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Arizona Aquifer Recharge Suitability Analysis

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Abstract

Aquifer recharge can be either passive or active, and is implemented in a variety of ways. This analysis seeks to identify regions across AZ which are broadly suitable for aquifer recharge projects as a general template for more focused analysis.

Plain Language Summary

Identifying regions in AZ where surface water can be stored long-term as ground water.

1 Introduction

2 Data & Methods

These methods and data layers are preliminary and subject to change

Elevation #### DEM Elevation and elevation derivatives from 30-m NASA SRTM. USGS 3-DEM (10m) product not suitable for full study area analysis due to (1) the large area of missing data in Mexico, and (2), the excessively high spatial resolution (massively increasing computational requirements).

SRTM elevation sinks filled prior to calculating slope and aspect.

Should elevation be directly used in the suitability analysis?

2.0.1 Slope

Slope derived from hydrologically conditioned (filled) 30-m SRTM layer using quadratic surface function and a fixed 30-m neighborhood. Slope measured in $^{\circ}$.

Higher slopes are less suitable because thinning is both more expensive and more precipitation will end up as runoff.

Slope classified from 1-10 using a **continuous function** in ArcPro Suitability Mapper.

Pamameter	Setting
Function	MSSSmall
Mean multiplier	1
Sddv multiplier	2
Lower threshold	0
Value below threshold	0
Upper threshold	90
Value above threshold	0
Invert function	FALSE
Save transformed dataset	TRUE
Output	Transformed_SRTM_slope

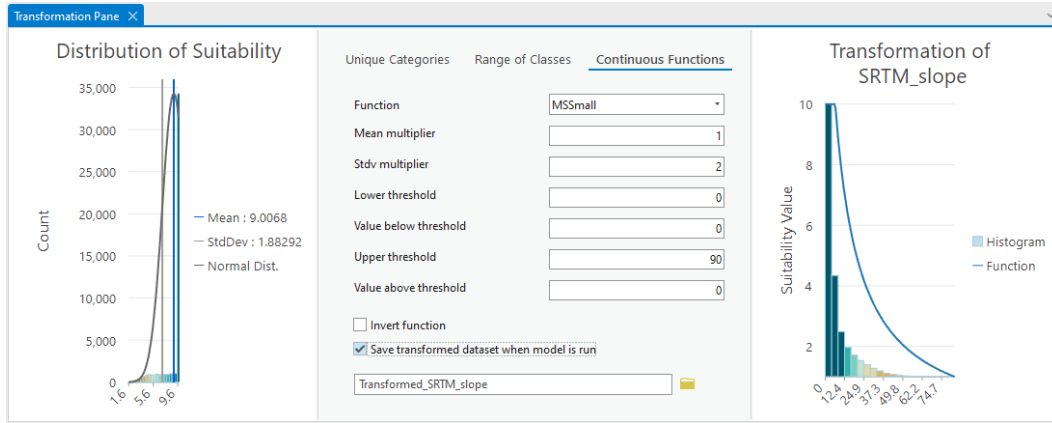


Figure 1: Slope suitability mapper rescale transformation setup.

2.0.2 Aspect

Aspect calculated as with slope. Aspect reference point at N. Pole.

Aspect has a large impact on solar radiation.

Closer to 0 or 360 is desired, low suitability scores for closeness.

Aspect classified from 1-10 using a **continuous function** in ArcPro Suitability Mapper.

Pamameter	Setting
Function	Near
Mid Point	180
Point spread	0.0011049638968393428 (default)
Lower threshold	-1 (flat)
Value below threshold	0
Upper threshold	360
Value above threshold	0
Invert function	TRUE
Save transformed dataset	TRUE
Output	Transformed_SRTM_aspect

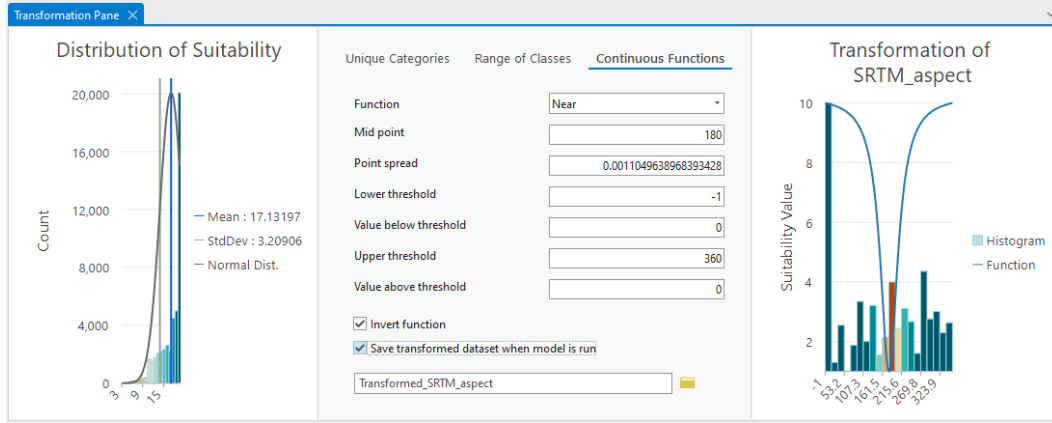


Figure 2: Aspect suitability mapper rescale transformation setup.

2.1 Precipitation

PRISM normals, 800m resolution. Annual precipitation.

Mean annual precipitation must be higher than 500mm 1990 - 2020

Precipitation classified from 1-10 using a **continuous function** in ArcPro Suitability Mapper.

NOTE: The logistic growth function may also be a good choice for this dataset. See [Logistic Growth function](#)

Pamameter	Setting
Function	MSLarge
Mean multiplier	1.68 (aproximates 500mm at x-intercept)
Sddv multiplier	1
Lower threshold	67.33789825439453 (default, minimum)
Value below threshold	0
Upper threshold	1214.5689697265625 (default, maximum)
Value above threshold	0
Invert function	FALSE
Save transformed dataset	TRUE
Output	Transformed_PRISM_ppt_30yrnormal_800m

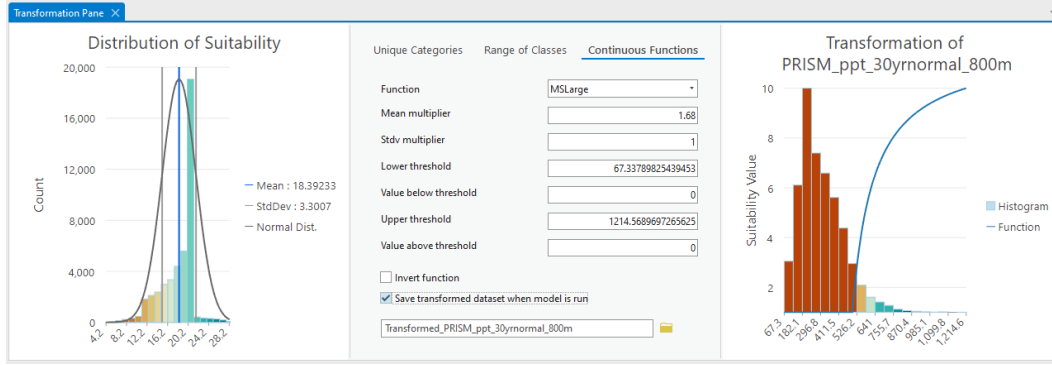


Figure 3: Aspect suitability mapper rescale transformation setup.

2.2 Vegetation Characteristics

2.2.1 NLCD 2021 Total Canopy Cover

2.2.2 Landfire

2.3 Soil Hydrology

AZ_Soil_Hydric_Group data layer

Classification Schema

Class	Count (pixels)	Text	Value
A	62559472	Group A soils consist of deep, well drained sands or gravelly sands with high infiltration and low runoff rates.	10
B	76665198	Group B soils consist of deep well drained soils with a moderately fine to moderately coarse texture and a moderate rate of infiltration and runoff.	10
C	88491710	Group C consists of soils with a layer that impedes the downward movement of water or fine textured soils and a slow rate of infiltration.	8
D	155095790	Group D consists of soils with a very slow infiltration rate and high runoff potential. This group is composed of clays that have a high shrink-swell potential, soils with a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material.	3
A/D	43192	Group A/D soils naturally have a very slow infiltration rate due to a high water table but will have high infiltration and low runoff rates if drained.	??
B/D	18456	Group B/D soils naturally have a very slow infiltration rate due to a high water table but will have a moderate rate of infiltration and runoff if drained.	??

Class	Count (pixels)	Text	Value
C/D	217771	Group C/D soils naturally have a very slow infiltration rate due to a high water table but will have a slow rate of infiltration if drained.	??

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3 Conclusion
References