


Pacific RISA

# Pacific Possessions: The Challenges of Drought on the Islands


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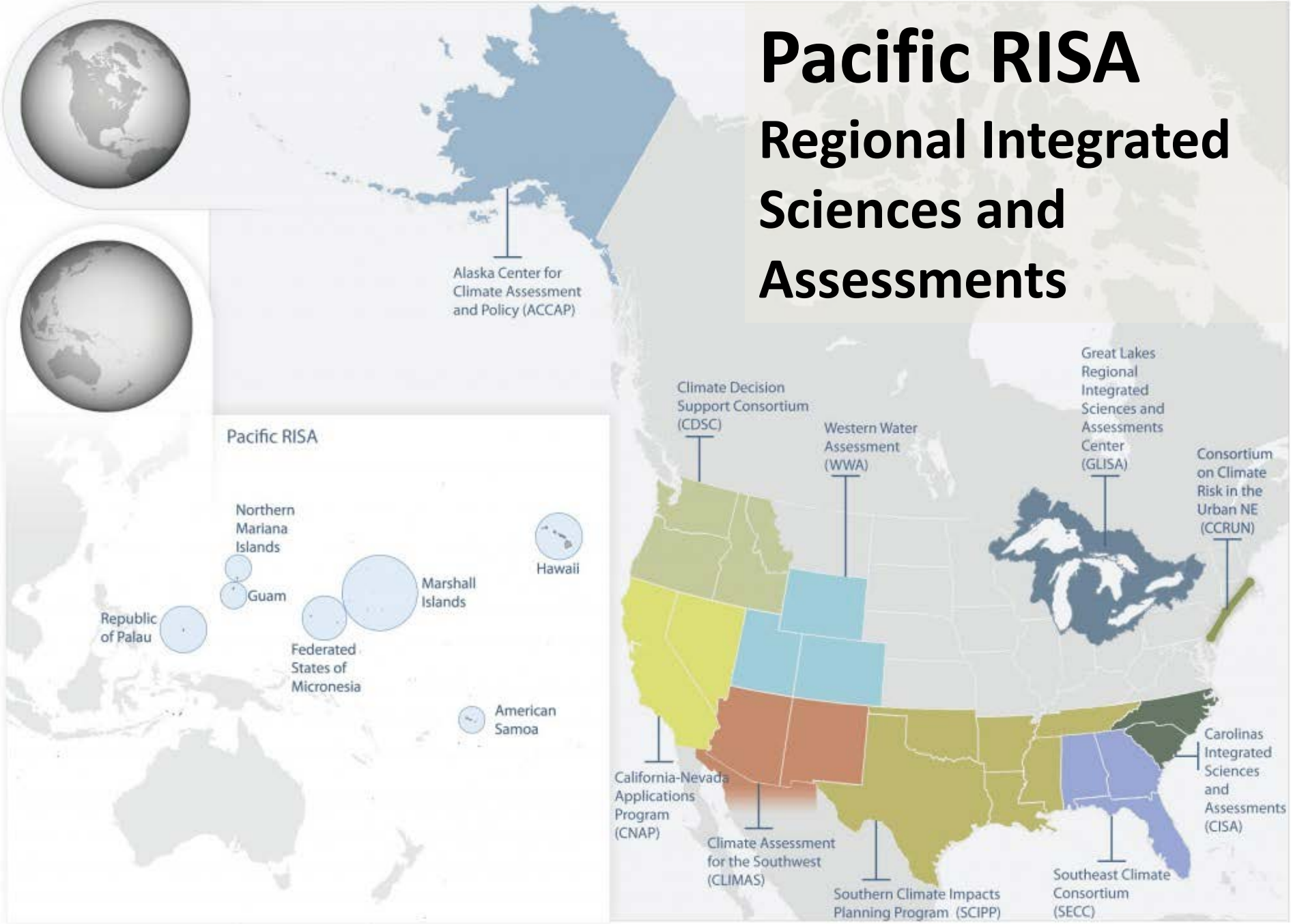
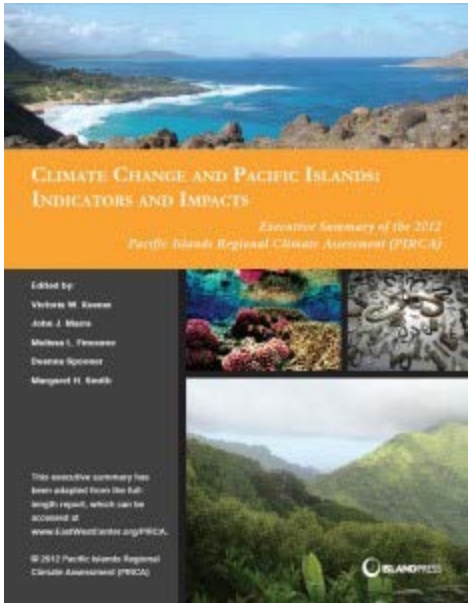
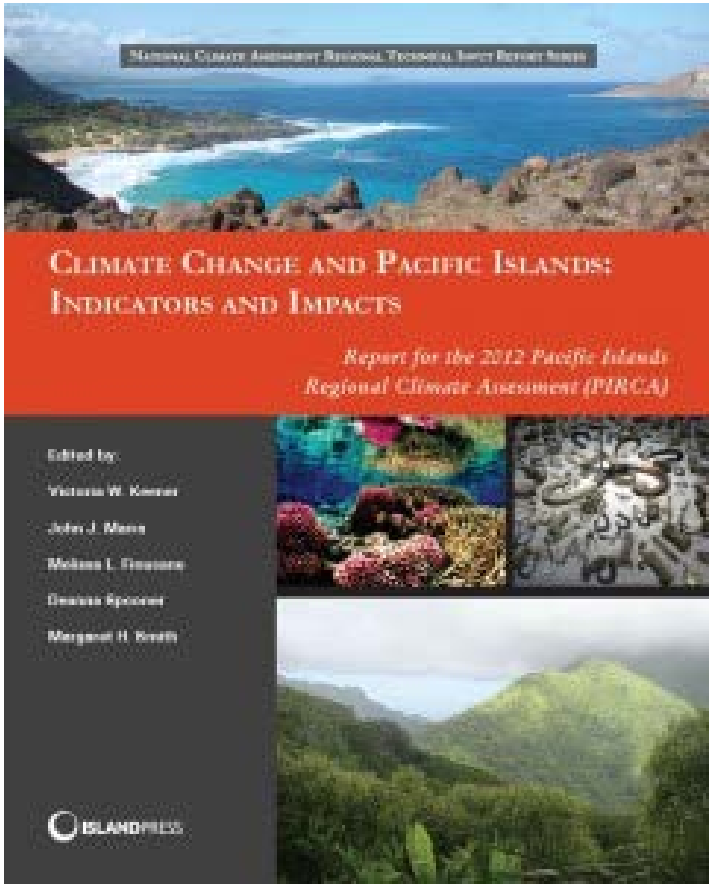
# Pacific RISA

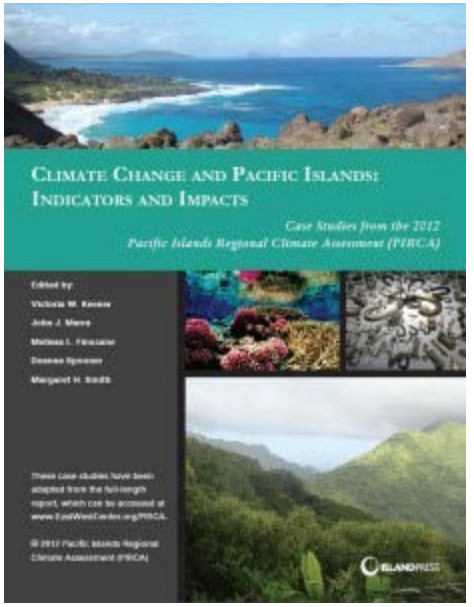
## Regional Integrated Sciences and Assessments



# Pacific Islands Regional Climate Assessment (PIRCA)




http://www.pacificrisa.org/projects/pirca/report-materials

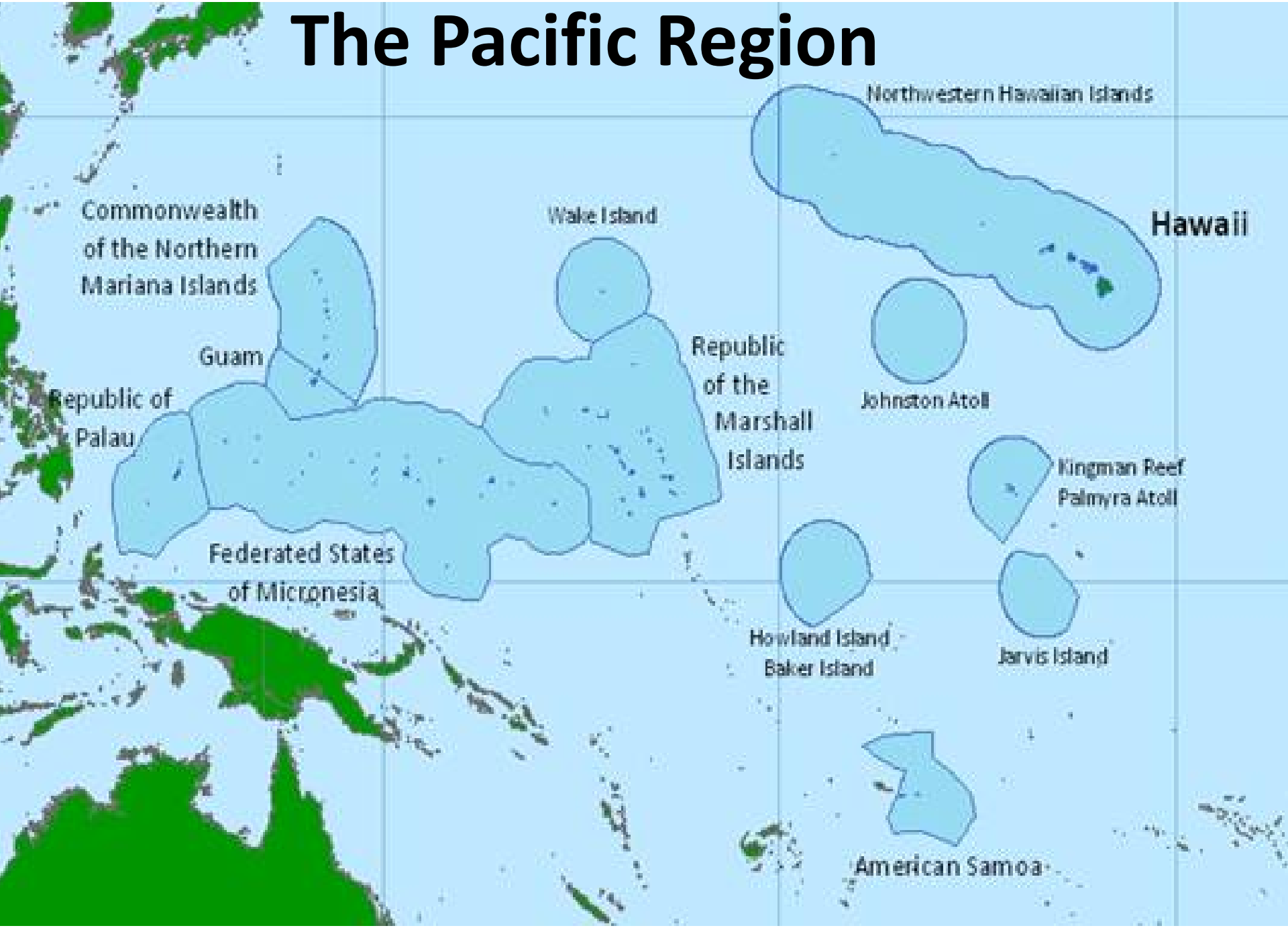
The MISSION of the **Pacific ENSO Applications Climate Center** is to conduct research and develop information products specific to the USAPI on the ENSO climate cycle, its historical impacts, and latest long-term forecasts of ENSO conditions, in support of planning and management activities in such climate-sensitive sectors as water resource management, fisheries, agriculture, civil defense, public utilities, coastal zone management, and other economic and environmental sectors of importance to the communities of the USAPI.

# PEAC's Main Collaborators

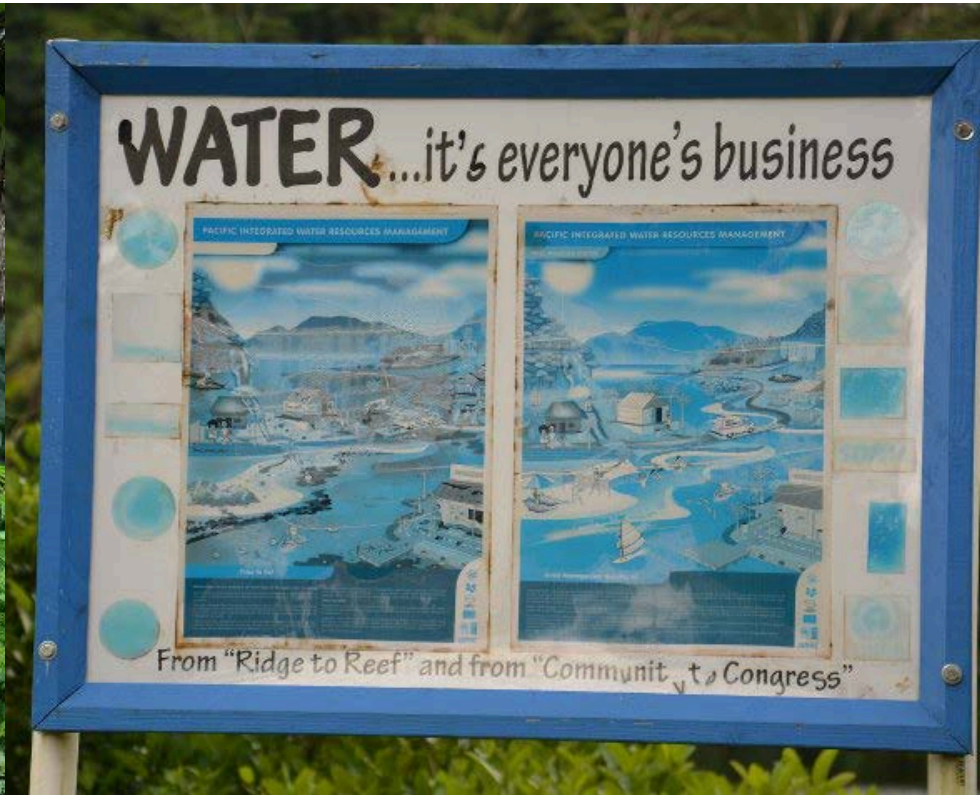
The National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS) Pacific Region, the University of Hawai'i – JIMAR, and the University of Guam – Water and Environmental Research Instituted (UOG/WERI).

Additional Partnerships: NOAA Climate Program Offices (NOAA/CPO), the NOAA Climate Prediction Center (NOAA/CPC), and the International Research Institute for Climate and Society at Columbia University (IRI)

# The Pacific Region



PEAC Center affects the livelihoods of more than two million people, speaking fourteen different languages, spread out over ten million square miles in Hawai‘i and the US Affiliate Pacific Islands (USAPI).

# PEAC's Monthly Conference Calls

- PEAC-sponsored call in an hour-long workshop format
- WSO from each of the island communities is invited to attend to discuss:
  - PEAC forecasts (sea-level, rainfall, tropical cyclone, etc.)
  - Issues related to past, present, and future climatic conditions

CONSENSUS FORECAST:

- Based on observations provided by the WSO representatives
- Rainfall, sea-level, and tropical cyclone forecasts for each zone
- Forecasts expressed as probabilities of occurrence


- Quarterly Newsletter
- Sea-level, rainfall summaries and forecasts for American Samoa, CNMI, FSM, Guam, Hawai‘i, Palau, and RMI
- Special section in each issue discusses tropical cyclone outlook, SOI, SST and sea-level forecasts
- Published every 3 months (with special bulletins issued as needed)
- About 500 hardcopies are mailed worldwide
- Electronic versions of the newsletter are available at http://www.prh.noaa.gov/peac/

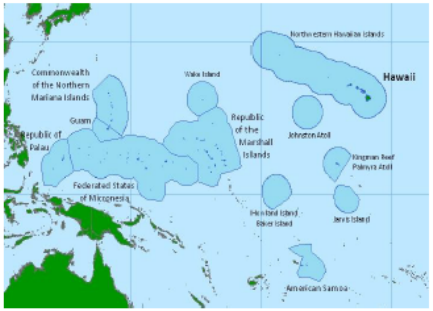
# Climate Impacts and Outlooks

## Climate Impacts and Outlook

## Hawaii and U.S. Pacific Islands Region

*1st Quarter 2013*

## Significant Events and Impacts for 4th Quarter 2012




*The U.S.-Affiliated Pacific Islands.*
*Shading indicates each Island's Exclusive Economic Zone (EEZ).*

Hawaii and Northwestern Hawaiian Islands – Drought persisted through the rainy season, with extreme drought on leeward areas of Maui, Lanai, Molokai and the Big Island.

Guam/Commonwealth of the Northern Mariana Islands (CNMI) – Large 20' waves hit the island this December, along with numerous fast-moving, trade-wind showers.

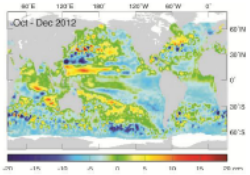
Republic of the Marshall Islands (RMI) – Lower than normal rainfall has reduced reservoirs on Majuro, while Kwajalein was wetter than normal.

Federated States of Micronesia (FSM) – Strong trade winds downed banana trees in December, but no inundation was reported.

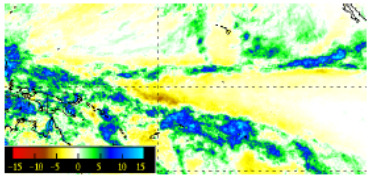
Republic of Palau – Super Typhoon Bopha impacted Palau with high winds, storm surge, and heavy rains, significantly damaging or destroying over 250 houses and displacing over 350 people.

American Samoa – Cyclone Evan struck the island in December with minimal damage. Rainfall was above normal. In neighboring island nations damage from Evan was significant.

## Regional Climate Overview for 4th Quarter 2012




*Seasonal Sea Surface Height (SSH) anomalies relative to the 1993-2012 baseline average. Source: www.aviso.oceanobs.com Courtesy M Merrifield.*




*30-day TRMM satellite estimated precipitation anomalies for January 2013. Source: http://trmm.gsfc.nasa.gov/*


*U.S. Drought Monitor – Drought Conditions in Hawaii. Source: http://droughtmonitor.unl.edu*

**ENSO-neutral conditions continued in the Equatorial Pacific Region.** The monsoon trough was relatively weak during the period, with low latitudes of the western North Pacific were dominated by anomalous easterly winds. In contrast, the Australian Northwest Monsoon was quite active, with some winds breaking containment of the South Pacific Convergence Zone (SPCZ) which resulted in the development of many tropical cyclones near American Samoa.

*Sea surface temperature (SST)* anomalies trended down across much of the Pacific Ocean. This relative cooling was consistent with a strengthening of *the Trade Winds* across the east-central Pacific. This resulted in a relative minimum in *sea-surface heights* over the eastern Pacific, and above normal heights across the far western Pacific. *Sea level* this quarter was 3-6 inches higher than normal.

*Rainfall* throughout much of the region was close to normal. In Hawaii, rainfall was below-normal in many areas of the state. In Guam and the CNMI, rainfall was near-normal. In the RMI, rainfall was below-normal. In the FSM, rainfall was above-normal in Chuuk, below-normal in Kosrae, near-normal in Pohnpei, and near-normal in Yap. In Palau, rainfall was near-normal. In American Samoa, rainfall was above-normal.

*Drought* conditions continued and worsened a bit over the Hawaiian Archipelago. By late January, over 71% of the state of Hawaii was abnormally dry or in drought. Drought in Majuro worsened during the quarter. Improvement over the leeward areas is expected toward the end of the rainy season.

*Tropical Cyclone* activity for November-January in the western North Pacific and southwest Pacific was near normal. The activity in the western North Pacific was displaced to the west and north of average, giving Micronesia another well-below normal typhoon season.



## Regional Impacts for 4th Quarter 2012

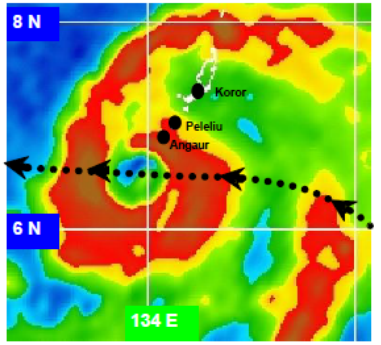
***Agriculture and Husbandry***
The Counties of Maui and Hawaii have been declared disaster areas due to prolonged drought.

***Water Resources***
As of mid-January 2013, the Majuro, RMI reservoir contained 9.947 million gallons of water, or less than one-third capacity. Strong water conservation measures will be needed.

***Facilities and Infrastructure***
A few of the villages on the eastern side of the island of Babeldaob, Palau were hit extremely hard by sea inundation from Bopha . An Initial damage assessment of 666 residences in 6 affected states found 112 houses completely destroyed and 136 houses with major damages.

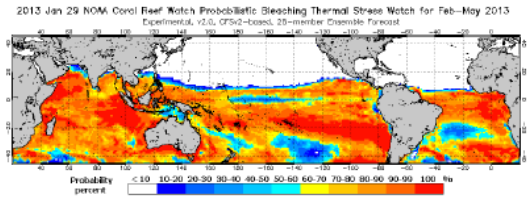
***Recreation and Tourism***
On Maui, Hawaii, the season-opening Tournament of Champions of the Professional Golf Association was postponed for two straight days in early January because of gusts that topped 40 mph and made it impossible to play.

***Fisheries***
A cold core ocean eddy developed off of Oahu, Hawaii. The eddy was associated with upwelling of deep, cold and nutrient-rich water.




*TRMM satellite image of Typhoon Bopha as it passed to the south of Palau on the night of December 02, 2012. This image shows the cloud structure in the 85 GHz band of the microwave spectrum. The track of the eye is indicated by the dotted black line with arrows. Courtesy of the U.S. Naval Research Laboratory, Monterey, CA.*

## Regional Outlook for 2nd Quarter 2013 (February-April)




*Bleaching Thermal Stress Outlook, Feb-May 2013. Source: http://coralreefwatch.noaa.gov/*

**ENSO Neutral conditions expected to continue.**

Due to the trend of increasing *SSTs*, a coral bleaching watch exists across much of the west Pacific and portions of the south central Pacific . Portions of the equatorial central Pacific have greater than 70% chance of seeing coral stress during the next three months.

The forecasts values of sea level for the 2nd quarter indicate that most of the stations in the north Pacific region are likely to be about 1-3 inches higher than normal. American Samoa is likely to be about 3-4 inches higher than normal , and in Hawaii, both Honolulu and Hilo are likely to be closer to normal.

There is an increased potential for heavy rain events through early spring in Hawaii as ENSO neutral conditions dominate. As a result, drought conditions may abate somewhat, especially over the leeward areas. The northwest Australia monsoon and developing tropical storms should bring continued rains to American Samoa. In the FSM, rainfall is anticipated to be above-normal in Kosrae, near-normal in Pohnpei, near- to below-normal in Majuro, and near-normal in Yap. In Palau, rainfall is expected to be near- to above-normal.

Tropical cyclone activity is expected to be near-normal.

## Regional Partners

Pacific ENSO Applications Climate Center:
http://www.prh.noaa.gov/peac/

NOAA NWS Weather Forecast Office Honolulu:
http://www.prh.noaa.gov/pr/hnl/

NOAA NWS Weather Forecast Office Guam:
http://www.prh.noaa.gov/pr/guam/

NOAA NESDIS National Climatic Data Center:
http://www.ncdc.noaa.gov/sotc/

NOAA NMFS Pacific Island Fisheries Science Center: http://www.pifsc.noaa.gov/

NOAA OceanWatch - Central Pacific:
http://oceanwatch.pifsc.noaa.gov/

NOAA Coral Reef Watch:
http://coralreefwatch.noaa.gov/

USGS Pacific Islands Water Science Center:
http://hi.water.usgs.gov/

University of Hawaii - Joint Institute of Marine and Atmospheric Research:
http://www.soest.hawaii.edu/jimar/

University of Guam - Water and Environmental Research Institute:
http://www.weriguam.org/

# Defining Drought in the Pacific Region

- There are a number of island-specific impacts that could potentially be used as indices of drought associated with the ENSO cycle.
  - E.g., food and water security
- Despite a clear understanding of ENSO impacts on the islands, especially in relation to drought impacts, there remain only a few drought indices available in the Pacific.


# **High Islands** vs. Low Islands

- The higher islands typically have stream flow, aquifers, and catchments to meet water needs.
- Rainclouds gather at mountain peaks.
- Watersheds run from the upland ecosystems down to coastal areas.
- During droughts, the uplands suffer from lack of moisture from the cloud cover and stream flow diminishes. Water stores in the aquifers and catchment tanks dwindle.

# High Islands vs. **Low Islands**

- On the lower islands, there is no stream flow, and aquifers – if they exist – are small and brackish.
- Catchments become the sole source of water supply.
- There are only two reservoirs in the USAPI used for drinking water, located in Guam and Palau.

# Challenges of drought monitoring in the Pacific

Drought is defined differently in the USAPI than the mainland

- Atolls lacking streams
- Very little agriculture

# Challenges of drought monitoring in the Pacific

- Need for clearly defined objective as well as subjective indicators specific to each group of islands.
- Without quantifiable data, the USDM in the Pacific Islands will not be significant.
  - Note: we do have SPI established for most of the islands in our network.

# Challenges of drought monitoring in the Pacific

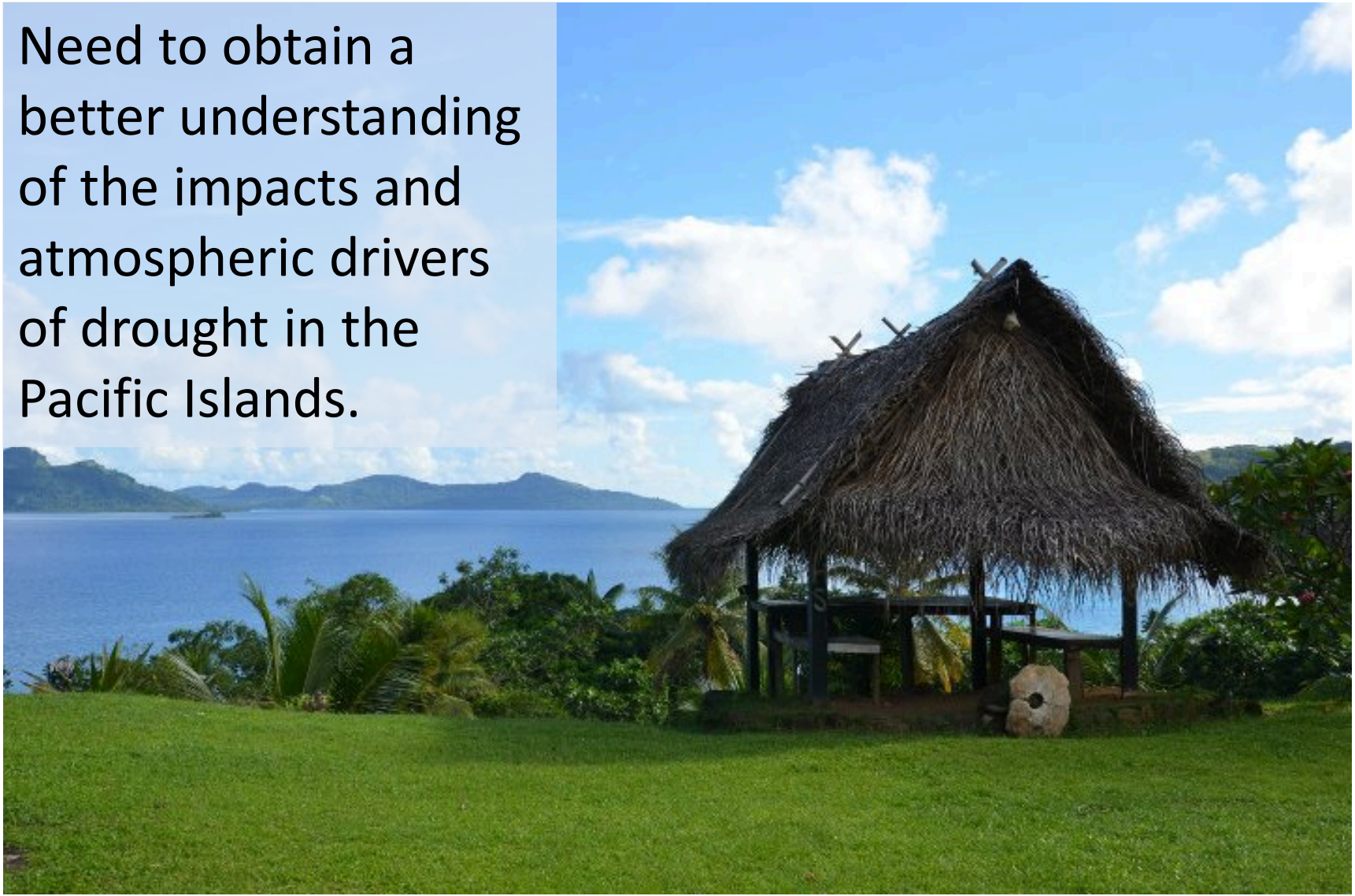
Weather extremes are more frequent, more destructive, and more relevant in the changing climate.

# Challenges of drought monitoring in the Pacific

In Kosrae, 1997 was the wettest year on record, while the following year in 1998 was the driest.

# Challenges of drought monitoring in the Pacific

Need to obtain a better understanding of the impacts and atmospheric drivers of drought in the Pacific Islands.



# Challenges of drought monitoring in the Pacific

- Although a meteorological drought is over when rains finally arrive, an island community's food sources can take 8-10 months more to recover.
- Additionally, heavy rains due to a tropical storm system may dump a large amount of rain at one time, but may not necessarily end a drought.

# Challenges of drought monitoring in the Pacific

Real time data is limited in many of the USAPI.

- Insufficient data monitoring stations
- Logistical issues in very remote areas—travel and technology
- Turnover and replacement of employees with long training periods affects information distribution
- Language and cultural diversity in communication

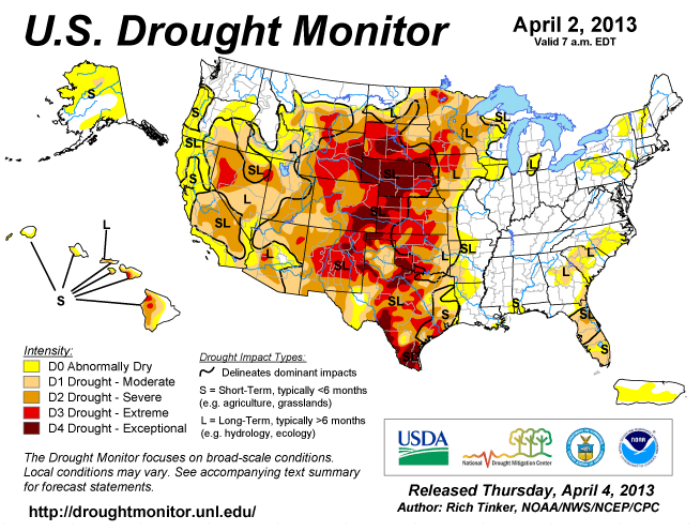
# Experimental drought monitoring in the Pacific

| | | |
|---|---|---|
| Procedure: | 1. Is monthly rainfall this month and last couple months > or = minimum sufficient rainfall amount? If <. then go to 2. | |
| | 2. examine SPI & percent normal precip for current & multi-months (in light of seasonality of precip); if anomalies wet, no drought; if dry, then go to 3 & 4: | |
| | 3. examine other special island-based rules | |
| | 4. check for impacts reports | |

| | | | NWS: | |
|---|---|---|---|---|
| D0: | Abnormally Dry | SPI: -0.5 to -0.9 | | |
| D1: | Drought - Moderate | SPI: -1.0 to -1.2 | SPS | may be issued |
| D2: | Drought - Severe | SPI: -1.3 to -1.5 | DGT | issued |
| D3: | Drought - Extreme | SPI: -1.6 to -1.9 | DGT | in effect |
| D4: | Drought - Exceptional | SPI: -2.0 or less | DGT | in effect |
| S: | Short-term impacts, typically < 4 months (e.g., 3 consecutive months with < 2" rain) (e.g. agriculture, grasslands) | | | |
| L: | Long-term impacts, typically > 4 months (e.g., hydrology, ecology) (but hydrological impacts can occur < 4 months, e.g., no catchment, no groundwater recharge, & lowering of sea levels due to El Nino) | | | |

**SAMPLE / EXPERIMENTAL**

| hi/lo island | Pacific Island | Drought Status | | Reasoning: (Conditions at the end of the month: March 31, 2013) |
|---|---|---|---|---|
| high | Koror | D0 | was D-none | dry season ... Mar pcp < 8" (4.13"); 4 of last 5 months< 8" & < 100% of normal; SPI < -0.5 for -MO thru 18-MO |
| high | Yap | D0 | D-none?? | dry season ... **DGT but rainfall sufficient** Mar pcp < 8" (5.95"); last 3 months each < 6"; but this is dry season so % of normal > 100% & SPI positive (not < -0.5). (From Chip last month: For March -- D-none is OK. [regional rain is beginning to increase and reservoir on Yap island is fine.]) **But I still think D0 to reflect meteorological dryness (D0 = Abnormally Dry). April dry so far (http://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/sn91413_30.gif).** |
| high | Guam | D1-S | was D1 | dry season ... Mar pcp < 8" & < 4" (3.95"); this is dry season, but each of last 5 months < 8" & three < 4", but SPI not < -0.5; however, impacts occurring in Guam in Feb -- fires, trees defoliating, grass turning brown. Not much rain thus far April (http://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/sn91212_30.gif) |
| high | Saipan | D1-S | was D1 | dry season ... Mar pcp < 8" & < 4" (2.40"); each of last 5 months < 8" and four < 4", but this is dry season & SPI not < -0.5 |
| high | Chuuk | D-Nothing | | dry season ... Mar pcp > 8" (16.00") -- Chuuk is okay **but northern and western islands have concern.** (2+" rain Truk so far in Apr ... http://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/sn91334_30.gif) |
| low | Lukonor | D-Nothing | | dry season ... Mar pcp > 8" (11.34") |
| low | Kapingamarangi | D-Nothing | | Mar pcp > 8" (22.79") |
| high | Pohnpei | D-Nothing | D0 ??? | dry season ... Mar pcp > 8" (8.78"); Feb < 8" (5.14") but 11 of last 12 months each > 8"; SPI < -0.5 all time periods from 1-MO thru 24-MO, and < -1.0 most time periods |
| high | Kosrae | D-Nothing | | Mar pcp > 8" (10.20") |
| low | Kwajalein | D2-S | was D1 | dry season ... DGT Mar pcp < 8" (1.73") & DGT in effect; Jan, Feb, Mar very dry, 1-MO SPI = -0.63 (D0), SPI < -1.0 for 2- & 3- & 6-MO and < -0.5 for 12- & 18- & 24-MO; 3-MO SPI = -1.44 (D2). **Some other northern atolls are D2.** US Army Kwajalein Atoll wants Kwajalein mentioned in DGT?? |
| low | Majuro | D0 | | dry season ... **DGT but improving** Mar pcp < 8" (5.13") & 78% of normal; SPI > -0.5 at 1- & 2- & 3-MO but < -0.5 at 6-MO & < -1.0 at 12- to 24-MO; catchments/reservoir OK (reservoir > half full). **But monitor due to its large population.** |
| high | Pago Pago | D-Nothing | | Mar pcp > 8" (9.97") |



# Standardized Precipitation Index
# Micronesia and Samoa data

Current -1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11

SELECTED PACIFIC ISLANDS STANDARDIZED PRECIPITATION INDEX (SPI) SUMMARY
NATIONAL WEATHER SERVICE HONOLULU HI
DATA THROUGH THE END OF MAR 2013

SPI VALUES BASED ON PROVISIONAL COOPERATIVE OBSERVER AND TELEMETERED RAINFALL DATA FROM SELECTED PACIFIC ISLANDS.

NOTE: THIS SUMMARY WAS DEVELOPED AND PRODUCED IN SUPPORT OF RAINFALL MONITORING REQUIREMENTS. THE SPI PROVIDES A NORMALIZED VIEW OF MONTHLY RAINFALL. FOR MORE INFORMATION ON THE SPI AND THE PRODUCTION OF THIS SUMMARY, PLEASE SEE THE SPI INFORMATION PAGE.

| SPI CATEGORIES ARE AS FOLLOWS: | |
|---|---|
| 2.00 AND GREATER | EXTREMELY WET |
| 1.50 TO 1.99 | VERY WET |
| 1.00 TO 1.49 | MODERATELY WET |
| 0.99 TO -0.99 | NEAR NORMAL |
| -1.00 TO -1.49 | MODERATELY DRY |
| -1.50 TO -1.99 | VERY DRY |
| -2.00 AND LESS | EXTREMELY DRY |
| -99.00 | MISSING DATA |

| STATION | 1-MO | 2-MO | 3-MO | 6-MO | 12-MO | 18-MO | 24-MO |
|---|---|---|---|---|---|---|---|
| WSO CHUUK | 1.20 | 1.20 | 1.01 | 1.01 | 1.30 | 1.30 | 1.63 |
| WFO GUAM | 0.74 | 0.34 | 0.39 | -0.48 | 0.46 | 0.49 | 0.86 |
| WSO KOROR | -0.99 | -0.54 | -0.71 | -1.17 | -0.88 | -1.21 | 1.01 |
| WSO MAJURO | -0.31 | 0.22 | -0.32 | -0.70 | -1.66 | -1.12 | -1.16 |
| WSO PAGO PAGO | -0.14 | -0.39 | 0.13 | 0.44 | 0.32 | 0.24 | -0.50 |
| WSO POHNPEI | -0.75 | -1.07 | -0.90 | -1.04 | -1.93 | -1.38 | -1.56 |
| WSO YAP | 0.23 | 0.23 | -0.05 | 0.33 | 0.96 | 0.66 | 1.44 |
| SAIPAN AP | 0.14 | -0.24 | 0.23 | 0.39 | 0.26 | 0.17 | 0.15 |
| KWAJALEIN | -0.63 | -1.14 | -1.44 | -1.05 | -0.99 | -0.78 | -0.68 |
| KOSRAE AP | -0.65 | 0.07 | 0.05 | 0.07 | 0.12 | 0.33 | 0.55 |
| LUKUNOR | 0.17 | 0.34 | -0.04 | -0.18 | -0.30 | 0.38 | 0.99 |

On other Pacific Islands (maps — Micronesia, Marshall Islands, basinwide), March was drier than normal at Majuro and Pago Pago, and much drier than normal at Koror, Pohnpei, Kosrae, and Kwajalein. March rainfall amounts were below 4 inches at Kwajalein, Saipan, and Guam and below 8 inches at Koror, Yap, and Majuro. (This is the dry season for several of these stations, so even low rainfall amounts may show up as high percent of normals [for example, Saipan, Guam, Yap].) Majuro has been below normal for 9 of the last 12 months, Kwajalein and Pohnpei for 8 of the last 12 months. Twelve-month rainfall totals (April 2012-March 2013) for Koror, Kwajalein, Majuro, and Pohnpei are below normal.

According to NWS reports, parts of the northern Marshall Islands have become critically dry and parts of Yap state have become very dry during March and into early April. Serious drought conditions are occurring for atolls of the Marshall Islands north of Majuro, including Ebeye, Enewetak, Wotje, Ujae, Maloelap, Wotho, Utirik and other islands and atolls north of 8 degrees north. Conditions have improved somewhat across Chuuk state and from Majuro southward, and drought conditions are no longer expected there.

Impacts: On Majuro, dry-season type rain showers have recently helped water conditions, increasing the Majuro reservoir to a little over half full with 18.468 million gallons by early April. Despite the increased rainfall, water conservation measures are still recommended for the next month or so as week-long periods of dry weather are still possible. For atolls north of Majuro, stringent conservation measures are needed to avoid the depletion of wells and catchments. The mayor of Wotje indicates that the well-water on Wotje has become too salty to drink and that catchments are nearly empty. Water augmentation measures are urgently needed there.

Percent of Normal Precip | Precipitation | Normals

**Pacific Island Percent of 1981-2010 Normal Median Precipitation**

| Station Name | Apr 2012 | May 2012 | Jun 2012 | Jul 2012 | Aug 2012 | Sep 2012 | Oct 2012 | Nov 2012 | Dec 2012 | Jan 2013 | Feb 2013 | Mar 2013 | Apr 2012-Mar 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chuuk | 40% | 173% | 131% | 141% | 169% | 86% | 128% | 144% | 116% | 99% | 146% | 192% | 128% |
| Guam NAS | 121% | 224% | 107% | 66% | 179% | 126% | 92% | 74% | 55% | 128% | 97% | 191% | 118% |
| Kapingamarangi | 102% | 143% | 179% | 146% | 192% | 147% | 138% | 167% | 74% | 197% | 154% | 199% | 152% |
| Koror | 120% | 122% | 95% | 88% | 102% | 111% | 78% | 67% | 103% | 72% | 92% | 56% | 93% |
| Kosrae | 84% | 86% | 99% | 124% | 144% | 109% | 113% | 119% | 110% | 98% | 146% | 64% | 106% |
| Kwajalein | 68% | 161% | 117% | 120% | 95% | 57% | 73% | 45% | 230% | 39% | 17% | 74% | 94% |
| Lukonor | 76% | 106% | 125% | 82% | 73% | 148% | 74% | 178% | 62% | 60% | 134% | 122% | 101% |
| Majuro | 97% | 59% | 81% | 68% | 87% | 67% | 46% | 154% | 53% | 31% | 152% | 78% | 81% |
| Pago Pago | 90% | 126% | 115% | 105% | 59% | 195% | 54% | 181% | 143% | 137% | 87% | 93% | 117% |
| Pohnpei | 45% | 115% | 100% | 92% | 96% | 90% | 82% | 109% | 71% | 83% | 54% | 67% | 85% |
| Saipan | 33% | 166% | 118% | 77% | 135% | 101% | 172% | 31% | 89% | 191% | 78% | 127% | 113% |
| Yap | 89% | 142% | 99% | 84% | 128% | 187% | 140% | 121% | 102% | 90% | 113% | 130% | 121% |

Percent of Normal Precip | Precipitation | Normals

## Pacific Island Precipitation (Inches)

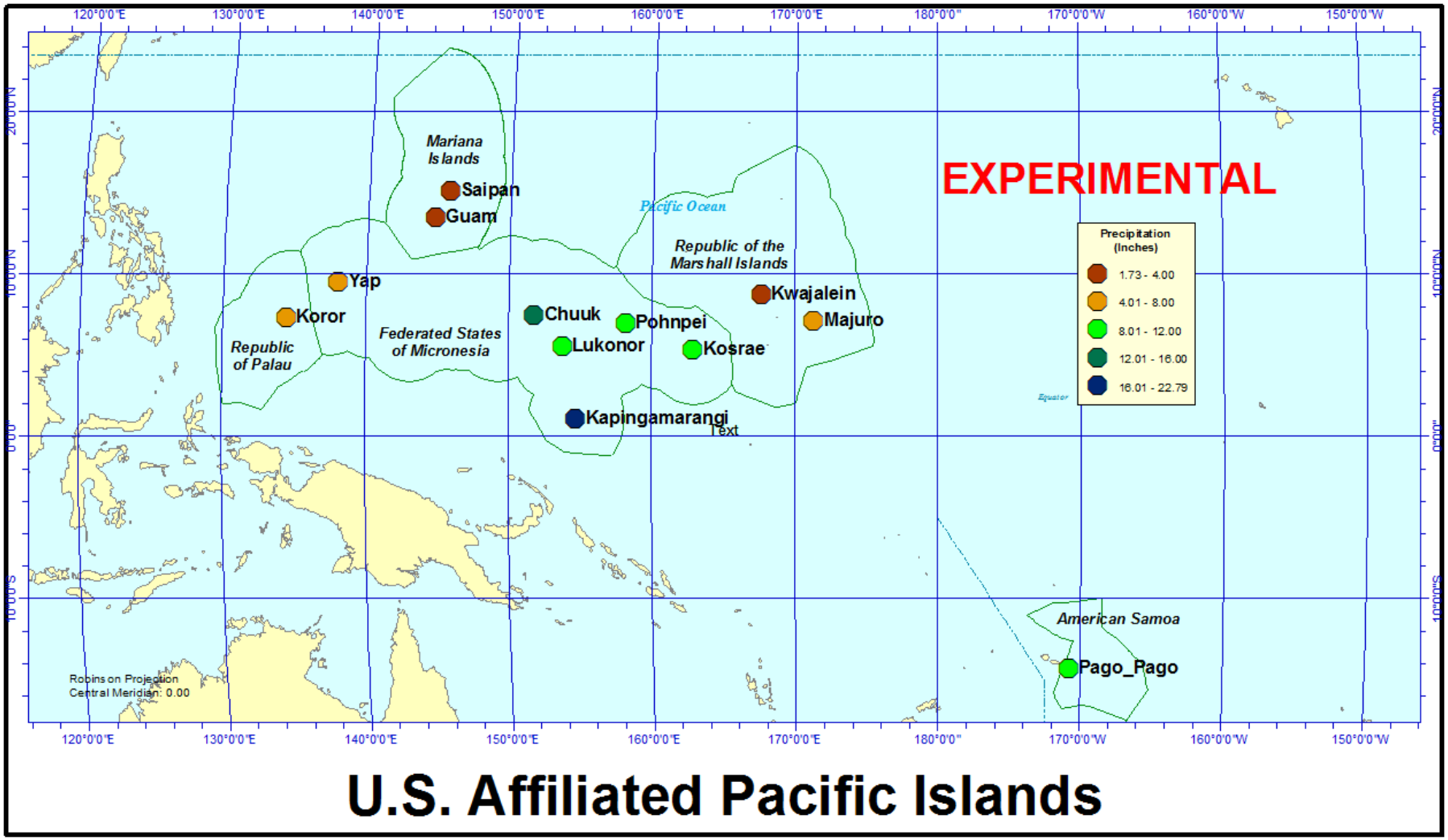
| Station Name | Apr 2012 | May 2012 | Jun 2012 | Jul 2012 | Aug 2012 | Sep 2012 | Oct 2012 | Nov 2012 | Dec 2012 | Jan 2013 | Feb 2013 | Mar 2013 | Apr 2012-Mar 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chuuk | 5.02 | 19.56 | 15.27 | 16.92 | 21.78 | 10.04 | 14.68 | 15.30 | 13.09 | 10.00 | 10.60 | 16.00 | 168.26 |
| Guam NAS | 3.05 | 7.63 | 6.63 | 6.74 | 26.42 | 15.98 | 10.56 | 5.45 | 2.81 | 5.12 | 2.95 | 3.95 | 97.29 |
| Kapingamarangi | 13.91 | 17.24 | 24.68 | 20.65 | 15.57 | 14.56 | 11.32 | 15.44 | 7.25 | 18.02 | 14.25 | 22.79 | 195.68 |
| Koror | 8.79 | 14.49 | 16.54 | 16.36 | 13.72 | 13.01 | 9.23 | 7.68 | 11.52 | 7.29 | 7.91 | 4.13 | 130.67 |
| Kosrae | 14.70 | 15.35 | 14.56 | 18.55 | 20.46 | 15.52 | 12.33 | 16.49 | 17.75 | 16.27 | 18.89 | 10.20 | 191.07 |
| Kwajalein | 3.58 | 10.82 | 8.08 | 11.83 | 9.23 | 6.17 | 8.18 | 5.09 | 15.33 | 1.22 | 0.46 | 1.73 | 81.72 |
| Lukonor | 8.60 | 12.35 | 14.53 | 13.08 | 10.26 | 15.02 | 8.39 | 16.18 | 7.00 | 5.05 | 11.93 | 11.34 | 133.73 |
| Majuro | 9.14 | 5.96 | 8.89 | 7.54 | 10.15 | 7.47 | 5.84 | 20.69 | 6.09 | 2.42 | 10.44 | 5.13 | 99.76 |
| Pago Pago | 8.41 | 12.15 | 6.13 | 5.84 | 3.19 | 12.73 | 4.99 | 18.34 | 18.31 | 18.27 | 10.48 | 9.97 | 128.81 |
| Pohnpei | 8.31 | 22.98 | 14.86 | 14.21 | 13.62 | 11.27 | 12.59 | 16.18 | 11.37 | 10.88 | 5.14 | 8.78 | 150.19 |
| Saipan | 0.88 | 3.96 | 4.26 | 6.86 | 17.73 | 10.24 | 18.31 | 1.75 | 3.44 | 4.83 | 2.03 | 2.40 | 76.69 |
| Yap | 5.00 | 11.14 | 11.95 | 12.74 | 18.92 | 25.19 | 17.08 | 10.67 | 8.68 | 5.72 | 5.86 | 5.95 | 138.9 |

Percent of Normal Precip | Precipitation | Normals

## Pacific Island 1981-2010 Normal Median Precipitation (Inches)

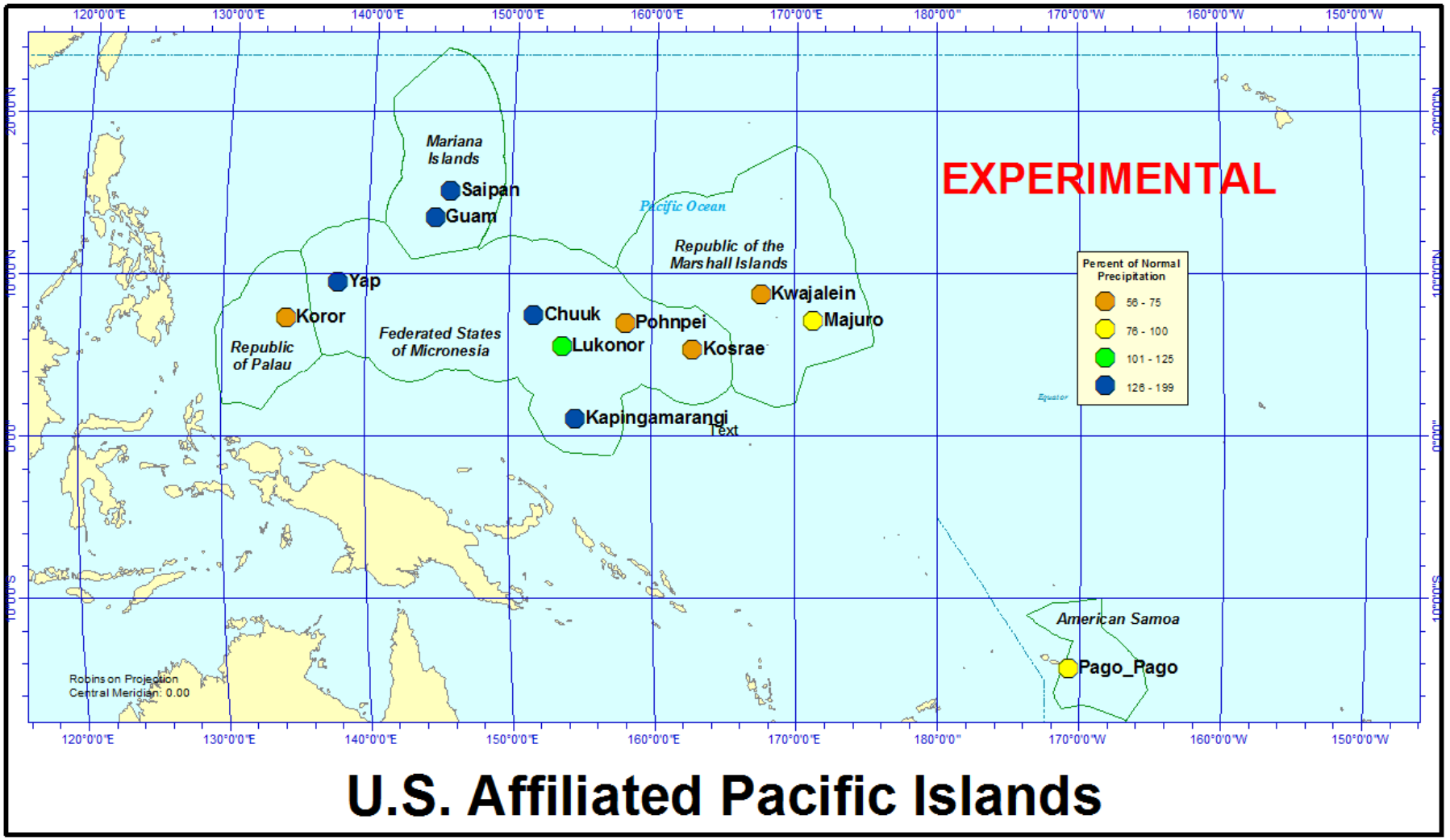
| Station Name | Apr 2012 | May 2012 | Jun 2012 | Jul 2012 | Aug 2012 | Sep 2012 | Oct 2012 | Nov 2012 | Dec 2012 | Jan 2013 | Feb 2013 | Mar 2013 | Apr 2012-Mar 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chuuk | 12.47 | 11.30 | 11.66 | 11.98 | 12.86 | 11.71 | 11.51 | 10.61 | 11.25 | 10.10 | 7.25 | 8.32 | 131.02 |
| Guam NAS | 2.53 | 3.40 | 6.18 | 10.14 | 14.74 | 12.66 | 11.44 | 7.38 | 5.11 | 4.01 | 3.03 | 2.07 | 82.69 |
| Kapingamarangi | 13.64 | 12.08 | 13.78 | 14.15 | 8.13 | 9.93 | 8.19 | 9.27 | 9.84 | 9.15 | 9.27 | 11.43 | 128.86 |
| Koror | 7.32 | 11.83 | 17.48 | 18.53 | 13.50 | 11.77 | 11.84 | 11.39 | 11.16 | 10.18 | 8.56 | 7.44 | 141 |
| Kosrae | 17.51 | 17.75 | 14.64 | 14.91 | 14.22 | 14.22 | 10.94 | 13.83 | 16.11 | 16.67 | 12.93 | 16.06 | 179.79 |
| Kwajalein | 5.26 | 6.72 | 6.93 | 9.87 | 9.74 | 10.74 | 11.18 | 11.28 | 6.66 | 3.16 | 2.64 | 2.35 | 86.53 |
| Lukonor | 11.31 | 11.69 | 11.65 | 15.93 | 14.04 | 10.15 | 11.32 | 9.08 | 11.27 | 8.41 | 8.93 | 9.26 | 133.04 |
| Majuro | 9.42 | 10.11 | 11.01 | 11.17 | 11.69 | 11.17 | 12.73 | 13.44 | 11.39 | 7.74 | 6.88 | 6.58 | 123.33 |
| Pago Pago | 9.39 | 9.66 | 5.33 | 5.55 | 5.38 | 6.53 | 9.26 | 10.14 | 12.84 | 13.34 | 12.00 | 10.68 | 110.1 |
| Pohnpei | 18.41 | 19.96 | 14.81 | 15.43 | 14.26 | 12.55 | 15.27 | 14.83 | 16.08 | 13.18 | 9.55 | 13.17 | 177.5 |
| Saipan | 2.63 | 2.38 | 3.62 | 8.91 | 13.13 | 10.09 | 10.62 | 5.61 | 3.85 | 2.53 | 2.59 | 1.89 | 67.85 |
| Yap | 5.63 | 7.85 | 12.04 | 15.08 | 14.82 | 13.50 | 12.18 | 8.83 | 8.51 | 6.39 | 5.19 | 4.56 | 114.58 |

# March 2013 Precipitation (Inches)



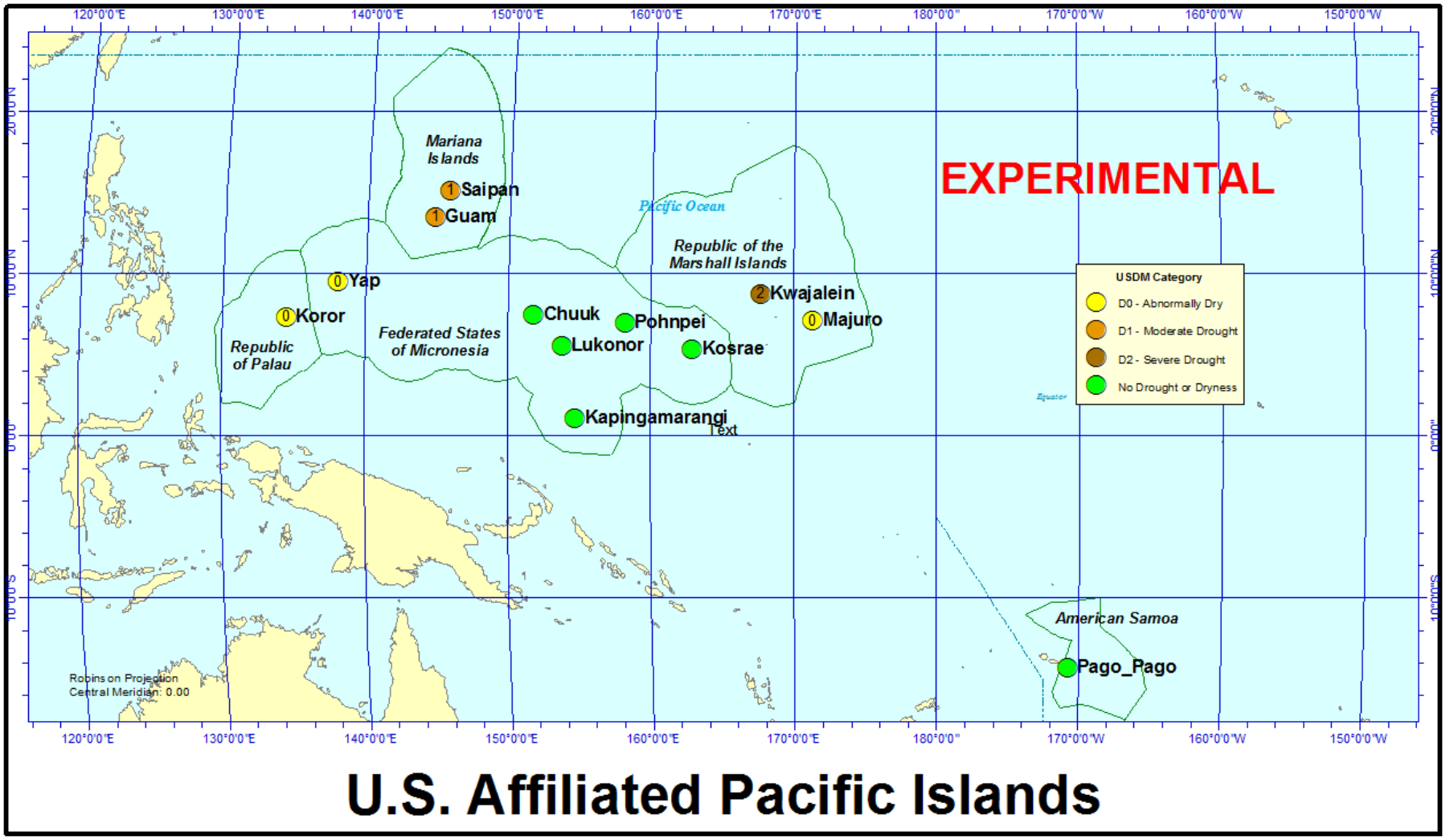

# U.S. Affiliated Pacific Islands

# March 2013 Precipitation (Percent of Normal)



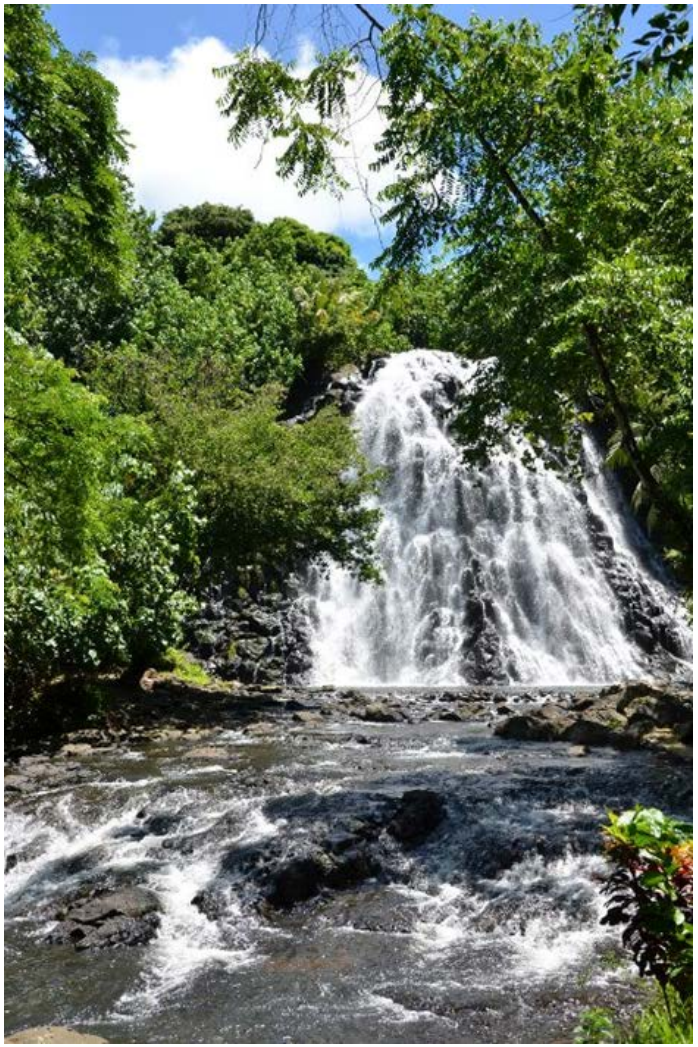

# U.S. Affiliated Pacific Islands

# March 2013 U.S. Drought Monitor Classification




# U.S. Affiliated Pacific Islands

# Future of drought monitoring in the Pacific



Clearly define objective and subjective indicators and impacts for each island community.

Include number of days since last X" rainfall for each island community.

# Future of drought monitoring in the Pacific

Transition monthly climate information sharing can transition to weekly information sharing to work with the USDM established drought monitoring system. Automate daily precipitation.

**Thank You!**

**Mahalo Nui Loa!**

**Fa'afetai Lava!**

**Kommol Tata!**

**Kinisou!**

**Kalahngan!**

**Kulo!**

**Kammagar!**

**Si Yu'us Ma'ase!**

**Ke Kmal Mesaul!**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