**Background**

- This indicator is one in a group of vulnerability indicators known as “elasticities,” in which the percent change in one variable is divided by the percent change in another variable that causes the change in the first variable.
- This indicator is computed from observations of streamflow and precipitation without relying on the assumptions and caveats needed in a hydrologic model.\(^1\)
- For example, an indicator value of 2 would imply that a 1% increase in monthly precipitation would result in a 2% increase in monthly runoff.
- Higher values suggest higher vulnerability relative to other watersheds.

**Data Sources**

<table>
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<tr>
<th>Data Source</th>
<th>Description</th>
<th>Spatial Resolution</th>
<th>Temporal Resolution</th>
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</thead>
<tbody>
<tr>
<td>Coupled Model Intercomparison Project (CMIP-5)</td>
<td>Local runoff and precipitation within 4-digit hydrologic code (HUC-4) watersheds</td>
<td>HUC-4 watersheds</td>
<td>2035-2064 and 2070-2099</td>
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</table>

**Calculation**

- Use local runoff and precipitation values from 47 CMIP-5 climate model traces specific to each future wet or dry scenario.\(^3\)
- Calculate yearly precipitation, \(P_t\), and average local runoff, \(Q_t\), for each model trace.
- Calculate the mean annual precipitation, \(\bar{P}\), and mean average local runoff, \(\bar{Q}\), by averaging the yearly values.
- For each year, calculate the yearly elasticity as: 
  \[
  \left( \frac{Q_t - \bar{Q}}{P_t - \bar{P}} \right)
  \]
- Rank the yearly elasticity values for each model trace from low to high, and select the 15th value. This value is a model trace’s elasticity estimator.
- Rank climate model traces’ elasticity estimator values from low to high, and select the 42nd value.

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\(^2\) CMIP-5 output is available for download online at: [http://gdo-dcp.ucar.edu/downscaled_cmip_projections/dcpInterface.html](http://gdo-dcp.ucar.edu/downscaled_cmip_projections/dcpInterface.html)

\(^3\) Indicator values were calculated for two scenarios (a wet and a dry future) and two time periods (2035-2064 and 2070-2099).