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PRESIDENT'S LETTER

BY KATY DESHOTELS-MOORE

ALOHA LICH,

I hope this publication finds you all in a good place so far this year. We've had a full year (2022) to shake off the cob webs and rebuild our businesses and get back to what is now the "new normal." Most of us are still working with a shortage of labor and making adjustments to deal with the rising costs of goods, fuel, housing, and more. In order to keep our businesses in the black these elevated rates will have to be transferred to the client, which can make selling our services difficult in a world that is adjusting to a higher cost of living.

Living with the "new normal" may mean thinking outside the box and coming up with clever new ways to make our businesses thrive. Here's where LICH can help. Becoming a member and/or volunteering to serve on a committee will increase your network of like-minded professionals that serve the same industry. Find out what's happening at LICH by visiting our new website at https://hawaiiscape.com. Click on the "EVENTS" tab and you'll find information on the upcoming LICH Conference to be held September 14, 2023. Mark your calendars and plan to attend. The conference provides a great opportunity to send staff for extra training and education that can help build morale and self-esteem by increasing their knowledge. Employees that feel valued will likely have better work ethics and strive to provide excellence in their work performance.

Keeping our industry strong with businesses that provide exceptional services directly affects Hawaii's largest industry—tourism. The first impression of our guests typically comes from the landscape they see as they exit their rental car and arrive at their destination. Striving to deliver perfection with our work should be the end goal no matter which industry we're working in.

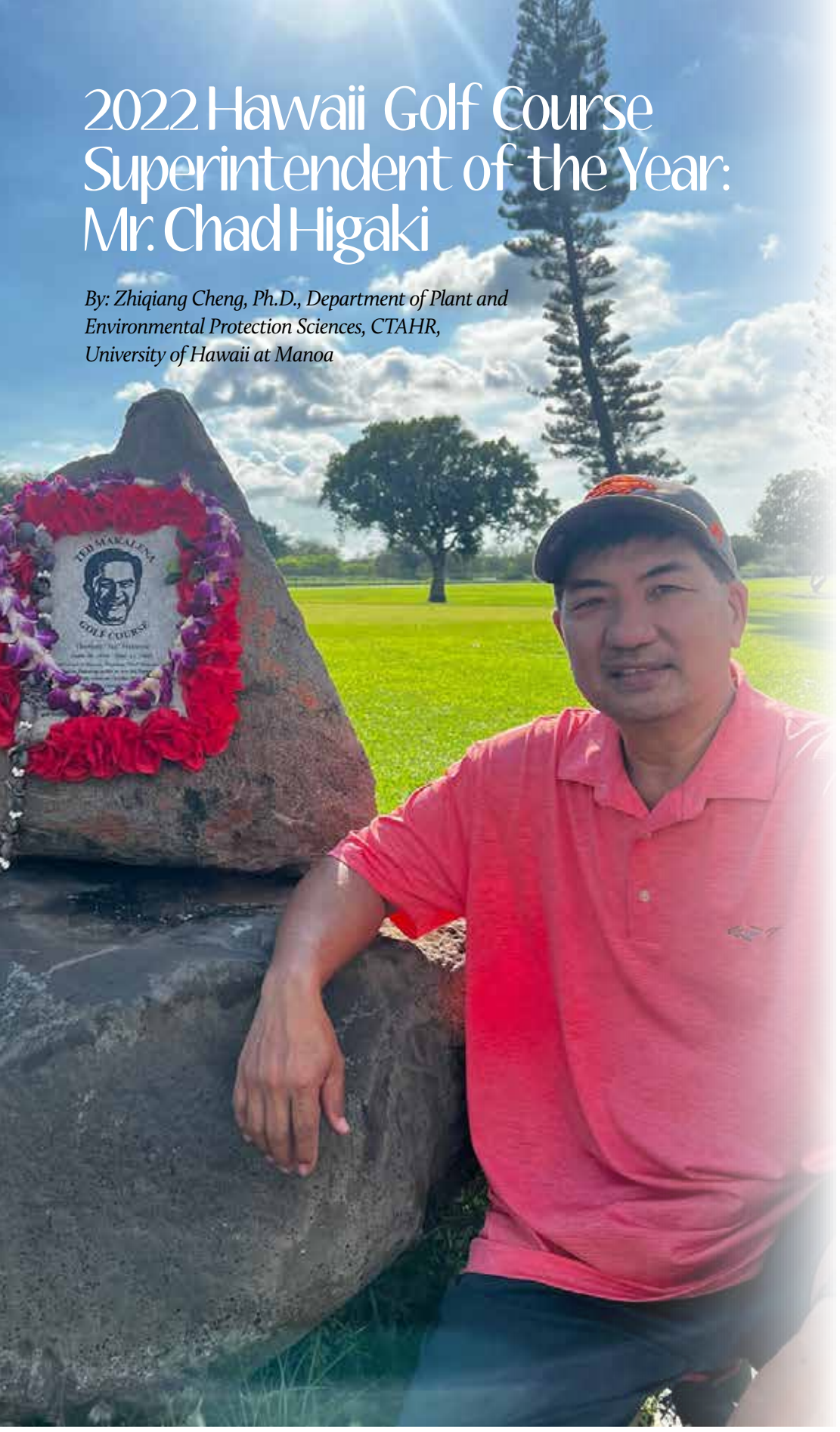
I hope you enjoy the publication and learn something valuable that can be applied to your business. Wishing you all good luck while navigating through the "new normal."

Let's keep growing together!
A Hui Hou!

Katy Deshotels-Moore, LICH President

2022 Hawaii Golf Course Superintendent of the Year: Mr. Chad Higaki

By: Zhiqiang Cheng, Ph.D., Department of Plant and Environmental Protection Sciences, CTAHR, University of Hawaii at Manoa



Mr. Chad Higaki at Ted Makalena Golf Course

It is with great pleasure that I report here that my colleague and friend, Mr. Chad Higaki, was the recipient of the 2022 Hawaii Golf Course Superintendent of the Year Award. Chad came from the Big Island, and went to Oregon State University for his Bachelor of Science degree in Horticulture. After several progressively responsible golf course positions on Maui and Oahu, Chad assumed the role of the Superintendent of Ted Makalena Golf Course (TMGC), a City and County of Honolulu municipal golf course, in 2009. At TMGC, Chad is responsible for day-to-day planning, directing, and supervising the operation, improvement, development and maintenance of the entire 18 hole golf course. Chad also monitors construction projects performed by contractors for compliance with plan specifications, and maintains records, prepares reports and evaluation for the status of all programs. As a City and County of Honolulu public employee, Chad also attends personnel development training with the Department of Human Resources. But it takes a lot more to receive the Award.

The nominee, and ultimately the recipient of the Award, needs to be someone that has had a major project or has significantly improved their golf course within their budget, and has done something significant for the community or chapter. Based on these criteria, Chad was nominated and then voted by Hawaii Golf Course Superintendents Association (HGCSA) members to receive the 2022 Award. And there are good reasons for that.

Since Chad began his position at TMGC, he quietly, gradually, but consistently conducted a major project; converting the turfgrass species at TMGC from Bermudagrass to seashore paspalum. For a big task like this, some golf courses in Hawaii actually chose to totally close down for a good 2 years or so and do a total renovation, which is apparently not feasible for

TMGC, a City and County of Honolulu municipal golf course with limited operation budget. Chad chose a very different approach to take on this task by converting turfgrass on one green at a time. Surely it took much longer time, but it was well done and probably equally importantly, with practically no additional budget needed. Now TMGC is approximately 90% seashore paspalum.

Chad is also very active in his professional field and in the community. Professionally, Chad is a Certified Golf Course Superintendent, and a member of the Golf Course Superintendents Association of America (GCSAA), and has served on the Board of Directors of HGCSA for many years. Chad was also one of the few members of the 2022 GCSAA Melrose Leadership Academy. In the local community, Chad is very supportive with many programs and events. For examples, I take students in my classes (PEPS 405 Plant Pathogens and Diseases, and PEPS 421 Foundations of Pest Management) for a field trip to TMGC twice a year to observe turfgrass and landscape insects, fungal pathogens, and weeds. Chad has always been a great host for my classes and he was very excited to share his experiences with the students (Picture 2). Chad also collaborates with me on my field research projects on coconut rhinoceros beetle in which I use 70+ coconut palms on TMGC for the research. Further, Chad (and several other superintendents) was very active in promoting our local turf and golf industry at various UH and CTAHR events in which we participated on UH Manoa campus (Picture 3) or at CTAHR's Pearl City Urban Garden Center.

I am sure I will continue collaborating with Chad on many projects and activities in the years to come. Congratulations to Mr. Chad Higaki again on receiving the 2022 Hawaii Golf Course Superintendent of the Year Award! Well deserved!

Zhiqiang Cheng, is the Ph.D., Department of Plant and Environmental Protection Sciences, CTAHR, University of Hawaii at Manoa

Top photo: Chad sharing his experiences with students in Dr. Cheng's class.
Bottom photo: Chad at CTAHR Day event on UH Manoa Campus.

Celebrating the Holidays:
Harvesting the Honolulu and Kapolei City Lights Trees

By: Brandon Au

During the past two years, gatherings were not recommended and the holiday season was largely restricted to smaller celebrations with close family and friends. As society returned back to normal, so did the holiday spirit! Not many people know, but the holiday trees fronting Honolulu and Kapolei Hale do not appear magically. Actually, the City and County of Honolulu's Division of Urban Forestry (DUF) of the Department of Parks and Recreation, selects and installs each of the pine trees, measuring over 50+ feet tall when harvested.

Kaiemi Street, Kailua-City crew removed 60- feet from the top of the tree.

City crew preparing the tree to be transported.

Decorated Kapolei City Lights Tree

You know, Santa can't deliver all those toys by himself, he has help and so does DUF. The Department of Environmental Services provided their 100-ton crane, the Department of Facility Maintenance provided their 95-foot bucket truck, Park's Maintenance Support Services provided their truck and trailer, and the Honolulu Police Department provided traffic control and escorted the trees from their harvest sites, Kailua and Kāhala, to Honolulu and Kapolei Hale respectively for installation. However, not many people see the behind-the-scenes crews and others who make this event spectacular for the residents of our community. The coordination and camaraderie amongst the different City agencies and the public brings out the best in people, especially during the holiday season.

We hope you got the chance to enjoy the holidays and appreciate all of the joy and excitement from the Honolulu and Kapolei City Lights. If not, make sure to enjoy the 2023 City Lights! For more information about both events, please visit honolulucitylights.org and bit.ly/kapoleicitylights

Brandon Au is the head of the Nursery and Landscape Section for the City's Department of Parks and Recreation, Division of Urban Forestry and Board Member for LICH.
Photos by Brandon Au

INSTAGRAM vs. REALITY:
PAMPAS GRASS EDITION

By: Erin Bishop, OISC Outreach Coordinator

We've all seen them, feathery plumes splashed across our Instagram feed in some kind of muted home décor, perfectly manicured palatial yards or golf courses, and of course…weddings. Yes, these are the feathery plumes of the highly invasive pampas grass (*Cortaderia spp*). It last rose to popularity in the 1970s along with macramé and a color scheme of avocado greens and yellow ochre on everything. The invasive grass has once again returned to popularity over the past couple of years, trending on social media. However, many people aren't aware of the reality that pampas grass is terribly invasive.

This plant is no beauty, it's a beast! Pampas grass is on the Hawai'i State Noxious Weed List, making it illegal to sell or transport in the state. The Division of Forestry and Wildlife has designated pampas grass as one of Hawaii's Most Invasive Horticultural Plants. That's because of this plant's ability to produce thousands of lightweight seeds that can blow 20 miles away from the parent plant. It also has razor-sharp leaves and grows in giant bunches up to 10 feet tall and eight feet in diameter, creating fire-prone clumps of biomass. They can establish in remote areas, crowd out native species and take over pastures, steep cliffs, gulches, and roadsides.

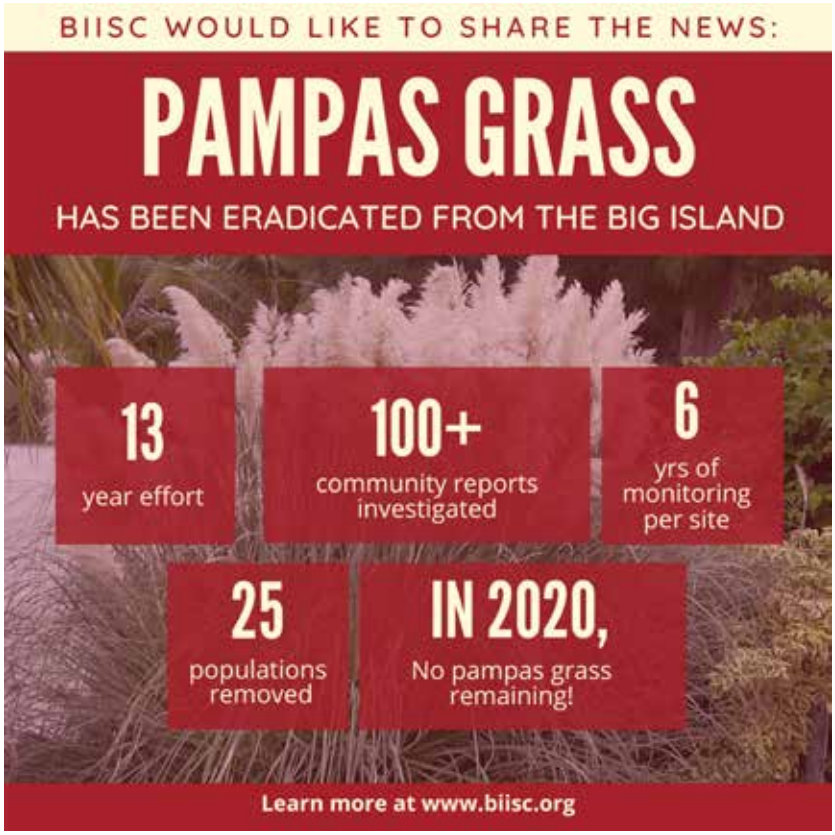
In Hawai'i, efforts to control pampas grass began in the late 1960s and continue to this day. Some islands are doing better than others... but, can we eradicate it statewide? The Invasive Species Committees (ISCs) are committed to this mission. Control efforts continue and the ISCs have made strides toward containing this invader, but successful eradication depends on increased funding and support from the community. Successes will continue if funding can meet the demand, and with supportive local growers, the state could be free from this threat.

Eradicated all known locations.

- Kaua'i had two locations of pampas grass in Līhu'e and Kōke'e that have been removed. There are no known locations of pampas grass today and the Kaua'i Invasive Species Committee (KISC) continue to monitor the island and educate the public about pampas grass risks.

- Moloka'i: All known plants on the island were in landscaping situations and the Moloka'i Invasive Species Committee (MoMISC) have removed them and continue to monitor and respond to any reports of pampas grass.

- Hawai'i Island is the most recent success story. The Big Island Invasive Species Committee (BIISC) recently finished their monitoring phase with no plants found and a successful eradication program achieved. However, you never know if or when it will pop back up, so BIISC continues to monitor and will respond to all reports.



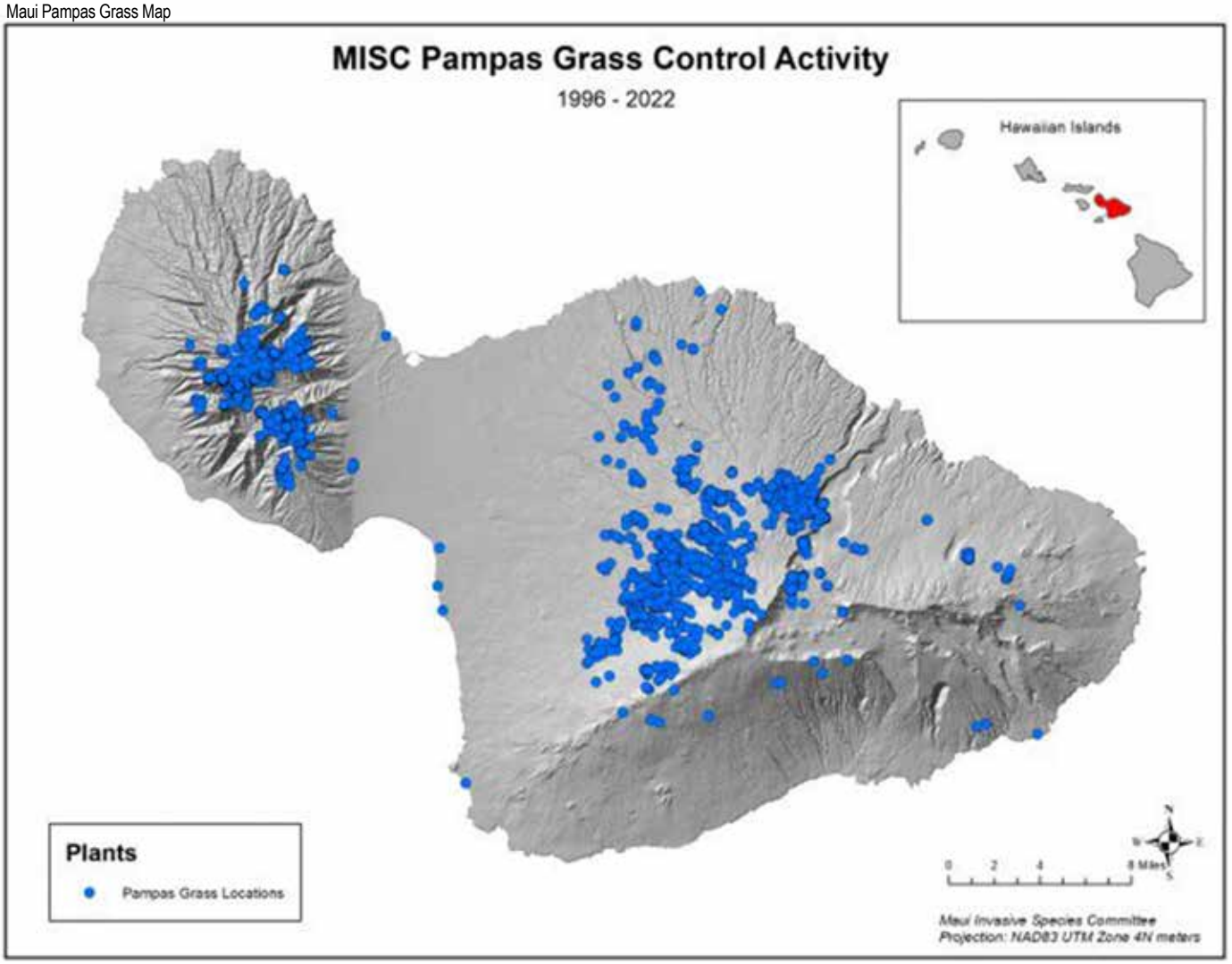
In Progress...

- O'ahu: Beginning in 2008, the O'ahu Invasive Species Committee (OISC) was able to receive funding to start removing pampas grass from yards, forests, and golf courses across the island. However, due to a dip in funding in the mid-2010s, they have had to suspend that effort. The good news is that all known wild populations have been removed and only three known populations remain on private land in the Makaīwa, Kalo'i, and Ke'ehi watersheds. OISC hopes to secure funds to work with the landowners and remove these remaining plants.

OISC removing Pampas Grass from a golf course.

BIISC removing Pampas grass.

Maui Pampas Grass Map



• Maui has the largest distribution of pampas grass in the state and while it's a big challenge, the impacts of dropping it as a target are even bigger. The Maui Invasive Species Committee (MISC) has been controlling it since the 1980s, removing more than 50,000 plants from yards, marshes, pastures, and even the slopes and craters of Mount Haleakalā. Pampas grass remains a top target for MISC and they will continue to progress towards island-wide eradication, even removing it from yards for free.

Not Known to Occur...

• Lānaʻi and Kahoʻolawe have never had detections of pampas, but MISC will follow up on any reports on either island.

Is having cute or trending plants worth the years of work, cost of removal, the threat of wildfire, ecosystem damages, and stress to native Hawaiian species? If you have pampas grass and the reality of it isn't looking so rosy now, contact your local Invasive Species Committee to help you remove it. If you suspect you see pampas grass anywhere in the state, please report it to www.643pest.org. Besides, who needs pampas grass when numerous other native and non-invasive "pono" plants are safe for Hawaiʻi? You can find them all at: www.plantpono.org.

Instagram VS Reality

Billed as low-maintenance...until it blows 20 miles & invades a mountainside!

Your local Invasive Species Committees:

- BIISC: www.biisc.org / E: biisc@hawaii.edu
- MIISC: www.mauiisc.org / E: miscpr@hawaii.edu
- MoMISC: www.molokaiisc.org / E: molokailori@gmail.com
- OISC: www.oahuisc.org / E: oisc@hawaii.edu
- KISC: www.kauaiisc.org / E: kisc@hawaii.edu

Testing different Bermuda grasses side by side

Summarizing results of commercially available Bermudagrass tested by the National Turfgrass Evaluation Program

By: Russell Galanti

Many turfgrass species are advertised as the best. When you read a company brochure or speak to a representative from that seed company, they will ultimately cite some portion of an evaluation that represents that cultivar in the best light. It may be #1 at establishment, have the best fall color, be the most durable, and so on. But there are many considerations when choosing turfgrass. Luckily the National Turfgrass Evaluation Program (NTEP) is designed to develop and coordinate uniform trials of turfgrass species. NTEP is an organization whose offices are located in Maryland, but operates by partnering with collaborators countrywide. Multiple turfgrass species are evaluated at sites across the country, at golf courses and research facilities. Unfortunately Hawaii was not on the list for sites where bermudagrass is evaluated in 2021. Why is Hawaii not on this list when it could be the southernmost experimental site? Hawaii currently has no volunteered collaborators for the project. If there is any interest in helping to develop a partnership with NTEP, the contact phone number is (301)-504-5125.

NTEP provides a useful and free source of data for understanding turfgrass performance and characteristics. The sheer amount of information can be a drawback though, as there are many data points and they are divided by each location. We will review bermudagrass (*Cynodon dactylon*) in this article to give a more approachable review of the species.

Locations

First the locations. Bermudagrass was evaluated in the following states; Alabama, Arkansas, California, Florida, Indiana, Kansas, Maryland, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, Tennessee, Texas, and Virginia. Most of these states had multiple test sites. Table 1 reviews the characteristics and management of each site.

Location (State)	Soil Texture	Soil pH	Soil Phosphorous (lbs/acre)	Soil Potassium (lbs/acre)	Soil Nitrogen (lbs/1000 sq ft)	Sun	Mowing Height (In)	Irrigation
AL	Sandy Loam	6.6-7.0	0-60	0-150	0.0-1.0	Full sun	1.6-2.0	To prevent stress
AR	-	6.6-7.0	0-60	0-150	-	Full sun	1.1-1.5	-
CA	Sandy Loam	7.1-7.5	0-60	241-375	3.1-4.0	Full sun	2.1-2.5	To prevent stress
FL	Sandy Loam	5.6-6.0	61-150	0-150	4.1-5.0	Full sun	2.1-2.5	To prevent stress
FL	Sandy Loam	6.6-7.0	-	-	-	Full sun	0.6-1.0	To prevent stress
IN	Silt Loam and Silt	7.1-7.5	61-150	241-375	2.1-3.0	Full sun	0.6-1.0	To prevent dormancy
KS	Sandy Loam	-	-	-	2.1-3.0	Full sun	2.6-3.0	No irrigation
MD	Silt Loam and Silt	6.1-6.5	61-150	151-240	1.1-2.0	Full sun	1.1-1.5	-
MO	Sandy Loam	-	-	-	-	Full sun	-	To prevent stress
MS	Sandy Loam	7.1-7.5	271-450	241-375		Full sun	2.1-2.5	To prevent stress
NC	Sandy Loam	6.1-6.5	61-150	0-150	3.1-4.0	Full sun	2.1-2.5	To prevent stress
NC	Sandy Loam	6.1-6.5	61-150	0-150	3.1-4.0	Full sun	2.1-2.5	-
NM	Sandy Loam	7.6-8.5	0-60	151-240	3.1-4.0	-	-	-
NM	Sandy Loam	7.6-8.5	0-60	151-240	-	-	-	To prevent stress
OK	Loam	7.1-7.5	61-150	241-375	-	Full sun	0.0-0.5	To prevent stress
OK	Loam	7.1-7.5	61-150	241-375	3.1-4.0	Full sun	0.0-0.5	To prevent stress
OK	Loam	7.1-7.5	61-150	241-375	3.1-4.0	Full sun	1.1-1.5	To prevent stress
TN	Silt Loam and Silt	6.1-6.5	0-60	0-150	3.1-4.0	Full sun	2.1-2.5	To prevent stress
TN	Silt Loam and Silt	6.1-6.5	0-60	0-150	3.1-4.0	-	-	-
TX	-	7.6-8.5	-	-	0.0-1.0	Full sun	2.1-2.5	No irrigation
TX	-	7.6-8.5	-	-	0.0-1.0	Full sun	2.1-2.5	To prevent stress
VA	Silt Loam and Silt	6.1-6.5	61-150	151-240	3.1-4.0	Full sun	1.1-1.5	To prevent dormancy

Table 1: Summary of the 2021 NTEP program bermudagrass evaluation sites, labelled by two letter state abbreviations.

Varieties

35 bermudagrass varieties were trialed during the most recent evaluation. Only 8 of those are currently available commercially in the US or other countries in 2022. The vegetatively propagated varieties are as follows; Tifway, Tiftuf, Latitude 36, Tahoma 31, and Astro. Seed propagated varieties trialed were Sun Queen, Riviera and Monaco.

The NTEP evaluation process is primarily a subjective process based on visual estimates. The program evaluates turfgrass for overall quality, color, texture, density, greenup, vigor/establishment, living ground cover, drought tolerance, frost tolerance, disease and insect damage, and traffic tolerance.

Evaluation of Overall Quality

The overall quality evaluation considers the aesthetic and functionality of the turf. Ratings are based off color, density, uniformity, texture, and disease or environmental stress. The overll quality evaluation is a summation of these characteristics. It is graded from 1-9 with 9 a score of 9 being outstanding, and a rating of 1 being poorest or dead. Generally, a rating of 6 or higher is considered acceptable.

The following table outlines the results of the overall quality evaluation. Varieties that met or exceeded the 6.0 acceptable level were Tiftuf, Latitude 36, Tahoma 31 Astro, and Tifway. The other varieties did not meet the acceptable level, and Sun Queen was third to last in terms of overall quality.

Name	Tiftuf	Latitude 36	Tahoma 31	Astro	Tifway	Monaco	Riviera	Sun Queen
Avg Quality	6.5	6.4	6.4	6	6	5.9	5.8	5.3

Table 2: Summary of the overall average quality of the 8 commercial available varieties of bermudagrass during the 2021 NTEP program.

Latitude 36 bermudagrass, received second to highest overall quality rating.

Living Groundcover

Living groundcover might be considered the second most important parameter to evaluate. Living groundcover is based on the area covered by the originally planted species and used to express amount of damage by abiotic, and biotic issues like disease, insects, weeds, and environmental stress. It is measured using percentages showing the amount of area still covered by the original species.

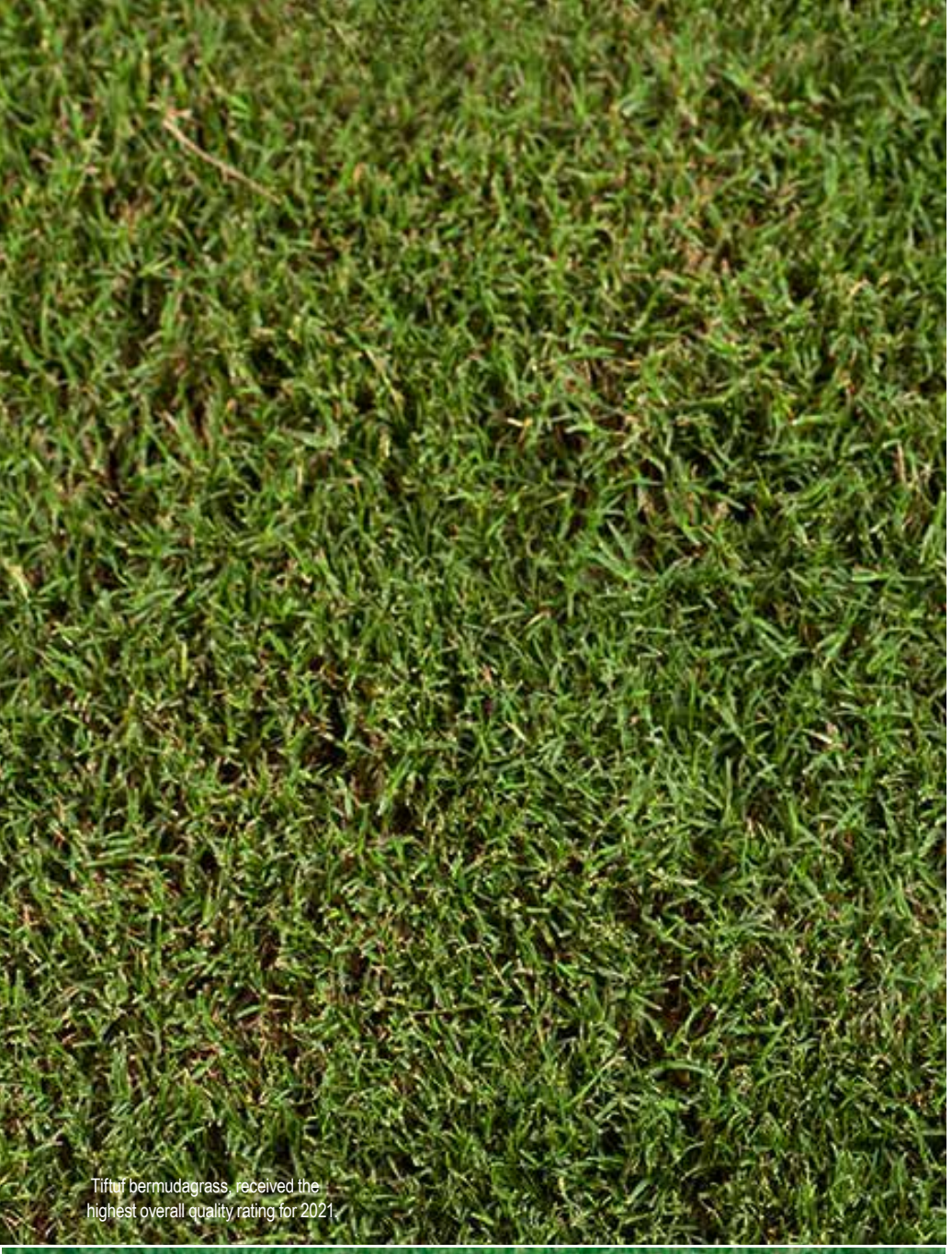
The following table outlines the results of the living groundcover evaluation. The results show the average percentage of ground still covered by live tissue of that bermudagrass variety across all of the evaluation sites that monitored this parameter during the spring, summer and fall. The results show all the grasses maintained a living mat between 86% and ~88% for spring. The results for each species vary by only small amounts, most less that 1-2%. If you consider the large amount of area that bermudagrass covers on a golf course, the difference of even 2% may mean more acres of turfgrass loss. If a golf course has 74 acres of land, almost 1.5 more acres would be dead if the golf course was covered with Tifway (86% living groundcover) versus Riviera (88.1% living groundcover) after a year.

Summer and fall measurements show that the living groundcover percentages changed over the seasons with Tifway now having the highest percentage of cover at 93.8% and Astro having the least cover at 91.9%. All of the living cover increased into the summer due to seasonal growth. Again the percentages only vary by 1-2% between each variety. Fall had even higher coverage percentages that had slightly higher variation than the other seasons measured. Sun Queen had the highest coverage at 97% and Monaco the lowest at 93.3%. Overall these are all considered acceptable levels of living ground cover, but the average of all the seasons may indicate which species is the most resilient in terms of total area of living groundcover. The highest overall was Sun Queen and lowest was Monaco with a difference of 1.6%.

Name	Sun Queen	Tiftuf	Tahoma 31	Tifway	Latitude 36	Astro	Riviera	Monaco
Spring	88.00%	87.60%	86.70%	86.00%	88.10%	86.90%	88.10%	88.10%
Summer	93.40%	93.20%	92.60%	93.80%	91.70%	91.90%	93.00%	92.20%
Fall	97.00%	96.90%	97.30%	95.70%	95.50%	95.50%	94.50%	93.30%
Average	92.80%	92.57%	92.20%	91.83%	91.77%	91.43%	91.30%	91.20%

Table 3: Summary of the average percentage of living groundcover of the 8 commercially available varieties of bermudagrass during the 2019-2021 NTEP program.

Sun Queen bermudagrass. An excellent establisher.



Tiftuf bermudagrass, received the highest overall quality rating for 2021.

Tahoma 31 bermudagrass

Seed Vigor/Establishment

Seed vigor and establishment of vegetative propagules is the next consideration. This is an important consideration. Establishment of new plots would ideally be instantaneous and 100% successful, but this does not occur. The following evaluation is based on percent coverage during establishment period over several month in the 8 varieties at multiple sites. The data from all sites has been averaged.

The table below shows the establishment evaluation results. Sun Queen has the best establishment (83.92%) followed by Riviera (80.74%). Tahoma has the lowest establishment at 65.86%.

Turfgrass Density

Density is defined as the number of living plants or tillers per unit area and is measured visually. Density partially controls how good the grass is for playability and aesthetics. The scale of measurement is from 1-9 with 1 being no turfgrass at all and 9 being maximum density.

Name	Sun Queen	Riviera	Monaco	Tiftuf	Astro	Latitude 36	Tifway	Tahoma 31
% Establishment	83.92	80.74	78.94	72.42	68.94	68.78	67.54	65.86

Table 4: Summary of the average percentage of establishment of the 8 commercially available varieties of bermudagrass during the 2019-2021 NTEP program.

Monaco bermudagrass, it is a seeded variety but can also be established vegetatively

The following table summarizes the results of the density evaluation. Tiftuf was recorded to have the highest average density across all seasons, followed closely by Tifway and Tahoma 31. Sun Queen had the lowest density.

Name	Astro	Latitude 36	Tifway	Tahoma 31	Tiftuf	Sun Queen	Monaco	Riviera
Density Spring	6.3	7.0	7.3	7.0	6.7	4.0	5.0	5.0
Density Summer	6.5	7.0	6.8	7.1	7.5	5.3	6.2	5.9
Density Fall	6.5	6.6	6.8	6.9	7.1	5.6	5.5	5.8
Average	6.4	6.9	7.0	7.0	7.1	5.0	5.6	5.6

Table 5: Summary of the average density of the 8 commerically available varieties of bermudagrass during the 2019-2021 NTEP program.

So while being excellent at establishment, Sun Queen is the least dense overall.

Summary

The NTEP program provides useful information on commercially available and unreleased varieties of important turfgrass species. Many of the parameters evaluated will be directly important to the use of these grasses in golf courses and athletic fields. This article reviewed one of those turfgrass species important in Hawaii. For information on other species, visit the National Turfgrass Evaluation Program website at https://www.ntep.org/bg.htm.

There is no one perfect bermudagrass, especially for Hawaii, with its dramatically different microclimates. Luckily the NTEP program evaluates turfgrass species across different growing regions. While none perfectly imitate Hawaii, they may give some insight into the response these varieties will have at your course. The generalizations can also be used to understand the durability of these species. This article was not written to decide which of the respresented bermudagrasses you should choose. That being said, some species stand out. Tiftuf for example scored first in overall quality and average density, second for living groundcover, and fourth for establishment. Sun Queen scored first for establishment and living groundcover, but last for overall quality and density. Density most likely plays a large role in the overall quality score, because density is so important for turfgrass aesthetics and playability. There are other parameters and turfgrass species covered by the NTEP evaluation, so if you are interested check it out for yourself.

Russell Galanti is a Junior Extension Agent at the University of Hawaii at Manoa.

Figure 1. Degraded soil at Keālia Pond National Wildlife Refuge on Maui after a wildfire in July 2019. An extended drought made it difficult for native plants several years later. Photos by Sonny Gamponia

Restoring Health to Degraded Soils with Native Plants and Microbes

by: Barry Solomon and Sonny Gamponia

A degraded patch of soil along Maui Veterans Highway at Keālia Pond National Wildlife Refuge is in need of healing after some difficult years. Less than an inch of rain during the "rainy season" in 2022 pushed the dryland native plants beyond their wilting point. The temperature of bare soil at midday one day in November was 139 degrees, hot enough to shut down the soil biology ecosystem (figure 1). When volunteers at the Refuge replant the lands near the wetlands, a long-term project, it has been increasingly necessary to pay more attention to retaining soil moisture.

While agricultural methods measure effective strategies by crop yield, conservationists measure effectiveness of their projects by ecosystem function—does the plant community provide adequate foraging, breeding, and nesting conditions for wetland birds or native pollinators? Each vegetative ecosystem, whether it's a wetland meadow, dryland savanna, shrubland, or woodland has a unique native plant community. At the foundation of each of the plant communities are soil microbes and layers of predators and prey near their collective roots. Referred to as the rhizosphere, this long overlooked ecosystem and the root microbiome (the total assemblage of microbes in the soil) can play an important part in drought and heat tolerance.

A United Nations report released in 2000, State of Knowledge of Soil Biodiversity, provides workable and inexpensive solutions for putting life back into unhealthy soils using microbes. The microbes are able to survive beyond the wilting point where water is no longer available to plants. They cling to hygroscopic water remaining in each particle of soil. The microbes literally are holding on to the last ounce of water in dryland soils.

As leaves collect carbon and nitrogen through photosynthesis, roots send chemical signals into the soil. These secretions, called exudates, attract bacteria and fungi that feed on the carbohydrates produced by the roots. In exchange, bacteria and fungi provide nutrients from organic matter and soil particles nearby. Nutrients are fertilizers, and are divided into macro and micro. Macronutrients include nitrogen, potassium, phosphorous, calcium, sulfur, and magnesium. Micronutrients include iron, boron, chlorine, copper, manganese, molybdenum, and zinc. Research by plant pathologist John White of Rutgers University has shown how root hairs select specific species of microbes into their root tips. The microbes release nutrients into the plants, then are expelled to repeat the cycle. Other bacteria are taken in by the plant and stored in leaves, stems and seeds.

The roots, fungi and bacteria are at the center of an expanding ecosystem that includes protozoa, nematodes, arthropods, millipedes, and earthworms. This ecosystem transforms dirt and sand into a living soil. Their movement creates air spaces and new channels for tiny droplets of moisture. This underground infrastructure decomposes leaf mulch into compost, transforming dirt and sand into soil.

The whole process can be jumpstarted by extracting microbes locked in roots, leaves, and stems, using small scale composting methods (figure 2). The native species growing in the drylands at Keālia Pond include ʻākulikuli, ʻōhai, naio, pili,

‘ilima, ‘ā’ali’i, ‘ūhaloa, ‘āweoweo, and pā’ū o’ hi’iaka. This core community of native plants have historically adapted to the soils and climate in this location before human settlers arrived. The plant material is first saturated with water to start the decomposition process. As the the plant material decomposes, it is aerated so oxygen reaches all portions of the bundle. Each batch of cultured microbes is ready to be used for compost tea in 4 to 6 weeks.

The decomposed plant material is placed in a nylon bag and brewed in a 5-gallon bucket using an aquarium pump (figure 3). A spoonful each of molasses, fish fertilizer, and kelp provides food for the microbes. Constant air bubbles provide oxygen, favoring beneficial aerobic bacteria. At 75 degrees, the bacteria population will double every 20 minutes, and fungi population will double every 3 hours.

An informal experiment at the Refuge involved planting fragments of a dryland savanna, with a primary goal of retaining moisture in the soil. Each plot within a temporary drip system followed soil health guidelines recommended by the U.S. Department of Agriculture: 1) maximize living roots; 2) maximize biodiversity: 3) maximize soil cover; 4) minimize disturbance. Microbial compost tea was applied near the roots of each young plant (figure 4).

Larger leaves and new growing tips appeared within the first 3 weeks of the initial application. Revitalized growth spread to established shrubs several feet beyond the irrigation zone. Within 2 months, a diverse savanna took shape, creating shade

Figure 2. Small scale methods of composting is an inexpensive way to extract bacteria and fungi from plant material. Illustrations by Sonny Gamponia

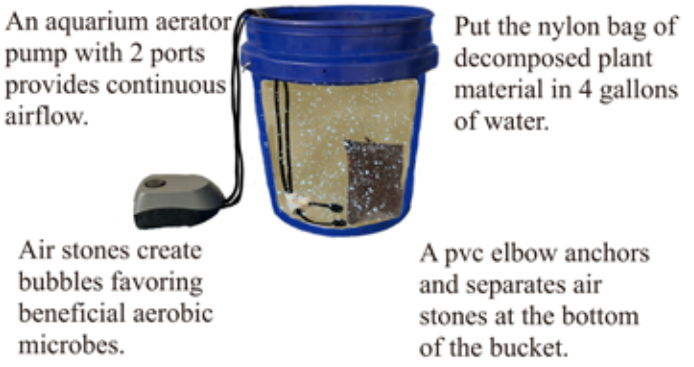


Figure 3. Aerated compost tea in a 5-gallon bucket will multiply diverse microbes in 20 to 24 hours. Illustration by Sonny Gamponia

over 75% of the growing plot (figure 5). Soil temperature at midday was 85 degrees in the shade. Soil under a mulched area at the edge of a low shrub canopy was still moist 40 days after the most recent rainfall. Sow bugs, millipedes, beetle larvae and earthworms were visible in the soil, an indication that higher predatory levels of the soil food web were in place.

A well-known concept in ecology is keystone species. These are species whose addition to or loss from an ecosystem leads to significant changes in occurrence or abundance of other species, or otherwise has a positive influence on the structure or function of the ecosystems in which they occur. Thus, a keystone species has a disproportionately large effect on an ecosystem, although they are not always the most abundant or largest species. Wolves, beavers, ivory tree coral, sea stars, tiger sharks and pollinators are well-known examples. Perhaps microbes and native roots are the unheralded keystone species for restoring native soils.

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Sonny Gamponia has been a volunteer at Kealia Pond National Wildlife Refuge for over 12 years working on habitat restoration using native plants in wetlands, dry shrublands and dunes.

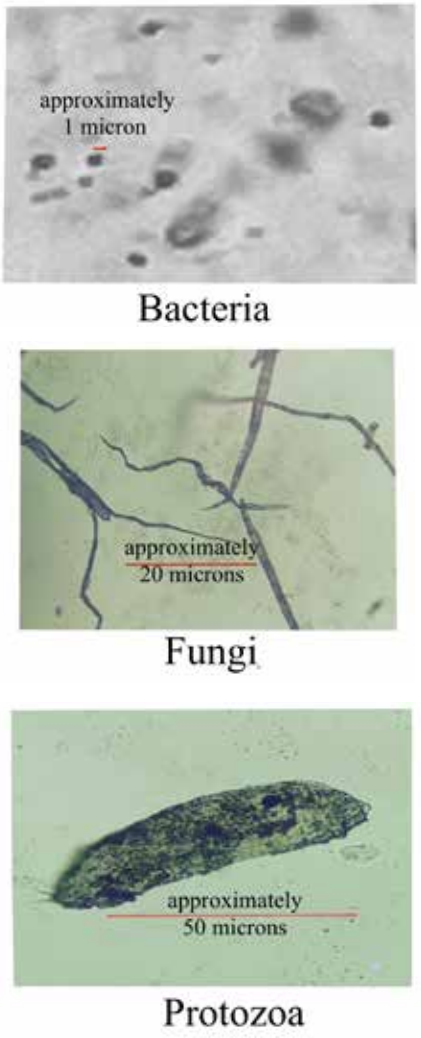

Figure 4. Thousands of bacteria, 50 strands of fungi (hypha) and 10-20 protozoa can be found 1 drop of compost tea. Photos by Sonny Gamponia

Figure 5. Microbes helped jumpstart this fragment of a native dryland savanna growing in a once a bare patch of degraded soil. Photo by Sonny Gamponia

HAWAI'I WILDFIRE MANAGEMENT ORGANIZATION

Hazard Reduction for Arborists and Landscapers

Written by Elizabeth Pickett, Co-Executive Director

Hazard Reduction Saves Lives and Homes

What is Firewise landscaping?

Firewise landscaping is a way of designing and maintaining a home's yard that gives a building the best chance of survival during a wildfire. Firewise landscaping is a global phenomenon that is **based on science and observations** of past fires and is proven to be effective in **reducing wildfire risk** for residents. As an arborist or landscaper, you play an important role in creating **safety in the community**. Incorporating these core wildfire risk reduction concepts highlighted here will add fire protection value to your vegetation management services.

Why should I incorporate this into my work?

A Firewise or fire-resistant landscape around a home that is **well-designed and well-maintained** can make the difference between a simply close call and a burned home during a wildfire. On average, fires in Hawai'i burn as much land each year (proportional to the size of the state) as the most fire-prone states on the mainland. Along with destroying Hawaii's native forests and impacting coral reef health from post-fire erosion, wildfires endanger lives and property. In 2018, a wildfire in West Maui burned 30 homes — homes that were surrounded by flammable vegetation. By incorporating Firewise practices, you will not only **increase your business opportunities**, but also **protect Hawaii's communities and natural resources from wildfire.**

Core Concepts for Hazard Reduction

Be Ember Aware

Most homes that burn down during wildfires are from embers produced by nearby burning vegetation or structures. The more you can do to keep plants, especially shrubs and trees, from igniting near a home, the better.

Create Defensible Space

Defensible space is the required space between structures and the wildland area that, under normal conditions, creates a sufficient buffer to slow or halt the spread of wildfire to a structure. It can protect the home from igniting due to direct flame or radiant heat and provide access for firefighters to defend the structure and put out the fire. Defensible space is essential for structure survivability during wildfire conditions.

This fact sheet brought to you by:
Hawai'i Wildfire Management Organization,
a 501(c)3 non-profit that has been providing the Hawaiian Islands with nationally recognized wildfire protection services since 2000.

HWMO HAWAI'I WILDFIRE MANAGEMENT ORGANIZATION

Lean, Clean, Green

The plants around a home can act as fuel during a wildfire.

To reduce vegetative hazards, limit the amount of flammable vegetation (lean), remove dead or dry flammable debris (clean), and create a well-irrigated greenbelt using mostly, if not all, native or drought tolerant vegetation (green).

Home Ignition Zones (HIZ)

There are two zones in the HIZ:

ZONE 1: 30 feet out from all structures

ZONE 2: 30 to 100 feet out from all structures (or up to the property line)

Essentially, you want to put the most effort closest to the home and work your way out.

Wildfire Hazard Reduction Strategies

Focus on: Vulnerable Areas

- The **roof** is the most vulnerable part of the home to ignition. Trim tree branches to keep a minimum of 10 feet from structures.
- **Windows** are weak spots as heat from plants nearby can cause them to shatter. Keep plant growth away from windows as much as possible.
- **The Fire-Free Zone:** the first 5-10 feet around a home should have very little to no flammable materials. The most optimal surfacing in this zone is paving, gravel, cinder, or other non-combustible materials.
- Utilize existing **"hardscaped**" areas such as driveways, walkways, patios, water features, and boulders as ways to break up the continuity of fuels.
- Combustible **fencing** can become engulfed and if attached to the home's sidings can carry the fire right to the structure. Keep vegetation trimmed low and away from fences.

Focus on: Plant Spacing

- *Vertical Spacing*
  Ladder Fuels, or low-level vegetation that allows the fire to spread from the ground to the tree canopy, should be removed. Create at least 10 feet of separation between low-level vegetation and tree branches. This can be done by reducing the height of low-level vegetation and/or trimming lower tree branches.

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HWMO HAWAI'I WILDFIRE MANAGEMENT ORGANIZATION

- *Horizontal Spacing*
  Prevent horizontal wildfire spread by spacing **lateral fuels**, or vegetation that are connected horizontally, farther apart and into clusters or islands. The minimum spacing between clusters of vegetation is **3 times** the height of the tallest plants. Clusters of vegetation should also be kept as far away from structures as possible.

Focus on: Wiser Plant Choices

Firewise landscaping is about having the **right plants in the right place.** Non-native, lush plants often drop hazardous debris and can become fire-prone in drought conditions. For drier areas of Hawai'i, consider using native dryland plants that are specially adapted to local conditions and require less upkeep, water, and fire maintenance, saving yourself a great deal of time, money and resources. Check out a list of recommended Firewise plants in the "Ready, Set, Go! Hawai'i Guide" on our website's "HWMO Products" page: hawaiiwildfire.org/hwmo-products.

Focus on: Keeping a Good Maintenance Schedule

Regular maintenance is a key function of long-term wildfire risk reduction — this aside from promoting plant health, improving aesthetics, and other benefits of a well-mapped-out plant maintenance schedule.

How will this help my business?

- Add value to your services
- Stand out from the competition
- Recognition that you care for the safety of your community
- More business opportunities (year-round fire season in Hawai'i)

Thank you for helping us protect people and their homes from wildfire!

For more information and resources:

HawaiiWildfire.org

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Flip the page for tips and tricks

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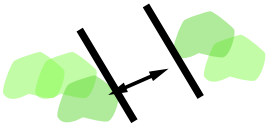

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Some information based on Texas A&M Forest Service information from a 2014 presentation.

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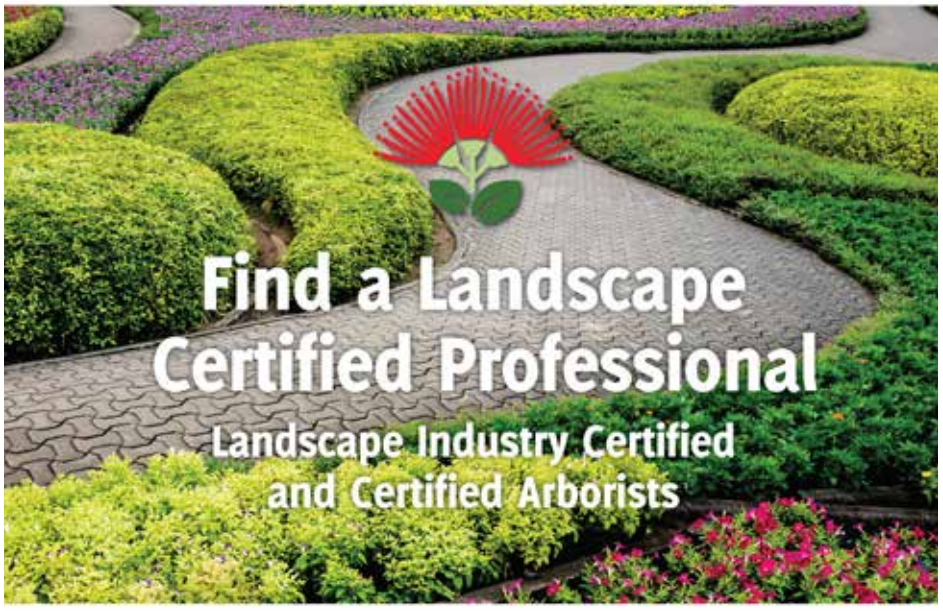

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Hawaii Convention Center,
1801 Kalakaua Ave,
Honolulu, HI 96815.

SEPTEMBER 14, 2023
More info at:
hawaiiscape.com/conference/

The new **Find a Landscape Certified Professional** on the LICH website has a list of companies having Certified Arborists in Hawaii, provided by the International Society of Arboriculture. If you don't see your Company, let the LICT Hawai'i State Manager, Garrett Webb know by sending your information to: *palmsinkona@yahoo.com.*

If your company is listed, but you want additional information, also let Garrett know. Company information can include; postal address and location, email address, and website. Names of Certified Arborists are **NOT** included.

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