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| **Variable name** | **Description and ecological significance**  | **Variable created with** |
| Aspect | Solar radiation  | GAO DEM using Geomorphometry and Gradient Metrics Toolbox (Evans, Cushman and Theobald, 2014) |
| Compound Topographic Index (CTI) | Soil moisture potential  | GAO DEM using Geomorphometry and Gradient Metrics Toolbox Based on Gessler, Moore, McKenzie, & Ryan (1995) |
| Distance to 4x4 roads  | Disturbance and human assisted access of non-native propagules  | GAO dem created using ESRI 2017. ArcGIS Desktop: Release 10.6 Redlands, CA: Environmental Systems Research Institute. |
| Distance to Private land  | Disturbance, and other anthropogenic impacts (e.g., source non-native seeds and fire ignition) | GAO dem and Hawaii TMK data obtained from the state of Hawaii (https://planning.hawaii.gov/gis/) |
| Elevation | Proxy for long term temperature and precipitation patterns | Generated from the GAO DEM data  |
| Past Fire  | Human disturbance with built in feedback loops favoring non-native grasslands  | Digitized burned areas from 1954 on. Obtained from the Hawaii Wildfire Management Organization. Hawaii State Wildfire History Data Set. Available online at gis.ctahr.hawaii.edu. |
| Roughness  | Terrain complexity incorporating slope and aspect. Also, possible indicator of areas of lower livestock use due to high values of rugosity. | GAO dem using Vector Ruggedness Measure from Sappington, Longshore, & Thompson, (2007)applied with the Benthic Terrain Modeler Toolbox (Wright *et al.*, 2005) |
| Slope Position  | Microclimates associated with wind and water availability  | GAO DEM using Geomorphometry and Gradient Metrics Toolbox (Evans et al. 2014)  |
| Soil Type  | Nutrient and water potential and storage  | Soils data is from the U.S. Department of Agriculture, Natural Resources Conservation Service. Downloaded from <http://datagateway.nrcs.usda.gov> |
| Substrate Age  | Indication of nutrient availability and in some cases ungulate accessibility  | Geological data was created by sherrod et al. (2007 ) and obtained from the state of Hawaii (http://geoportal.hawaii.gov/datasets/geological-units) |
| Variation in mean annual rainfall | Stability of annual moisture patterns  | Rainfall data obtained from the rainfall atlas of Hawaii (Giambelluca *et al.*, 2013) http://rainfall.geography.hawaii.edu/) |
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