Cycad Aulacaspis Scale

Invasive Pest with Extinction Potential!

Photo: Anne Brooke, Guam National Wildlife Refuge

Jody Haynes

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General Cycad Information

Order: Cycadales

Families: Boweniaceae, Cycadaceae, Stangeriaceae, Zamiaceae

Extant species: 302 currently recognized

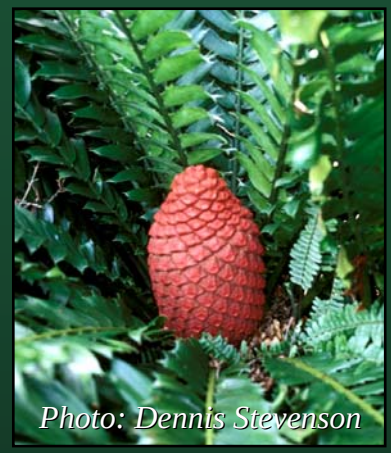


Photo: Dennis Stevenson

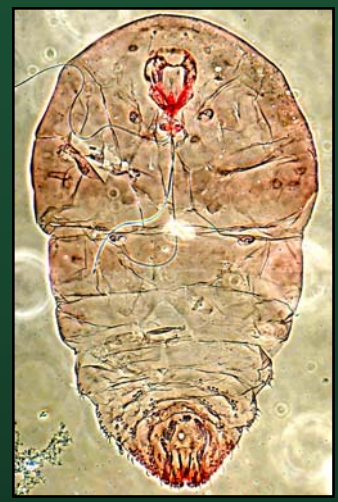
Distribution: Pantropical

Conservation status: Cycads represent one of the most threatened plant groups worldwide; >50% listed as threatened or endangered


Photo: Tom Broome


Photo: Mark Bonta

Aulacaspis yasumatsui Takagi


W. Tang, USDA-APHIS-PPQ

Order: Hemiptera/Homoptera

Family: Diaspididae

Common names:

Official cycad aulacaspis scale (CAS)

Other Asian cycad scale, Thai scale, snow scale

Native distribution: Andaman Islands to Vietnam, including Thailand and probably Cambodia, Laos, peninsular Malaysia, Myanmar, southernmost China, and possibly India

Invasive distribution:

United States proper Alabama, Florida, California, Georgia, Hawaii, Louisiana, South Carolina, Texas

Caribbean Cayman Islands, Puerto Rico, St. Kitts, U.S. Virgin Islands, Vieques

Other Costa Rica, Guam, Hong Kong, Singapore, Taiwan

Aulacaspis yasumatsui Takagi

Adult ♂ (L) and ♀ (R) scale insects

Eggs and adult ♀ w/ cover removed

Photos by W. Tang, USDA-APHIS-PPQ

Typical Damage

Time series of CAS-infested *Cycas revoluta* plant in Guam, showing reduction of leaf size and ultimate death.

Photos by Dr. Thomas Marler, University of Guam

Host Range

Family	Genus	Species	Geographic origin
Cycadaceae	*Cycas*	*media*	Australia & Papua New Guinea
		panzhihuaensis	China
		revoluta	Japan to Ryukyu Islands
		rumphii	India, Southeast Asia, Oceania
		seemannii	Oceania
		szechuanensis	China
		thouarsii	Africa
		wadei	Philippines
Zamiaceae	*Dioon*	*califanoi*	Mexico
		edule	Mexico
		merolae	Mexico
		rzedowskii	Mexico
		spinulosum (strobili only)	Mexico
		sonorense	Mexico
	Encephalartos	*barteri* (strobili only)	Africa
		ferox	Africa
		hildebrandtii	Africa
		manikensis	Africa
		pterogonus	Africa
		whitelockii	Africa
	Microcycas	*calocoma* (strobili only)	Cuba
Stangeriaceae	*Stangeria*	*eriopus*	Africa

Information from Weissling et al., *1999*

Host Range

Photo: Holly Glenn, UF-IFAS

Photo: Michael Calonje

Cycas revoluta

Host Range

Stangeria eriopus

Host Range

Family	Genus	Species	Geographic origin
Zamiaceae	*Ceratozamia*	*microstrobila*	Mexico
		miqueliana	Mexico
	Encephalartos	*gratus* (strobili primarily)	South Africa
		umbeluziensis (strobili primarily)	South Africa
Boweniaceae	*Bowenia*	*serrulata*	Australia

Personal observations at Montgomery Botanical Center, Miami, FL

Host Range

Ceratozamia microstrobila

Host Range

Encephalartos gratus

Host Range

Bowenia serrulata

Control Options

Control recommendations for CAS are diverse and variable in their effectiveness. They include the following:

1. Chemical
   - Dimethoate/oil
   - Imidicloprid
   - Pyriproxifen/dinotefuran

2. Physical/Cultural
   - Pressure washing
   - Removal of leaves
   - Sanitation

3. Biological
   - *Cybocephalus nipponicus*
   - *Coccobius fulvus*
   - *Rhyzobius lophanthae*

4. IPM

   Multi-pronged approach that combines many of the above, plus scouting

Independent Outbreaks

1. **Bogor Botanic Gardens, Java (late 1980s)**
   - Origin unknown; wiped out garden's entire *Cycas* collection
   - Unknown if CAS still persists in Java
   - Outbreak not publicized
   - No warning given to avoid future outbreaks

2. **Florida (1994/5)**
   - Originated from collected plants in Vietnam or China
   - Not caught by plant inspectors
   - Pest alerts and restrictions too slow to prevent spread
   - Quickly established and spread throughout Florida
   - Caused millions of dollars of damage to nursery industry
   - Later spread throughout Gulf coast—via chain stores—and onto several Caribbean islands and elsewhere on infected *Cycas revoluta* plants exported from Florida

Independent Outbreaks

3. **China (mid 1990s)**
   - Wholesale quantities of wild-collected *Cycas inermis* imported from southern Vietnam to two botanic gardens in China
   - Additional quantities planted as ornamentals for businesses and city landscapes in China
   - Now widespread in botanic gardens and nurseries throughout southern China
   - As with Florida, southern China is center for nursery industry that grows and exports *Cycas revoluta*
   - May have led to introduction of CAS to Taiwan, another center of *C. revoluta* production and export

Dependent Outbreaks

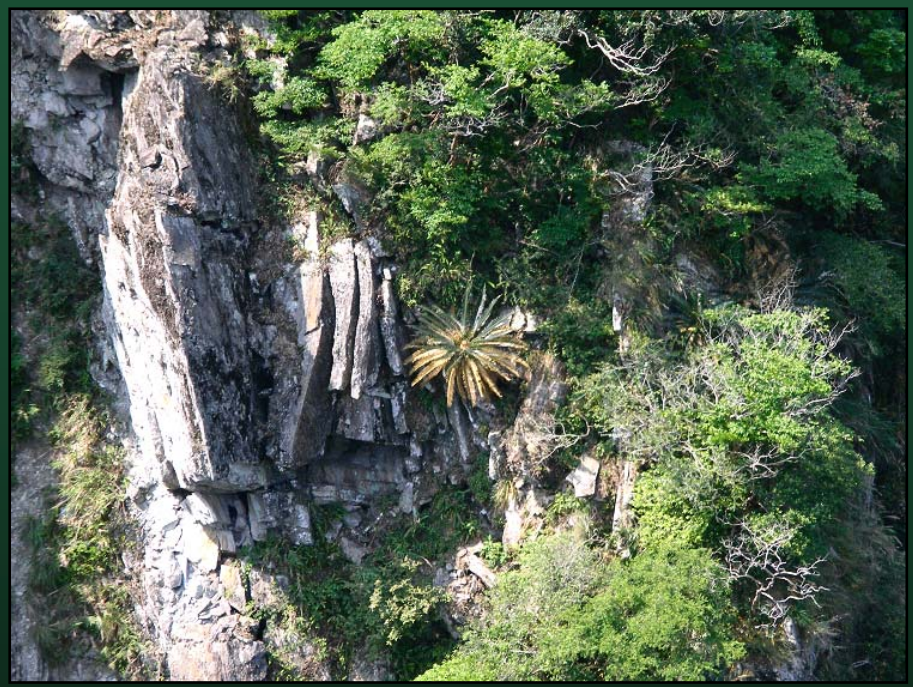
1. **Taiwan (2000)**
   - Arrived from unknown source, possibly nurseries in S. China
   - Arrival not publicized; presence unknown until 2005
   - Killed 100,000+ nursery cycads (*Cycas revoluta*) in Taoyuan County—south of Taipei—the first year
   - Spread to wild population of *Cycas taitungensis* in Taitung Cycad Nature Reserve (S. Taiwan) in 2004
   - Widespread in other wild cycad populations by 2005

Taiwan Invasion Timeline

Date	Event & Location
2000	CAS introduced into northern Taiwan through an unknown channel, killing 110,000 nursery cycads (seedlings and adults of various ages) in Taoyuan County—a northern county south of the capital of Taipei—in its first year (**#1 on map**).
Sep. 2003	The predatory beetle, *Cybocephalus nipponicus*, imported from Thailand to the quarantine facility at National Pingtung University, Neipu, Pingtung, Taiwan.
2004	CAS invaded the Taitung Cycad Nature Reserve—home of one of the largest populations of the endemic *Cycas taitungensis*—in southeastern Taiwan (**#2 on map**).
Oct. 2005	*Cybocephalus nipponicus* field released in Taitung Cycad Nature Reserve (**#2 on map**).
Nov. 2005	*C. nipponicus* released at Pingtung and Taichung (**#3 on map**).

Information provided by Dr. Po-Yung Lai (National Pingtung University of Science & Technology) & Dr. Jung-Tai Chao (Taiwan Forestry Research Institute). Taiwan base map courtesy maps.com.

CAS in Taiwan



Cycas taitungensis plants grow on cliffs within the Taitung Cycad Nature Reserve, making them very difficult to access for study and/or to treat for CAS.

Photos by Chin-Ying Hwang, Taiwan Forestry Research Institute

Conservation Status in Taiwan

Cycas taitungensis was classified as Vulnerable in the 2004 IUCN Red List, based on estimates of total population decline of 30% over the last 10 years or three generations.

It is a narrow endemic in Taiwan, and CAS is no doubt greatly increasing the decline of this species in the wild.

Because of CAS, the IUCN/SSC Cycad Specialist Group provisionally elevated conservation status to *Endangered*.

Information from IUCN & Dr. John Donaldson, Chair, IUCN/SSC Cycad Specialist Group

Dependent Outbreaks

2. Guam (2003)

- Arrived on infested *Cycas revoluta* plants from Florida, despite repeated warnings by Dr. Thomas Marler, University of Guam
- Arrival widely publicized; repeated warnings and control recommendations failed to keep it from spreading
- Spread to wild populations of *Cycas micronesica* by Sep. 2004
- Widely distributed in wild cycad populations by 2005

CAS in Guam

GARDENING

Looking out for scale insects

By Thomas Marler
For Pacific Sunday News

Gardeners, environmentalists, fadang plants take heed. A voracious scale insect has been marching throughout the landscapes of southern Florida for the past few years, and very recently found its way to Hawaii, which means it's not far from Guam.

The tiny insect was a stowaway in the mid-1990s, hiding on cycad plants that were transported from Asia to Florida as landscape plants. And because the insect's natural enemies were not along for that fateful trip, the population of the tiny insect in Florida virtually exploded. The very recent jump of the scale insect to Hawaii, also by way of cycad plants, brings the threat a little closer to home.

Scale insects are pros at hiding among the nooks and crannies of nursery plants. If they were to find their way to Guam on board imported cycad plants, what we know of them indicates that they would be quite happy to claim Guam as their new home.

Scale insects damage plants by feeding through their tiny piercing and sucking mouths.

Plants can coexist with some scales, but other scales can severely damage the health of or even kill plants. The cycad scale from Asia is among the more voracious types, and their feeding can literally kill mature cycad plants.

Richard Baranowski has been conducting research on methods of biologically controlling the scale's population.

"We first released a predaceous beetle in 1997, then released a parasitic wasp in 1998," says Baranowski, a professor with the University of Florida's Tropical Research and Education Center in Homestead Florida. "The scale populations rapidly declined due to the release of these bio-control agents."

But a bothersome characteristic of the scale is that it feeds on roots as well as leaves. Hiding among plant roots may have been the means by which the scale made it to Florida and Hawaii unnoticed.

According to Baranowski, this characteristic is also a reason that the bio-control agents are not completely effective.

"The bio-control agents can't get to the scales located below ground, so after the above-ground scales are killed, the beetles and wasps move out of the area," Baranowski says. The scale insects below ground are then free to gradually build up their population again to begin another feeding frenzy.

Although the urban landscapes of Hawaii and Florida are now plagued with the pest, neither state has an indigenous cycad species that is susceptible to the scale. So the scale has not been an ecological problem.

But here on Guam we boast of our indigenous fadang, or the Guam cycad.

And unfortunately, Guam's cycad is very closely related to the cycads that are known to be the most susceptible to attack by the scale. So if the scale were to arrive on Guam, it would no doubt threaten the natural population of plants throughout the island.

All importers of nursery plants would demonstrate admirable environmental stewardship by refraining from importing cycad plants from Florida or Hawaii until we learn more about the insect and its natural enemies. The most common cycad that is imported is the King sugo, also called the Sago palm, and this cycad is a known host of the scale. For now, ensuring that no new cycad plants are brought to Guam is likely our only means of protecting the indigenous cycad population.

Thomas Marler is an associate professor with the University of Guam.

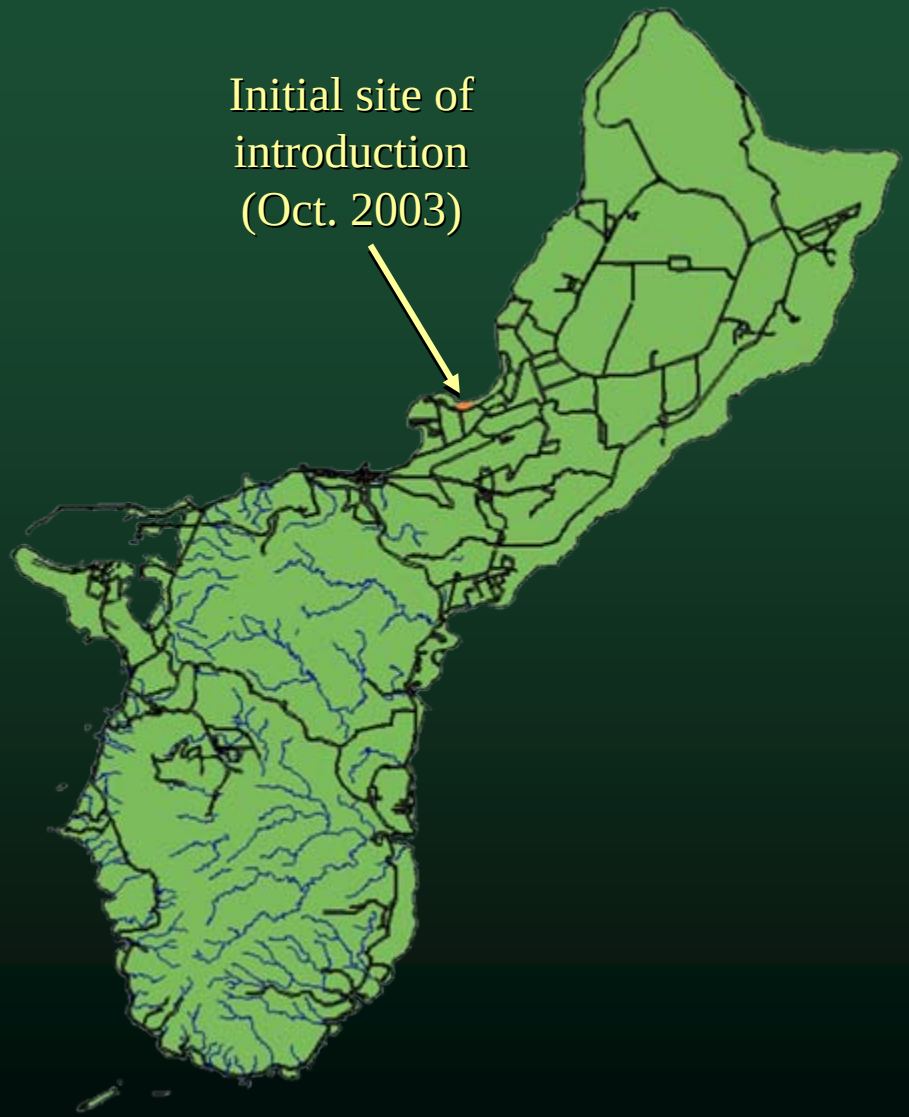
Heidi Hirsh/For Pacific Sunday News

Potential target: The Guam cycad is one of the island's most interesting indigenous plants, and makes a beautiful addition to any yard. Its survival in the wild may depend on keeping the cycad scale from finding its way to the island.

In February 2000, Dr. Thomas Marler warned of the possibility of CAS coming to Guam. His warnings went unheeded.

Article from Pacific Daily News

CAS in Guam



- CAS first arrived on Guam (from FL) in the Tumon Bay hotel district in 2003

Base map and distribution information provided by Drs. Ross Miller & Thomas Marler, University of Guam

CAS in Guam

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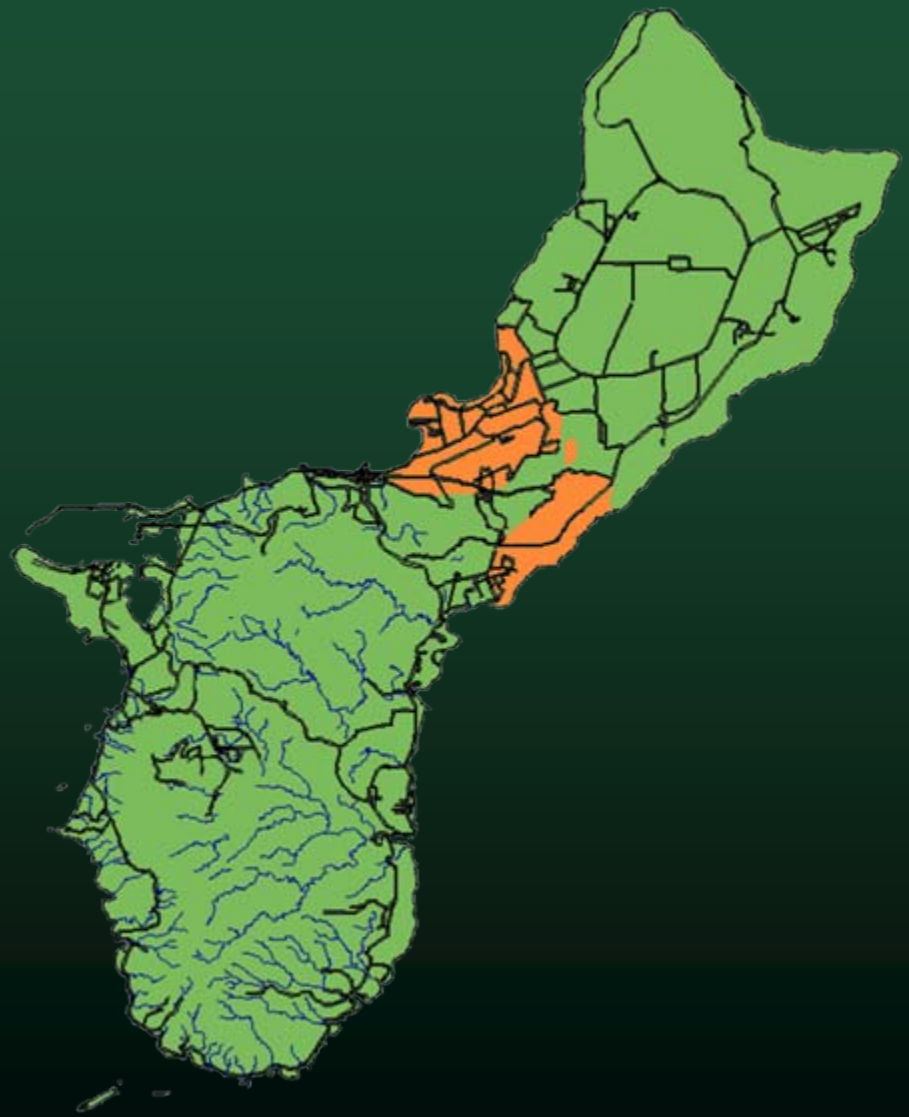
- Within a month, it had infested a native population of *Cycas micronesica* at Ypao Point

Base map and distribution information provided by Drs. Ross Miller & Thomas Marler, University of Guam

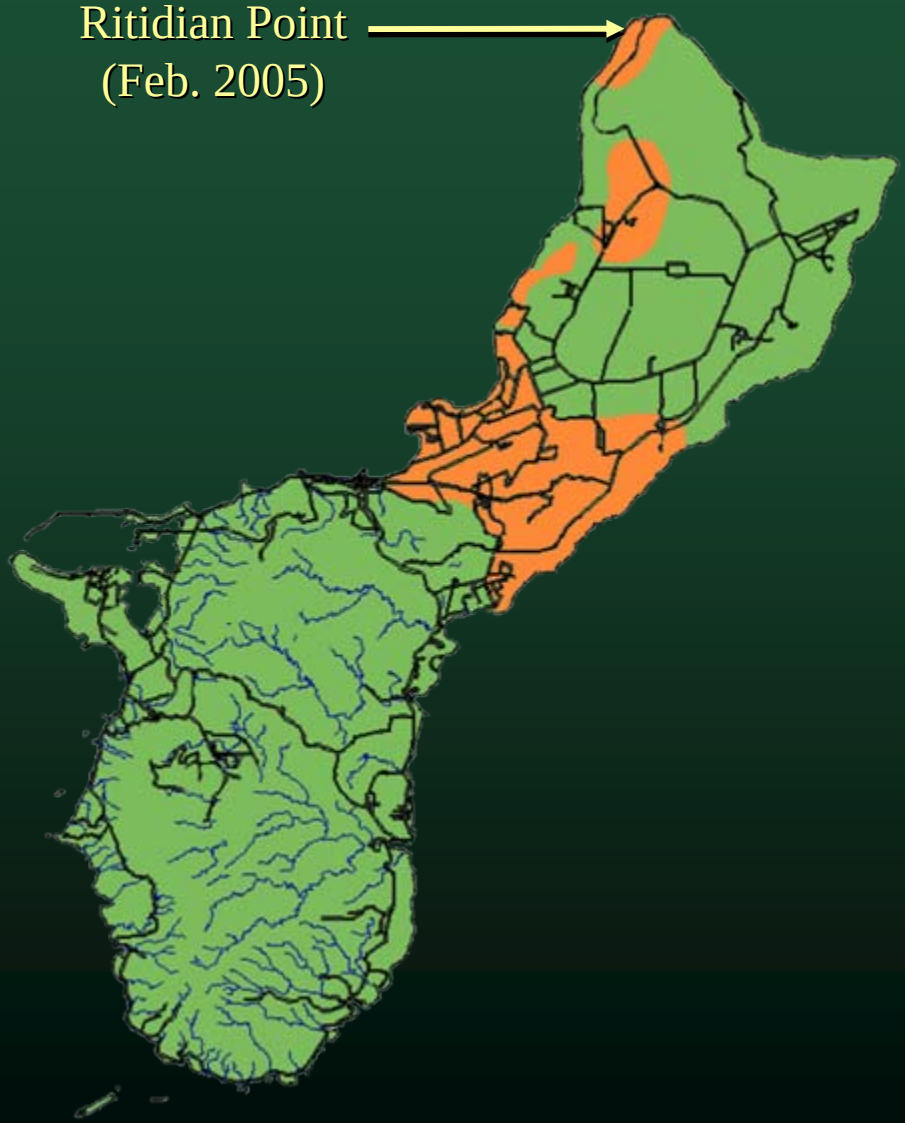
CAS in Guam



- CAS first arrived on Guam (from FL) in the Tumon Bay hotel district in 2003
- Within a month, it had infested a native population of *Cycas micronesica* at Ypao Point
- Two months later, Jan. 2004, CAS had spread into the surrounding villages and forests of central Guam

Base map and distribution information provided by Drs. Ross Miller & Thomas Marler, University of Guam

CAS in Guam



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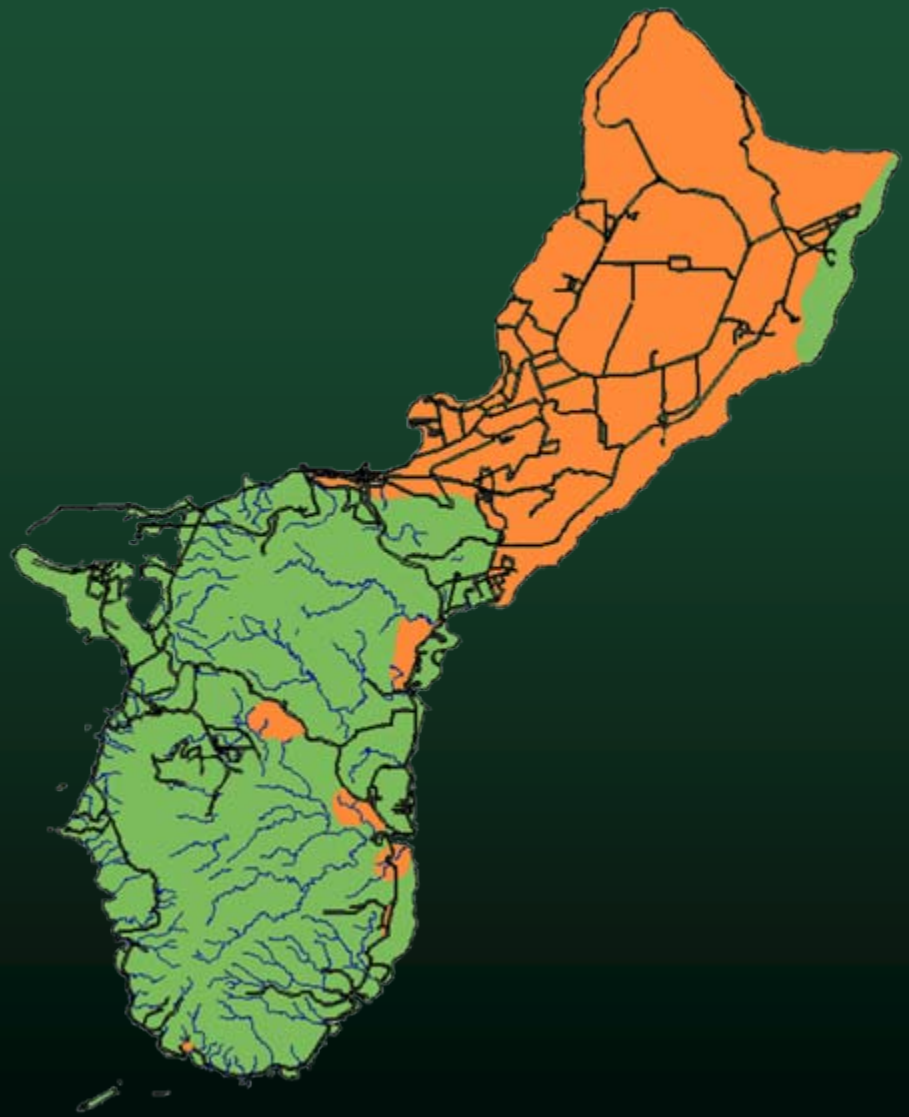
Base map and distribution information provided by Drs. Ross Miller & Thomas Marler, University of Guam

CAS in Guam



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- In June 2005, CAS covered entire northern end of Guam and official survey began

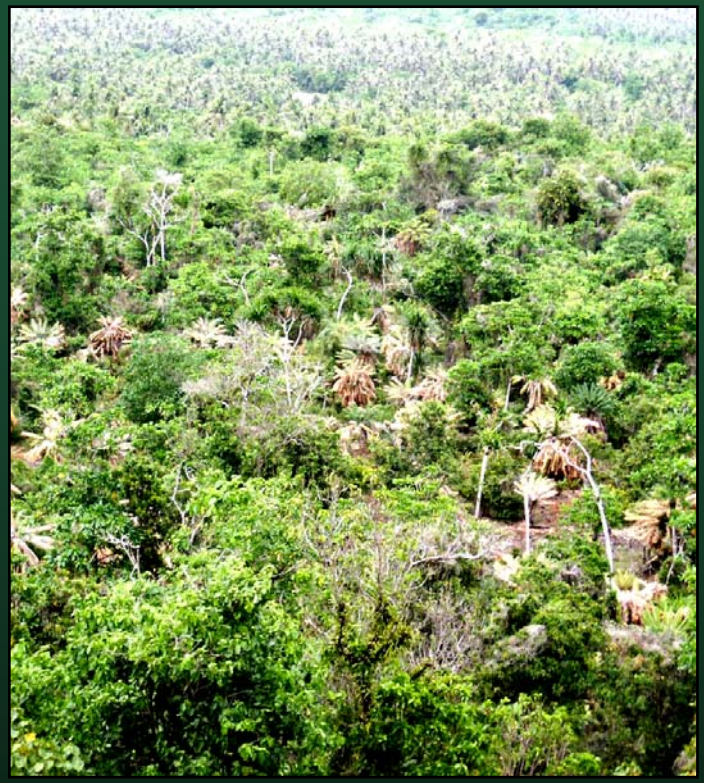
Base map and distribution information provided by Drs. Ross Miller & Thomas Marler, University of Guam

CAS in Guam

- One year later, CAS had reached cycad populations in the North; beetles were released at Ritidian Point
- In June 2005, CAS covered entire northern end of Guam and official survey began
- By Feb. 2006, CAS had infested entire island, except for two isolated populations in the South.

Base map and distribution information provided by Drs. Ross Miller & Thomas Marler, University of Guam

CAS in Guam



- First noticed at Tarague (northern Guam) in January 2005, CAS was already widespread.
- It quickly spread throughout this population and into neighboring populations.

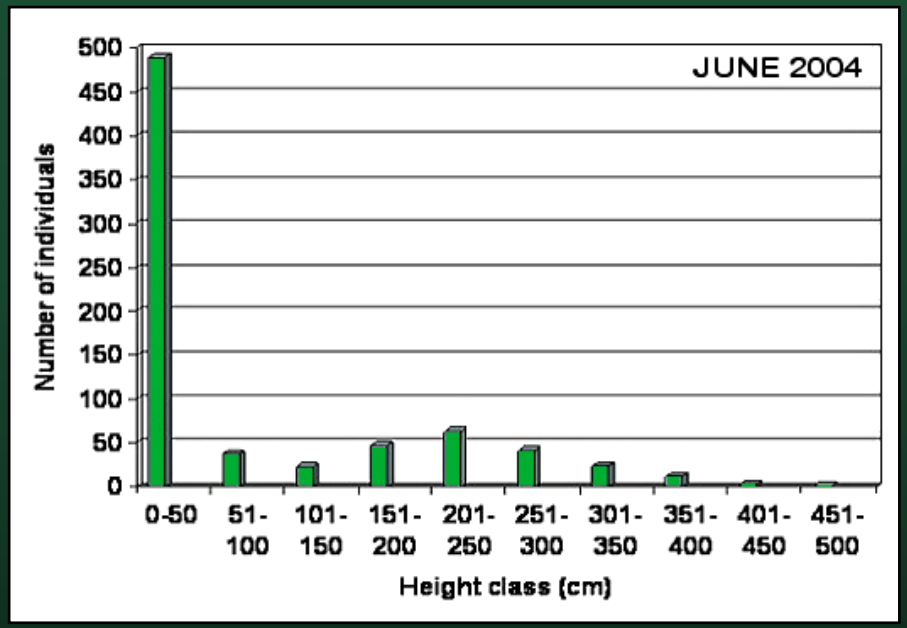
Photos by Anne Brooke, Guam National Wildlife Refuge

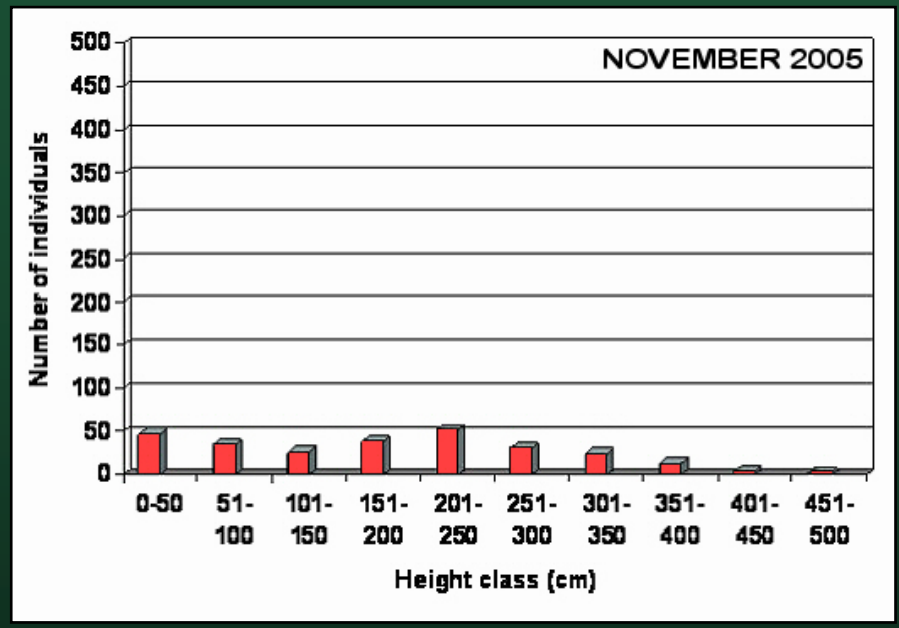
CAS in Guam

In addition to leaves, CAS infests cones and developing seeds, reducing the reproductive potential of populations.

Photos by Anne Brooke, Guam National Wildlife Refuge

CAS in Guam





- A significant reduction in the smallest demographic age class has occurred in one *Cycas micronesica* population within 10-11 months of infection.
- Long-lasting population effects are likely.

Graphs provided by Dr. Thomas Marler, University of Guam (unpublished data)

Conservation Status in Guam

Cycas micronesica has never been classified for inclusion in the IUCN Red List of Threatened Plants.

Once present on Saipan and Tinian, it was entirely removed by the Japanese prior to and during World War II.

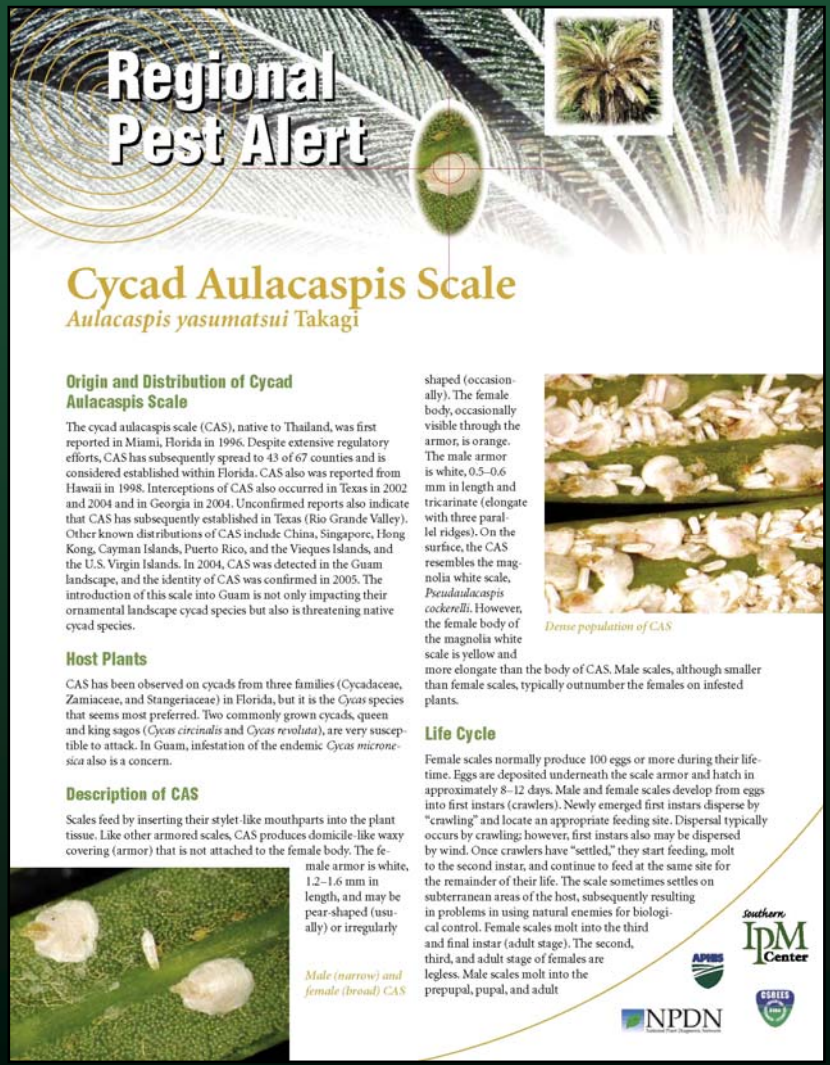
Habitat loss has occurred on Rota & Guam in recent years.

Based on its narrow distribution and the rapid rate of decline due to CAS, the IUCN/SSC Cycad Specialist Group has made a provisional assessment of *Endangered*.

Information provided by Dr. Thomas Marler, University of Guam & Dr. John Donaldson, IUCN/SSC CSG Chair

Solution?

Regional/National Awareness



Regional Pest Alert

Cycad Aulacaspis Scale

Aulacaspis yasumatsui Takagi

Origin and Distribution of Cycad Aulacaspis Scale

The cycad aulacaspis scale (CAS), native to Thailand, was first reported in Miami, Florida in 1996. Despite extensive regulatory efforts, CAS has subsequently spread to 43 of 67 counties and is considered established within Florida. CAS also was reported from Hawaii in 1998. Interceptions of CAS also occurred in Texas in 2002 and 2004 and in Georgia in 2004. Unconfirmed reports also indicate that CAS has subsequently established in Texas (Rio Grande Valley). Other known distributions of CAS include China, Singapore, Hong Kong, Cayman Islands, Puerto Rico, and the Vieques Islands, and the U.S. Virgin Islands. In 2004, CAS was detected in the Guam landscape, and the identity of CAS was confirmed in 2005. The introduction of this scale into Guam is not only impacting their ornamental landscape cycad species but also is threatening native cycad species.

Host Plants

CAS has been observed on cycads from three families (Cycadaceae, Zamiaceae, and Stangeriaceae) in Florida, but it is the *Cycas* species that seems most preferred. Two commonly grown cycads, queen and king sagos (*Cycas circinalis* and *Cycas revoluta*), are very susceptible to attack. In Guam, infestation of the endemic *Cycas micronesica* also is a concern.

Description of CAS

Scales feed by inserting their stylet-like mouthparts into the plant tissue. Like other armored scales, CAS produces domicile-like waxy covering (armor) that is not attached to the female body. The female armor is white, 1.2–1.6 mm in length, and may be pear-shaped (usually) or irregularly shaped (occasionally). The female body, occasionally visible through the armor, is orange. The male armor is white, 0.5–0.6 mm in length and tricarinate (elongate with three parallel ridges). On the surface, the CAS resembles the magnolia white scale, *Pseudaulacaspis cockerelli*. However, the female body of the magnolia white scale is yellow and more elongate than the body of CAS. Male scales, although smaller than female scales, typically outnumber the females on infested plants.

Male (narrow) and female (broad) CAS

Dense population of CAS

Life Cycle

Female scales normally produce 100 eggs or more during their lifetime. Eggs are deposited underneath the scale armor and hatch in approximately 8–12 days. Male and female scales develop from eggs into first instars (crawlers). Newly emerged first instars disperse by "crawling" and locate an appropriate feeding site. Dispersal typically occurs by crawling; however, first instars also may be dispersed by wind. Once crawlers have "settled," they start feeding, molt to the second instar, and continue to feed at the same site for the remainder of their life. The scale sometimes settles on subterranean areas of the host, subsequently resulting in problems in using natural enemies for biological control. Female scales molt into the third and final instar (adult stage). The second, third, and adult stage of females are legless. Male scales molt into the prepupal, pupal, and adult stage within a few days. Adult males have legs, a single pair of obvious wings, and do not feed. Depending on the temperature, females will mature, mate, and produce another generation in 21–35 days.

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Cycad infested with CAS

Plant Symptoms and Monitoring

Although CAS crawlers initially settle on the trunk and base of the leaves, they also may infest the leaf blades, cones, seeds, and even the roots. Early symptoms include chlorotic spots on the upper side of leaves. CAS also can deform and kill new plant growth. Infested leaves become brown and desiccated as populations grow. Very dense populations result in layers of live and dead scales that form a "white crust" on infested plant surfaces. Heavy infestations eventually lead to plant death.

Pest management of CAS is difficult because 1) initial infestations typically go undetected or may be confused with those of the commonly occurring magnolia white scale, 2) rapid outbreaks are caused by high population growth rates, and 3) scales feed in protected plant structures such as roots and at the bases of leaves, where they are not apparent.

Infested cycad plants in unmanaged landscapes act as pest reservoirs and are sources for infestation of "healthy" plants in managed landscapes. Check new plants before purchase to make sure they are not already infested with this scale. Monitor plants frequently for the presence of the scale or the initial symptoms, particularly in areas where this pest has been seen attacking sago and other *Cycas* palm species. Look for "white specs" (scale armor) in the crown and at the base of leaves.

Control Recommendations

Two natural enemies of CAS were introduced into Florida in 1997–1998 by University of Florida researchers: a predaceous beetle, *Cybocephalus binotatus*, and a parasitic wasp, *Coccobius fulvus*. Both have become established in southern Florida and contribute to the control of the scale. However, because of the explosive nature of this pest species, the natural enemies cannot provide acceptable control levels so far. Generally, management of CAS will require the use of oils, other conventional insecticides, or a combination.

Wash infested plants with high-pressure water sprays (before any insecticide spray) to dislodge dead and live scales. The second and third instars (adult female) cannot move back onto the plant. Apply horticultural oils and insecticides at recommended rates. Good coverage is extremely important to the effectiveness of contact sprays. Repeated applications may be necessary for heavy infestations, under certain weather conditions, and for some products. No single product will kill all the insects on your plants or prevent recolonization for extended periods. Typically, oils and contact insecticides require more frequent applications (10 days to 3 weeks apart). Oils are generally safer to use and less detrimental to native and introduced natural enemies. Check for the presence of natural enemies and scales bearing parasitoid emergence holes before deciding which product to use. Applications may not be necessary during the winter and should be stopped when active scales are not present. An apparently clean plant may still harbor scales on its roots. Removal of heavily infested leaves may reduce population density but should not be done frequently because it may reduce plant vigor. Careful disposal of removed leaves is necessary to avoid spreading scales to other plants. Maintenance of clean, healthy plants probably will require a continuous investment of time and effort if CAS is problematic in the area.

Cycad scale with cover flipped off

False oleander scale without cover

For more information on cycad scale, visit our Web site at

http://www.ncipm/org/alerts/cyadscale

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Photo credits: H. Glenn, UF–IFAS and FDACS–DPI

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Southern 1862 Land-Grant Universities

Auburn University University of Arkansas University of Florida University of Georgia University of Kentucky Louisiana State University Mississippi State University North Carolina State University Oklahoma State University University of Puerto Rico Clemson University University of Tennessee Texas A&M University Virgina Tech University of the Virgin Islands

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International Awareness

CAS has been given ***top priority*** status by the IUCN/SSC Cycad Specialist Group (CSG). The CSG Invasive Pests Subgroup has assumed the following responsibilities:

- Compiling information and writing a report to the CSG on the status of CAS in cycad habitats and collections of conservation importance worldwide (*completed*)

- Creating a Pest Alert and providing updated CAS-related information on a centralized "clearinghouse" web page (*completed*)

- Organizing global media campaign to alert governments and NGOs in countries with native *Cycas* populations—including additional islands in the Pacific, as well as India, SE Asia, and Australia—of the seriousness of this pest (*ongoing*)

International Awareness

IUCN/SSC CYCAD SPECIALIST GROUP

PEST ALERT

Cycad Aulacaspis Scale

Scale covers, male & female (3 mm long)


Adult female (1 mm long) & egg after removal of scale cover

Scientific name: *Aulacaspis yasumatsui* Takagi (Order: Hemiptera; Family: Diaspididae)

Other common names: Asian cycad scale, snow scale, Thai scale

Description: Adult females are immobile, with a white, waxy, ovate cover 3 mm in diameter (above left). Underneath, the living female is 1 mm long and orange in color (above right). Adult males are immobile, elongate, 1 mm long, white with three longitudinal ridges. Infestations on leaves first appear as flecks of white (below left) and may rapidly cover foliage and reproductive parts within days or weeks, giving them a snow-covered appearance (below right).

Native range and hosts; artificial introductions: Native to tropical SE Asia including India, Andaman Islands, Thailand, Vietnam, and probably Cambodia, Laos, Myanmar, southern China, and peninsular Malaysia, where it specializes on cycads of the genus *Cycas*. Recent introductions outside of its natural range include the United States (Florida, Alabama, California, Georgia, Hawaii, Louisiana, South Carolina, Texas) and its territories (Guam, Puerto Rico, U.S. Virgin Islands), as well as the Cayman Islands, St. Kitts, Singapore, and Taiwan.

Mode of attack: Living mainly on the surface of leaves and sucking plant juices, in the absence of effective control this scale will multiply rapidly and engulf foliage within a few weeks. Repeated attacks on successive flushes of leaves, without intervention of effective control, are fatal to *Cycas* plants within a year. This insect also feeds on reproductive parts and will persist on stems and roots. Young of this insect (crawlers) are the dispersal stage and are easily spread to other plants by wind.

Vulnerable species: All *Cycas* species outside of the natural range of this pest are at risk, including those in Australia and New Guinea and those in the *C. rumphii* complex, which occur from islands in Micronesia and Indonesia to Madagascar and East Africa. Other cycad genera are also susceptible to varying degrees. *Stangeria* is highly susceptible, as is *Macrozamia lucida*. The cones of some species are completely engulfed by this plant, preventing successful seed production – *Encephalartos manikensis* and *Ceratozamia robusta* (Belize) are two examples. In the absence of natural predators, even cultivated plants of *Cycas* from within the native range of this pest may become heavily infested with this scale.

Control: Insecticides such as chlorpyrifos and diazinon are briefly effective in knocking down populations of this pest, but pest numbers usually recover quickly. Systemic insecticides such as dimethoate may be more effective, for a month or more, in keeping its number down. Two newer insecticides, pyriproxyfen and dinotefuran, have been shown to be effective in keeping scale populations under control in south Florida. Two natural insect predators of this scale have been identified, a parasitoid wasp, *Coccobius fulvus* (Compere & Annecke), and a beetle, *Cybocephalus binotatus* Grouvelle (Howard *et al.*, 1999); they have been released in south Florida for biocontrol, but have been slow to establish and have not reduced its virulence to acceptable levels. Introduction of ladybird beetles (Coccinellidae), such as *Rhyzobius lophanthae* (Blaisdell), has been locally successful in Hawaii.

Currently, no reliable control, besides repeated, labor-intensive applications of insecticide or mechanical removal with water pressure sprayer, are available. More research on the natural predators of this scale is urgently needed. Prevention is the most effective action for this pest. Quarantine measures to prevent the introduction of this pest should be established in areas where it is currently absent. In countries free of this pest, customs/agricultural quarantine authorities should consider all host plant materials from infected countries as possible conduits of infestation; host plants are primarily *Cycas revoluta*, but include other species of *Cycas* and other cycad genera from infected areas. Possible quarantine measures include: 1) prohibiting entry of host cycad plants from countries known or suspected of having infestations; 2) mandatory insecticide treatment as a condition of entry for host plants coming from infected countries; and 3) close inspection of host plants for scale infestations with subsequent insecticide treatment if infestations are found. Effective treatments for plants infested with scale may include exposure to methyl bromide in a chamber under 15 inches of vacuum or soaking infected plants in pesticide solutions of chlorpyrifos or other insecticide for 12 hours. Approved treatments for scale insects on established container or landscape plants vary from country to country.

Additional Information:

Hodges, G., F. Howard & E. Buss (2003) Update on management methods for cycad aulacaspis scale. Website: http://www.doacs.state.fl.us/pi/enpp/ento/aulacaspis.html

Howard, F., A. Hamon, M. McLaughlin, T. Weissling & S. Yang (1999) *Aulacaspis yasumatsui* (Hemiptera: Sternorrhyncha: Diaspididae), a scale insect pest of cycads recently introduced into Florida. *Florida Entomologist* 82:14-27.

Howard, F. & T. Weissling (1999) Questions and answers about the cycad aulacaspis scale insect. *Cycad Newsletter* 22(4):19-22. Website: http://www.cycad.org/Howard&Weissling-1999.html

IUCN/SSC Cycad Specialist Group website (2005) Cycad Aulacaspis Scale Information Page: http://www.iucn.org/themes/ssc/sgs/csg/pages/CAS.htm

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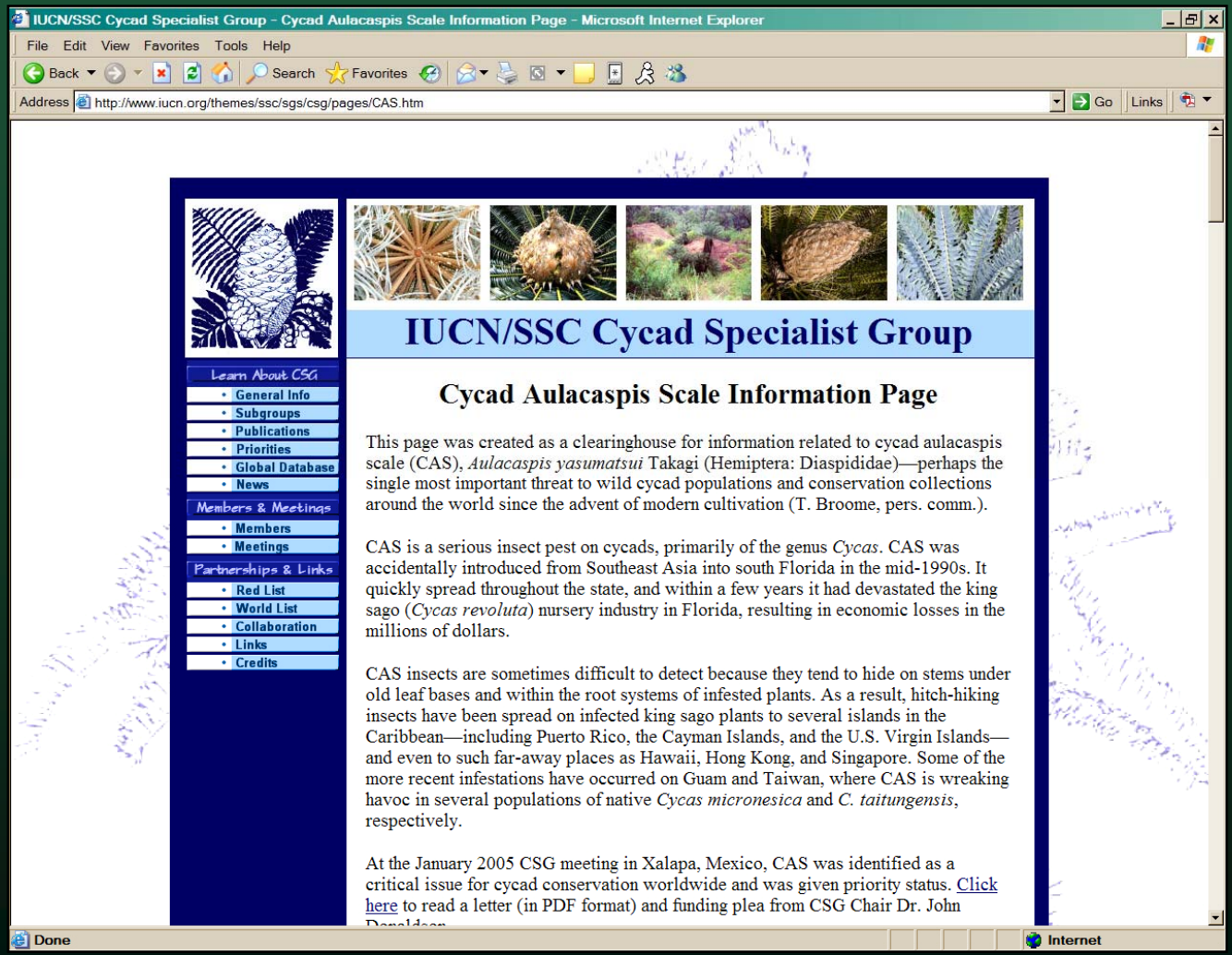
***Left**: Cycad aulacaspis scales on the underside of a* Cycas *leaf.*
***Right**: Heavy infestation on* Cycas revoluta*; note leaves are so heavily infested that insects appear like snow.*

Developed by IUCN/SSC Cycad Specialist Group Invasive Pests Subgroup

International Awareness



http://www.iucn.org/themes/ssc/sgs/csg/pages/CAS.htm

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International Awareness/Support

- IUCN/SSC Invasive Species Specialist Group recently added *Aulacaspis yasumatsui* to its Global Invasive Species Database.

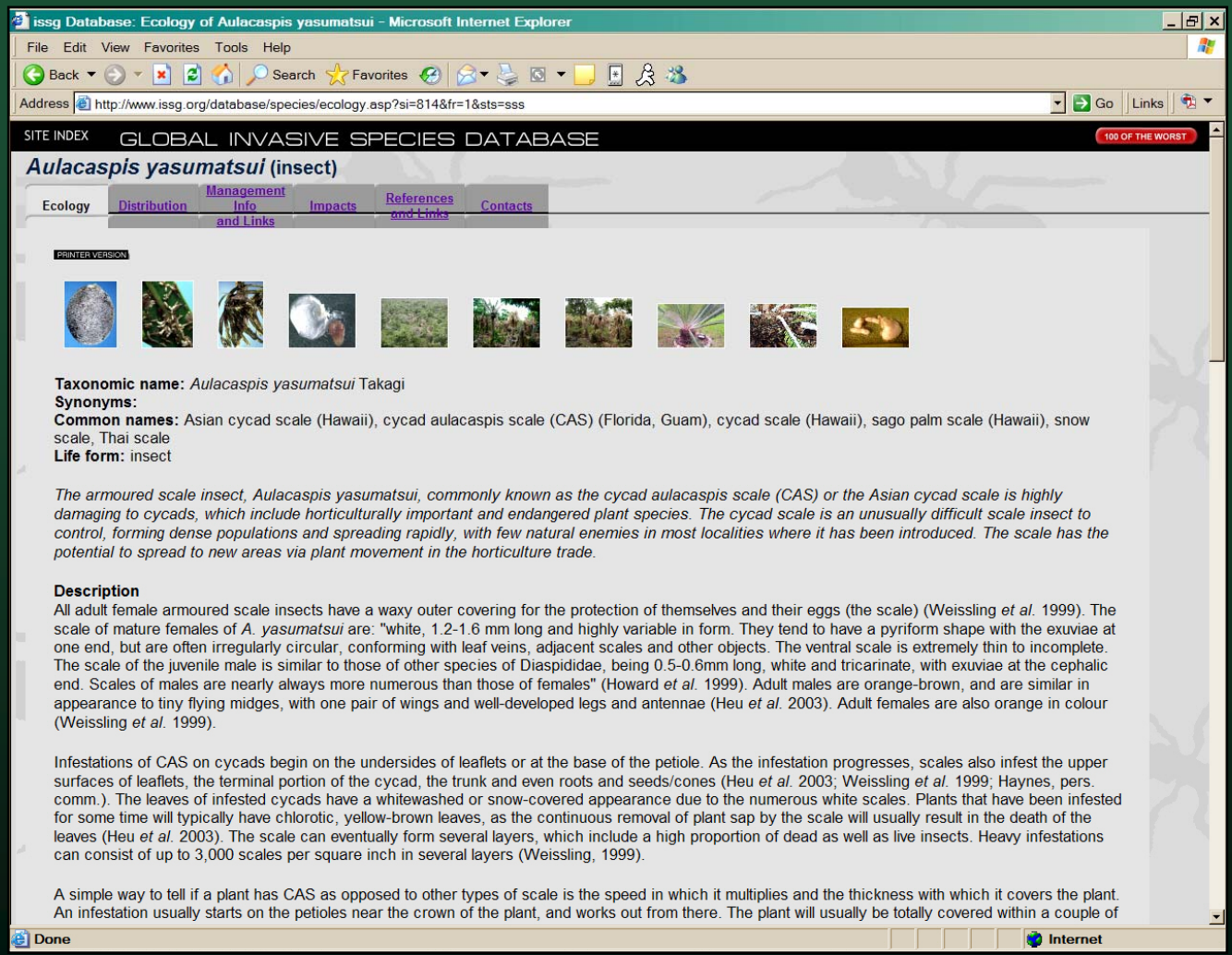
- Pacific Programme of the Cooperative Islands Initiative, Pacific Regional Environment Programme, and Small Island Developing States Network have all begun alerting member nations of the seriousness of CAS.

- In Sep. 2005, The Cycad Society (TCS) donated $2,500 toward CAS biocontrol research in Guam. TCS also dedicated the Sep./Dec. 2005 supplement issue of *The Cycad Newsletter* to CAS, announced a new CAS Fund, and solicited donations from TCS members.

- U.S. Navy approved $80,000 grant to develop a population-based *ex-situ* collection of *Cycas micronesica* on Tinian.

- Association of Zoological Horticulture approved a $5,000 grant to establish a back-up *ex-situ* collection of *C. micronesica* at MBC in Miami, FL.

International Awareness



http://www.issg.org/database/species/ecology.asp?si=814&fr=1&sts=sss

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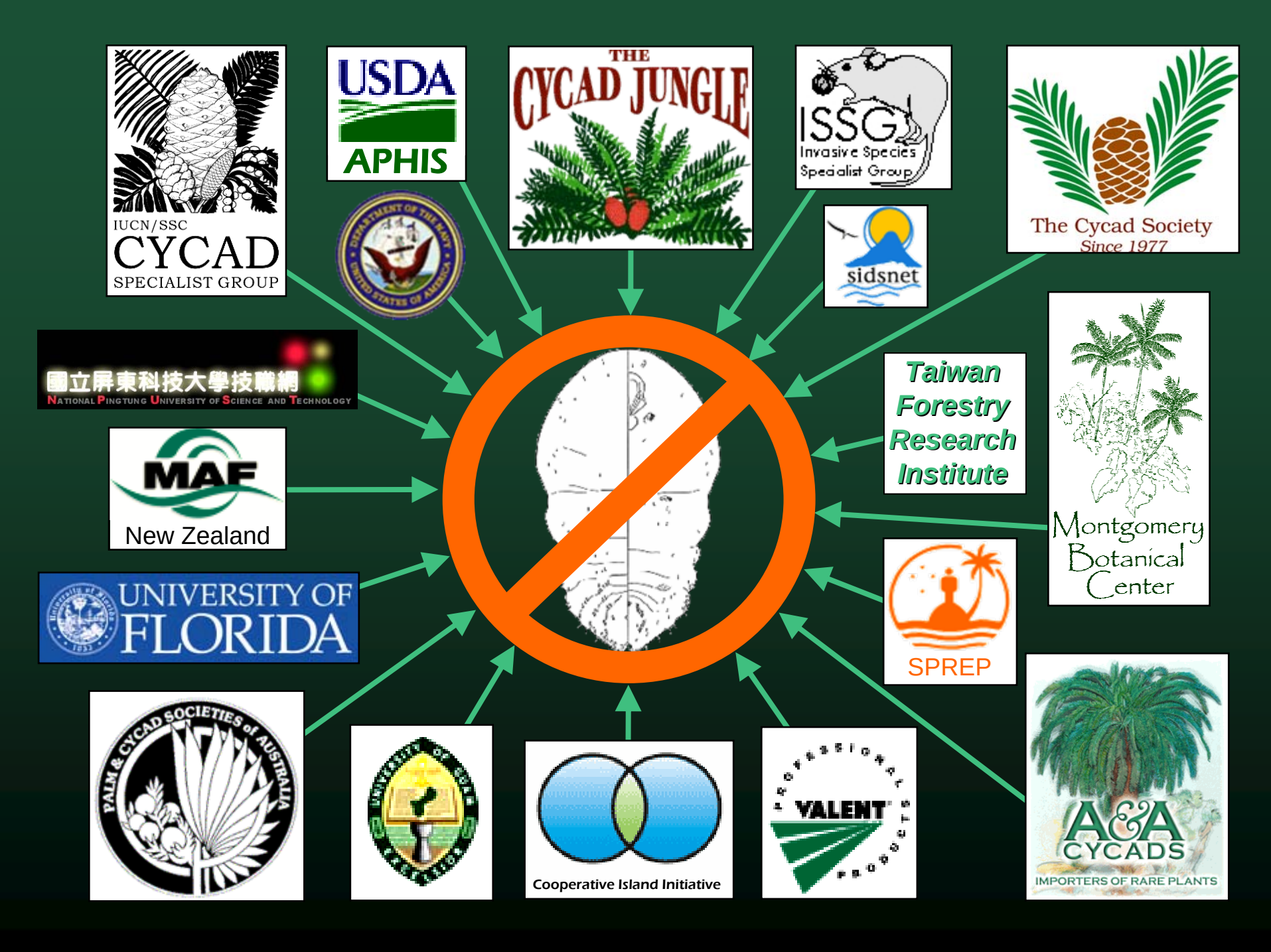
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