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Identification and Management of Invasive Grasses

Candice Prince, UF/IFAS Center for Aquatic and Invasive Plants

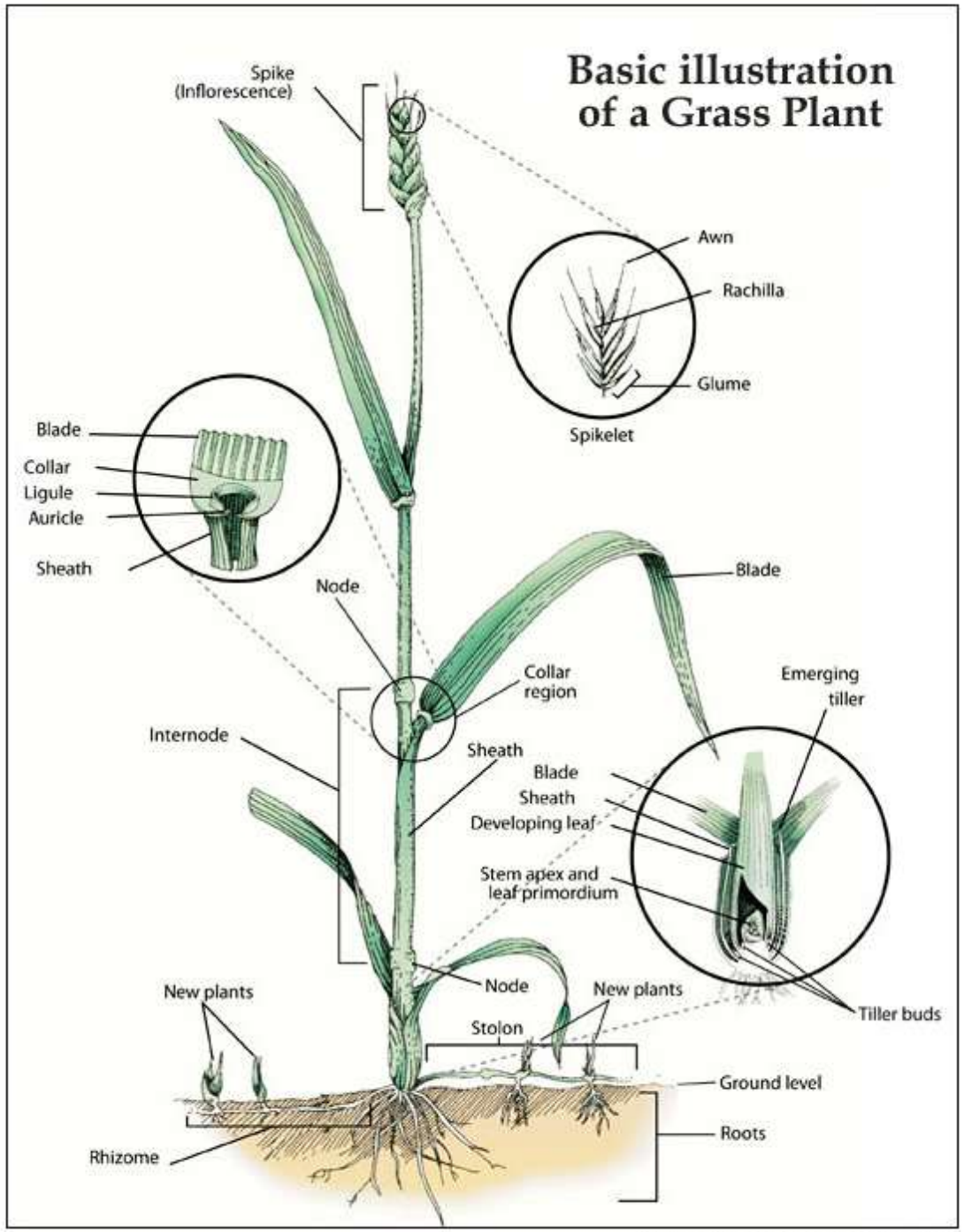
Invasive Aquatic Grasses

- Form dense monotypic stands that reduce biodiversity
- Aggressive vegetative growth
- Tolerant of varying environmental conditions

Management Steps

1. Identification
2. Control Method
3. Monitoring Regrowth

Step 1: Grass Identification



Questions to ask:

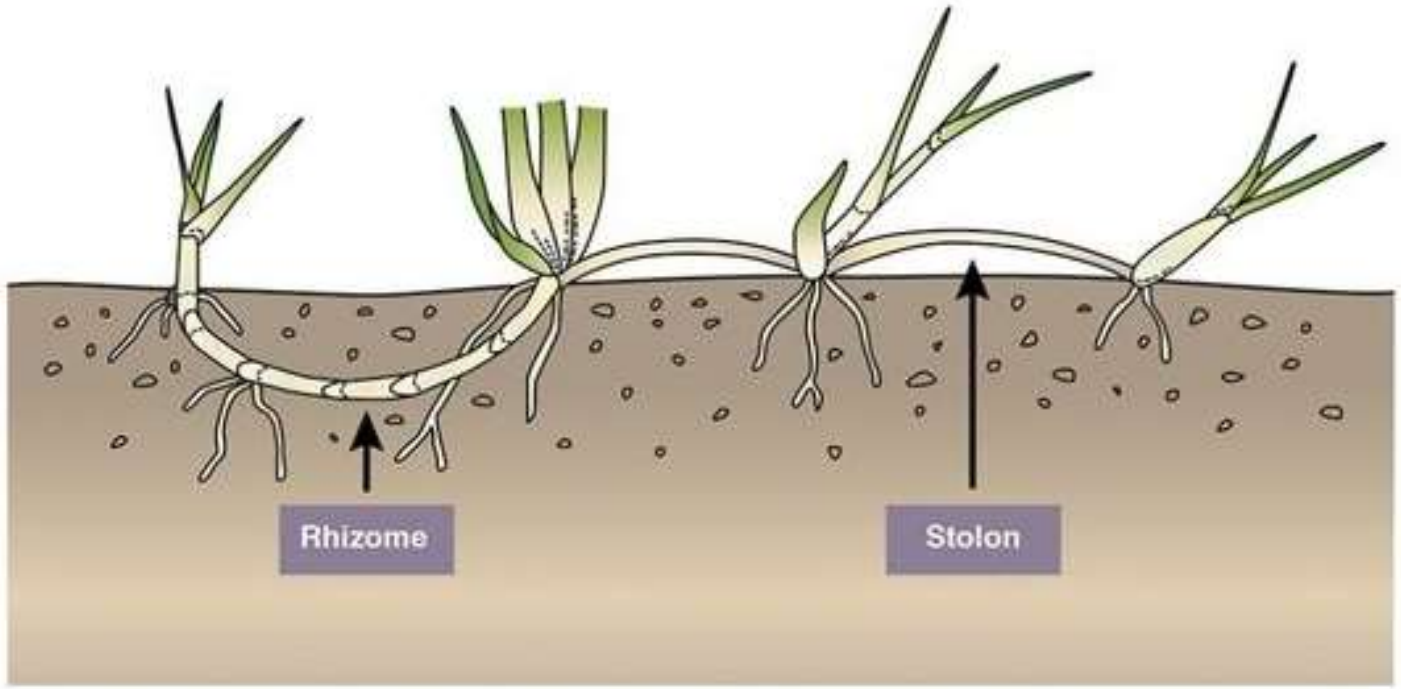
- What is the overall appearance?

What is the overall appearance?

- Is it a bunch (caespitose) or creeping grass?

What is the overall appearance?

- If creeping: rhizomes, stolons, both?



What is the overall appearance?

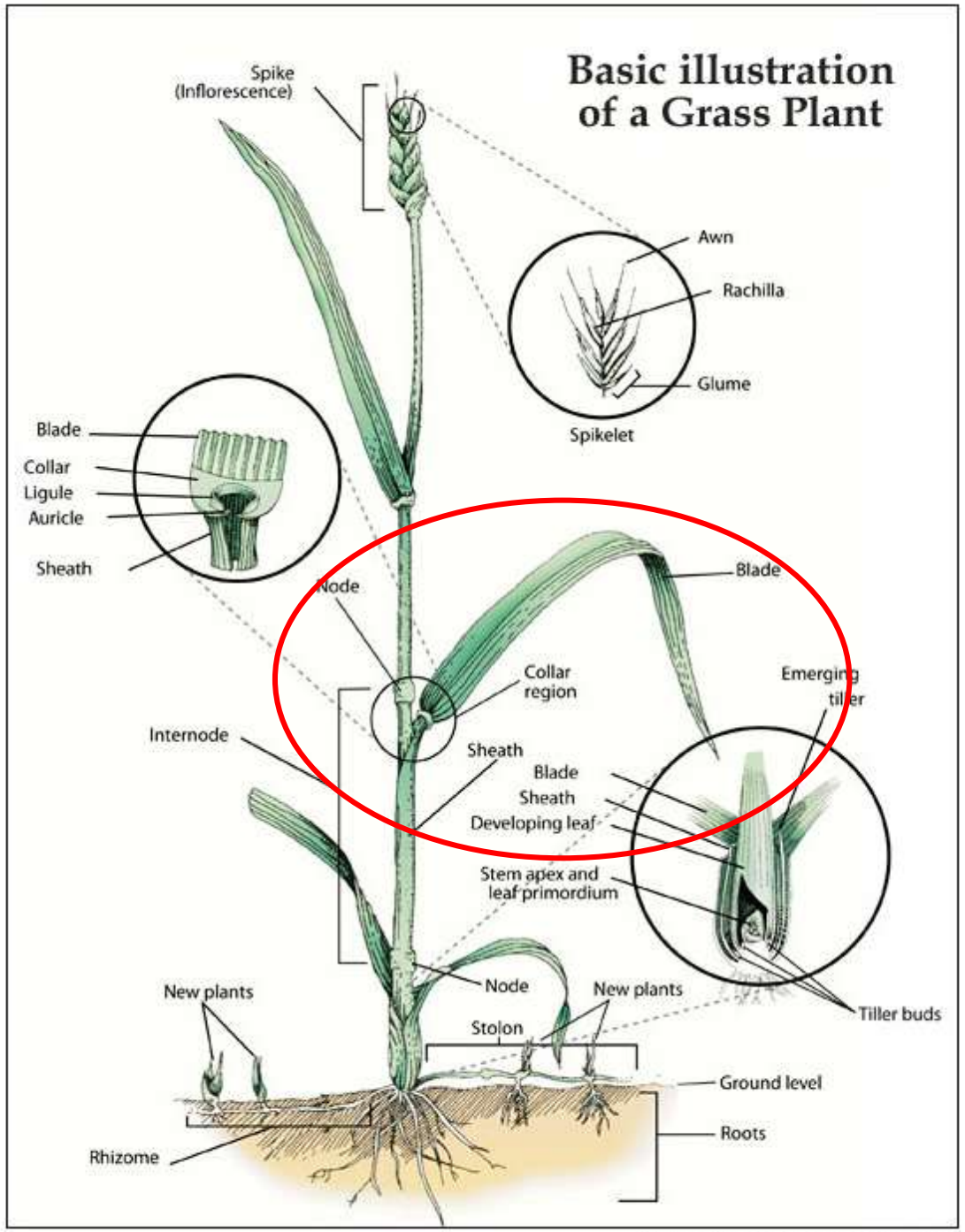
- Height? Color?


Walters Gardens


Kevin Hudson, MSU Ag Communications

What is the overall appearance?

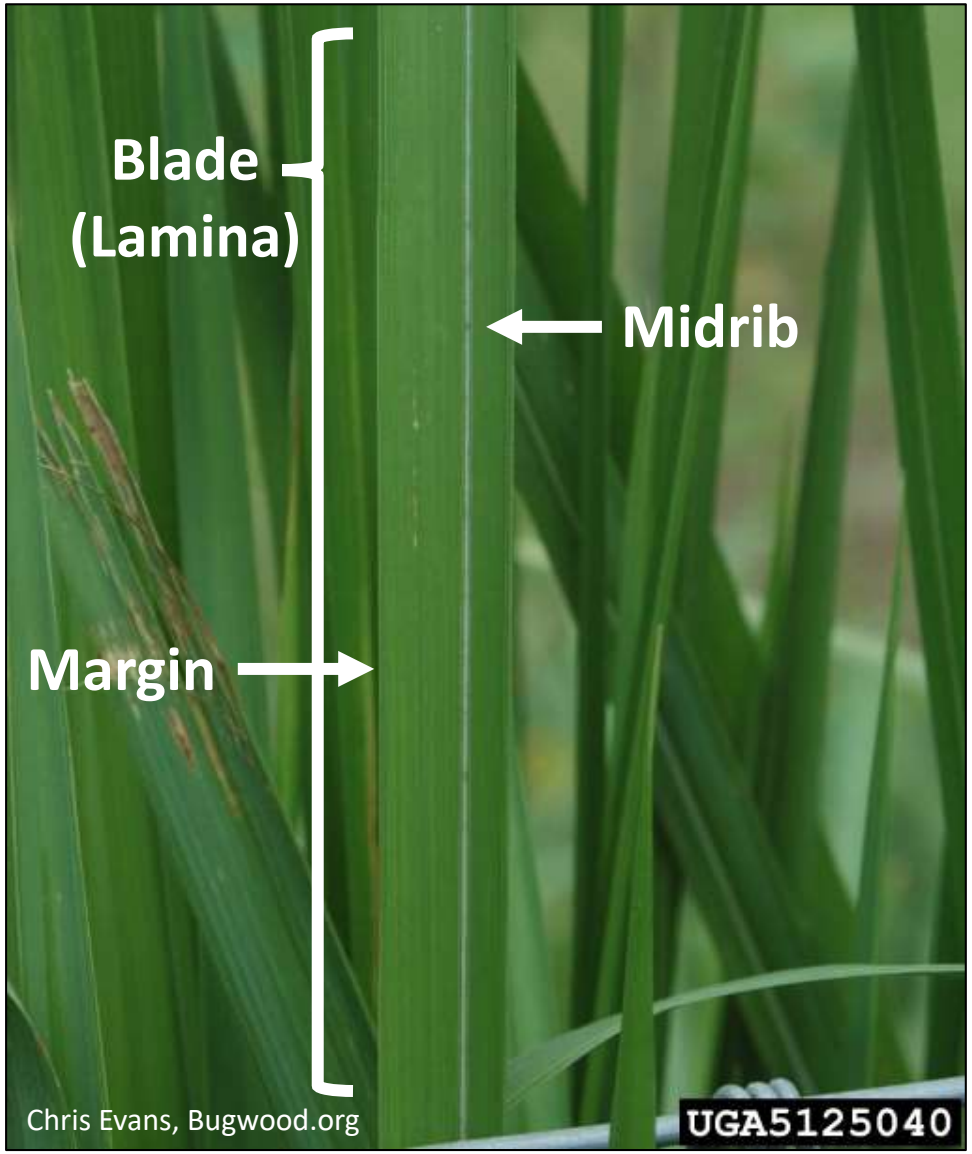
- What are the culms (stems) like?
  - Color?
  - Smooth? Ribbed?
  - Unique nodes?



Questions to ask:

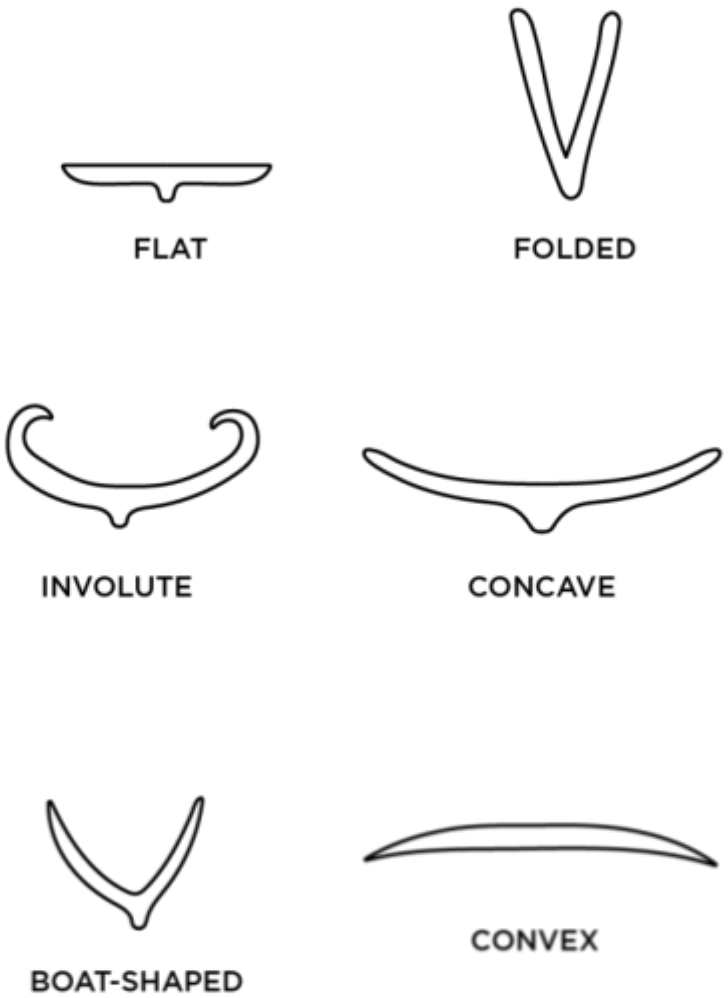
- What is the overall appearance?
- What are the leaves and sheath like?

What are the leaves and sheaths like?



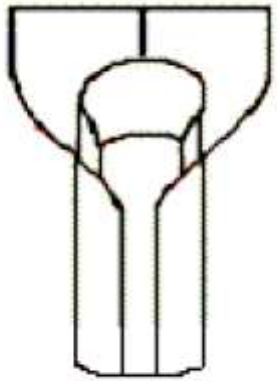
- What is the texture?
  - Smooth?
  - Hairy?
  - Waxy?
- Are the margins sharp?
- Are the veins or midrib prominent?

What are the leaves and sheaths like?

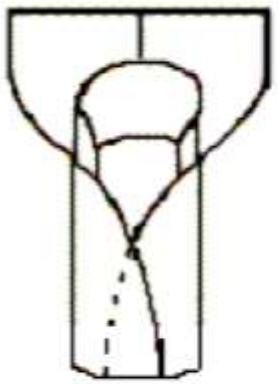


- How are the leaves folded?
- Are they flat? V-shaped?

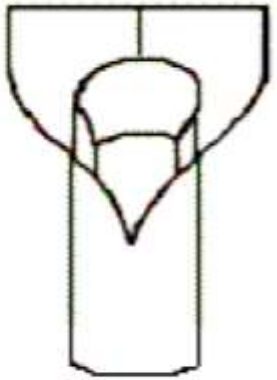
What are the leaves and sheaths like?



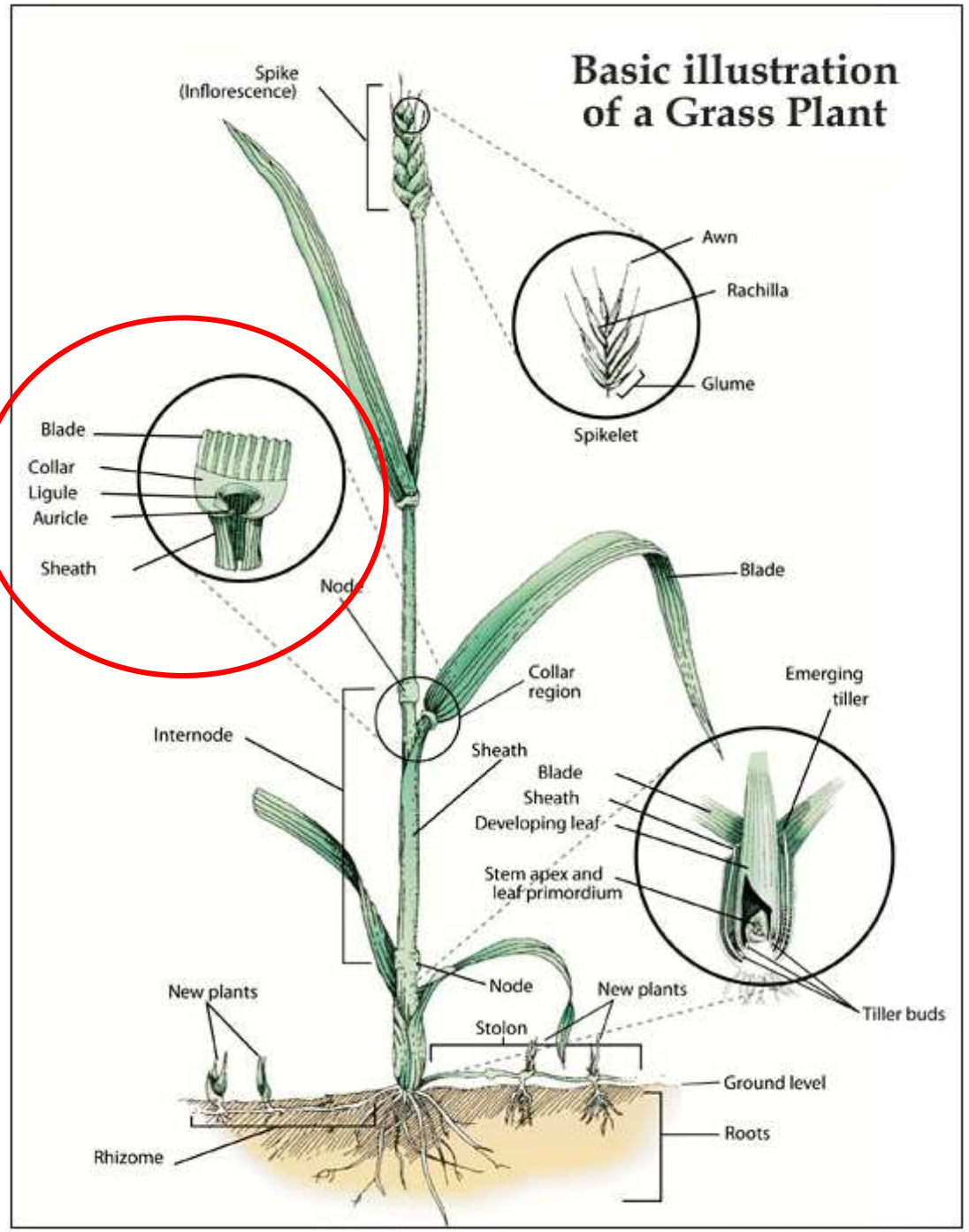
Split or Open



Overlapping



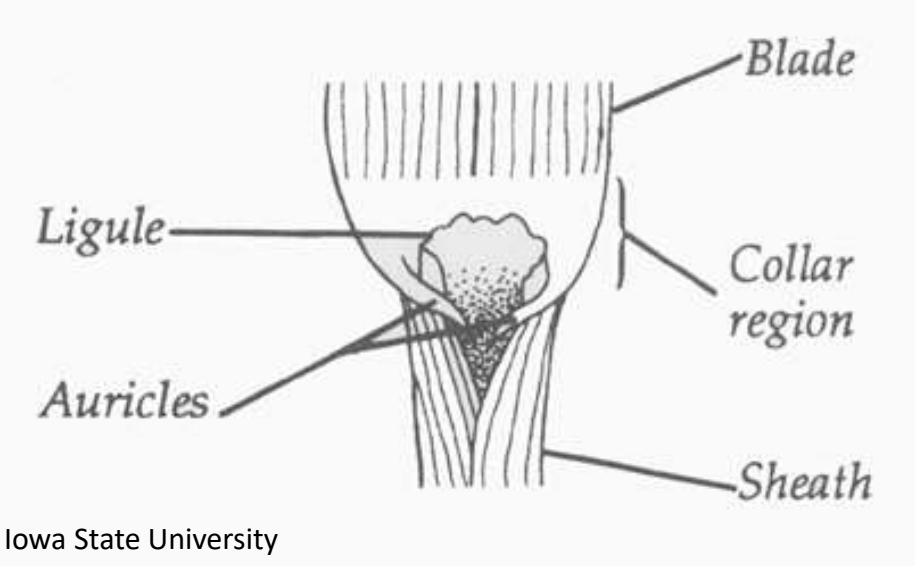
Closed or United



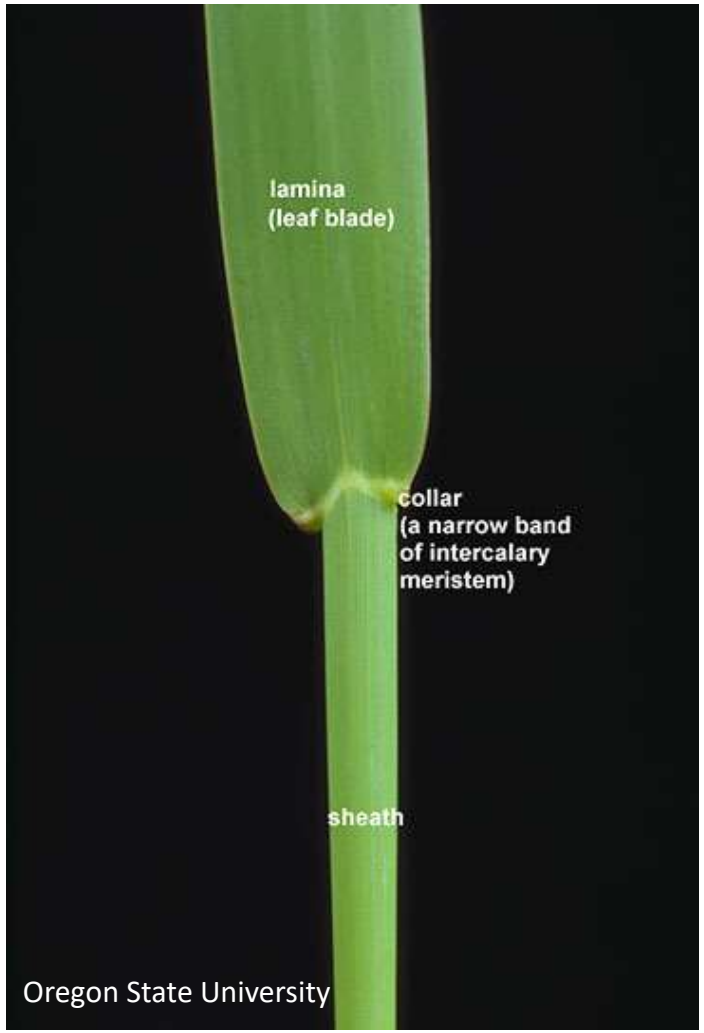
Questions to ask:

- What is the overall appearance?
- What are the leaves and sheath like?
- What is the collar region like?

What is the collar region like?

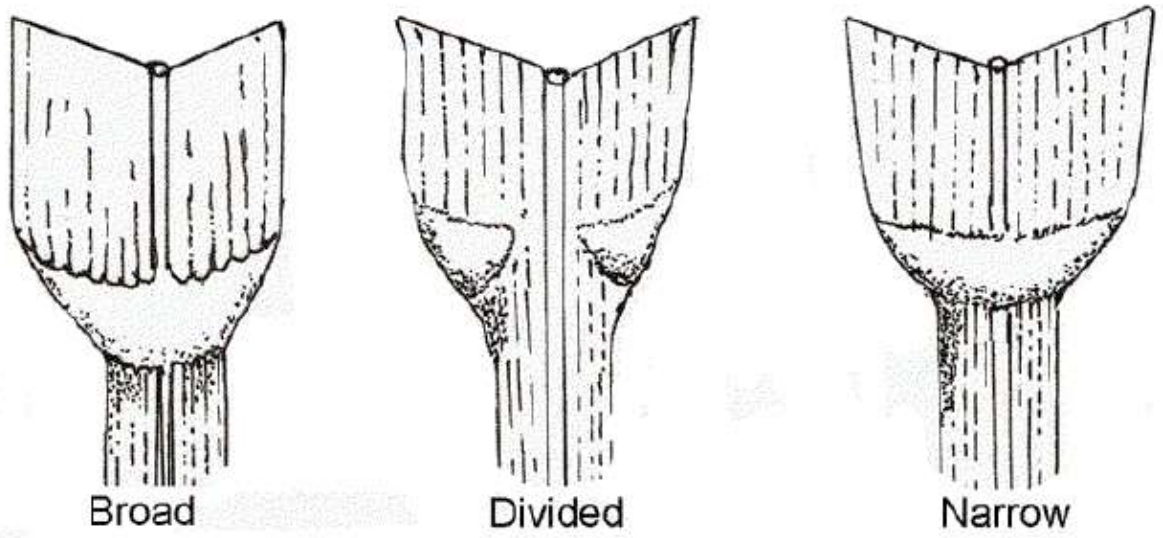


Iowa State University



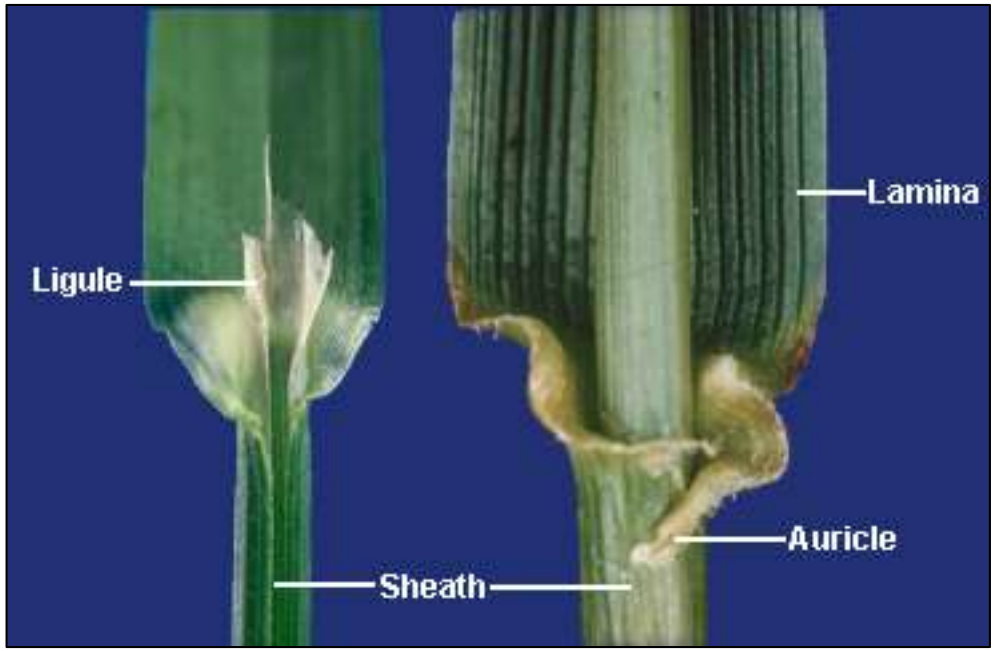
Oregon State University

What is the collar region like?



Penn State Extension

What is the collar region like?



Oregon State University

- Does it have a ligule?
- Size of the ligule?
- Is the ligule a membrane? Hairy?

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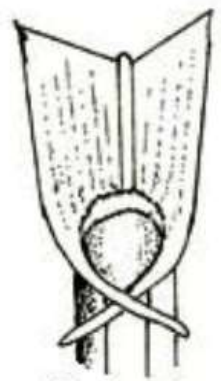
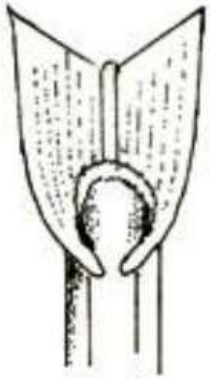
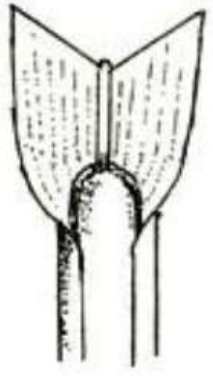
- Does it have auricles?







Penn State Extension

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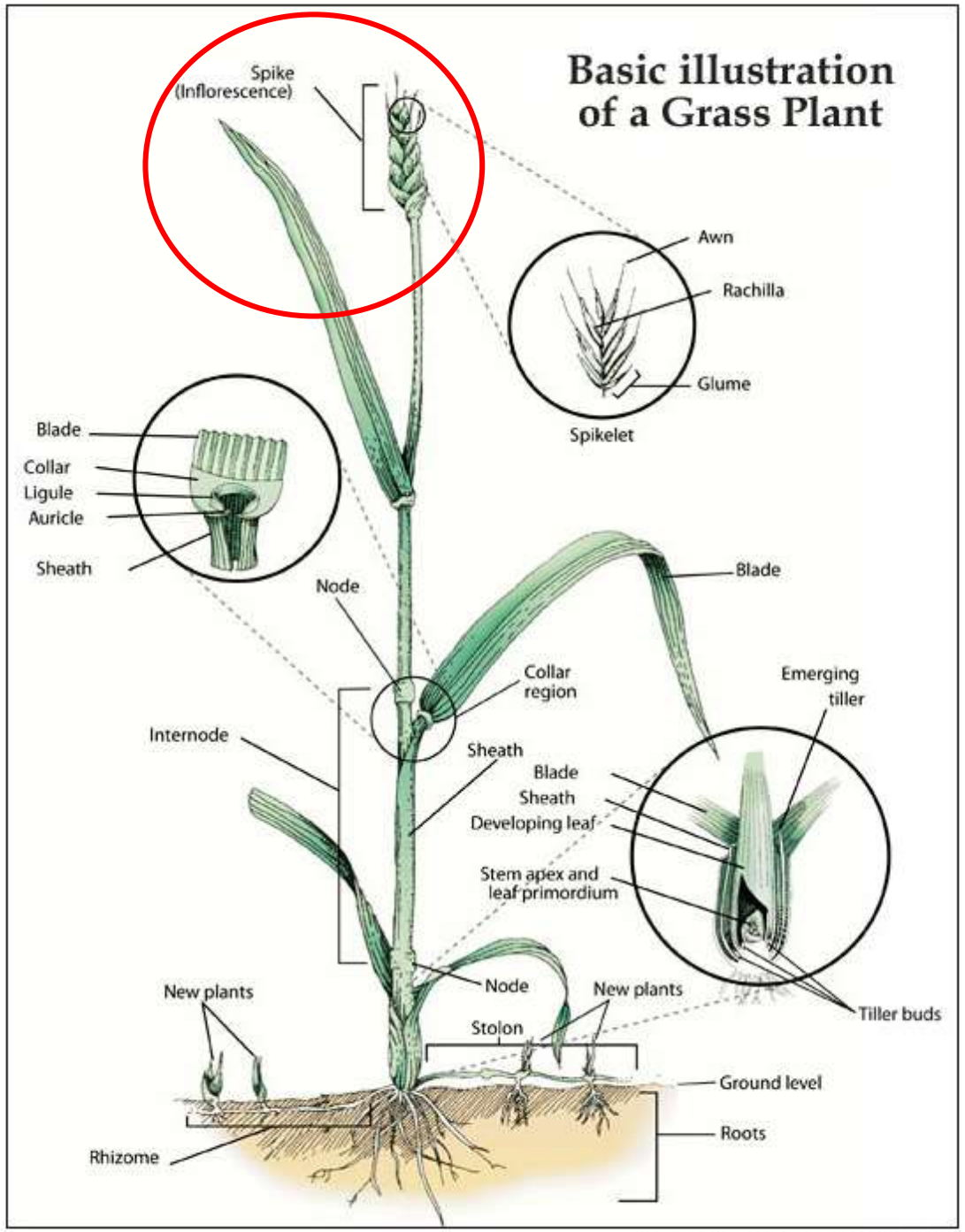


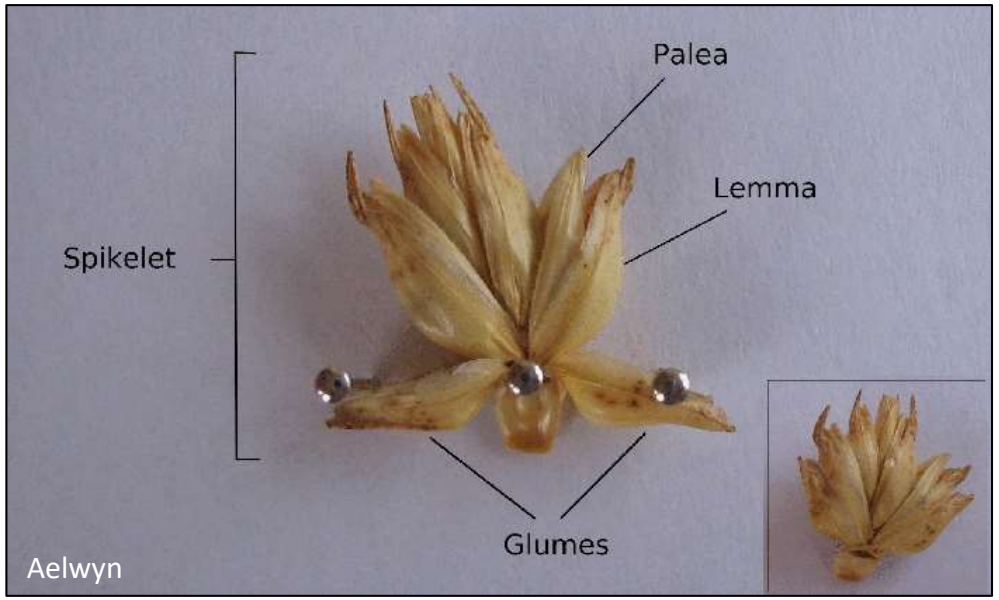
Questions to ask:

- What is the overall appearance?
- What are the leaves and sheath like?
- What is the collar region like?
- What type of inflorescence or seed head (if present)?

Grass Inflorescence

- Floret = grass flowers

- Spikelet = one to several florets
  - Basic unit of inflorescence



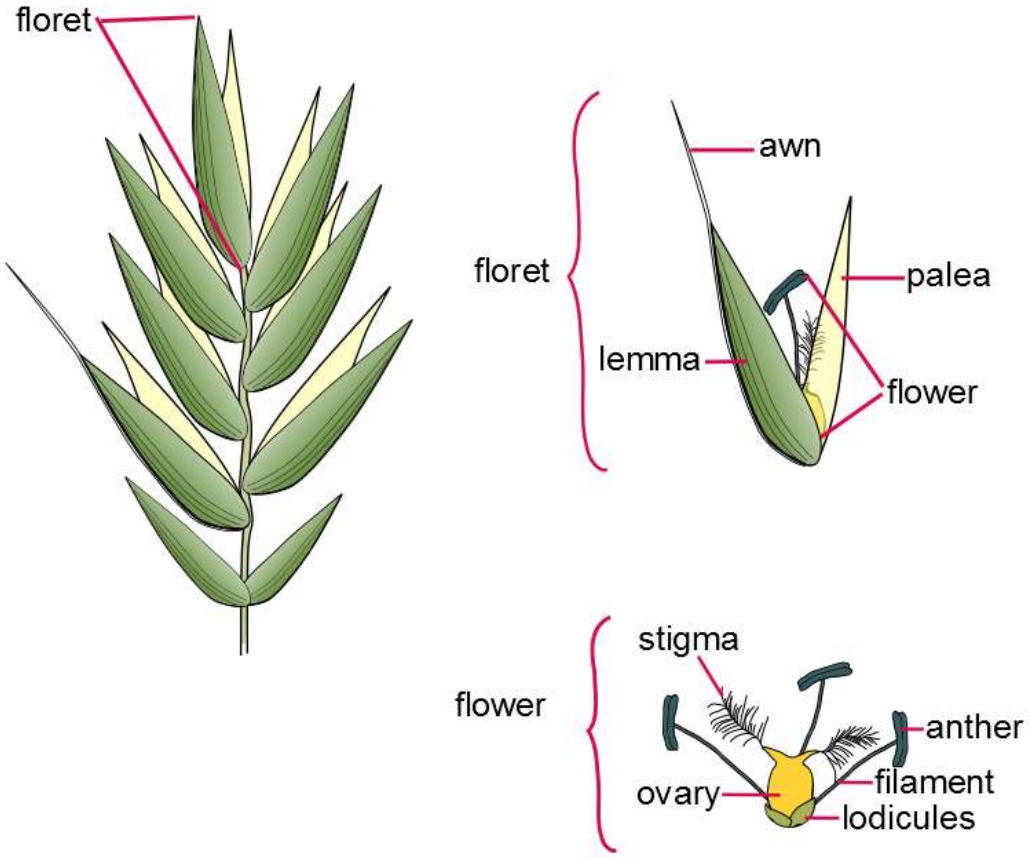
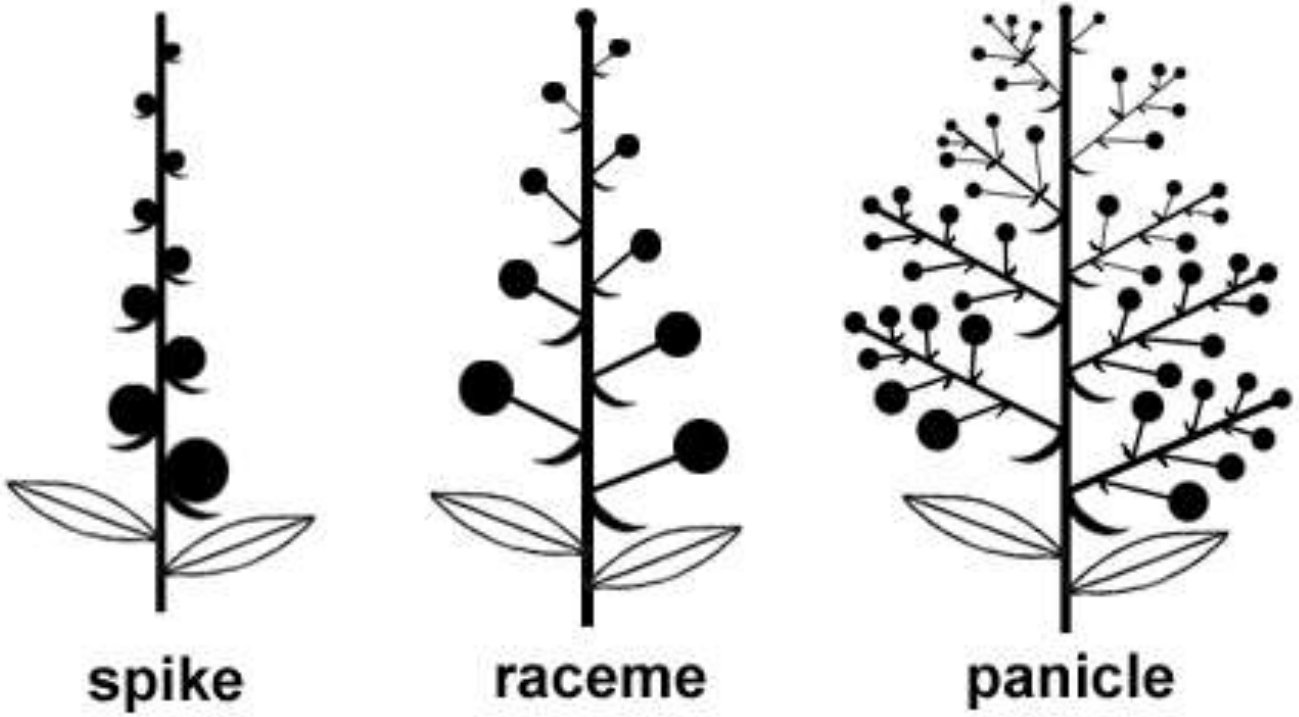


Image: E-Monocot

What type of inflorescence?

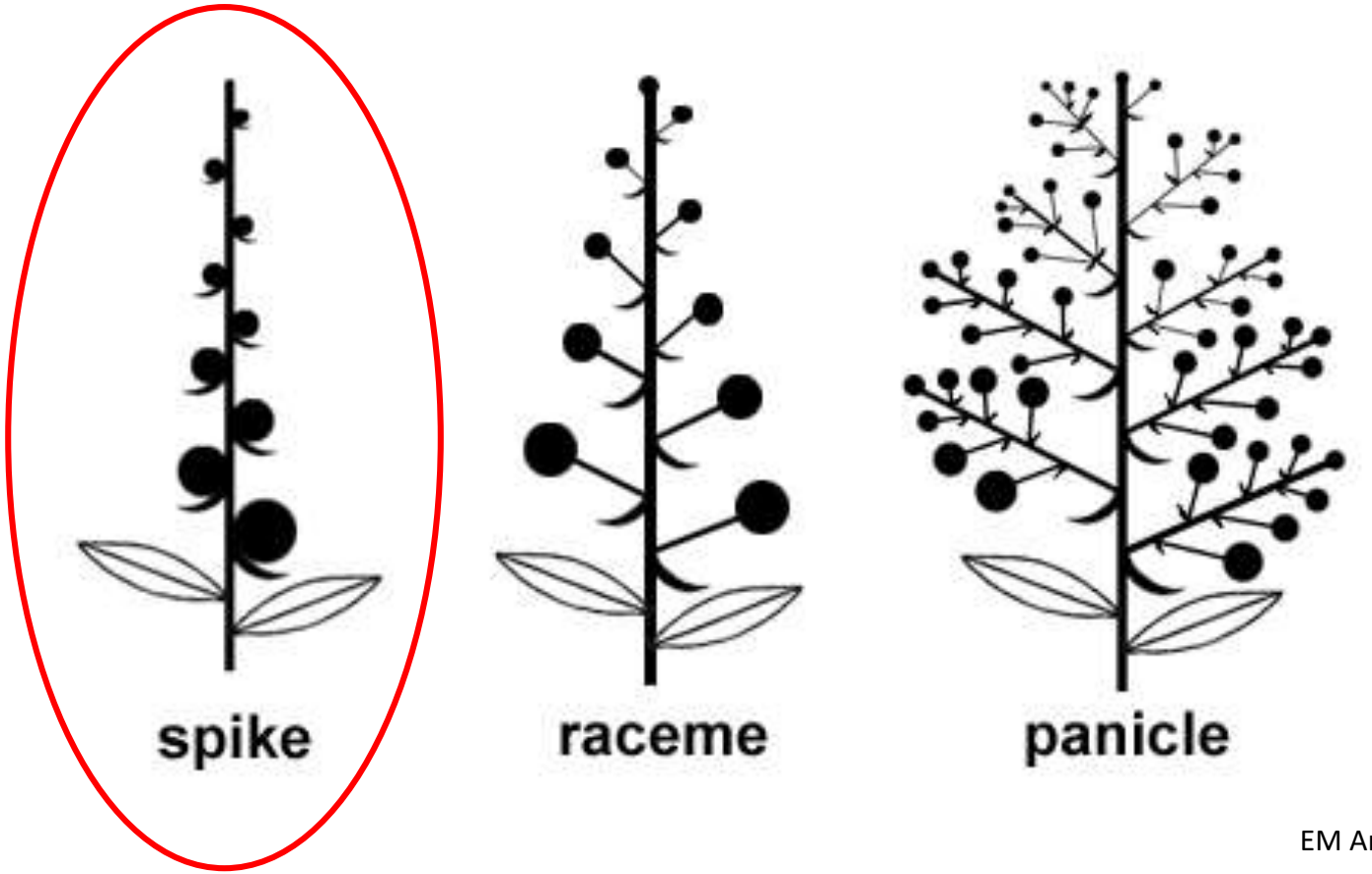
- Spike, raceme, or panicle?



EM Armstrong

What type of inflorescence?

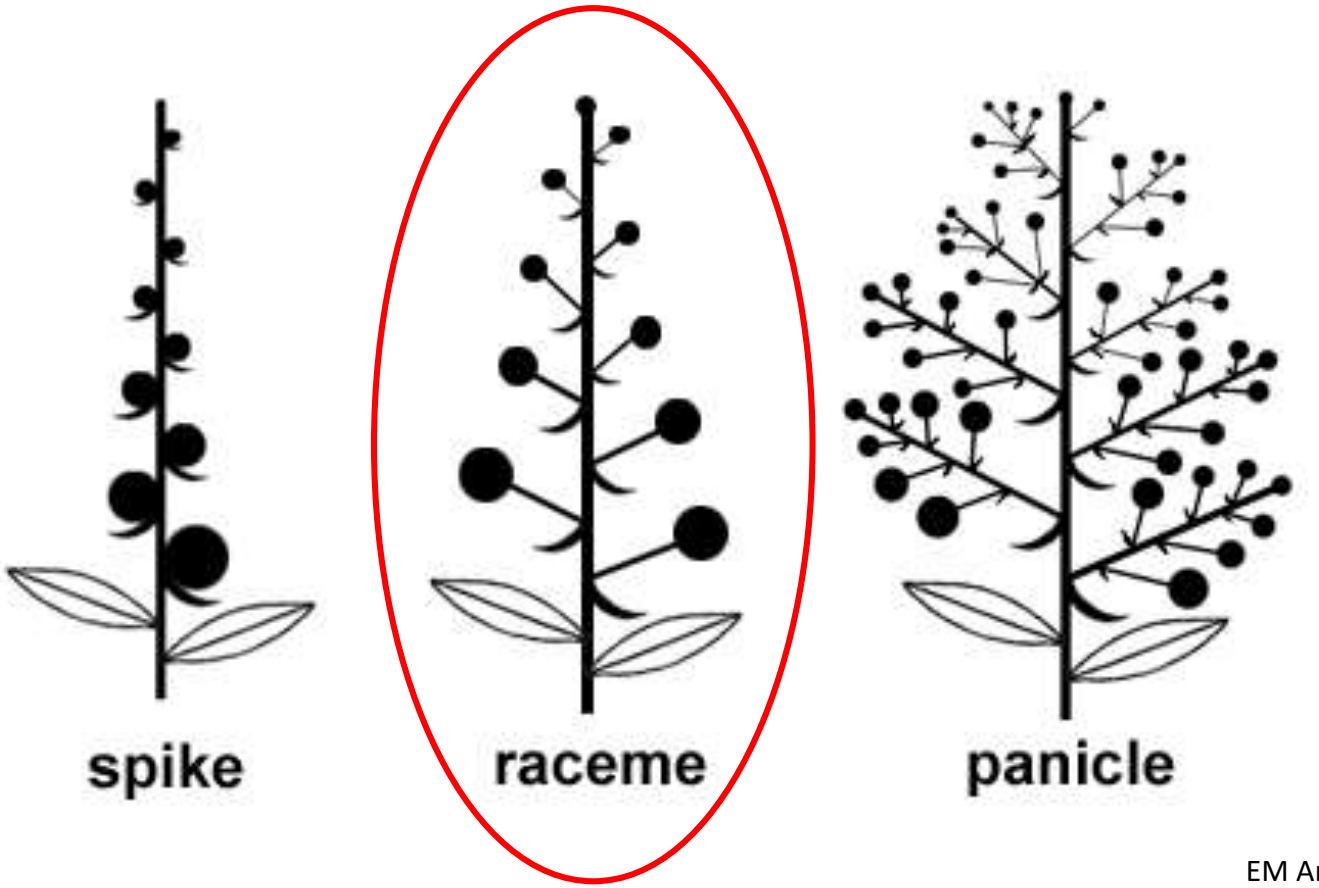
- Spike: unbranched, sessile (spikelets attached directly, no stalks)



EM Armstrong

What type of inflorescence?

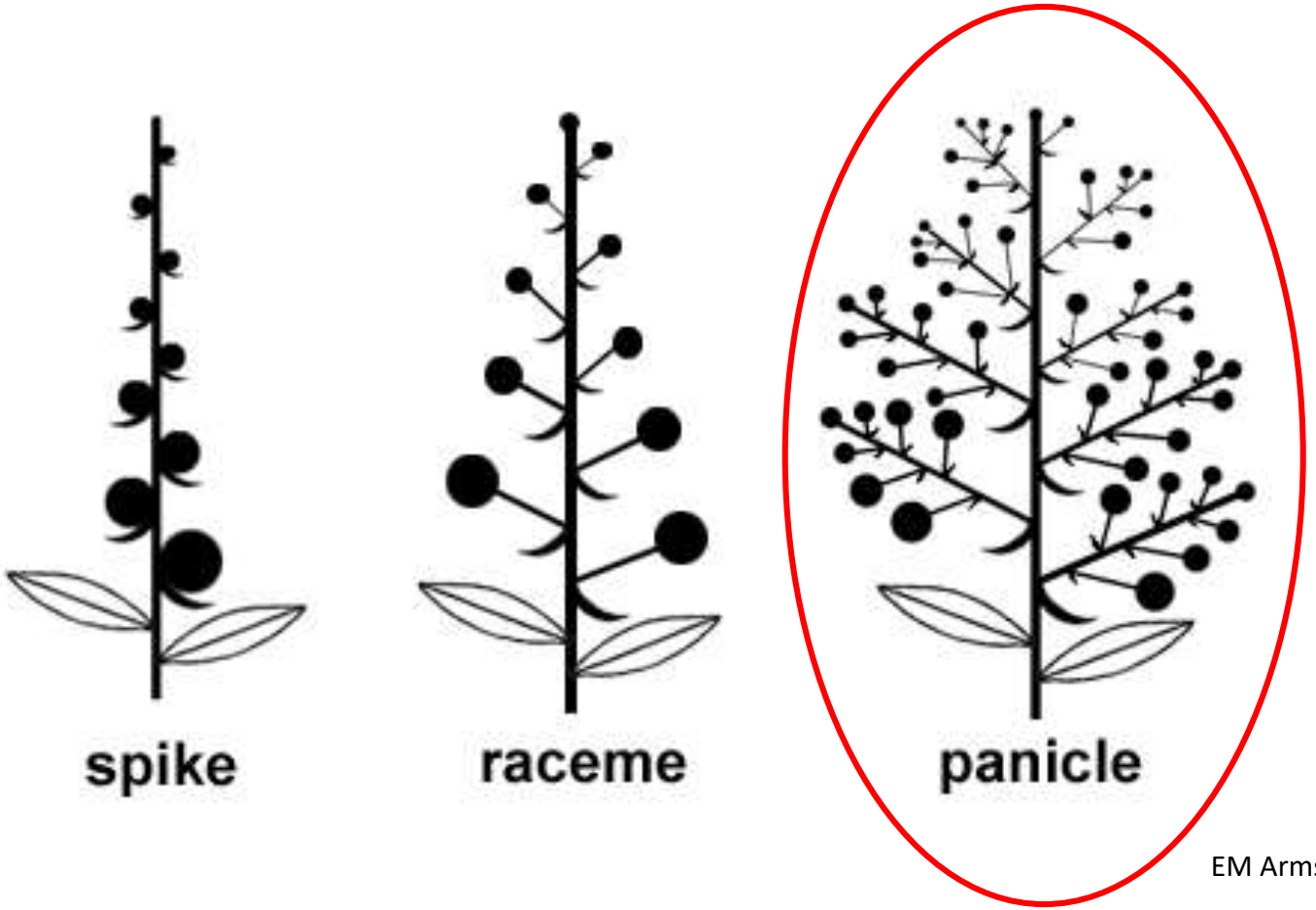
- Raceme: unbranched, spikelets attached by pedicels (stalks)



EM Armstrong

What type of inflorescence?

- Panicle: branched, spikelets on pedicels



EM Armstrong

Species Identification


Kaitlyn Quincy, UF/IFAS


Graves Lovell, Bugwood.org

5400547


Para grass
Urochloa mutica
Photo by Ann Murray


Forest and Kim Starr, Bugwood.org

UGA5287018


Photo by Jeff Norcini

Wetland Grasses

- *Panicum repens* (torpedograss)
- *Hymenachne amplexicaulis* (West Indian marshgrass)
- *Urochloa mutica* (paragrass)
  - *Brachiaria mutica*

Panicum repens (torpedograss)

P. repens – overall appearance

- Spreads via rhizomes and stolons
- Up to 3 ft. in height
- Hollow stems
- Blue-grey color

P. repens – leaves, sheaths, ligule

- Stiff and folded
- Leaves and sheaths hairy
- Ligule hairy

P. repens – inflorescence

- Loose, open panicle

Hymenachne amplexicaulis – West Indian Marshgrass

H. amplexicaulis - overall appearance

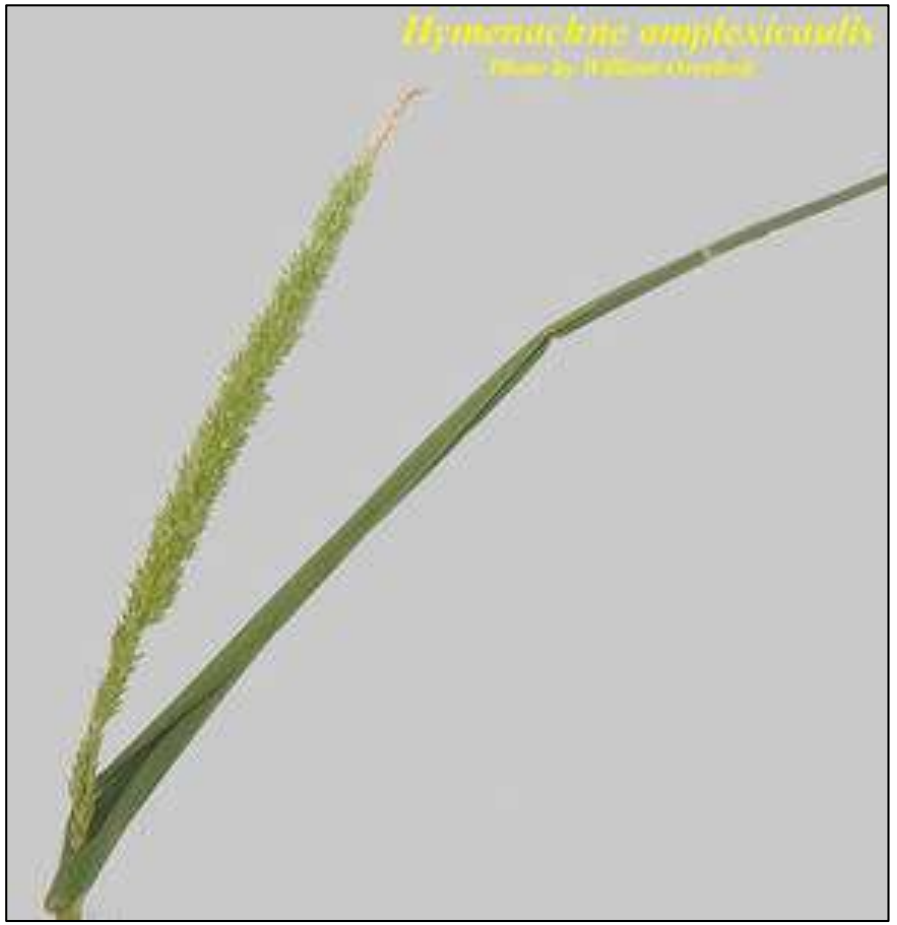
- Spreads via stolons and seeds
- 3-8 ft. in height
- Stems filled with white pith

H. amplexicaulis – leaves, sheath, ligule

- Hairs near base
- Ligule a small membrane
- Auricles wrap around culm

H. amplexicaulis - inflorescence

- Spike-like panicle



Urochloa mutica (paragrass)

U. mutica - overall appearance

- Spreads via stolons (seed germination low)
- 3 ft. in height
- Hollow stems
- Swollen hairy nodes

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U. mutica - leaves, sheath, ligule

- Short hairs on leaves and sheaths
- Ligule is a hairy membrane

U. mutca - Inflorescence:

- Pyramidal panicle
- Often purple-tinged

	Panicum repens	*Hymenachne amplexicaulis*	*Urochloa mutica*
Spread	Rhizomes and stolons	Stolons and seed	Stolons
Stem	Hollow	Filled with white pith	Hollow, hairy and swollen nodes
Leaves	Blue-grey, stiff and folded, leaves and sheath hairy	Hairs near base, auricles wrap around culm	Short hairs on leaves and sheaths
Ligule	Hairy	Small membrane	Hairy membrane
Inflorescence	Loose, open panicle	Spike-like panicle	Purple-tinged, pyramidal panicle

Cane Grasses – tall, with cane-like stems


James H. Miller, Bugwood.org


Jennifer Possley


Leslie J. Mehrhoff, Bugwood.org

Cane grasses

- *Phragmites australis* (common reed) – native and exotic forms
- *Arundo donax* (giant reed) – exotic

Phragmites australis (common reed)

P. australis – overall appearance

- Up to 20 ft. tall
- Spreads through rhizomes, stolons, and seeds

P. australis – leaves, sheath, ligule

- Leaves have sharp margins
- Ligule is a fringe of hairs

P. australis – inflorescence

- Large panicle
- Awns on upper florets
- Silky hairs at maturity

Phragmites haplotypes

	Eurasian Haplotype	Gulf Coast Haplotype
Inflorescence	Compact, erect	Open, drooping
Stem	Ribbed	Smooth
Height	6.5 to 13 ft.	Up to 20 ft.

Arundo donax (giant reed)

A. donax – overall appearance

- To 20 ft. tall
- Forms clumps
- Spreads via rhizomes, stem fragments

A. donax – leaves, sheath, ligule

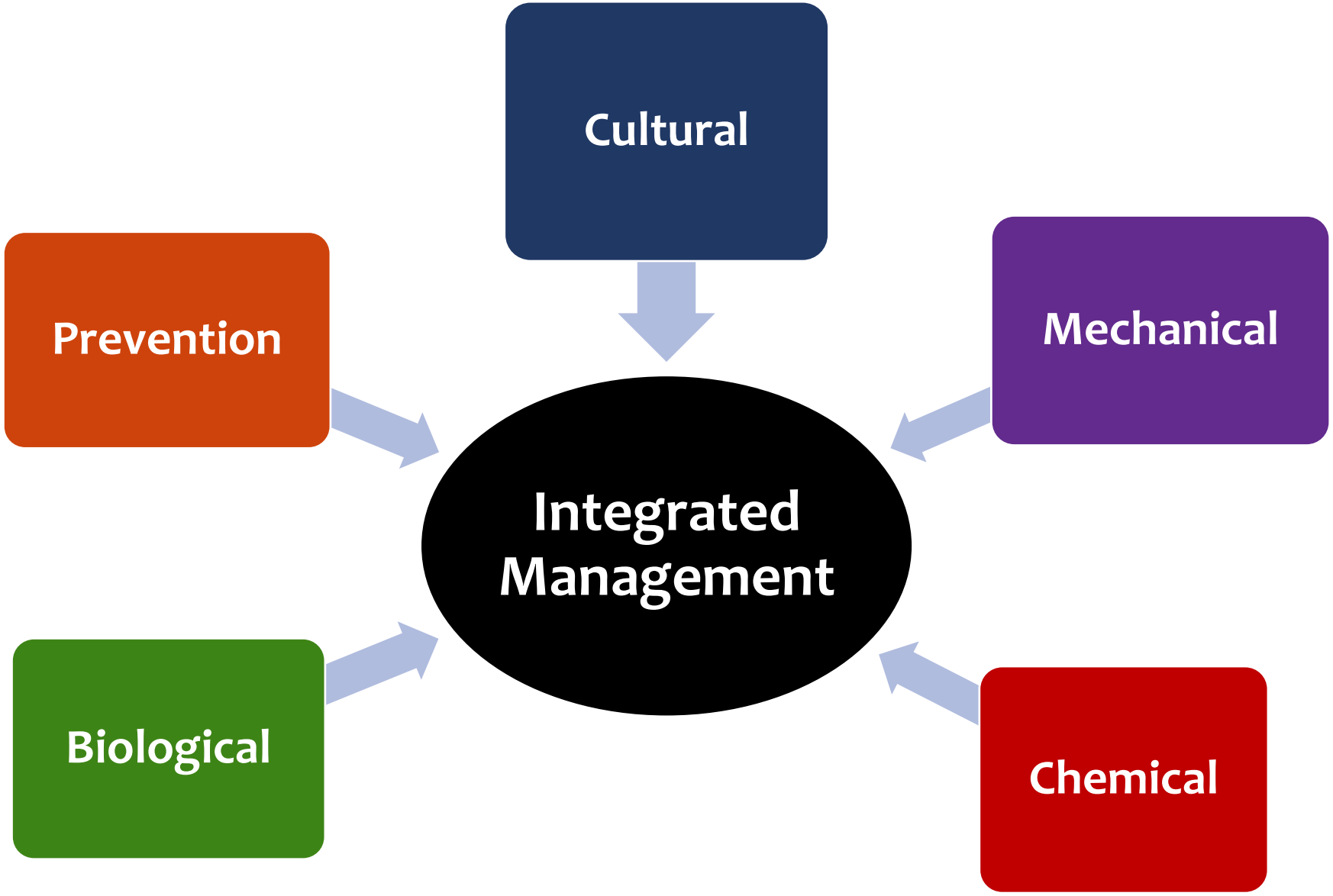
- Light brown collar and auricle
- Sharp margins
- Hairy ligule

A. donax – inflorescence

- Plume-like, compact panicle
- Upright
- Spikelets have awns

	Phragmites australis	*Arundo donax*
Spread	Rhizomes and stolons	Rhizomes and stolons
Height	To 20 ft.	To 20 ft.
Leaves	Smooth, sharp margins	Smooth, sharp margins, light brown auricles
Ligule	Hairy	Hairy
Inflorescence	Open panicle	Plume-like, compact panicle

Step 2: Control Method

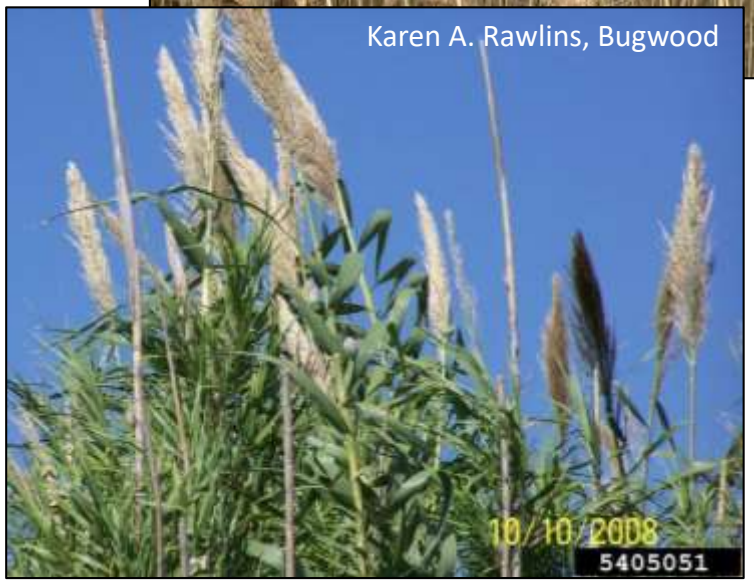

Cultural
Prevention
Mechanical
Integrated Management
Biological
Chemical

Prevention

- Easy to talk about, hard to do
- Clean equipment – prevent transport of seeds, rhizome fragments, etc.
- Avoid/remove ornamental plantings

Biological?

- Few biocontrol agents for grasses
- Closely related commercial grass crops



Biological?

- Cattle grazing may keep torpedograss in check

- West Indian Marsh Grass: *Ischnodemus variegatus (Diaz, 2008)*
  - Major stressor in summer

Sean McCann

Cultural

- Broad tolerance to environmental conditions
- Manipulating water levels, etc. may not be effective for these species

Mechanical

- Mowing or burning may be ineffective as a stand-alone treatment for some rhizomatous species
  - *P. australis*

Mechanical

- Repeated, aggressive mowing may provide control for certain species (*A. donax*)

- Repeated tillage – torpedograss
  - May be impractical in many natural areas

Chemical

- The herbicide label is the law!
- Late summer through early fall for aggressive perennial grasses

Chemical Control – glyphosate and imazapyr

- Imazapyr – the most effective
  - Works slowly (several months)
  - Persists in soil for several months
  - Good root and rhizome kill
- Glyphosate – very effective, but no soil activity
- Retreatment usually required with both herbicides
- Both are non-selective


Torpedograss
Panicum repens
Photo by Jeff Schwerd
Florida FWC


Torpedograss
Panicum repens
Photo by Ann Murray
© 1999 University of Florida

Selectivity with graminicides

- Sethoxydim and fluazifop-*p*-butyl show promise for torpedograss, West Indian marshgrass (research by Dr. Stephen Enloe's group)

- Sethoxydim: 24(c) special local needs label for aquatic grass control in **Florida**

Selectivity with graminicides

- Sethoxydim:
  - Enloe et al. (2018): best control with sequential applications in late spring before flooding
  - May require sequential treatments
  - May be less effective when flooded
- Further research needed to optimize treatments
- May be a great tool for improving native species recovery

Integrated Management

1. Cut, burn, or mow early in the summer
2. Treat with herbicides in late summer/fall

- Improved outcomes:
  - Stimulate new growth
  - Reduce belowground energy reserves
  - Improved access to dense infestations

Selecting a Control Method

1. Level of Infestation
   - Small enough to feasibly mow, till?
   - Level of native species?

2. Location and Ecosystem
   - Access?

3. Site Conditions

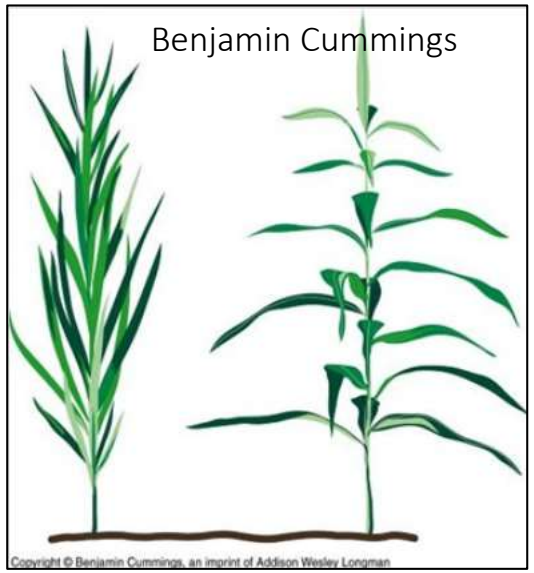
Site Conditions

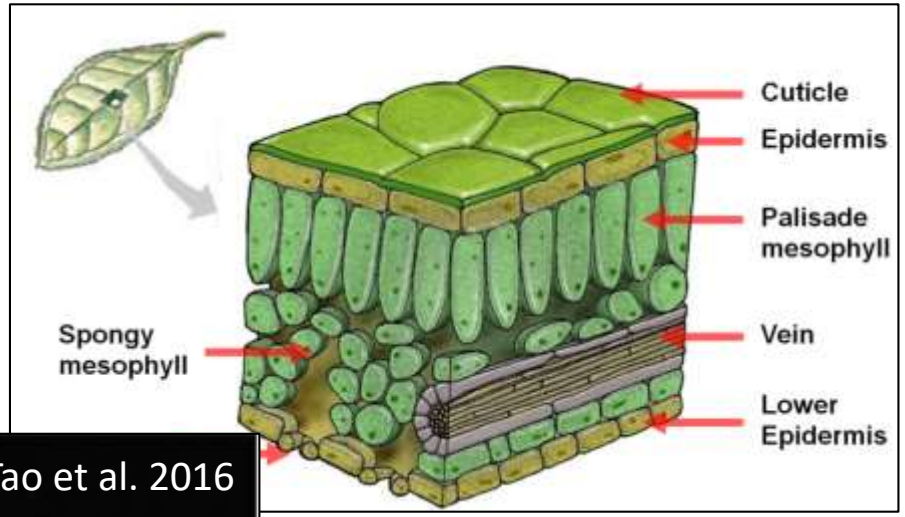
- Many grasses tolerate a wide range of environmental conditions

- Site conditions can affect herbicide efficacy

Traits affecting efficacy

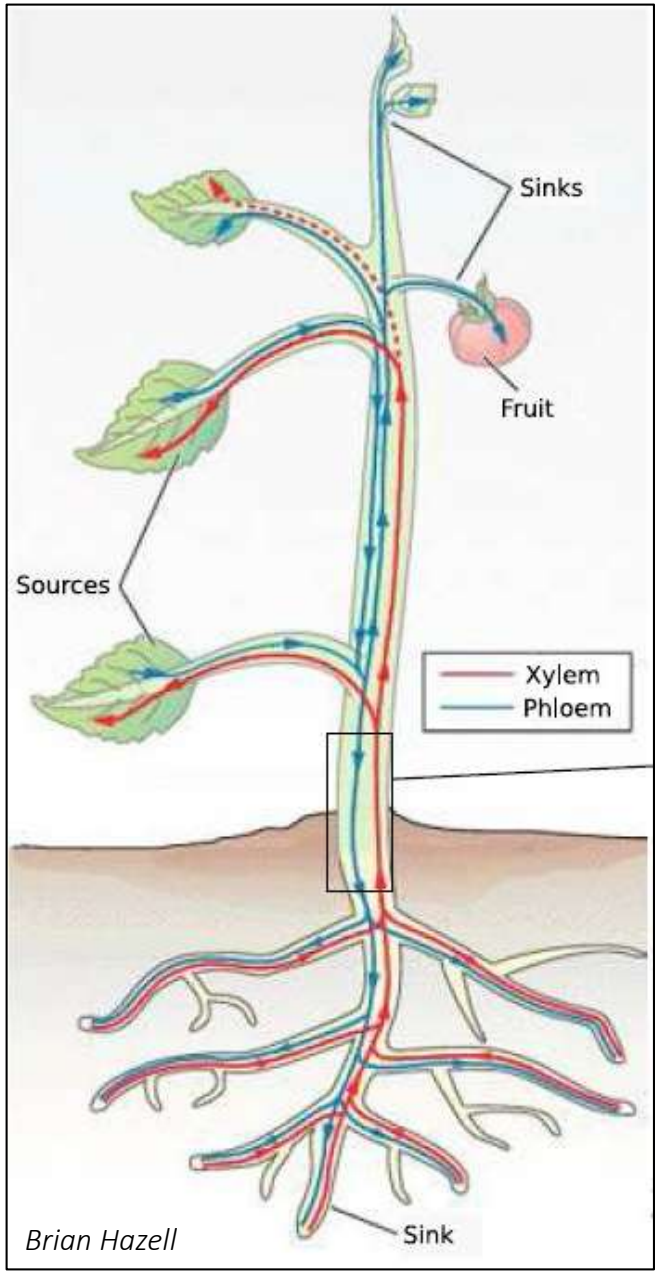
- Leaf traits - how much herbicide is taken up by plants?
  - Cuticle width
  - Leaf number and size
  - Leaf angle





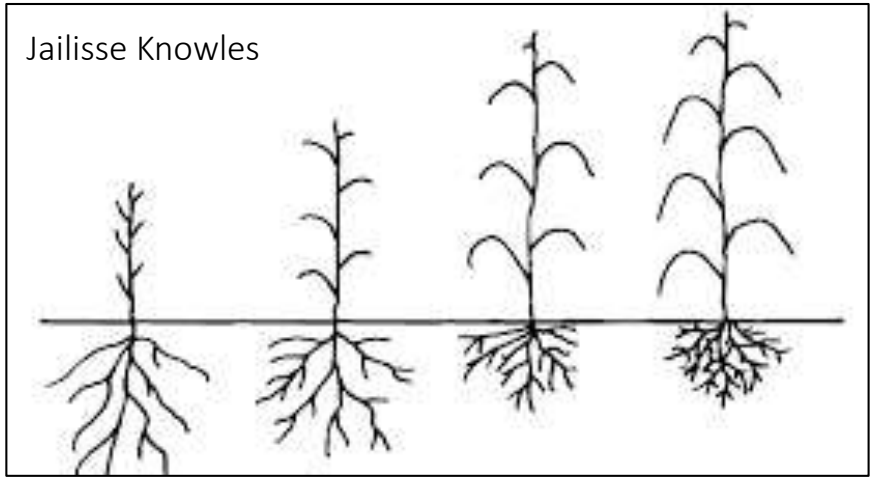
Traits affecting efficacy

- Growth rate, photosynthesis - translocation of systemic herbicides



Traits affecting efficacy

- Biomass can affect management success in rhizomatous species
  - Root to shoot ratios
  - Regrowth potential



Site conditions can impact these plant traits

- Flooding
- Salinity
- Drought

Flooding

- ↓ leaf area
- ↓ photosynthesis
- May initially limit number of leaves exposed to herbicide applications
- These factors may limit herbicide efficacy

Flooding

- Torpedograss – flooding may reduce performance of graminicides (sethoxydim and fluazifop)
  - Glyphosate and imazapyr were less effected
  - Prince et al. 2019

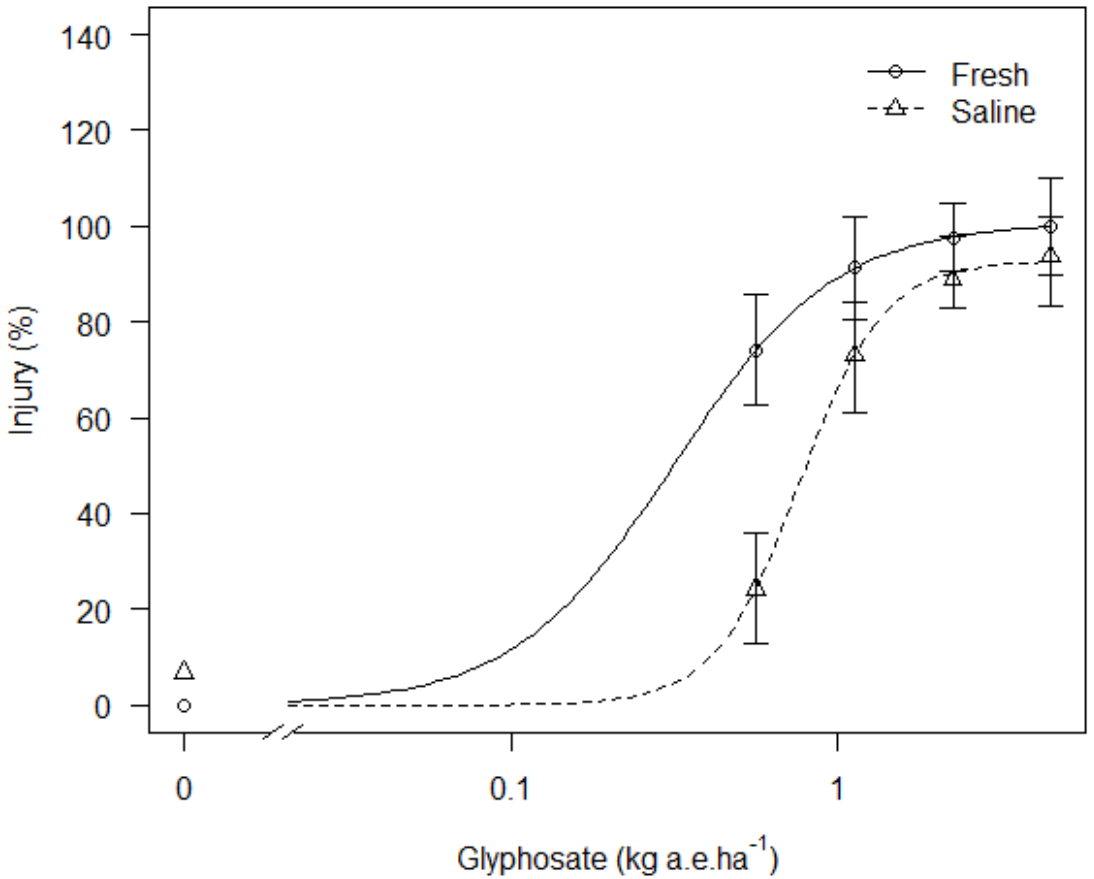
- Further research needed to optimize graminicide use in flooded areas

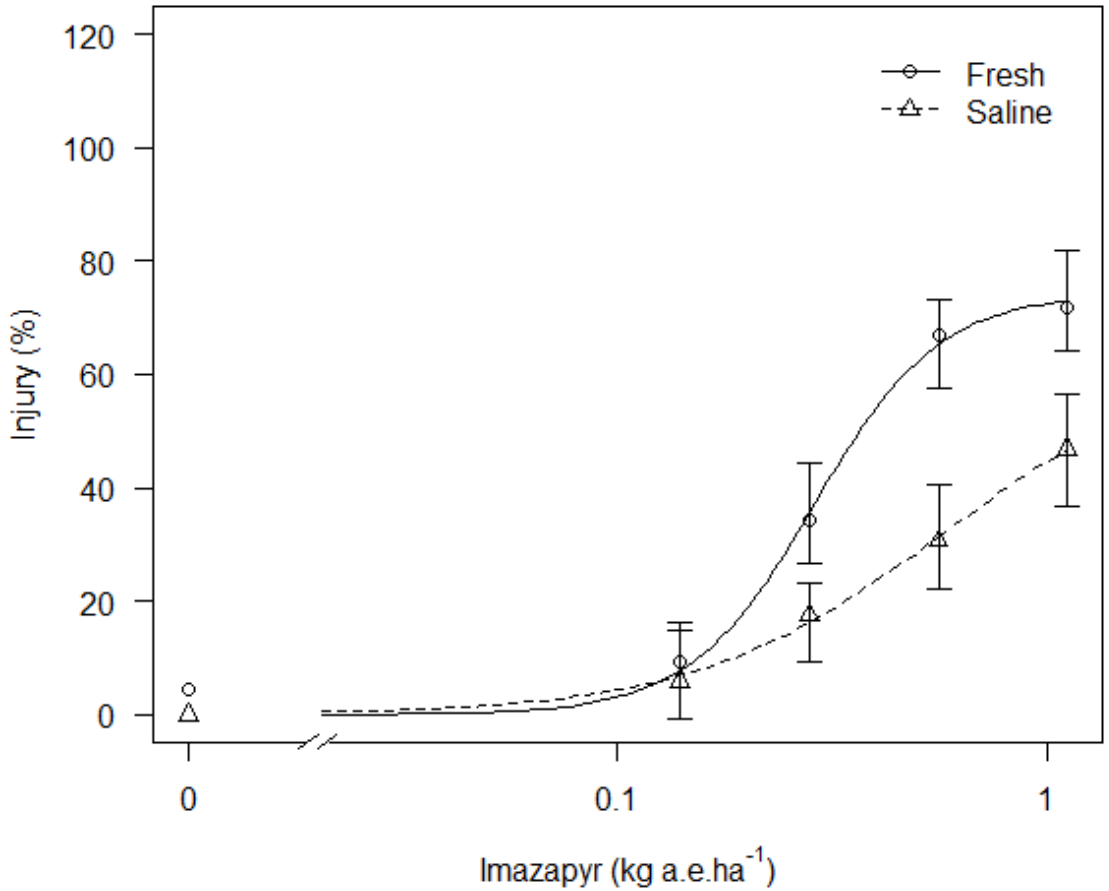
Increased Salinity

- ↓ photosynthesis, growth
- ↓ leaf area, leaf number
- ↑ leaf thickness
- ↑ root:shoot ratios

Salinity

- Torpedograss: salinity decreased performance of glyphosate and imazapyr (Prince 2020)





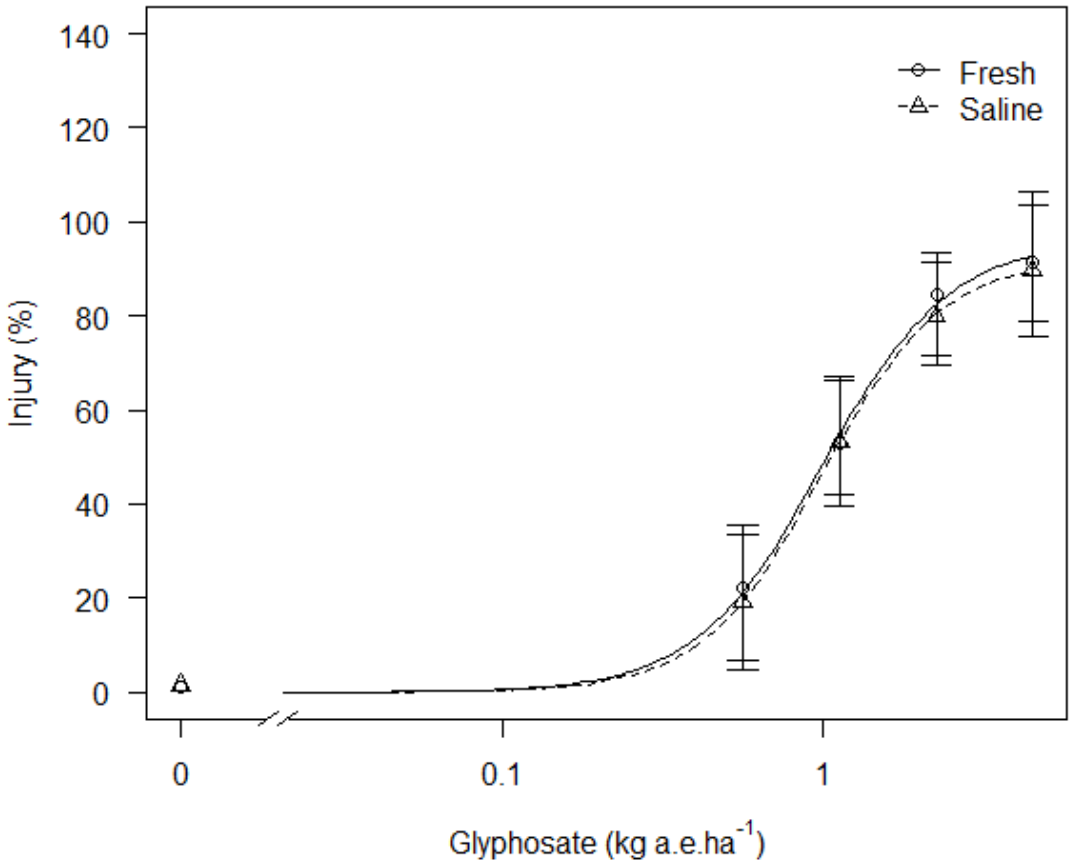
Saline (15 ppt)

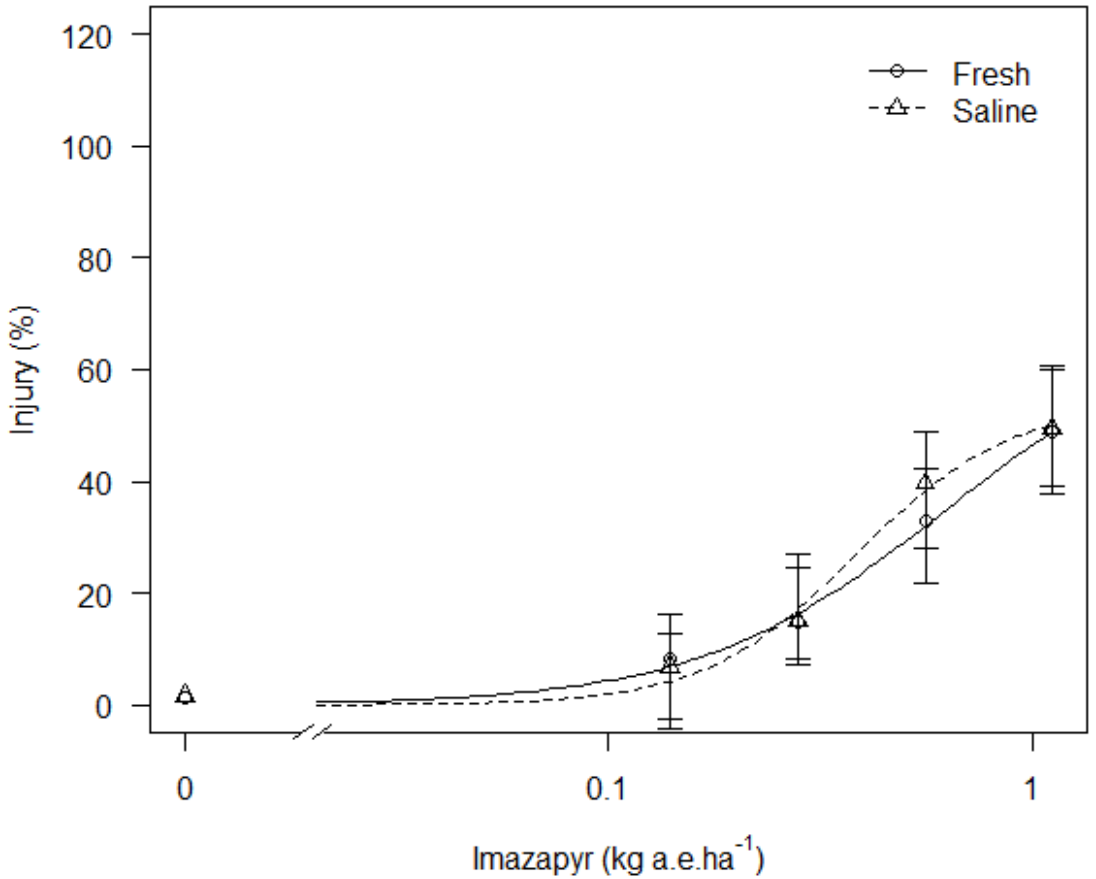
Freshwater (0.7 ppt)

Torpedograss treated with glyphosate (4 lb. a.i./A)

Salinity

- Common reed (phragmites): no effect of salinity on either herbicide

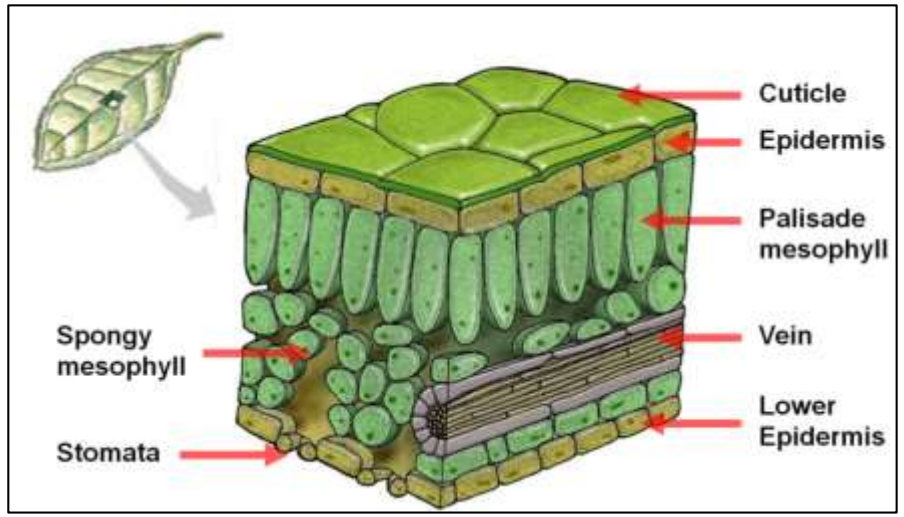


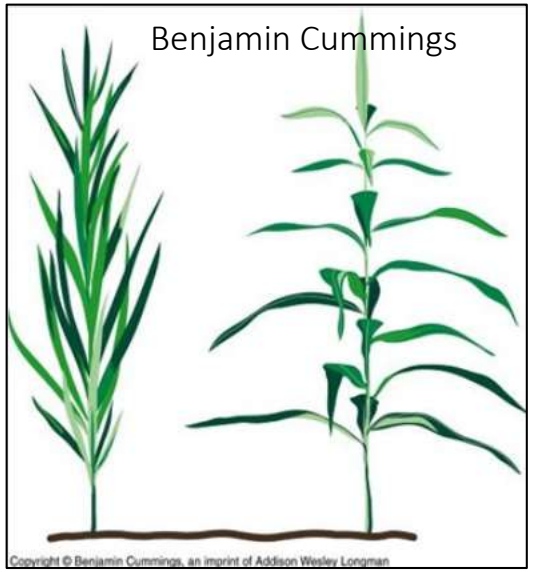


Drought

- Upright leaf angle
- ↓ photosynthesis, growth
- ↓ leaf area, leaf number
- ↑ leaf cuticle thickness

- May also decrease herbicide efficacy





Site Conditions

- Take-Away: consider the environmental conditions when planning, try to apply when growing conditions are ideal

- **Flooding** → may decrease efficacy
- **Salinity** → may decrease efficacy
- **Drought** → may decrease efficacy

Step 3: Monitoring for Regrowth

Monitoring for Regrowth

- Multiple applications will likely be required
  - Regrowth from rhizomes
  - Regrowth from seed bank

- Potential use for graminicides

Thank you!

- cprince14@ufl.edu