Tannehill (1947) notes:

“We may truthfully say that we scarcely know a drought when we see one. We welcome the first clear day after a rainy spell. Rainless days continue for some time and we are pleased to have a long spell of fine weather. It keeps on and we are a little worried. A few days more and we are really in trouble. The first rainless day in a spell of fine weather contributes as much to the drought as the last, but no one knows how serious it will be until the last dry day is gone and the rains have come again ... we are not sure about it until the crops have withered and died.”
Drought Damage in Cambodia

Area damage by drought for 2004-2005 in 1000 ha

Frequency of drought for 1988-2011

Very Low  Low  Medium  High  Very High

Koh Kong, Paillin, Oddor Meanchey, Kratie, Kep, Sihanoukville, Phnom Penh, Kampong Cham, Mondul Kiri, Ratanakiri, Stung Treng, Preah Vihear, Kampong Chhnang, Kandal, Svay Rieng, Prey Veng, Battambang, Takeo, Kampong Speu
Drought and Rice Calendar

Rainfall in millimetres

- 1987
- 2001
- 2004

Climate

Dry Season

Wet Season

Long

Medium

Early

Note:

- Idle land
- Seedling
- Transplanting/Growing
- Harvesting
How Drought Is Monitored?

Major drought indices

<table>
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<th>Drought Indices</th>
<th>Description</th>
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<tr>
<td>Percent of Normal</td>
<td>Actual precipitation / normal precipitation (a 30-year-mean)</td>
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<tr>
<td>Standardized Precipitation Index</td>
<td>Probability of precipitation for any time scale</td>
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<tr>
<td>Palmer Drought Severity Index</td>
<td>Soil moisture algorithm for relative homogeneous regions</td>
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<td>Crop Moisture Index</td>
<td>A Palmer derivative to reflects moisture supply in the short term</td>
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<td>Deciles</td>
<td>Groups monthly precipitation occurrences into Deciles</td>
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Why Standardize Precipitation Index

Standardize Precipitation Index (SPI):
  • Need only rainfall data
  • Can be used for early warning of drought onset
  • Assess drought severity
  • Assess different time scales

Used by:
  • The U.S (National Drought Mitigation Centre)
  • Asia (such as India)
  • Europe (European Drought Centre)
SPI and Drought in Kampong Speu Province

SPI one month period


Months: June, August, November
SPI and Drought in Kampong Speu Province

SPI three month period for November

![Graph showing SPI values from 1983 to 2010 with peaks in 1988, 1990, 1994, 2004, and 2006]
SPI and drought in Kampong Speu Province

Paddy rice and Cash crop field damages (in ha) by drought in KPS, 1994-2010
Software to Run SPI

- SPI runs in C language at
  http://drought.unl.edu/MonitoringTools/DownloadableSPIProgram.aspx

- SPI runs in R language at
  http://cran.r-project.org/web/packages/SCI/

- World Meteorology Organization development manual for SPI run in C language at

- Meteorological Statistics can be found from:
Gamma function found to fit with meteorological data

\[ g(x) = \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1} e^{\frac{-x}{\beta}} \]

Where \( \beta \) is a scale parameter, \( \alpha \) is a shape parameter, and \( \Gamma(\alpha) \) is the ordinary gamma function of \( \alpha \).

\[ \hat{\alpha} = \frac{1}{4A} \left( 1 + \sqrt{1 + \frac{4A}{3}} \right) \]

And \( \hat{\beta} = \frac{\hat{x}}{\hat{\alpha}} \) where \( A = \ln\bar{x} - \frac{\sum \ln x}{n} \)
Let Monitor Drought

With proper data recording, drought can be monitored and possibly avoided by using Standardized Precipitation Index.

Thank You!