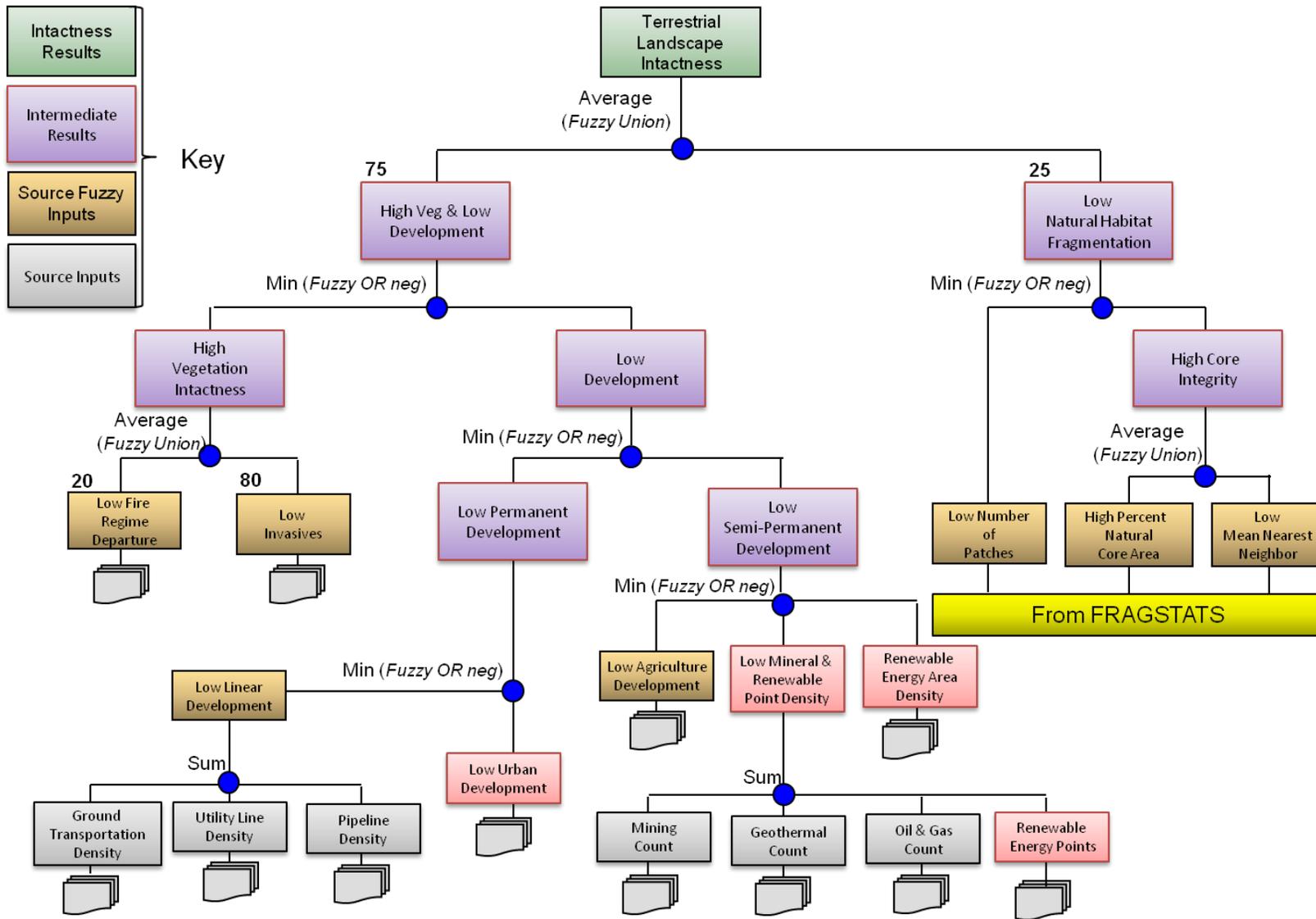


# Results for Current Terrestrial Landscape Intactness

## 5<sup>th</sup> 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)	Good-Fair
Low Agriculture Development	LANDFIRE - Existing Vegetation Type (version 1.1)	Very Good
Renewable Energy	BLM Solar Projects	Good
	BLM Renewable Energy Projects (2011)	Good
	California BLM Preliminary Renewable Energy Rights of Way	Good
	California BLM Verified Renewable Energy Rights of Way	Good
Mining Count	Arizona Mines (Arizona Electronic Atlas)	Good
	Active Mineral Operations (USGS)	Good
	California Mines (California Department of Conservation, Office of	Good
Geothermal Count	Geothermal Wells in California (State of California, Department of	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** – 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 5<sup>th</sup> level HUC and 4mk x 4km grid cells.**

**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	7–100	7 <sup>1</sup>	100
Invasive Grasses & Tamarisk	Percent Area	0–100	0 <sup>1</sup>	100
Linear Development	Linear Density	0–75	0 <sup>2</sup>	2.5
Urban Percent	Percent Area	0–100	0 <sup>3</sup>	15
Agriculture Percent	Percent Area	0–97	0 <sup>3</sup>	20
Renewable Energy	Percent Area	0–97	0 <sup>1</sup>	20
Energy & Mining Development	Number	0–10	0 <sup>1</sup>	2.5
Number of Patches	Number	0–2,868	0 <sup>4</sup>	700
Mean Nearest Neighbor	Linear Distance	60–1,897	60 <sup>5</sup>	180
Percent Natural Core Area	Percent Area	0–97	97 <sup>3</sup>	20

1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 0.5 Standard Deviation from the mean; 3: Skewed data range = 1 Standard Deviation from the mean; 4: Skewed data range = 2 Standard Deviations from the mean; 5: Skewed data range = 2.5 Standard Deviations from the mean

## Thresholds – 5<sup>th</sup> level HUC

Item	Data Type	Data Range	True Threshold	False Threshold
Fire Regime	Percent Area	8–73	8 <sup>1</sup>	73
Invasive Grasses & Tamarisk	Percent Area	0–91	0 <sup>1</sup>	91
Linear Development	Linear Density	0–9	0 <sup>2</sup>	2.5
Urban Percent	Percent Area	0–60	0 <sup>3</sup>	15
Agriculture Percent	Percent Area	0–81	0 <sup>3</sup>	20
Energy & Mining Development	Number	0–2.01	0 <sup>1</sup>	2.01
Renewable Energy	Percent Area	0–20	0 <sup>1</sup>	20
Number of Patches	Number	1–7,056	1 <sup>1</sup>	700
Mean Nearest Neighbor	Linear Distance	60–229	60 <sup>1</sup>	180
Percent Natural Core Area	Percent Area	0–93	93 <sup>2</sup>	20

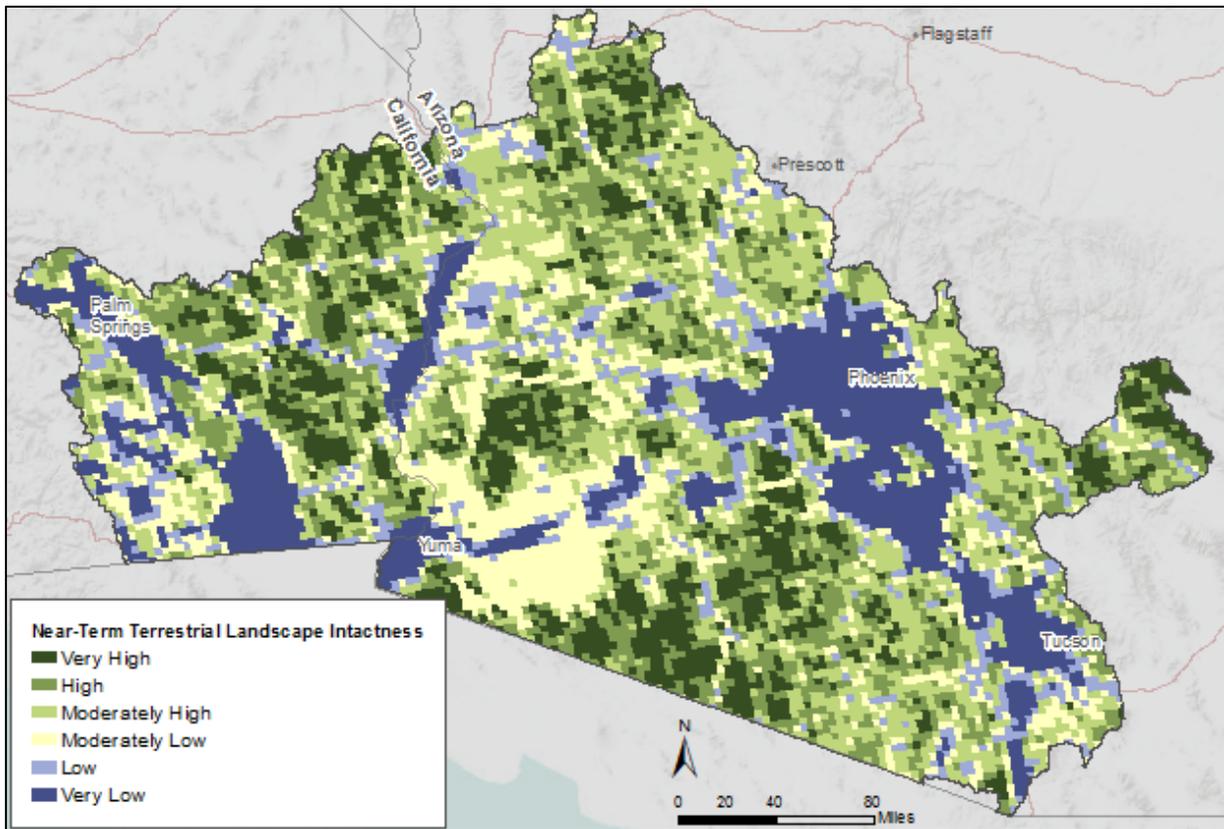
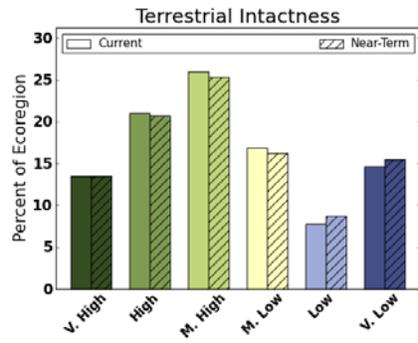
1: Used full range or full range with a few outliers ignored; 2: Skewed data range = 2 Standard Deviations from the mean; 3: Skewed data range = 1.5 Standard Deviations from the mean

## 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

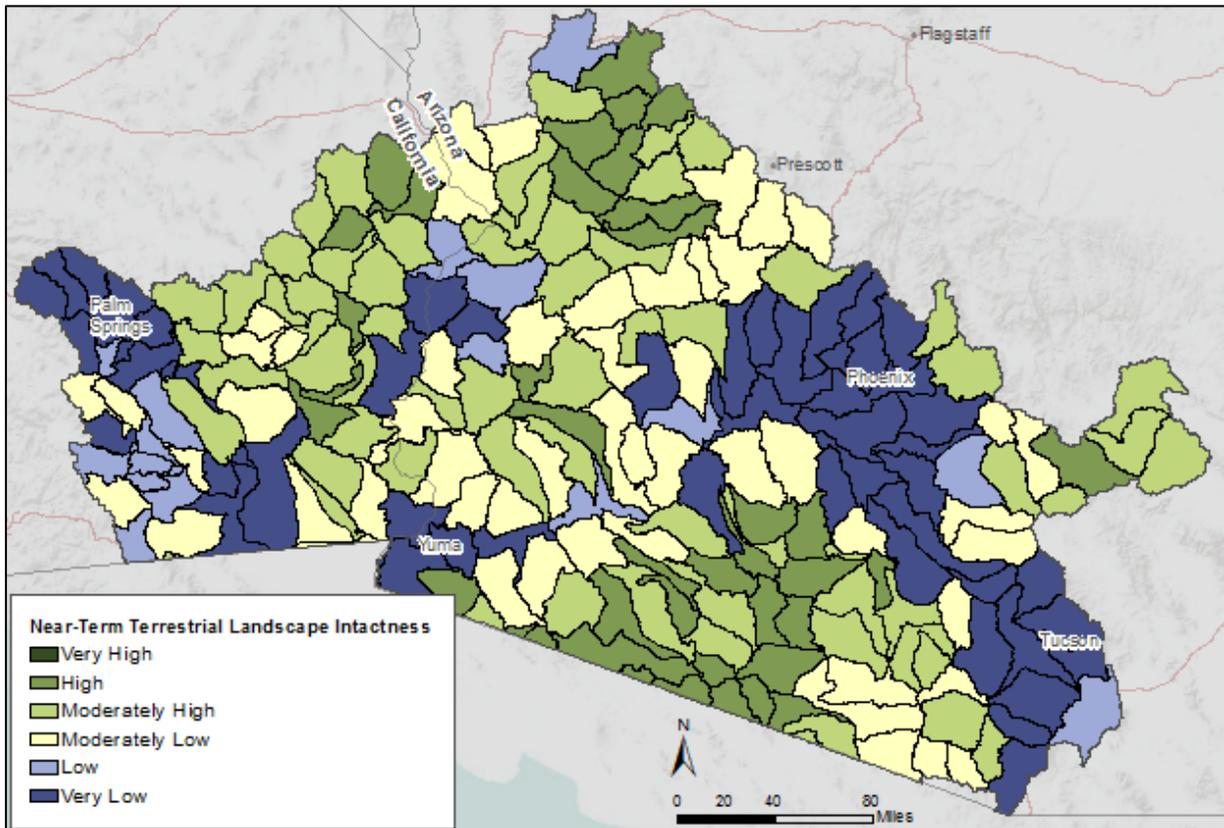
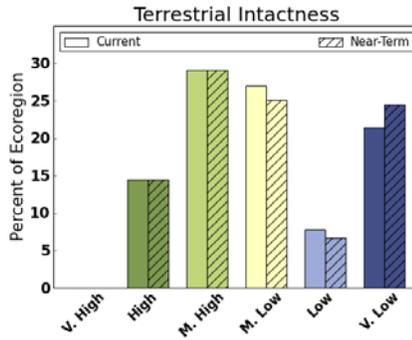
# Results for Near Term Future Terrestrial Landscape Intactness

4km x 4km grid cells

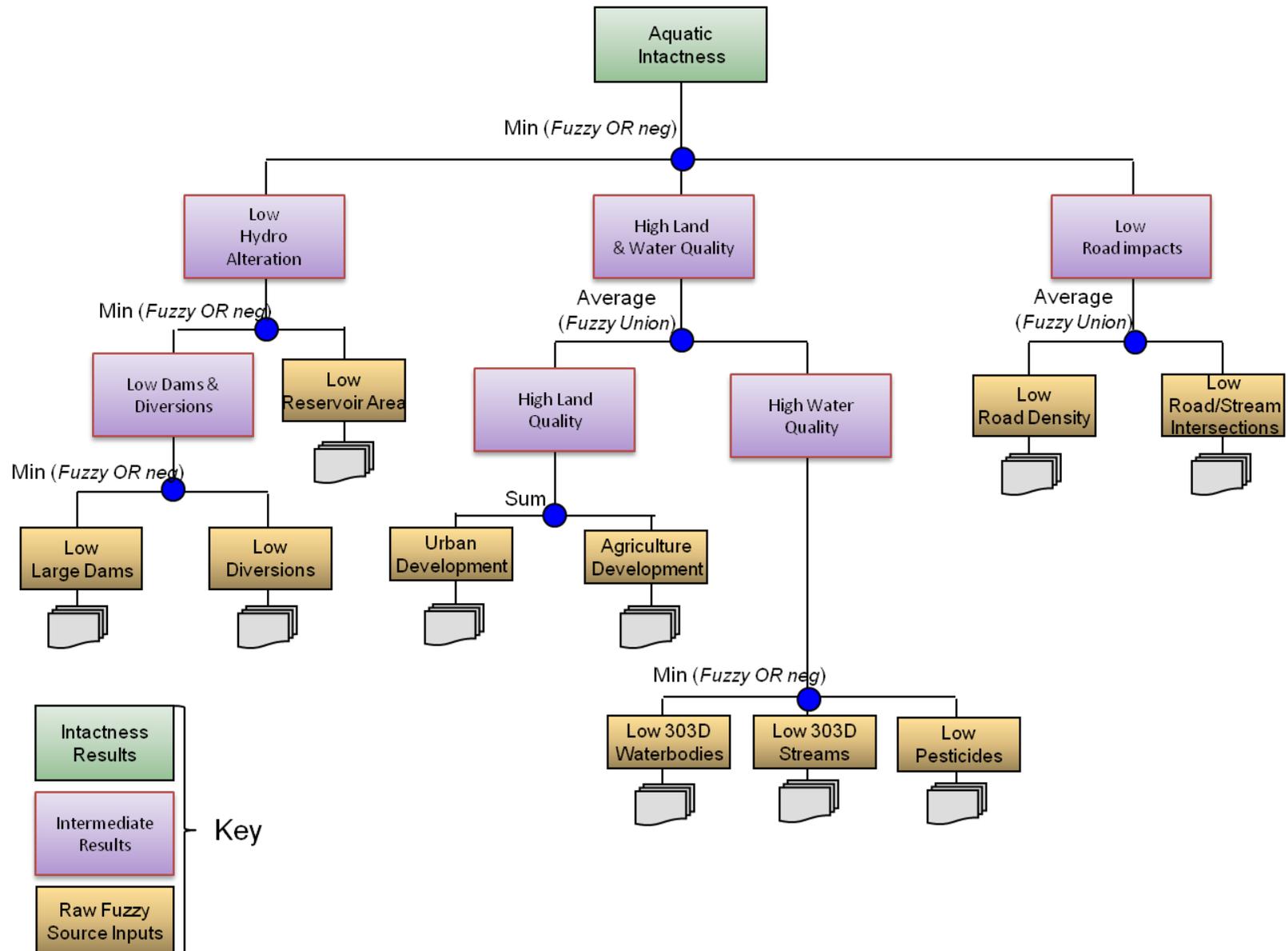


# Results for Near Term Future Terrestrial Landscape Intactness

## 5<sup>th</sup> level HUC



# Current Aquatic Intactness Logic Model



**Key**

- Intactness Results (Green box)
- Intermediate Results (Purple box)
- Raw Fuzzy Source Inputs (Yellow box)

## 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	Surface Water Rights in Imperial County (California Environmental Protection Agency)	Very Good
	Surface Water Rights in Arizona (Arizona Department of Water Resources)	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 and streams) (EPA)	Very Good
Low 303D Streams	EPA Office of Water (OW): 303(d) Listed Impaired Waters (waterbodies and streams) (EPA)	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 5<sup>th</sup> 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	0–0.031	0 <sup>1</sup>	0.02
Low Diversions	Point Density	0–0.9	0 <sup>2</sup>	0.9
Low Reservoir Area	Percent Area	0–100	0 <sup>2</sup>	2
Land Use	Percent Area	0–87	0 <sup>3</sup>	20
Low 303D Waterbodies	Percent Area	0–99	0 <sup>1</sup>	1
Low 303D Streams	Linear Density	0–0.9	0 <sup>4</sup>	0.2
Low Pesticides	Weighted Sum	0–0.066	0 <sup>4</sup>	0.02
Low Road Density	Linear Density	0–8	0 <sup>3</sup>	2.5
Low Road/Stream Intersections	Point Density	0–0.82	0 <sup>3</sup>	0.28

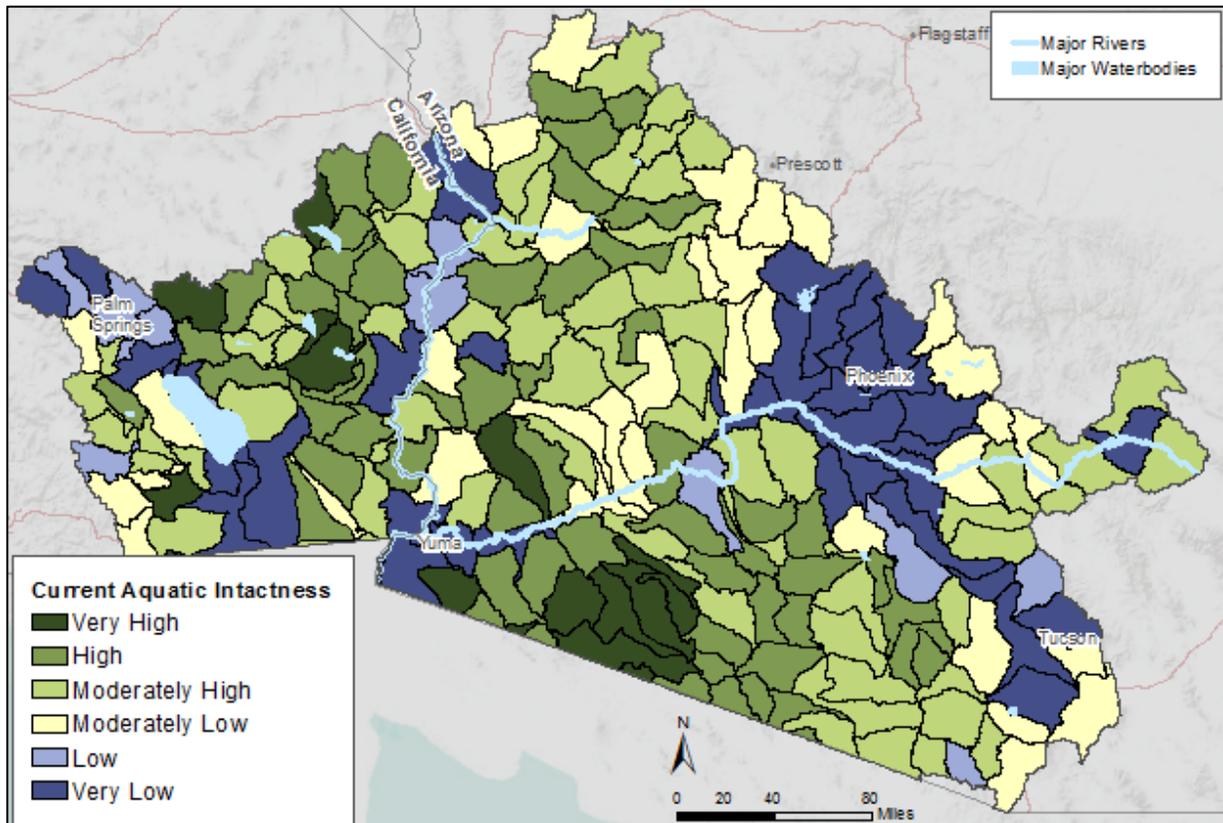
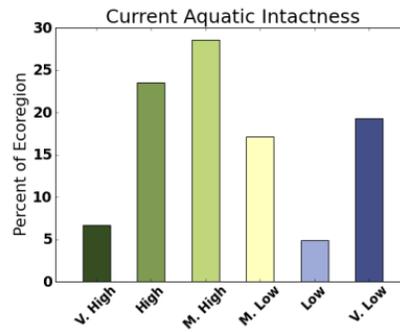
1: Skewed data range = 0.5 Standard Deviation from the mean; 2: Used full range or full range with a few outliers ignored; 3: Skewed data range = 1 Standard Deviation from the mean; 4: Skewed data range = 2 Standard Deviations from the mean

### Intactness Value Ranges and Legend Descriptions

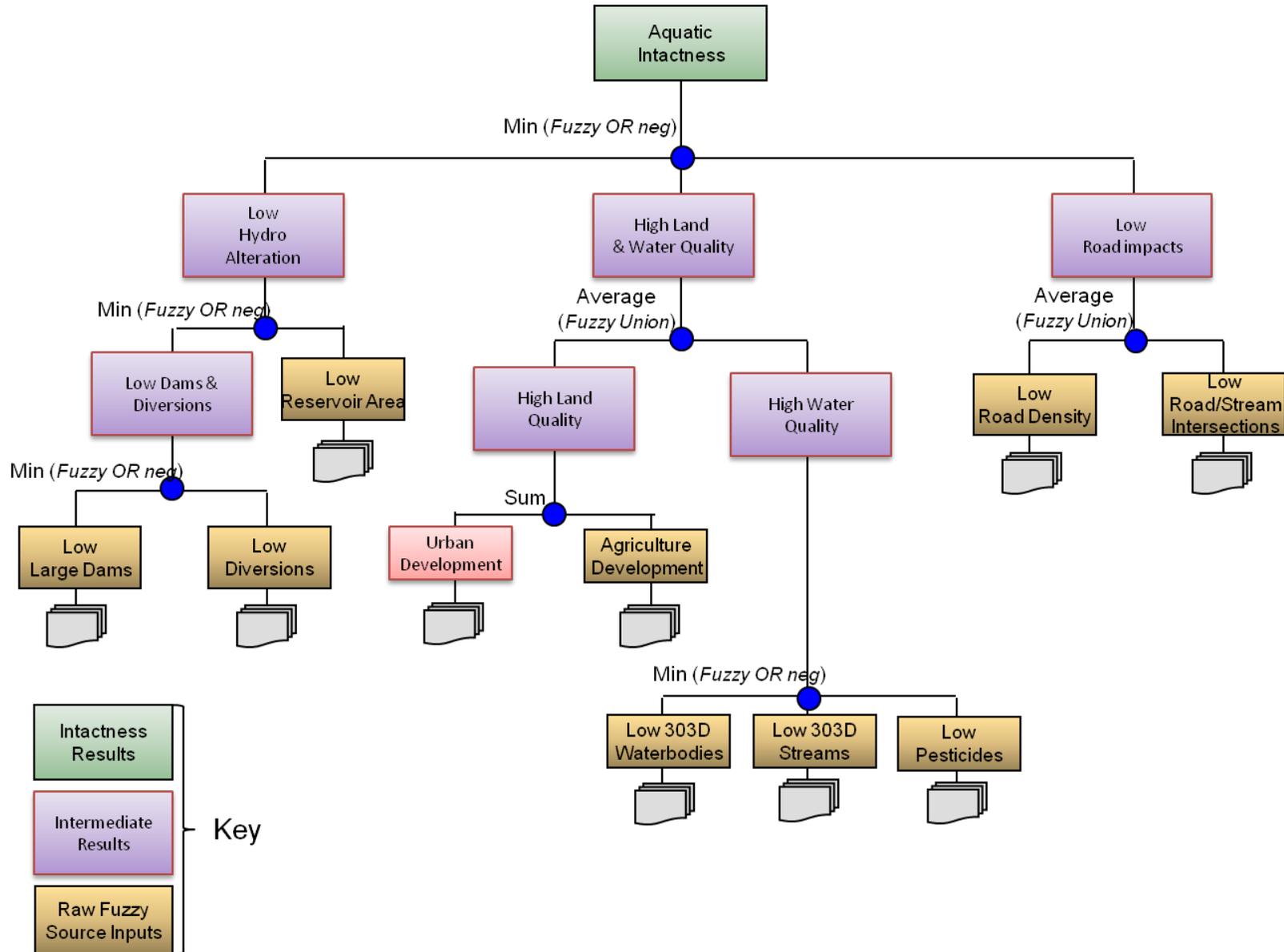
Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

# Results for Current Aquatic Intactness

## 5<sup>th</sup> 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 forecasted (e.g. ground transportation density), resulting in a model that significantly underestimates the near-term impacts.

**Model output reported at 5<sup>th</sup> 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	0–0.031	0 <sup>1</sup>	0.02
Low Diversions	Point Density	0–0.9	0 <sup>2</sup>	0.9
Low Reservoir Area	Percent Area	0–100	0 <sup>2</sup>	2
Land Use	Percent Area	0–92	0 <sup>3</sup>	20
Low 303D Waterbodies	Percent Area	0–99	0 <sup>1</sup>	1
Low 303D Streams	Linear Density	0–0.9	0 <sup>4</sup>	0.2
Low Pesticides	Weighted Sum	0–0.066	0 <sup>4</sup>	0.02
Low Road Density	Linear Density	0–8	0 <sup>3</sup>	2.5
Low Road/Stream Intersections	Point Density	0–0.82	0 <sup>3</sup>	0.28

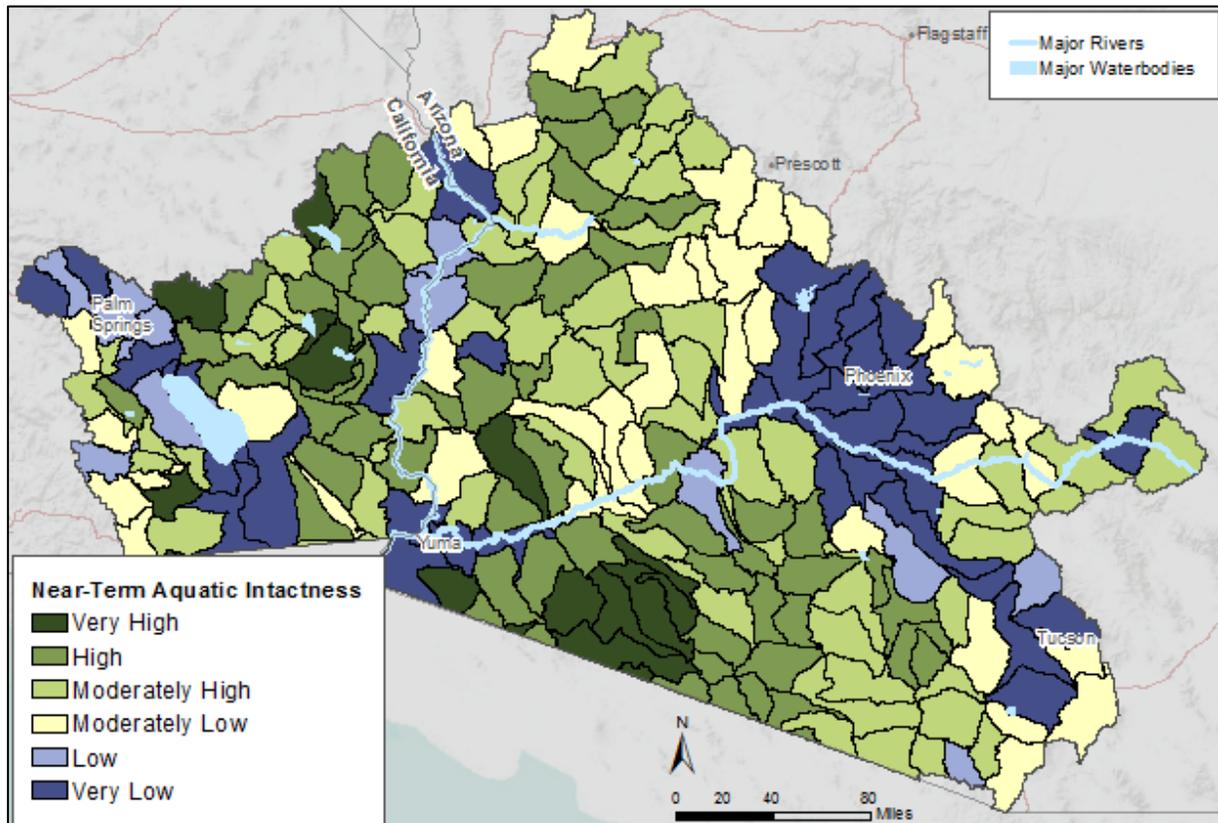
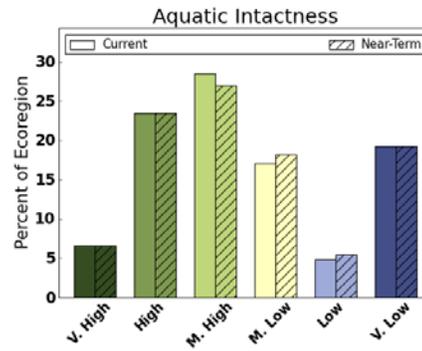
1: Skewed data range = 0.5 Standard Deviation from the mean; 2: Used full range or full range with a few outliers ignored; 3: Skewed data range = 1 Standard Deviation from the mean; 4: Skewed data range = 2 Standard Deviations from the mean

## Intactness Value Ranges and Legend Descriptions

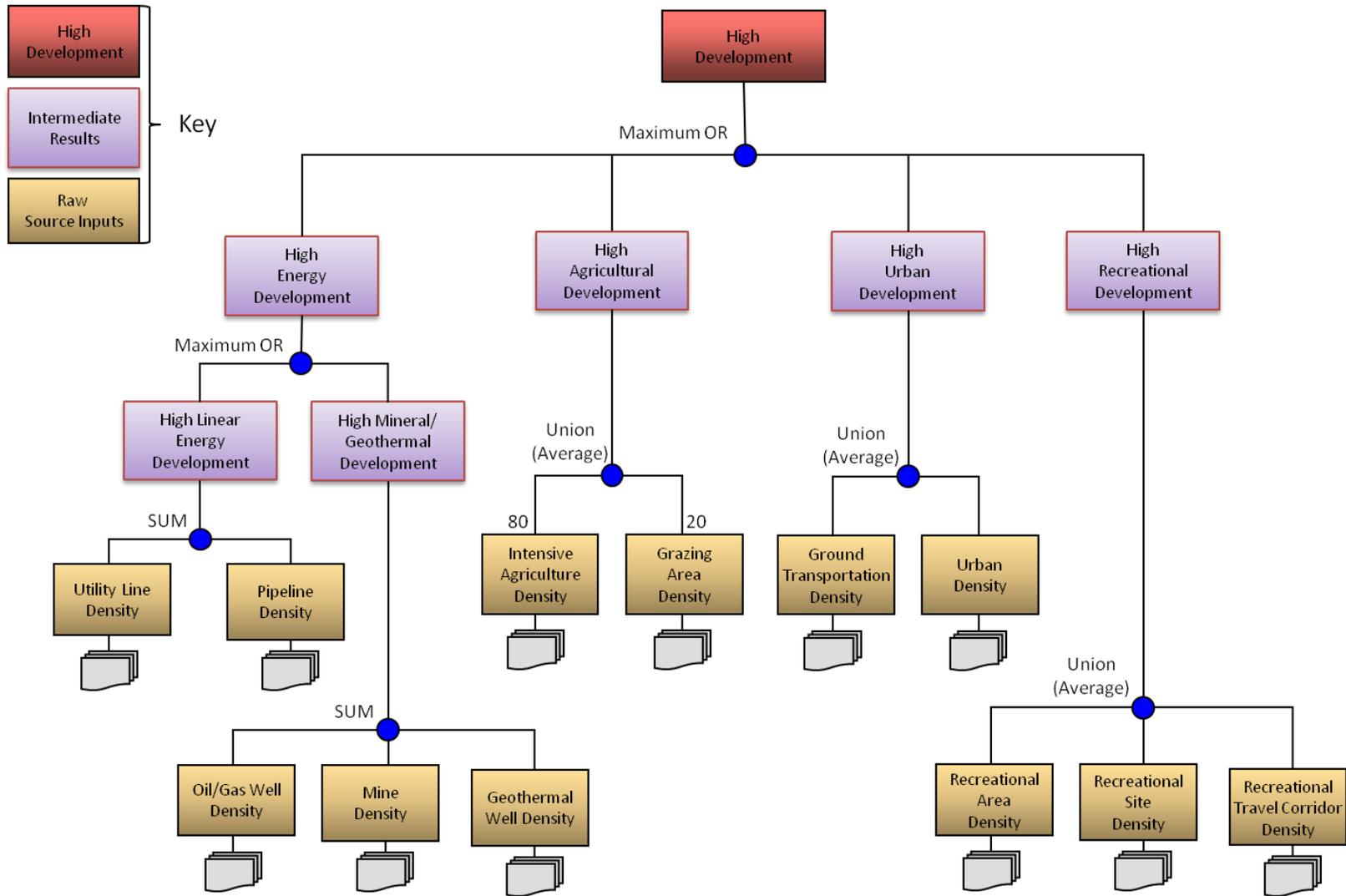
Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

# Results for Near Term Future Aquatic Intactness

## 5<sup>th</sup> 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
	California Mines (California Department of Conservation, Office of Mine Reclamation)	Good
Geothermal Well Density	Geothermal Wells in California (State of California, Department of Conservation, Division of Oil, Gas, and Geothermal Resources)	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 output 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	0–4.7	0.65	0
High Mineral/Geothermal	Point Density	0–9.3	0.70	0
Intensive Agriculture Density	Percent Area	0–97	39.71	0
Grazing Density	Percent Area	0–100	100	0
Ground Transportation Density	Linear Density	0–75	6	0
Urban Density	Percent Area	0–100	30.75	0
Recreational Area Density	Area Density	0–100	13.44	0
Recreational Site Density	Point Density	0–2.55	1.10	0
Recreational Travel Corridor Density	Linear Density	0–36.2	1.58	0

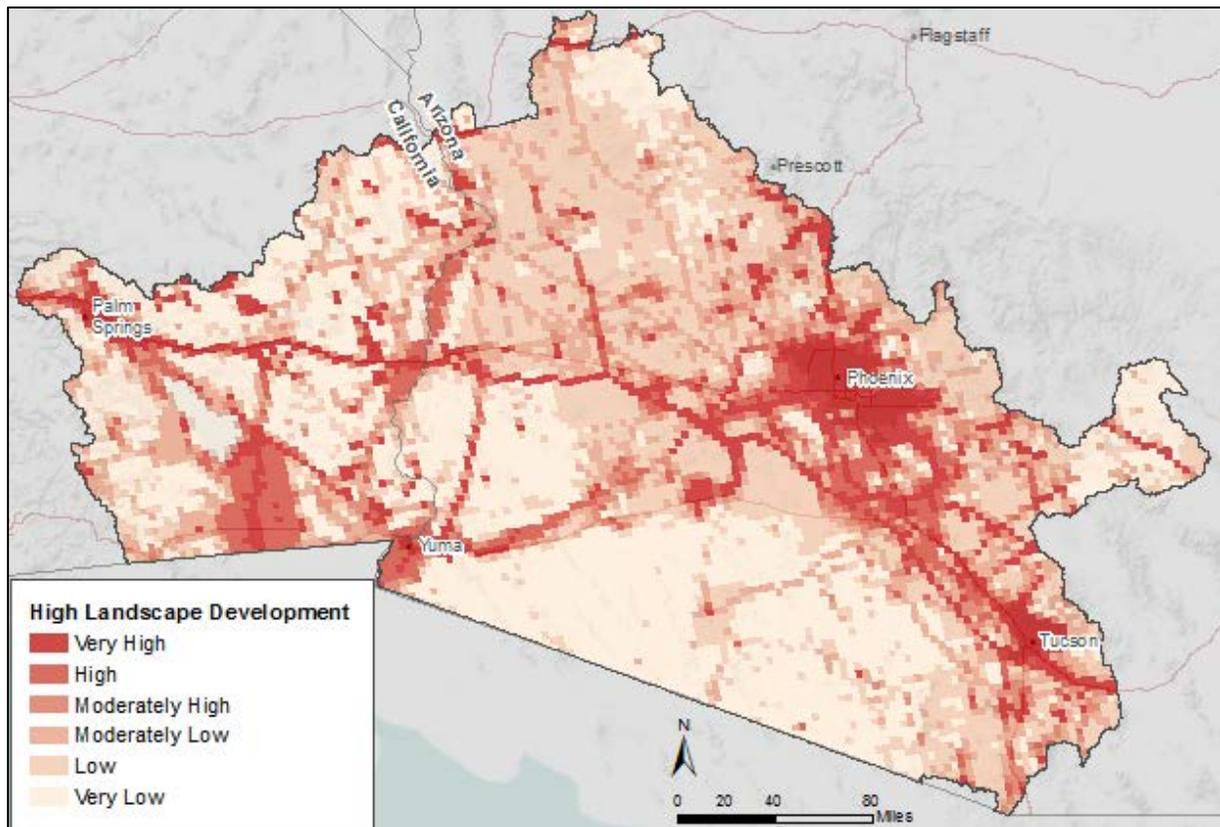
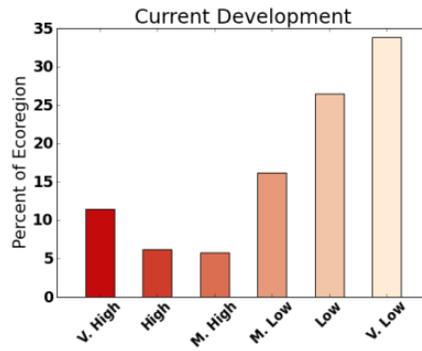
All thresholds based on 2 standard deviations from the mean value for each component.

**Intactness Value Ranges and Legend Descriptions**

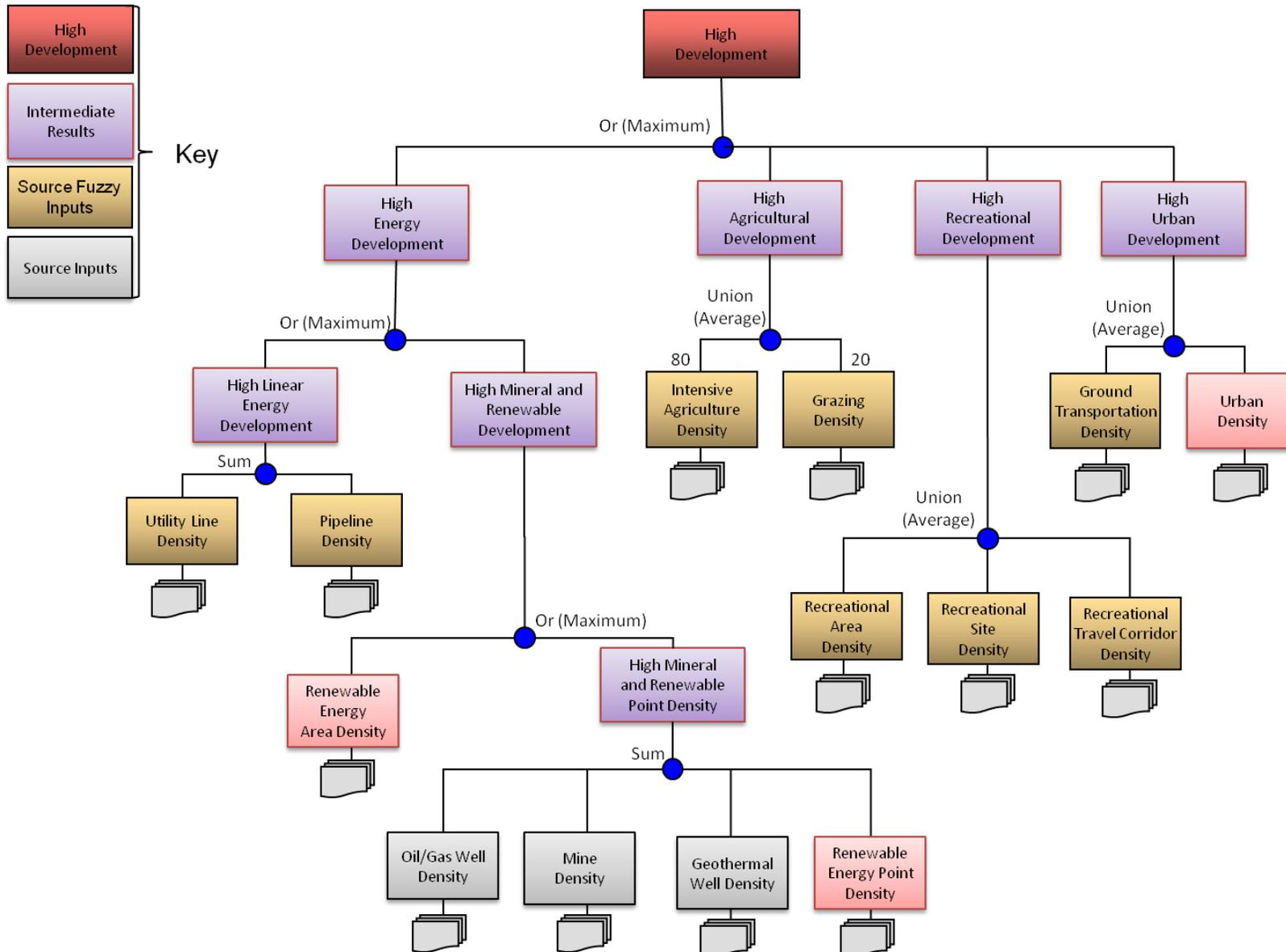
Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

# 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
Renewable Energy	BLM Solar Priority Projects	Good
	BLM Renewable Energy Projects (2011)	Good
	California BLM Preliminary Renewable Energy Rights of Way	Good
	California BLM Verified Renewable Energy Rights of Way	Good
Oil/Gas Well Density	Oil & Gas Wells (proprietary, provided by BLM)	Good
Mine density	Arizona Mines (Arizona Electronic Atlas)	Good
	California Mines (California Department of Conservation, Office of	Good
Geothermal Well Density	Geothermal Wells in California (State of California, Department of	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 forecasted (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
Renewable Energy Areas	Percent Area	0–100	8.74	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

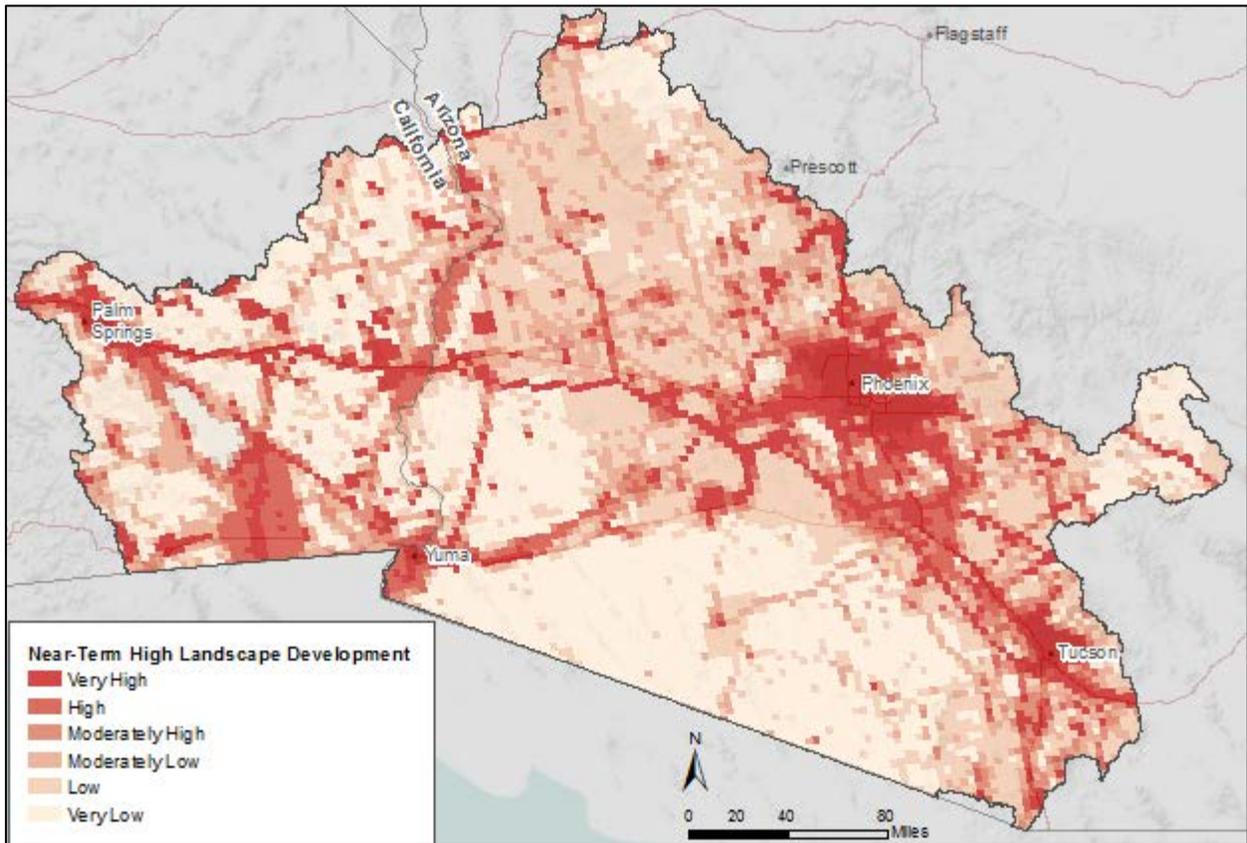
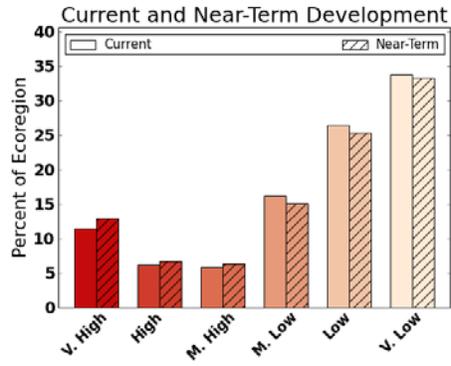
All thresholds based on 2 standard deviations from the mean value for each component.

## Intactness Value Ranges and Legend Descriptions

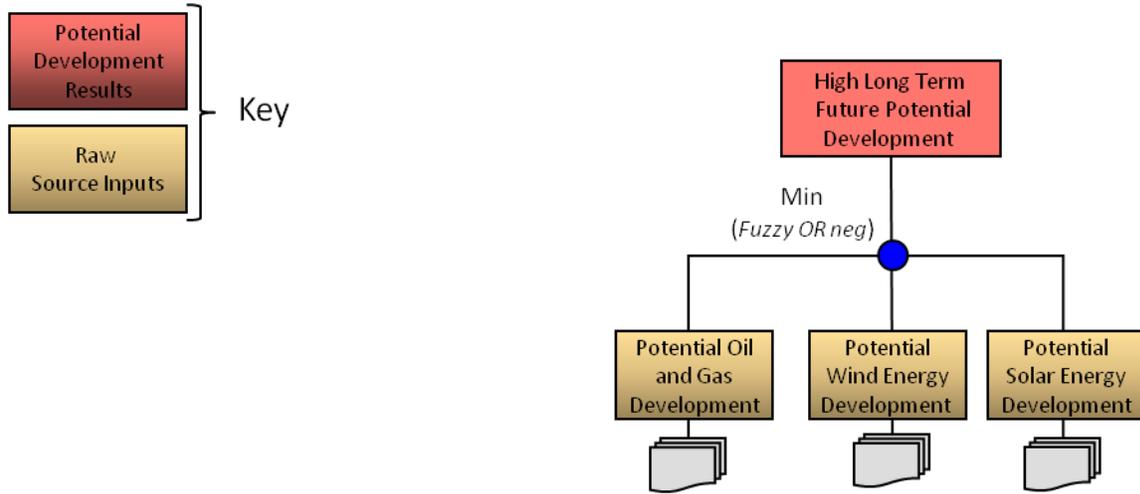
Intactness Value	Legend
-1.000 to -0.750	Very Low
-0.750 to -0.500	Low
-0.500 to 0.000	Moderately Low
0.000 to 0.500	Moderately High
0.500 to 0.750	High
0.750 to 1.000	Very High

# 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
Oil/Gas Well Density	Oil & Gas Wells (proprietary, provided by BLM)	Good
Potential Solar Energy Development	Average Solar Resource Potential (filtered to less than 1% slope)	Good
	BLM Solar Priority Projects	Good
	California BLM Preliminary Renewable Energy Rights of Way	Good
	California BLM Verified Renewable Energy Rights of Way	Good
	BLM Restoration Design Energy Project - Solar Analysis Area	Good
	BLM Restoration Design Energy Project - Alternative 1 Areas	Good
	BLM Solar Developable Areas (SEZ8)	Good
Potential Wind Energy Development	Wind Power Density (W/m <sup>2</sup> ) at 50 Meters Above Ground Level	Good

Removed 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 – 5<sup>th</sup> level HUC**

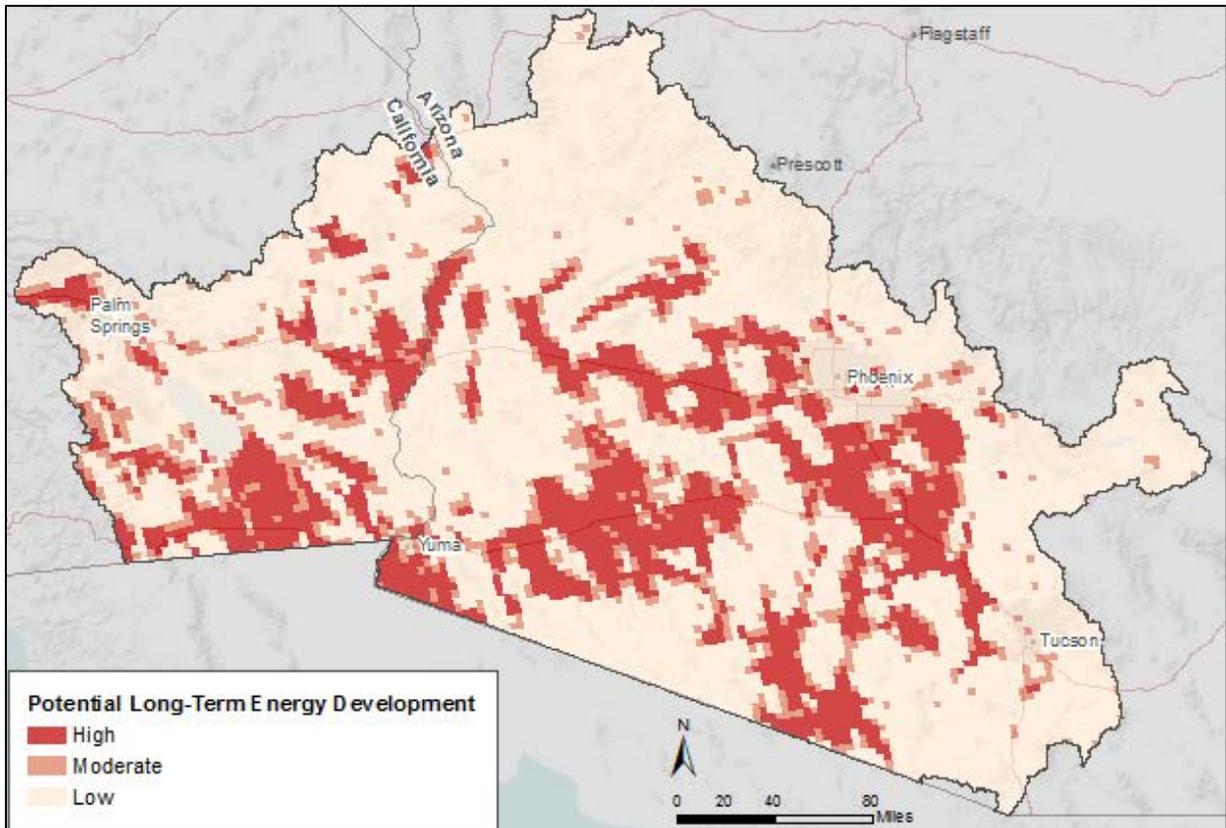
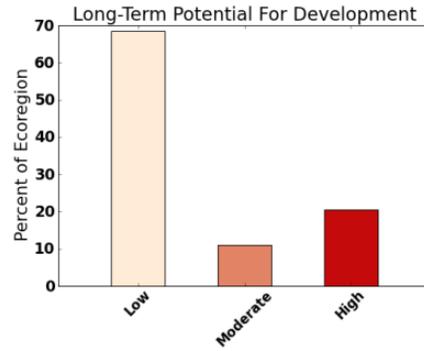
Item	Data Type	Data Range	True Threshold	False Threshold
Oil and Gas	Percent Area	0–29.3	0	29.3
Solar	Percent Area	0–93.5	0	93.5
Wind	Percent Area	0–59.4	0	59.4

**Intactness Value Ranges and Legend Descriptions**

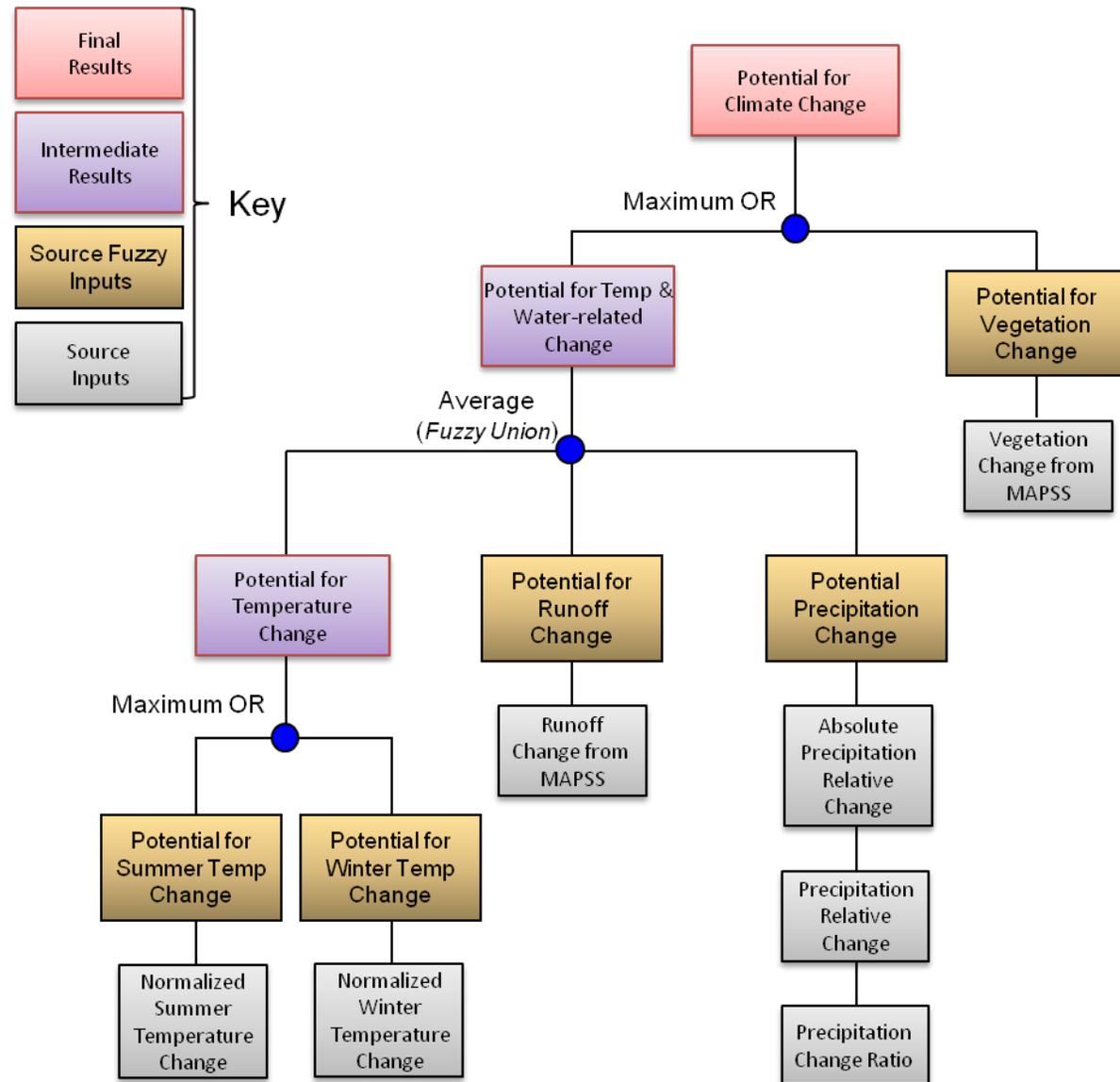
Intactness Value	Legend
0.333 to 1.0	High
--0.333 to 0.333	Medium
-0.333 to -1.0	Low

# 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 possess fairly high certainty; however, there is inherent uncertainty as discussed in the text that cautions over-interpretation, especially as it applies at 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	0.9–10	2 <sup>1</sup>	0
Potential Precipitation Change	See Below	0–2.16	2.16	0
Potential for Vegetation Change	Percent Area	0–100	100	0

<sup>1</sup> – Tail cutoff

## Thresholds – 5<sup>th</sup> level HUC

Item	Data Type	Data Range	True Threshold	False Threshold
Potential for Summer Temp Change	See Below	2.15–3.67	3.67	2.15
Potential for Winter Temp Change	See Below	1.05–1.67	1.67	1.05
Potential for Runoff	Percent Change	0–2.71	2 <sup>1</sup>	0
Potential Precipitation Change	See Below	0.59–2.63	2.63	0.59
Potential for Vegetation Change	Percent Area	0–100	100	0

<sup>1</sup> – 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

