Aquatics

SPRING 2024

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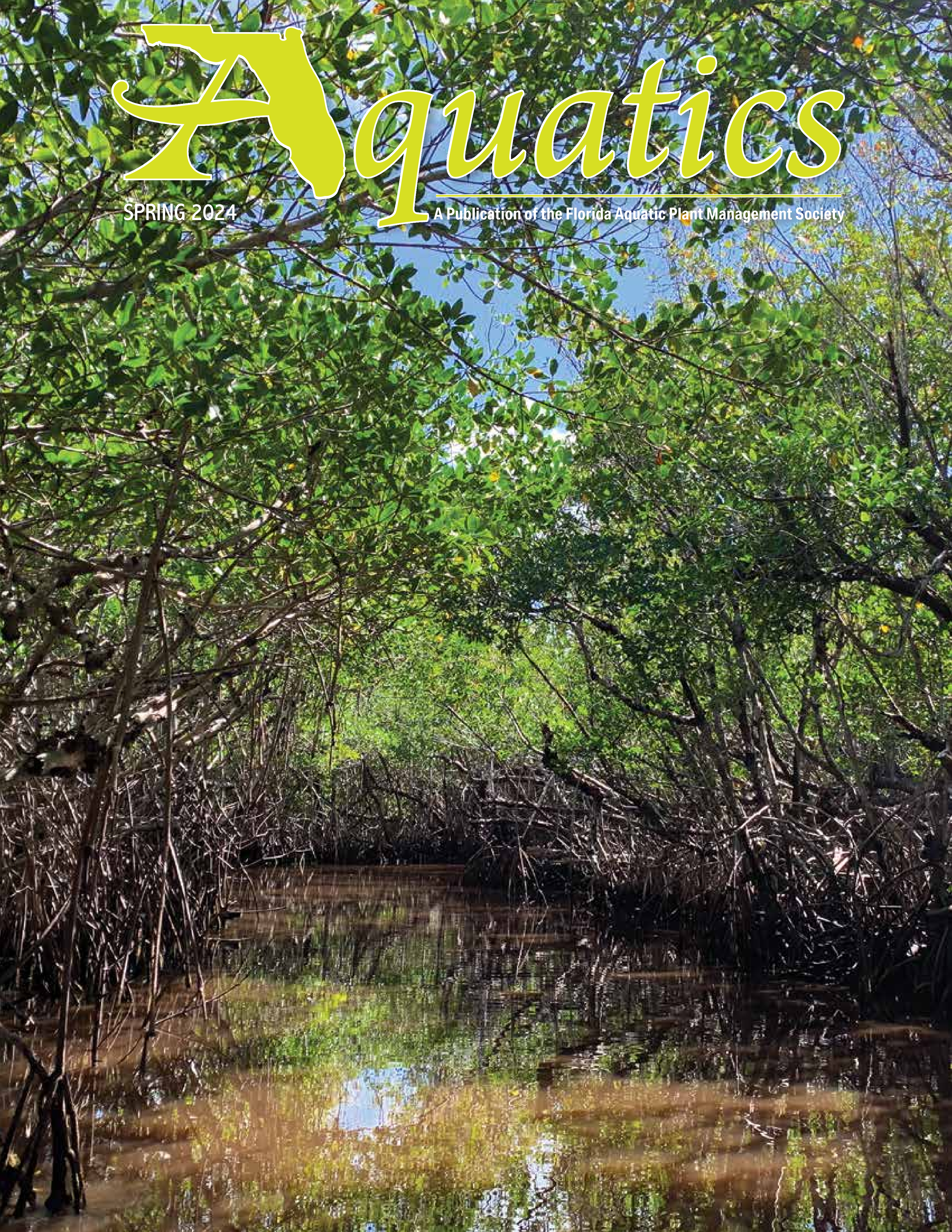

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Looking through a red mangrove tunnel in the Florida Everglades. Credit: Cayla Romano UF/IFAS CAIP Communications Specialist

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The vision of FAPMS is to be a leading resource for promoting excellence in the stewardship of Florida's aquatic ecosystems.

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Aquatics

Letter from the Editor

Shelby Thomas

Dear Aquatics Readers,

I am very excited to bring you the first issue of 2024 featuring the latest in the world of aquatics. From working in science communication to public relations, I have always found translational science to be some of my favorite work. This issue is special because it not only bids farewell to a dedicated invasive plant manager, features a story on the current Florida Aquatic Plant Management Society President, Matt Phillips, and contains an account of aquatic plant research from down under, but also shares vital policy updates our readers should be aware of.

This issue brings you a variety of updates. Lee Van Wychen, executive director of science policy for the Weed Science Society of America shares vital policy updates with our readers to keep them abreast of changes. He also shares updates funding opportunities and various organizational changes. Read more about these updates on page 26.

This issue also features a brief examination of the 17 aquatic herbicides registered for use in the state of Florida. Michael Durham and Dr. Benjamin Sperry attempt to discuss each herbicide in terms of its mode of action and how it is commonly applied to control hydrilla and water hyacinth as an in-water and/or foliar application. To read the full article flip to page 5.

On page 9 Applicator's Corner features a piece by Dr. Benjamin Sperry revisiting an article by Dr. Daniel Canfield about why aquatic plants favor asexual reproduction. The article explores plant evolution due to pollen, habitat isolation, and potential genetic advantages of asexual reproduction. The article also discusses the effect overreliance on asexual reproduction can have on aquatic plants.

Many of our readers spend their days amongst the beauty of Florida's waterbodies and natural habitat. This issue features an article by Cayla Romano giving you some tips and tricks for phone photography in the field. I would encourage you to take her advice and start snapping photos while you are in the field! If you send them our way, your photography might just be featured in an upcoming issue. Flip to page 20 to read learn something new.

Thank you again for the opportunity to serve as your Editor. I look forward to bringing you the latest information and features from our industry. Interested in being featured or writing for Aquatics, email Shelby Thomas at aquaticsmagazine@gmail.com.

Aquatic Herbicides Mode of Actions and Use Patterns in Florida

Introduction

This article briefly examines the 17 aquatic herbicides registered for use in Florida. It discusses each herbicide in terms of its mode of action and how it is commonly applied in Florida to control hydrilla and water hyacinth as an in-water and/or a foliar application. The information presented here condenses much of the extensive information on aquatic weed herbicides into, hopefully, a useful set of tables and summaries. While this information was collected from other publications and product labels, it is general in nature and should not replace the specific rates and use patterns found in the product label.

Acetolactate Synthase (ALS) Inhibitors

These herbicides inhibit the ALS enzyme which is responsible for the biosynthesis of branched-chain amino acids (isoleucine, leucine and valine). These three amino acids are only produced in plants and some micro-organisms. ALS-inhibiting herbicides are slow to cause plant death and can cause plant growth regulation effects.

Bispyribac-sodium is formulated as a wettable powder which is commonly packaged in water-soluble packages in aquatic formulations. These formulations need to be mixed with water prior to application. Bispyribac-sodium is highly effective on some key submersed weed species such as hydrilla. However, it is slow-acting and requires exposure times >60 days for effective control. This herbicide is also effective on some target emergent and floating species such as waterhyacinth and waterlettuce when used at rates of 1 to 2 oz/A but symptoms are slow to develop.

Imazamox

The limited data available on **imazamox** on hydrilla control indicates that control is rate dependent and lower rates may act as a growth regulator. **Imazamox** is effective on water hyacinth as an in-water treatment and foliar application. It is typically tanked mixed with a partner herbicide (like **carfentrazone**) when used as a foliar application.

Imazapyr, while highly effective at controlling waterhyacinth, is limited in its use pattern due to 120-day irrigation restrictions.

Penoxsulam. For hydrilla control, penoxsulam requires an exposure time of 90 to 120 days. However, it is often mixed with other herbicides, like endothall resulting in shorter exposure time requirements, greater selectivity, and less of each herbicide required for control of hydrilla. Likewise, penoxsulam is often tank-mixed with partner herbicides when made as a foliar application to waterhyacinth.

Protoporphyrinogen oxidase (PPO) Inhibitors

PPO (protoporphyrinogen oxidase) inhibitors are herbicides that inhibit the PPO enzyme. PPO enzymes are found in the chloroplasts of plants cells and are needed for chlorophyll production. Chlorophyll is one of the main structures in plants used to absorb light and convert it into sugars. When the PPO enzyme is inhibited, protoporphyrinogen IX (PPGIX) builds up in the chloroplast. Although not yet a functional chlorophyll, PPGIX can absorb sunlight which increases its energy state. Once energized, it can react with oxygen to produce singlet oxygen, a very reactive form of oxygen, or it can react with other organic compounds near to it. These reactive molecules attack nearby proteins and lipids, destroying chlorophyll, carotenoids, and cellular membranes.

Carfentrazone is a fast-acting herbicide available as a liquid formulation. Carfentrazone possesses in-water activity on some select submersed plant species; however, it is primarily used for emergent and floating species, often in combination with other herbicides.

While the required exposure time for hydrilla control with **flumioxazin** is relatively short, the typically high pH of many of Florida's lakes greatly decreases its half-life. **Flumioxazin** is generally applied early in the morning, when pH is often at its lowest, to prolong its half-life. When used as a foliar application, **flumioxazin** is effective on a broad range of species. It is frequently tank-mixed with other herbicides to enhance control of floating and emergent species.

Photosystem one (PS1) Inhibitors

Photosystem one (PS1) inhibiting herbicides interfere with the electro-chemical processes of photosynthesis. The light energy absorbed by chlorophyll is used to excite the energy state of an electron. Normally, the energy of the excited electron is harnessed by the plant in a series of controlled steps that ultimately lead to carbon fixation and other products needed by the plant. The PS1 inhibiting herbicide intercepts and reacts with this excited electron forming an unstable radical. This unstable herbicide radical then reacts with oxygen and water to produce highly reactive hydroxyl radicals. These radicals interact and break down the fatty acids in cell membranes which leads to necrosis of the tissue.

Diquat is a fast-acting herbicide used extensively both as an in-water treatment and as a foliar spray. It is strongly cationic which means it will quickly and irreversibly bind to suspended clay colloids and suspended organic materials and become inactivated. Consequently, use of diquat in turbid waters often leads to reduced efficacy. For submersed plant control, diquat is often mixed with other active ingredients as it can be weak as a stand-alone herbicide. As a foliar application, it is highly effective on a range of species and can be combined with other herbicides.

Enolpyruvyl shikimate-3-phosphate (EPSP) Synthase Inhibitors

Glyphosate is currently the only known herbicide that inhibits 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) which is an enzyme found in the chloroplast and is involved in a set of reactions that produce chorismate. Chorismate is used by plants to produce aromatic amino acids (phenylalanine, tyrosine, and tryptophan), auxin and many other essential compounds.

Glyphosate is only used as a foliar application. It is a broad-spectrum herbicide that will control many species of both monocots and dicots. Due to its lack of selectivity, glyphosate is not always the first choice for floating and emergent plant control where non-target plants are present. **Glyphosate** is ineffective as an in-water treatment because it readily adsorbs to particulates in the water column, is quickly broken down by microbes and does not readily diffuse into plant tissues below the water surface.

4-Hydroxyphenylpyruvate dioxygenase (HPPD) Inhibitors

4-hydroxyphenylpyruvate dioxygenase (HPPD) inhibitors prevent the production of homogentisic acid. Homogentisic acid is used by plants to produce structures associated with photosynthesis and certain types of vitamin E. A reduction of homogentisic acid can also lead to a reduction in carotenoid production, which is vital in protecting plants from photo-damage (too much sunlight). It is this loss of carotenoid production that leads to the bleached look of affected plants and their eventual death.

Topramezone is the only HPPD inhibitor registered for aquatic use. Initial studies indicated hydrilla control with topramezone requires a low rate of product (<45 ppb), but a long exposure time, similar to the use patterns of fluoridone and bispyribac-sodium. It is in a different herbicide group which will make it a good choice to use for herbicide resistance management programs. Foliar application use patterns are still being evaluated for topramezone.

Synthetic Auxins

Synthetic auxin herbicides derive their name from acting similarly to a naturally occurring plant hormone called auxin. Auxin, the plant hormone, is produced in the growing tips of plants and is associated with many functions, such as cell elongation, shoot growth and fruit set. The exact binding site or sites of the synthetic auxin have not been identified. Since the naturally occurring auxin plays many roles in plant growth and development, it may be that the synthetic auxins affect more than one plant process. It is known that synthetic auxins do affect cell walls, pH, cell growth and reproduction and stimulate ethylene production which often leads to the characteristic twisted growth associated with these herbicides.

Triclopyr are primarily used for controlling woody brush, such as tussocks and

Year Registered	Active Ingredient	Mode/Mechanism of Action	WSSA Group	Chemical Family
1950s	Copper	Undefined	NC	None recognized
1959	2,4-D	Auxin	4	Phenoxy-carboxylic-acid
1960	Endothall	Serine-Threonine Protein Phosphatase	31	None recognized
1962	Diquat	PS1	22	Bipyridylium
1977	Glyphosate	EPSPS	9	Glycine
1986	Fluridone	Phytoene Desaturase	12	None recognized
2002	Peroxides	Cell membrane oxidizer	NC	None recognized
2002	Triclopyr	Auxin	4	Pyridine carboxylic acid
2003	Imazapyr	ALS	2	Imidazolinone
2004	Carfentrazone	PPO	14	Triazolinone
2007	Penoxsulam	ALS	2	Triazolopyrimidine
2008	Imazamox	ALS	2	Imidazolinone
2011	Flumioxazin	PPO	14	N-phenylphthalimide
2012	Bispyribac-sodium	ALS	2	Pyrimidinyl(thio)benzoate
2013	Topramezone	4-HPPD	27	Benzoylpyrazole
2017	Sethoxydim	ACCase	1	Cyclohexanedione
2018	Florpyrauxifen-benzyl	Auxin	4	Arylpicolinate

*Rates, concentrations, and exposure time requirements based on label information or scientific literature.

*NC=Not Classified.

*WSSA = Weed Science Society of America.

Active Ingredient	Primary Environmental Fate Pathway	Avg half-life in water	Submersed	Foliar application	Speed of activity
Bispyribac-sodium	Microbial	30 days	30-45 ppb @ 60-90 days	1-2 oz/a	slow
Imazamox	Photolysis/Microbial	7-14 days	50-200 ppb @	16-32 fl oz/a	Slow
Imazapyr	Photolysis	2-3 days	-	1 qt/a	slow
Penoxsulam	Photoylsis	2-4 weeks	25-75 ppb @ 90-120 days	2-5.6 fl oz/a	slow
Carfentrazone	Microbial/Hydrolysis	3-5 days	200 ppb @unknown		fast
Flumioxazin	Hydrolysis	24 hours	200-400 ppb @hours		fast
Diquat	Irreversible Adsorption	1-7 days	370 ppb	1-2 qt/a	fast
Glyphosate	Microbial	12-60 days	-	1-7.5 pts/a	slow
Topramezone	Photolysis	4-6 weeks	25-40 ppb @ 60 days	1 pt/A	slow
Triclopyr	Photolysis	2-14 days	2.5 ppm?	2-8 qts/A	Intermediate
2,4-D	Microbial	1-3 weeks	4 ppm	1-4 qts/A	Intermediate
Florpyrauxifen-benzyl	Photolysis	0.5-2 days	24-48 ppb (PDUs) @ 36-48 hours	1.35-2.7 fl oz/A (1-2 PDUs)	Intermediate
Fluridone	Photolysis	>20 days	3-15 ppb @45-90 days		Slow
Endothall	Microbial	5-10 days	1-5 ppm @ 12-72 hours		Fast
Copper	Hydrolysis/ Adsorption	2-8 days	1 ppm	-	Fast
Peroxides	Hydrolysis	8 hours			Fast
Sethoxydim	Microbial/Photolysis	5-25 days	-	2.5 pt/A	Slow

primrose willow. Its use is often limited because of a 120-day irrigation restriction on treated waters. It is primarily used as an in-water treatment for controlling water milfoil.

2,4-D is used to target floating and emergent species, such as waterhyacinth and Cuban bulrush. There are irrigation restrictions after treatment, but they are much less than those imposed on **triclopyr.** **2,4-D** is also primarily used as an in-water treatment for controlling water milfoil.

Florpyrauxifen-benzyl is labeled for in-water use to control many weed species in static, or slow-moving systems. It is highly effective at controlling hydrilla at low use rates which can provide selectivity to many native species. At these lower use rates, exposure times will need to be in days verses hours. **Florpyrauxifen-benzyl** is also effective at controlling waterhyacinth and many other emergent and floating species when used as a foliar application. However, there is some evidence that cooler temperatures may either delay or reduce its efficacy. Research is still ongoing to document its activity profile and use patterns.

Phytoene Desaturase Inhibitors

Phytoene Desaturase is an enzyme in the beta-carotene pathway. Carotenes are used by plants to protect them from too much sunlight by dissipating energy as heat and preventing chlorophyll destruction. When plants are prevented from forming carotenes, chlorophyll will not accumulate either leaving newly formed leaves to appear white, or "bleached."

Fluridone is used as an in-water treatment for controlling submersed plants, like hydrilla and floating plants, such as duckweed. Although approved for use rates up to 150 ppb, typical use rates for controlling hydrilla are 8 to 15 ppb for 45-80 days. Longer exposure times may be required depending on the size of the plants. **Fluridone** use has declined in Florida waters because of the development of resistance by hydrilla.

Protein Phosphatase Inhibitors

Until 2012, the mode of action for **endothall** has been classified as unknown. Recent studies suggest that the target site for endothall is serine/threonine protein phosphatases (PPs). PPs are used in many organisms for signaling and controlling many cellular processes. The specific PPs targeted by endothall disrupt chromosomal and microtubule events during mitosis.

Endothall is commercially available in two salt formulations: potassium and amine salts of **endothall**. The potassium salt of **endothall** is used as in-water treatment to control key species such as hydrilla. Its has relatively short exposure time requirements (hours to days depending on concentration and target species) which makes it ideal for high water exchange sites. Amine **endothall** is generally more active on plants and algae but is also much more toxic to fish. This higher toxicity limits the use of this product to smaller treatment areas and at reduced rates.

Copper

Copper is considered a fast-acting herbicide and algaecide with typically low toxicity to fish, except in soft water (low carbonate hardness). The mechanism of action for copper is not fully understood, but it is believed to target elements of photosynthesis and cell division. It is available in two formulations, **copper sulfate** and **chelated copper.** The chelated formulation is purported to be more bioavailable, or active on plants and algae and less toxic to non-target organisms.

There are two types of **chelated copper** registered for use in Florida waters: **copper ethanolamine** and **copper triethonolamine**. **Copper ethanolamine** is used to control both algae and plants while **copper triethonolamine** is primarily used as an algicide. As with all herbicide applications, refer to specific copper product labels for restrictions and species susceptibility.

Cell Membrane Oxidizers

Peroxides work by oxidizing many different parts of a cell causing membrane disruption and eventual cell death. They are used in many states to control algae in water reservoirs. **Peroxides** can be combined with other algaecides to increase effectiveness and spectrum of algae control. There are many types and formulations of peroxide-based algaecides commercially available.

Acetyl CoA Carboxylase (ACCase) Inhibitors

ACCase-inhibiting herbicides are only active on grasses because the specific ACCase enzyme they target is only found in members of the Poaceae family. Inhibition of this enzyme prevents fatty acid production which results in eliminating the plant's ability to build new cell membranes during cell growth.

Sethoxydim has a FIFRA (24-c) – special local need label in Florida under the trade name TIGR allowing the use of this herbicide on invasive grass species in many aquatic areas.

Further Reading

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https://hracglobal.com/tools/classification-lookup

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Attack of the Clones! Why do Aquatic Plants Favor Asexual Reproduction?

Sexual reproduction is dominant amongst terrestrial plants. Sexual reproduction shuffles genes, allowing organisms to quickly evolve new traits that increase survival. The dominance of sexual reproduction is best illustrated by the prevalence of flowering plants (angiosperms). Flowers attract insect pollinators, which carry pollen far away to other plants, increasing the efficiency of sexual reproduction. This increased efficiency gave flowering plants a major advantage 66 million years ago when an asteroid devastated life on Earth (Benton et al. 2022). Today, flowering plants constitute 90% of plant species in almost every habitat on Earth (Benton et al. 2022). In contrast, only 2% of angiosperms are aquatic species. In aquatics, although many plants are angiosperms, asexual reproduction (where a plant makes identical clones of itself, often through turions, tubers, or plant fragments) is dominant over sexual reproduction. This stark contrast between terrestrial and aquatic plants has fascinated scientists for over a century. We will discuss only a few of the major hypotheses of why asexual reproduction is dominant in this article.

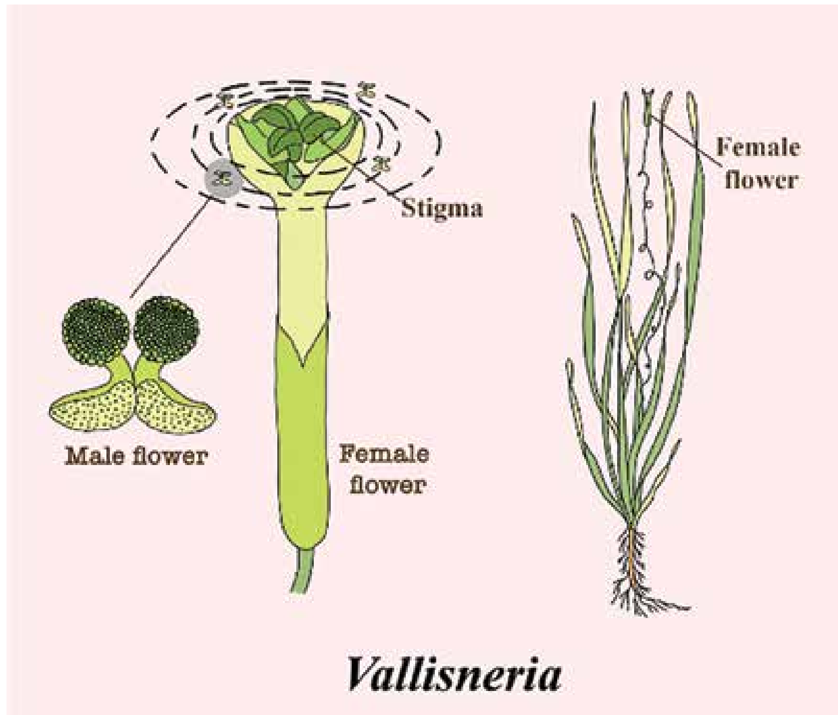

Figure 1 An illustration of the sexual reproduction of Vallisneria. Male and female flowers float on the surface until they meet, and the male flower falls into the female flower. Fertilized flowers are pulled back underwater. Figure credit belongs to Vendantu.com.

Many explanations for why asexual reproduction dominates focus on the challenges in sexual reproduction for aquatic plants, especially submersed aquatic plants (Sculthorpe 1967). Water can cause pollen to clump together (and not attach to insects), wash away from the flower, or even directly damage the pollen by overhydration (Mao and Huang 2009). Aquatic plants either needed to evolve pollen that can get wet or prevent their pollen from getting wet. Additionally, flowers near the water surface present a drowning hazard for insect pollinators. Emergent plants avoid these challenges by positioning flowers on their above-water stocks. However, submersed plants typically rely on buoyancy for support and must produce much stronger stocks to stick above the water. The extra hurdles plants face as they evolve to live a more aquatic lifestyle may simply reduce the efficiency of sexual reproduction (Eckert et al. 2016, Li 2014, Sculthorpe 1967). However, sexual reproduction has enough advantages that most aquatic plants undergo sexual reproduction occasionally (Eckert et al. 2016).

Habitat isolation may also play a role in the dominance of asexual reproduction. Many lakes are essentially islands of water separated by seas of land. Isolation from neighboring habitats makes the possibility of recolonization lower, increasing the likelihood of localized extinction. Therefore, aquatic habitats are more likely to possess traits that allow for species to persist through stressful events rather than traits that aid in recolonization after stressful events (Li 2014). Many of the asexual modes of propagation available to plants are underground, able to persist until the appearance of ideal conditions (Li 2014). Asexual modes of reproduction simply may be better adapted to the common stresses of the aquatic environment.

Colonization of isolated habitats may be one example where sexual reproduction has a slight edge over asexual reproduction. The major method of dispersal between watersheds has long been hypothesized to be birds, either via fragments or internally via seed (Li 2014). Evidence in favor of this is strong, though the exact role birds play has long been debated (Clausen et al. 2002, Green et al. 2002). Transport by birds would explain the wide distribution of aquatic plants, which often span continents (Santamaría 2002). Seeds may be further favored for their ability to survive through the gut, which is generally not observed for asexual propagules (Sculthorpe 1967). In this regard, sexual reproduction may play an important role in long-distance dispersal as one of the few between-watershed dispersal methods available (Li 2014).

The final argument to discuss is the potential genetic advantages for asexual reproduction. The stressful nature of the aquatic environment and the need to persist may favor the clonal reproduction of plants that have successfully persisted through stressful periods (Li 2014, Santamaría 2002). Additionally, aquatic plants may have to adapt to a narrower set of common conditions common across water bodies. For example, temperature changes in water are not as extreme as on land, meaning aquatic plants need to adapt to a narrow set of temperature ranges. Aquatic plants may only need a small "toolbox" of genetic code, picking the right tool (turning on and off genes) to adapt to many different water bodies (Li 2014, Sculthorpe 1967). Many authors debate this last point, contending the aquatic environment is not as uniform or consistent as other authors argue (Eckert et al. 2016, Santamaría 2002). Inbreeding is also problematic in these isolated habitats (Santamaría 2002).

However, the overreliance on asexual reproduction can make aquatic plants vulnerable to major disturbances. Li (2014) discusses a case in China of an ecosystem shift from *Potamogeton malaianus* to *Vallisneria* spp. after extreme flooding and drought. *P. malaianus* spreads prolifically through shallow rhizomes, whereas *Vallisneria* species produced buds at deeper depths and a lot of seeds. A severe drought likely killed most of the shallow rhizome system in *P. malaianus*, whereas deeper asexual buds and seeds of *Vallisneria* survived and allowed for successful recolonization. The *Vallisneria's* greater amounts of sexual reproduction likely helped in two ways. First, the greater seed production helped with recolonization as seeds are more tolerant to drought. Second, greater genetic diversity may allow for more variability in *Vallisneria* plants, so some plants will be better adapted to rare events like the extreme flood and drought Li (2014) describes. Li (2014) and others propose that asexual reproduction is better suited for surviving common short-term stresses (such as seasonal droughts and winter freeze). In contrast, sexual reproduction allows for better adaptation to high-stress events through genetic diversity and seed physiology (such as extreme droughts or floods).

In summary, aquatic habitats favor asexual reproduction most of the time. The difficulties in dispersal, a narrow set of common stresses, and the difficulties of sexual reproduction favor asexual reproduction for survival on a season-to-season basis. However, sexual reproduction increases survival over longer timespans by increasing genetic diversity and producing hardier seeds.

Management Implications

The rarity of sexual reproduction reduces the likelihood of herbicide resistance developing. However, hydrilla developed resistance to the aquatic herbicide, fluridone, relatively quickly after wide-scale adoption of fluridone use patterns through somatic cell mutations (asexual). Consequently, we have learned from the case of fluridone resistance that asexual reproduction alone does not protect against herbicide resistance and that other practices must be implemented for good herbicide stewardship.

Prevention strategies are likely more effective for aquatic plant control than terrestrial plant control. The relatively isolated habitats make spread between water bodies more difficult. Elimination of small colonies may be more realistic for aquatic plants if the habitat is sufficiently isolated. As discussed earlier, asexual propagules likely cannot spread as far as they get digested inside the guts of animals. However, the invention of the automobile allows asexual fragments to easily travel across hundreds or even thousands of miles (Bruckerhoff et al. 2015, Darnell 2022). Prevention of spread via humans is very important to slow invasion. Aquatic plant control should be timed to reduce the production of both asexual and sexual propagules, as both play unique roles in the plant's survival.

The research on the reproduction of aquatic plants indicates that underground asexual propagules (such as tubers) may be extra important for survival through disturbances. Above ground propagules can travel further but are less protected against disturbances such as drought. Herbicide applications should be timed to reduce the number of propagules produced. Herbicides that translocate to underground rhizome tissues would likely be especially effective in controlling aquatic plants.

There is much more to learn about aquatic plant reproductive strategies. Great strides have been made in the last 30 years with the rise of genetic tools (Eckert et al. 2016). We are now increasingly able to investigate questions of how aquatic plants spread and how they develop herbicide resistance mutations. Human curiosity may have started the investigation into why asexual reproduction is dominant in aquatic plants, but today, it is increasingly important for future management strategies.

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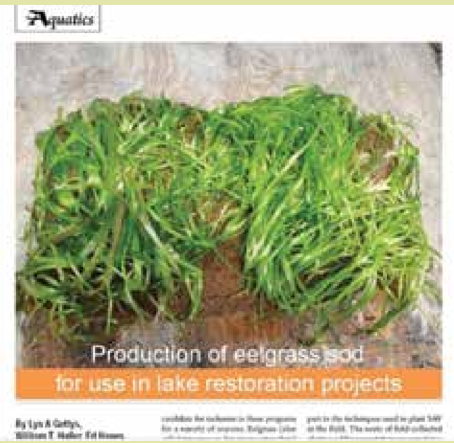
Aquatic plant research down under:
My excellent adventure in New Zealand

*Last year I got an email from my friend and colleague Dr. Deborah Hofstra, who is experimenting with a variety of techniques designed to improve the establishment of submersed native plants. She was interested in basing some of her trials on the eelgrass sod I developed with Bill Haller back in the day (check out our article about the subject in the Spring 2012 issue of **Aquatics**) and wanted to know if I had any tips, tricks, or important safety tips to share. We had a couple of productive Zoom meetings to talk about aquatic restoration, then Deb asked if I was interested in coming for a site visit to check out some of the restoration research she was working on.*


Aquatics

Production of eelgrass sod
for use in lake restoration projects

Oh, did I mention that Deb is in New Zealand?

Who could say no to a request like that? After a bit of planning, I renewed my passport, hopped on a plane (well, actually, a couple of planes), and went on an adventure!

Fun fact: New Zealand is really, really, really far away...

I left Atlanta on Tuesday afternoon, had a brief layover in Los Angeles, and landed in Auckland on Thursday morning. New Zealand is 18 hours ahead of Florida, but it was actually easier for me to think of it as being a day ahead and six hours behind. For example, if it's 11:30pm on Sunday in Florida, it's 5:30pm on Monday in New Zealand – that means it's already tomorrow

down under. The seasons are flipped too – it was cold and rainy when I left Atlanta but January is the height of summer in New Zealand. Customs officials conducted a very thorough inspection of my waders (biosecurity is extremely important and yes, of course I took my waders!), then I picked up my rental car. Driving on the wrong side of the road from the wrong side of the car was an adjustment but not as traumatic as I expected. I left the car rental lot and drove about 20 miles in the wrong direction before exiting the highway and heading south (cut me some slack – I'm directionally impaired on a good day, and at this point I was jet-lagged and had no GPS).

I arrived at my destination in Hamilton and slept for 14 hours, then headed over to meet Deb at her office on Friday morning. Deb is the Principal Scientist of Freshwater Ecology at New Zealand's National Institute of Water and Atmospheric Research (NIWA). According to the website (https://niwa.co.nz/), NIWA's mission is "to conduct leading environmental science to enable the sustainable management of natural resources for New Zealand and the planet".

After being issued my official visitor credentials and electronic "hall pass" so I could access the buildings, Deb took me around to some of her colleagues. A few of her peers included biogeochemist Dr. Ben Woodward, freshwater ecologists Mary de Winton, and Dr. Daniel (Dan) Clements. These folks went out of their way to make me feel welcome and they were excited to share their research with me. We visited the NIWA field lab, where I saw some of Deb's research, several times during my two weeks in New Zealand. Mary showed me some of the plants that are invasive in New Zealand, including our native aquatic plants pickerelweed (*Pontederia cordata*), coontail (*Ceratophyllum demersum*) and elodea (*Elodea canadensis*), and the infamous oxygenweed (*Lagarosiphon*

major) and egeria (*Egeria densa*).

Deb decided we should see some native plants, so we met up with the delightful-as-always Paul Champion and headed for Hamilton Gardens (https://hamiltongardens.co.nz/). The Garden is composed of many small enclosed gardens with different themes that are separated by paths and walls. This award-winning botanical extravaganza is definitely a must-see if you're ever in Hamilton.

I relaxed on my first Saturday in New Zealand, but I went exploring on Sunday. I drove to the east coast and visited Raglan, a black-sand beach on the east coast of the island. On my way back to Hamilton, I stopped at Bridal Veil Falls, which was absolutely spectacular.

The following week was a flurry of activity, but a highlight was our trip to the field, where we checked on some of the field research that was planted out at Ohinewai (pronounced "oh honey, why?") in December. Deb and Mary donned drysuits (and looked like astronauts without helmets), while Ben, graduate student Juliette, and I pulled on our waders. There were some interesting treatment effects but that's not my story to tell; you'll have to wait until Deb publishes the results. In addition to field work, Deb and I collaborated on a booklet about aquatic restoration throughout the week and I gave a seminar for NIWA researchers on Friday.

My last week in New Zealand started off with a bang. I was lucky to be able to spend all day Monday in the field with Dan, who took me to Rotorua and so many other lakes! We waded a bit, collected some plants, and saw some big meadows of oxygenweed… I have to say that we're extremely fortunate that this hydrilla relative hasn't made it to the US.

On Wednesday Mary, Deb and I took to

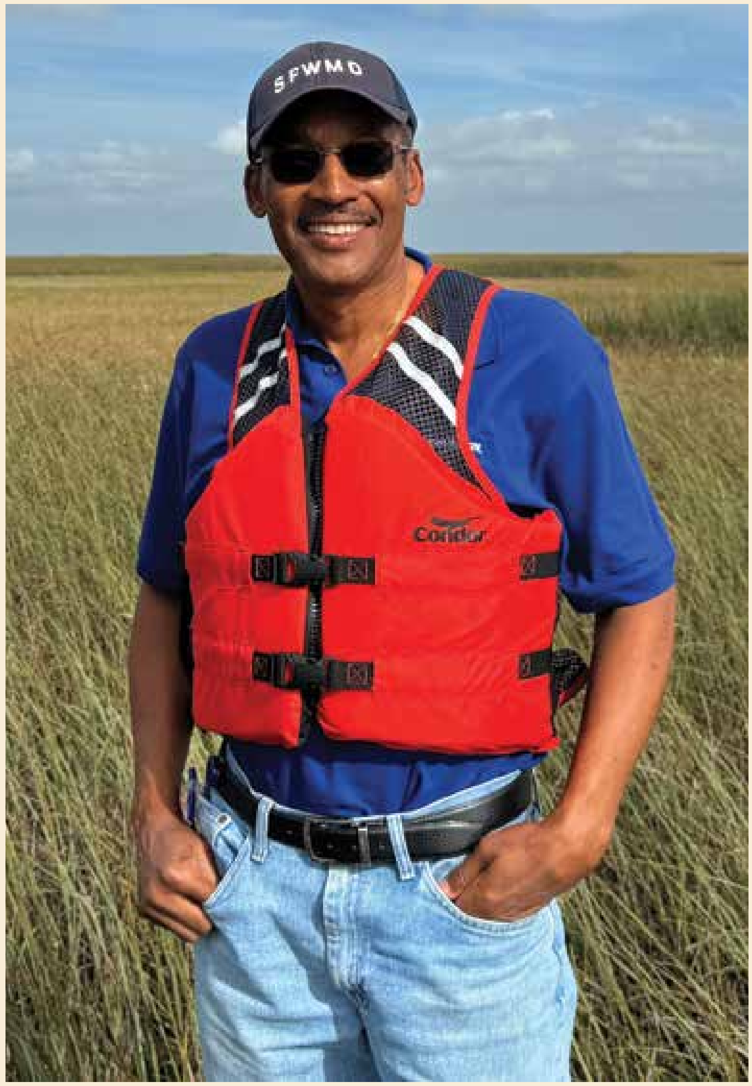
the field for my last day at NIWA. We went to several lakes, saw more oxygenweed and other submersed plants, collected plants, and at the end of the day we ended up at… Hobbiton! This is another must-see if you find yourself on New Zealand's North Island. The plantings were awesome and a cold, refreshing ginger beer at the end of the tour was a perfect way to close out my excellent adventure.

I headed north to Auckland on Thursday morning to catch my flight back home. I managed to return the rental car completely damage-free before boarding plane #1 to Los Angeles. Important safety tip: you have to clear US customs at the first airport you enter, even if you're connecting to another flight. I thought a two and a half hour layover in LA would be plenty of time; it almost wasn't. Regardless, I did make it to my connecting flight to Atlanta. Recall that on my way to New Zealand, I left in a Tuesday and arrived on a Thursday. I left Auckland at 2:50 pm on Thursday and arrived at Atlanta at 3:05 pm on Thursday – freaky!

As much as I enjoyed visiting with Deb, Mary, Ben, Dan, and Paul, I was very happy to be home. I owe Carlton Layne big-time for being my airport shuttle, and I couldn't have taken off on a trip like this without my awesome crew at FLREC. Jenny, Megan, Mady, Gaby, and Sebastian held down the fort while I was gone and it was a huge relief to know that the Aquatic and Wetland Plants Lab was in such good hands. My most heart-felt thanks goes to Deb for inviting me to visit New Zealand and I hope to see her and my Kiwi friends again soon.

Lyn Gettys *(lgettys@ufl.edu) is an Associate Professor of Agronomy – Aquatic and Wetland Plants at the University of Florida Fort Lauderdale Research and Education Center in Davie, FL.*

Farewell to Francois Laroche



After a 33-year career in invasive plant management, The Melaleuca Nuker (aka Francois Laroche) is retiring from the South Florida Water Management District (SFWMD). Within his role as Section Administrator of the SFWMD's Vegetation Management Section, Francois has not only led and mentored many over the years, but also overseen the removal of literally millions of invasive plants from South Florida natural areas.

In 1990, Francois had recently finished his Master of Science in Agronomy at the University of Florida and was working with Dr. Ken Langeland at the UF/IFAS Center for Aquatic Weeds (Now UF/IFAS Center for Aquatic and Invasive Plants) on a diquat re-registration project. Little did Dr. Langeland know that Dan Thayer of SFWMD was about to steal him away to help South Florida deal with its abundant invasive plant problems. Francois began his career at SFWMD with the primary assignment to establish a melaleuca management program for the Everglades. At the time, regional land managers had little practical knowledge of how to control melaleuca in vast natural landscapes like the Everglades. Francois jumped in machete first. Working with many collaborators in government, industry, and academia, Francois helped to develop one of the most accomplished, integrated invasive plant management programs in the U.S. The success of this effort led to the expansion of the SFWMD's vegetation management program to include other invasive species.

During his career, Francois published peer-reviewed scientific publications on melaleuca control, led the development of the first Statewide Melaleuca Management Plan, and played an active role in many professional organizations. Francois served as President of the Florida Aquatic Plant Management Society (1998-99) and sat on the board of the Florida Exotic Pest Plant Council (1994 – 1997, 1999-2001). When asked what he would miss the most, Francois smiled and said, "Working with passionate people who care so much about protecting native Florida." In retirement, Francois will not let weeds grow under his feet. He plans to focus much of his time on his non-profit initiative—Creole Inc.—to promote sustainable agriculture in his native Haiti (visit Creoleinc.org for more information). We wish Francois the best in his next pursuits and thank him for his dedication to invasive plant management in Florida and beyond.

LeRoy Rodgers
Section Administrator, Vegetation Management Section
South Florida Water Management District

Presidential Feature: Matt Phillips

Explaining hyacinth growth and control with FWC commissioners on Lake Okeechobee

Matt Phillips is the current President of the Florida Aquatic Plant Management Society (FAPMS) and is also the Section Leader for the Invasive Plant Management section for the Florida Fish and Wildlife Conservation Commission (FWC).

Phillips' dream was not always to work in invasive plant management. In fact, he had high hopes of being a professional bass fisherman as a child. However, while attending college at Florida State University, Phillips found a home within the world of invasive plant management and environmental protection. His career began as a volunteer sampling invertebrates lasted all of two weeks before he was hired on as a "part time bug picker".

Post-graduation his first full time job was Crew Leader for the St. Marks project where he worked with a research group for the Florida Department of Environmental Protection. In 1993, Phillips moved to Polk County to serve as a regional biologist where he stayed for 12 years of his career with a long-term goal of working as the Northwest Florida Regional Biologist. In 2005, that dream came true.

"I loved serving as the Northwest Florida Regional Biologist," Phillips said. "It has some of the prettiest areas. You could get lost working with the best waters in the state."

Over the years, Phillips has worked in almost every position within the Invasive Plant Management Section collecting knowledge and experience that would

Me with a 12 Point buck shot in the 2022 muzzleloader season.

eventually aid him in his current position. In his current role, Phillips spends the majority of his time in a supportive role rather than a direct management role.

"Field work is my favorite part of the job, but I don't get to do it as much in my current role," Phillips said. "I miss having the direct impact on a water system and in conservation, but I do enjoy seeing the impact my team makes."

Over the years Phillips has had a core of supporters and mentors who helped him form a foundation for fair leadership and work ethic. Phillips' father, Harry Phillips, instilled a foundation for how to live and a strong work ethic in him that he would later credit to his ability to lead well. Dr. Mike Netherland mentored Matt throughout his career and taught him how to think about aquatic plant management.

"He taught me how to think about things, what and how to use data and how to think about management of aquatic plants," Phillips said. "He had a great way of educating managers that wasn't so academic. He was able to speak in managers terms. Even now, I ask myself 'what would Mike do and what would he say'."

Phillips also looked up to a regional biologist as an example of who he was aspiring to be in his career, Jesse Van Dyke. According to Phillips, Van Dyke had a great impact on the local level and influenced him over the years.

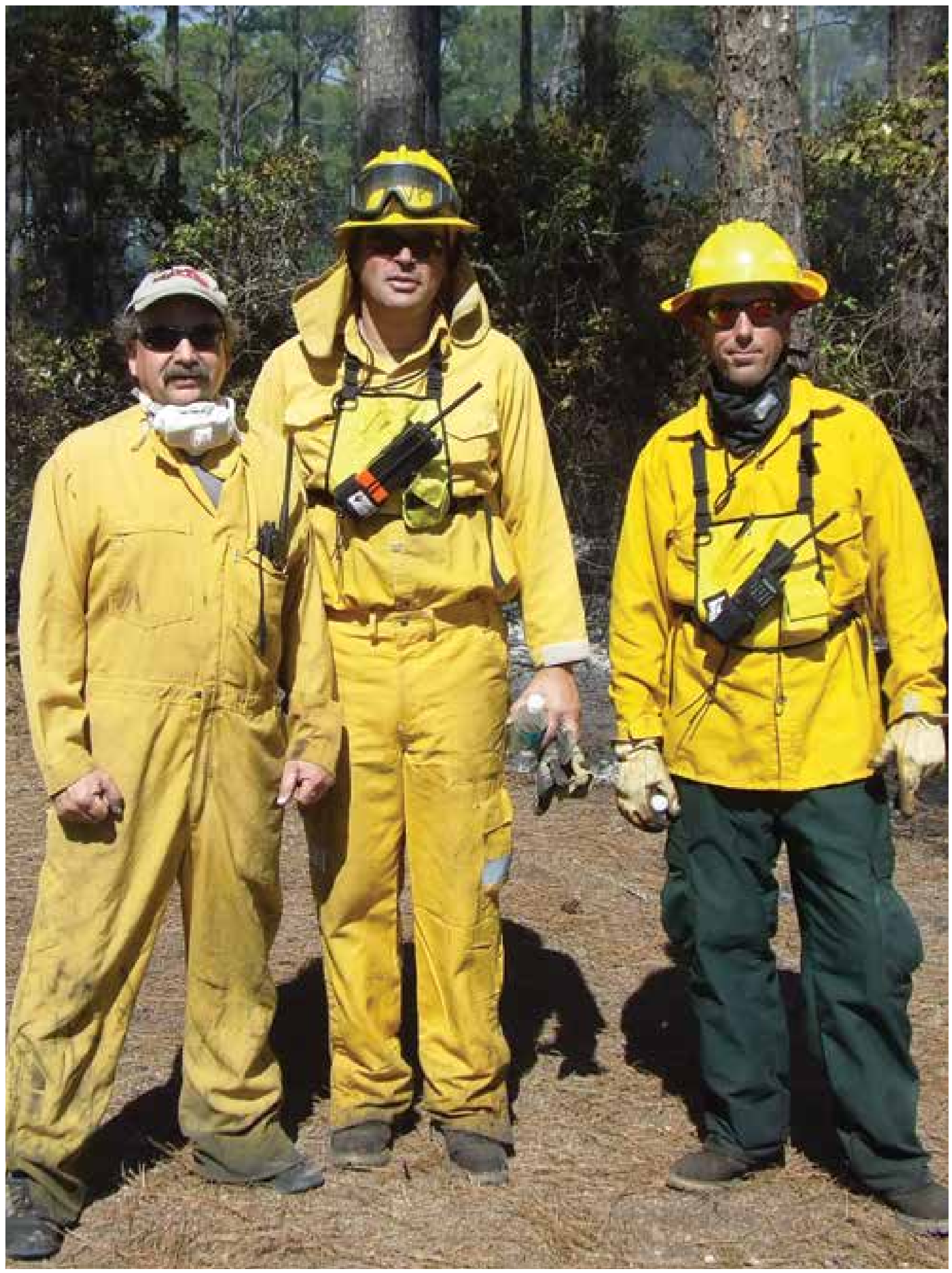
"He taught young staff how to be a good regional biologist and how to work in these systems while building relationships with local groups," Phillips said.

Phillips joined FAPMS early in his career because it was an industry related community of individuals, like his mentors, who knew what is going on in the field that could help find solutions. Phillips said FWC wanted their people to get involved because this specialized group could help them learn and grow in their career.

"The members of FAPMS will know what you need to know about aquatic plant management, and the people have the experience you need to grow," Phillips said.

Ultimately, Phillips said FAPMS has had a major impact on his career because it has made him better at his job. He said the society is a hub for problem solving and a very social community that supports each other both personally and professionally.

"Being involved in FAPMS has made me a better manager," Phillips said. "It has



Me with Jess VanDyke and Bruce Palladino burning the Coffeen Nature Preserve

Large Red Snapper caught in state waters of Panama City

Large 6lb+ Largemouth caught in Lake Talquin (Gadsden County).

made me a more confident and educated manager because it continues to expand my knowledge base."

Phillips said he has two major goals for his time as President of FAPMS. 1. To use technology to better tell our story; 2. To encourage the integration of new technology into our management program areas. Sharing the story of invasive plant management and FAPMS is top of mind for Phillips.

"We are letting other people tell our story and they seldom get it right," Phillips said.

He encourages other FAPMS members to share their story via social media or other means to spread the knowledge of the importance of aquatic plant management for the entire state of Florida.

For young applicators and others just getting started in their career, Phillips said, "FAPMS should be a vital piece of developing their career. We are a stewardship organization and one of our foundations is education. This is an organization you can learn and grow in and if you want to know about what's going on in your region, FAPMS is the place for you."

Phillips encourages those who are not yet members of FAPMS to join the organization because it is an organization that supports people in the aquatic plant management industry and works to educate them about regulation and management techniques.

"We are protecting a way of life in Florida. Invasive plants are changing our environment, and we need good young minds to confirm our management," Phillips said. "We need young folks with a passion for the environment, the outdoors, and the native Florida environment."

Holding the largest Bass I have ever caught! Lake Jackson (Leon county)

Summer Snapper lost to Sharks of Mexico Beach

This is a photo of me conducting a wetland burn on Lake Jackson in Tallahassee

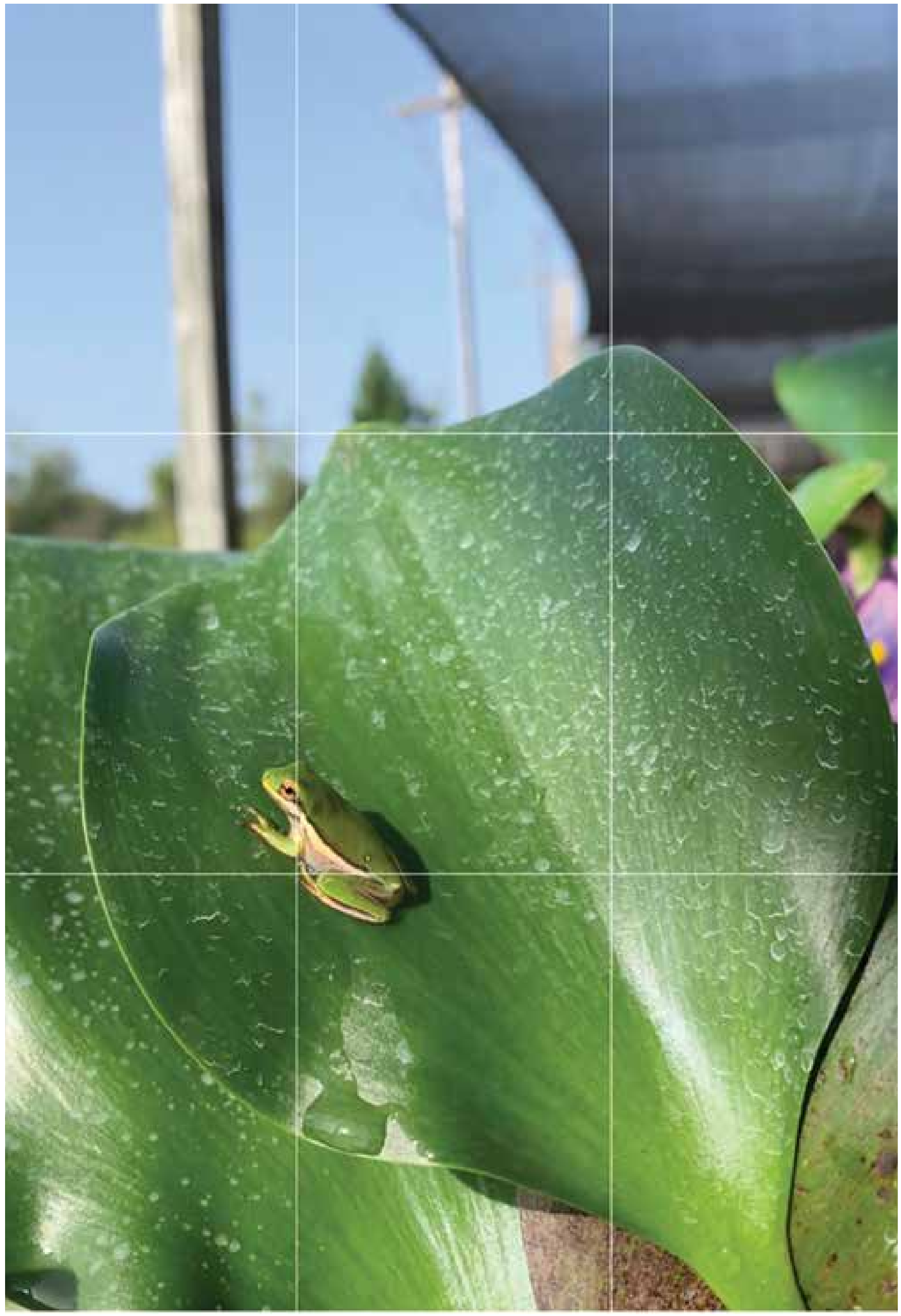
Tips & Tricks for Phone Photography in the Field

Photography is now more accessible than ever, and using your phone camera is as easy as a tap on the screen. Our smartphones have become a powerful and accessible tool for us to use anytime, and anywhere. It is standard for most phones to come with an extremely advanced camera, despite the small size. By utilizing a few photography techniques, capturing some eye-catching and visually appealing photos with your phone is simple, and can make days out in the field even more fun!

From landscapes to plants and animals, Florida has a lot to offer when it comes to outdoor photography. Depending on your interests, whether it's wildlife, portraits, landscapes, architecture, and many others. Using your phone camera can be helpful to exercise your skills and find the right techniques to use for that category. On the other hand, photography doesn't have to be so rigid, and our phones are a great tool to dip into a little bit of every style. I find the following techniques to be helpful across the span of photography interests and can be used with both a big rig camera and your phone.

Rule of Thirds

The rule of thirds is a technique where we focus on a subject, while purposely leaving room for negative space, which is the areas left empty around and in between the subject of a picture. The idea is that the human eye is naturally drawn to a point of intersection made by a set of four lines in the camera frame (see photo below). These points are slightly offset from the center, both on the left and right side, adding some opportunity for creative expression to your photography. Your phone most likely has an option in the camera settings to turn on the "grid," which will guide you to put your subject in one of the intersection points. You can also do this after the fact by cropping your photo. So, next time you're taking a picture of a flower, an animal, or anything else your photography eye may see, try using the rule of thirds! You may end up taking a very satisfying and well-composed photo.



The little frog is lined up with the bottom left intersection point, making for a nicely composed photo. We can see the entire water hyacinth leaf, the blue sky, and even some purple water hyacinth flowers in the background!

Leading Lines

Leading lines is the technique that uses natural or manmade lines to guide the viewer's eyes through the photo. River and lake banks and paths made by plants or trees tend to create interesting lines naturally. Maybe these lines lead to a

cypress stand or a tree island, or maybe an anhinga drying its feathers. Or perhaps they just lead to a vast landscape and a beautiful open sky. Either way, freshwater landscapes are a great place to lean into some leading lines. Next time you're out on the water try using leading lines!

Notice where the roots of the mangrove meet the waterline and how they create a distinct line. Your eyes are naturally guided down this path of mangroves by these lines, and it keeps you wondering – where does this path lead to?

Color

It's time to get creative! Our world is filled with color, especially in nature. Bright blues and greens cover landscapes with pops of unique colors from flowers, animals, and more. We can use color in interesting ways to create some striking perspectives and contrast. Think of a landscape filled with shades of green and sprinkled with purple flowers in bloom, or the deep contrast between a colorful sunset and the dark overcast of the land. Another option is to aim for a monochromatic look, where all the elements in the photo share the same shades of color. Things that may usually seem rudimentary can be brought to life by focusing on color.

Sunsets and sunrises are an excellent and simple way to incorporate vibrant colors into your photography. I liked this photo because of the peachy colors in the sky, and the way they reflected over the water. Reflections are another photography technique you can learn too!

These are just the tip of the iceberg when it comes to photography techniques. If these methods interest you, there are many more out there to learn about. When taking a photo, think about the story you want to tell through your lens, and how you want to tell it. Using a technique can help you build that story. The most important thing to remember with any technique is to practice. There is no way of getting better unless you get out there and do it. And what better way to practice than with your phone, which you probably have in your pocket anyway!

Happy Shooting!

Cayla Romano
UF/IFAS CAIP Communications Specialist
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Weed Science Society of America Policy Update

WSSA Comments on EPA's Vulnerable Species Pilot Project

The EPA has identified 27 pilot species that are classified as either endangered or threatened based on documentation from the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS). EPA did not consult with FWS or NMFS to develop the list, but considers these species have a medium or high overall vulnerability to pesticides. Many thanks to Bill Chism, WSSA Endangered Species committee chair, for his extensive work on **WSSA's comments for the vulnerable species pilot project.**

In 2022, Enlist was banned in 11 Arkansas counties because of the American Burying Beetle. A similar "prevention" tactic will be tested next year in Washington and Oregon, but **with a major difference.** In Arkansas, **no critical habitat** had been designated, but it will be in Oregon and Washington for **Taylor's Checkerspot butterfly**. EPA has determined that the appropriate mitigation measure for Taylor's Checkerspot butterfly is to **prohibit <u>all</u> broadcast and aerial spraying of pesticides** in the areas where the butterfly is found. These will be referred to as "Pesticide Use Limitation Areas" or **PULA's**. This will essentially create large areas of Oregon and Washington where pesticides cannot be sprayed. The plan is slated to go into effect next year. Without any changes, it will have a massive impact on pest management in places like Oregon's Willamette Valley.

EPA's initial set of priority species includes:

Group of plant species in Lake Wales Ridge area of Florida (including **Avon park harebells** (*Crotalaria avonensis*), **Garrett's mint** (*Dicerandra christmanii*), **wireweed** (*Polygonella basiramea*), **scrub blazingstar** (*Liatris ohlingerae*), **short-leaved rosemary** (*Conradina brevifolia*), **scrub mint** (*Dicerandra frutescens*), **Florida ziziphus** (*Ziziphus celata*), and several other species that occur in this area)

- **Leedy's roseroot** (*Rhodiola integrifolia ssp. leedyi*)
- **Mead's milkweed** (***Asclepias meadii***)
- **Okeechobee gourd** (*Cucurbita okeechobeensis ssp. okeechobeensis*)
- **Palmate-bracted bird's beak** (*Cordylanthus palmatus*)
- **White bluffs bladderpod** (*Physaria douglasii ssp. tuplashensis*)
- **Madison cave isopod** (*Antrolana lira*)
- **Ouachita rock pocketbook** (*Arkansia wheeleri*)
- **Rayed bean** (*Villosa fabalis; freshwater mussel*)
- **Scaleshell mussel** (*Leptodea leptodon*)
- **Winged mapleleaf** (*Quadrula fragosa*)
- **Riverside fairy shrimp** (*Streptocephalus woottoni*) and **San diego fairy shrimp** (*Branchinecta sandiegonensis*)
- **American burying beetle** (***Nicrophorus americanus***)
- **Poweshiek skipperling** (*Oarisma poweshiek*)
- **Rusty patched bumble bee** (*Bombus affinis*)
- **Taylor's checkerspot** (***Euphydryas editha taylori***)
- **Ozark cavefish** (*Amblyopsis rosae*)
- **Attwater's prairie chicken** (*Tympanuchus cupido attwateri*)
- **Buena vista lake ornate shrew** (*Sorex ornatus relictus*)
- **Wyoming toad** (*Bufo hemiophrys baxteri*)

EPA Publishes Update on its Vulnerable Species Pilot (VSP)

On November 21, 2023, EPA published an update on its **VSP** project based on the 10,000 plus comments (200 unique comments) they received during the 45-day comment period. The following summarizes EPA's current thinking on **revisions to the VSP framework:**

- Narrow the areas within the endangered species range map to only include locations that are important to conserving a species.
- Clarify the scope of the VSP for non-agricultural uses;
- Clarify potential exemptions to the proposed mitigation and whether additional exemptions are needed;
- Revise some of the proposed mitigations and include additional mitigation options specific to non-agricultural uses and specialty crops;

- Revisit how EPA selected the pilot vulnerable species; and
- Develop a consistent approach to reduce pesticide exposure to listed species from spray drift and run-off.

EPA's Office of Pesticide Programs said in an update to state regulators (SFIREG) on Dec. 4, 2023 that its "**current thinking for agricultural uses is that the proposed VSP mitigation would not need to include avoidance, but rather would focus on minimization**." The full update, along with additional details regarding the **VSP project** and mitigation proposals, are available in the public docket EPA-HQ-OPP-2023-0327. By fall 2024, EPA intends to provide additional updates on its **VSP project**.

Weed Science Societies Provide Comments to Improve EPA's "Herbicide Strategy" for Endangered Species Mitigations

Executive Summary- The Weed Science Societies suggest nine additional ways to mitigate the impact of herbicides on listed species due to spray drift, which includes decreased buffers for ultra-coarse droplets, additional types of vegetation to intercept spray droplets and grower education.

We also suggest six additional ways to mitigate herbicide runoff and erosion, which also includes grower education, more specific terminology for agricultural vs specialty crops as well as assigning more compensatory mitigation points for fields with subsurface drainage or cover crop practices.

Most importantly, the Weed Science Societies want to stress that grower education will be the most effective way to implement EPA's Herbicide Strategy. We recommend a minimum of a 3-5 year phase-in period for the herbicide strategy ESA mitigation practices, which corresponds to the 3-5 year interval that pesticide applicators must be recertified.

The Weed Science Societies also present the results of a survey of weed scientists from across the country that looked at the 13 crop scenarios for pesticide runoff and erosion mitigation points that the EPA provided, plus 2 additional crop scenarios. Alarmingly, only 2 of the 15 crop production scenarios, or 13%, could obtain the nine runoff/erosion mitigation points considered necessary to maintain existing weed control practices.

We provide additional information on conservation specialists and programs in different states as well as a rationale for why EPA should create a database of the mitigation points needed by crop, pesticide use limitation area (PULA), and herbicide. We also provide suggestions to enhance "Bulletins Live Two!" as well as a list of topics in dire need of research funding so we can best help protect T&E species and their critical habitat.

Finally, we have provided a list of suggested education and training activities to successfully launch the ESA mitigation practices for pesticides.

The Weed Science Societies comments and suggestions to improve **EPA's draft herbicide strategy** for endangered species are at: https://wssa.net/wp-content/uploads/Weed-Science-Society-comments-on-EPA-Herbicide-Strategy_Final.pdf

EPA Releases Final Report on the Use of 11 Controversial Atrazine Cosm Studies

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel (SAP) provides independent scientific advice to the EPA on health and safety issues related to pesticides. The FIFRA SAP conducted on August 22-24, 2023 was titled: "**Examination of Microcosm/Mesocosm Studies for Evaluating the Effects of Atrazine on Aquatic Plant Communities**". Many thanks to Aaron Hager, Jay Ferrell, John Madsen and Kurt Getsinger for their service and data review for this SAP.

To protect aquatic plant communities from the effects of atrazine, EPA developed an aquatic plant community-based concentration-equivalent level of concern (CE-LOC). The CE-LOC is determined using a combination of single-species aquatic plant toxicity studies and microcosm/mesocosm (cosm) studies. The cosm studies included in the CE-LOC calculation can be defined as complex experiments used to examine aquatic plant communities under semi-controlled conditions that simulate natural environments. Endpoints for these cosm studies were defined as single determinations of the response of one or more components of the aquatic plant community (e.g., phytoplankton, periphyton, macrophytes) for a defined individual atrazine test concentration as it relates to the controls in the study.

From 2002 to 2016, EPA considered over 70 cosm studies. However, a FIFRA SAP conducted in 2012 identified 11 of those studies as warranting further review because of concerns about study design or performance flaws, as well as EPA's interpretation of the results.

EPA received additional public comments about the 11 controversial atrazine cosm studies in its 2022 Proposed Revisions to the Atrazine Interim Registration Review Decision where they used a CE-LOC of 3.4 ppb. The CE-LOC for atrazine was previously 15 ppb. When the atrazine CE-LOC is exceeded, it triggers additional monitoring and/or mitigation to protect aquatic plant communities.

After EPA issued the 3.4 ppb CE-LOC last year, many stakeholder groups, including WSSA, asked the EPA to conduct this independent FIFRA SAP on the use of the 11 controversial atrazine cosm studies in calculating the CE-LOC.

To EPA's credit, they published an excellent white paper earlier this year that presents EPA's reevaluation of the 11 controversial atrazine cosm studies. The white paper also provides an overview of atrazine, its history as it relates to the cosm studies, and the "Charge Questions" (pg 16) for the 2023 FIFRA SAP that met in August.

On November 16, the FIFRA SAP final report on the use of the 11 atrazine cosm studies was released. Based on the SAP's discussions, most of the 11 atrazine cosm studies in question did suffer from various flaws and should not be used to calculate a CE-LOC for atrazine. There are nearly 50 other cosm studies that meet EPA's criteria for inclusion in its cosm database. If EPA follows the 2023 FIFRA SAP's recommendations, they would be using the best available science to calculate the CE-LOC for atrazine, which would likely mean a higher atrazine CE-LOC.

EPA Pesticide Label Reform is Finally Happening

On November 15, EPA released a white paper titled "***Benefits of the Adoption of Structured Content and Digital Pesticide Labels***" and is requesting feedback on its plan to adopt digital pesticide labels that will make labeling information clearer, more consistent, and more accessible to users.

EPA's plan for digital labels covers the creation of both a structured label—which would provide a framework for consistently placing and ordering label information—and a digital label, which would organize the label information as electronic data. Currently, the pesticide product label registration process is mostly manual, with EPA staff reading through long, detailed label submissions to pull out specific information, like application rate, to enter into the EPA's Pesticide Product and Label System. This has led to time-consuming reviews and high cost to registrants and regulators. Further, the increasing complexity of pesticide labels and lack of standardized label format and language can create challenges for pesticide users and the public seeking information about which products to use and how to use them.

Moving from traditional labels to digital labels and providing a database of accepted label language would make submitting label content simpler and more consistent for all pesticide registrants and would improve the Agency's ability to review and access submissions efficiently.

EPA is requesting public comment on all aspects of structured digital labels, including:

- anticipated benefits
- risks and challenges
- key information fields (such as pesticide use site, formulation, and maximum application rate), and
- potential phases of adoption.

USDA-ARS Weed Science News: Winter 2024

The winter 2024 edition of the USDA Agricultural Research Service (ARS) Weed Science Newsletter compiled by Dr. Steve Young is now available at: https://www.ars.usda.gov/people/steve-young-phd/weed-science-newsletter/weed-science-research-news-and-highlights/

The winter issue highlights ARS weed science research in the Northeast, Midwest, Plains, Pacific West and the Southeast, highlights the work of Dr. Ali Wright at the USDA-ARS Sugarcane Research Unit in Houma, LA, and lists event and announcements including:

Recent Hires

Casey Barickman – ARS Natural Products Utilization Research Unit, Oxford, MS

Olivia Landau – ARS Wheat Health, Genetics, and Quality Research Unit, Pullman, WA

Jens Beets – ARS Invasive Species and Pollinator Health Research Unit, Albany, CA

Vijaya Varanasi – ARS Crop Production Systems Unit, Stoneville, MS

Allen Dray – ARS Invasive Plant Research Unit, Fort Lauderdale, FL

Current Openings:

Weed Ecologist – ARS Columbia Plateau Conservation Research Center, Pendleton, Oregon (TBD)

Weed Scientist – ARS Northwest Sustainable Agroecosystems Research Unit, Pullman, Washington (TBD)

Annual Cost of Invasive Species Put at Half-A-Trillion Dollars

Invasive species cause more than $423 billion per year in damage to agriculture,

Table 1. Funding opportunities for select federal agencies that focus on weeds and invasive plants.

Agency	Program	Notes
ARS	Areawide Pest Management Program	This is an internally funded program at ARS
APHIS	Plant Protection Act Section 7721	Search website
DOD	Strategic Environmental Research and Development Program	Link to funding
	Environmental Security Technology Certification Program	Link to funding
EPA	EPA Grants	Search for weeds and/or invasive plants
NASA	Applied Sciences Program – Agriculture, Ecological Conservation	Browse practitioner resources, including opportunities that links to NSPIRES (NASA Solicitation and Proposal Integrated Review and Evaluation System)
NIFA	Agriculture and Food Research Initiative (AFRI)	Several programs, including inter-disciplinary, in plant health and production categories
	Crop Protection and Pest Management	Link to RFA
	Methyl Bromide Transition	Link to RFA
	IR-4	Link to RFA
	Organic Agriculture Research and Extension Initiative	Search program information
	Organic Transitions	Search program information
	Specialty Crop Research Initiative	Link to RFA
DOI	Funding Guide for Invasive Species Management	Search program information
NRCS	Conservation Innovation Grants	This program has funded projects on weeds and invasive plants
NSF	Plant Biotic Interactions	A joint program with NIFA that focuses on agricultural species
USFS	Invasive Forest Plants	Requests for applications through the Working with Us link

fisheries, water supplies, and other ecosystem-dependent benefits worldwide, according to the summary of a comprehensive review by dozens of scientists, released Sep. 4, 2023. The monetary losses, adjusted for inflation, have quadrupled every decade since 1970, the study's baseline, the summary says. The report is the first on the topic from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, which has 143 member nations. The estimated financial loss is "a huge, huge underestimate," Helen Roy of the UK Centre for Ecology & Hydrology, who co-chaired the group that wrote the report, said in a media briefing; many costs such as weeding invasive plants have not been quantified, she said. More than 3500 species are known to have become invasive after people moved them, intentionally or unintentionally, to new locations where they have crowded out native plants and animals, some of which supported local economies. The number of invasive species is rising faster than ever because increases in global trade and travel help spread them, the summary says. But only 17% of countries have laws or regulations to prevent or manage invasions of these species.

Meetings of the National and Regional Weed Science Societies

Jul. 14 - 18, 2024 Aquatic Plant Management Society (APMS), St. Petersburg, FL www.apms.org

Dec. 1 – 4, 2024 International Weed Science Society (IWSS), Jerusalem, Israel www.iwss.info

Dec. 9 - 12, 2024 North Central Weed Science Society (NCWSS), Kansas City, MO www.ncwss.org

Jan. 6 - 10, 2025 Northeastern Weed Science Society (NEWSS), Annapolis, MD www.newss.org

Jan. 20 - 23, 2025 Southern Weed Science Society (SWSS), Charleston, SC www.swss.ws

Feb. 24 - 27, 2025 Weed Science Society of America (WSSA), Vancouver, BC www.wssa.net

Federal Agency Funding Opportunities

By Steve Young, Jim Kells and Vijay Nandula

Federal departments and agencies with expertise in weed and invasive plant science were brought together at a symposium held during the Weed Science Society of America 63rd Annual Meeting. Individuals from Animal and Plant Health Inspection Service (APHIS), Agricultural Research Service (ARS), National Institute of Food and Agriculture (NIFA), Office of Pest Management Policy (OPMP), Natural Resources Conservation Service (NRCS), US Forest Service (USFS), Bureau of Land Management (BLM), US Geological Survey (USGS), National Park Service (NPS), Department of Defense (DOD), Army Corps of Engineers (ACOE), National Aeronautics and Space Administration (NASA), and National Science Foundation (NSF) shared current research and management efforts and participated in a discussion focused on the identification of funding opportunities and other issues pertaining to research gaps and management needs among this society's membership.

Each federal department and agency gathered at the symposium support weed and invasive plant science research and/or management through grant funding, technical assistance, and scientific studies. They represent a diversity of stakeholders who may be separated geographically yet have a common focus on weeds and invasive plants in crop, terrestrial, and aquatic ecosystems.

BLM Receives Approval for Use of Seven Herbicides in 2024

The National and Regional Weed Science Societies have been working with the Department of the Interior (DOI) Bureau of Land Management (BLM) over the past several years to get approval on final programmatic environmental impact statements (PEIS) for the use of the following seven herbicides on BLM land:

1. aminocyclopyrachlor
2. clethodim
3. fluazifop-p-butyl
4. flumioxazin
5. imazamox
6. indaziflam
7. oryzalin

These herbicides have already been approved by EPA (some for a long time!), in adjoining nonfederal land. In order to for them to be considered as a management option on BLM lands, they had to be in compliance with the National Environmental Policy Act (NEPA) of 1969 and the Federal Land Policy and Management Act (FLPMA) of 1976.

These additional herbicide active ingredients will diversify BLM's weed management plan and help meet the purposes that were first identified in BLM's 2007 and 2016 PEISs related to vegetation treatments. A **final record of decision** is expected in February 2024.

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Executive Director of Science Policy
Weed Science Society of America
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Cell: 202-746-4686

Calendar of Events

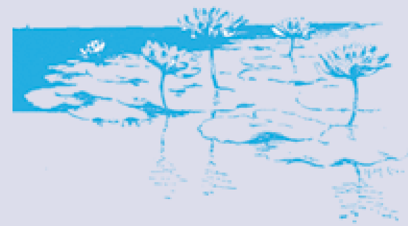
May 13-16, 2024
UF/IFAS Aquatic Weed Control Short Course
Orlando, FL
https://sfyl.ifas.ufl.edu/aquatic-weed-short-course/

July 15-18, 2024
64rd Annual Meeting of the Aquatic Plant Management Society
Hilton St. Petersburg Bayfront
St. Petersburg, FL
https://apms.org/2023-annual-meeting/

September 30 – October 2, 2024
South Carolina Aquatic Plant Management Society Annual Conference
Ocean Drive Beach and Golf Resort
North Myrtle Beach, SC
https://www.scapms.org/meetings.html

October 7-10, 2024
48th Annual Florida Aquatic Plant Management Society Annual Training Conference
Hilton Daytona Beach Oceanfront Resort
Daytona Beach, FL
https://fapms.org/conference/2023-conference/

December 1 – 4
9th International Weed Science Congress
Jerusalem, Israel
https://www.iwsc2024.com/



Call for Submissions – The Florida Aquatic Plant Management Society is preparing the Summer 2024 Issue of Aquatics magazine and is seeking articles from industry professionals, researchers, and other interested authors. Submissions can be directed to aquaticsmagazine@gmail.com.

Articles should be no longer than 2,500 words in length and include photos, captions, author bio and email.

Want to write for us, but aren't sure what to write about? Below are some topics our readers are always interested in:

- Plant Identification (Native and Invasive)
- Research Updates
- Stories on the people of the aquatic and related industries
- Photo stories – Do you spend a lot of time on the water taking photos that tell a story of some particular plant or a part of Florida? Submit your series of photos with captions and we can share your story!
- Waterbody updates
- Agency Updates

Please submit proposed content no later than May 1, 2024.

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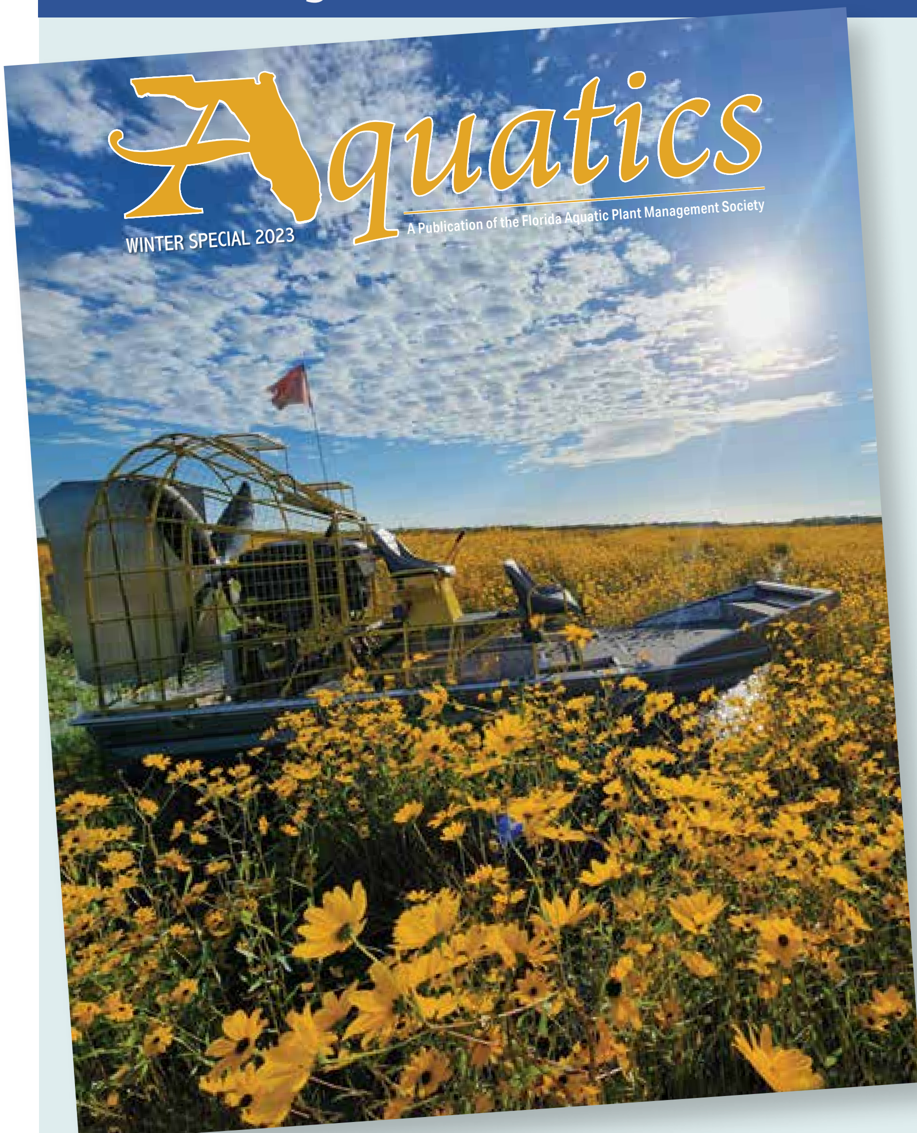

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