

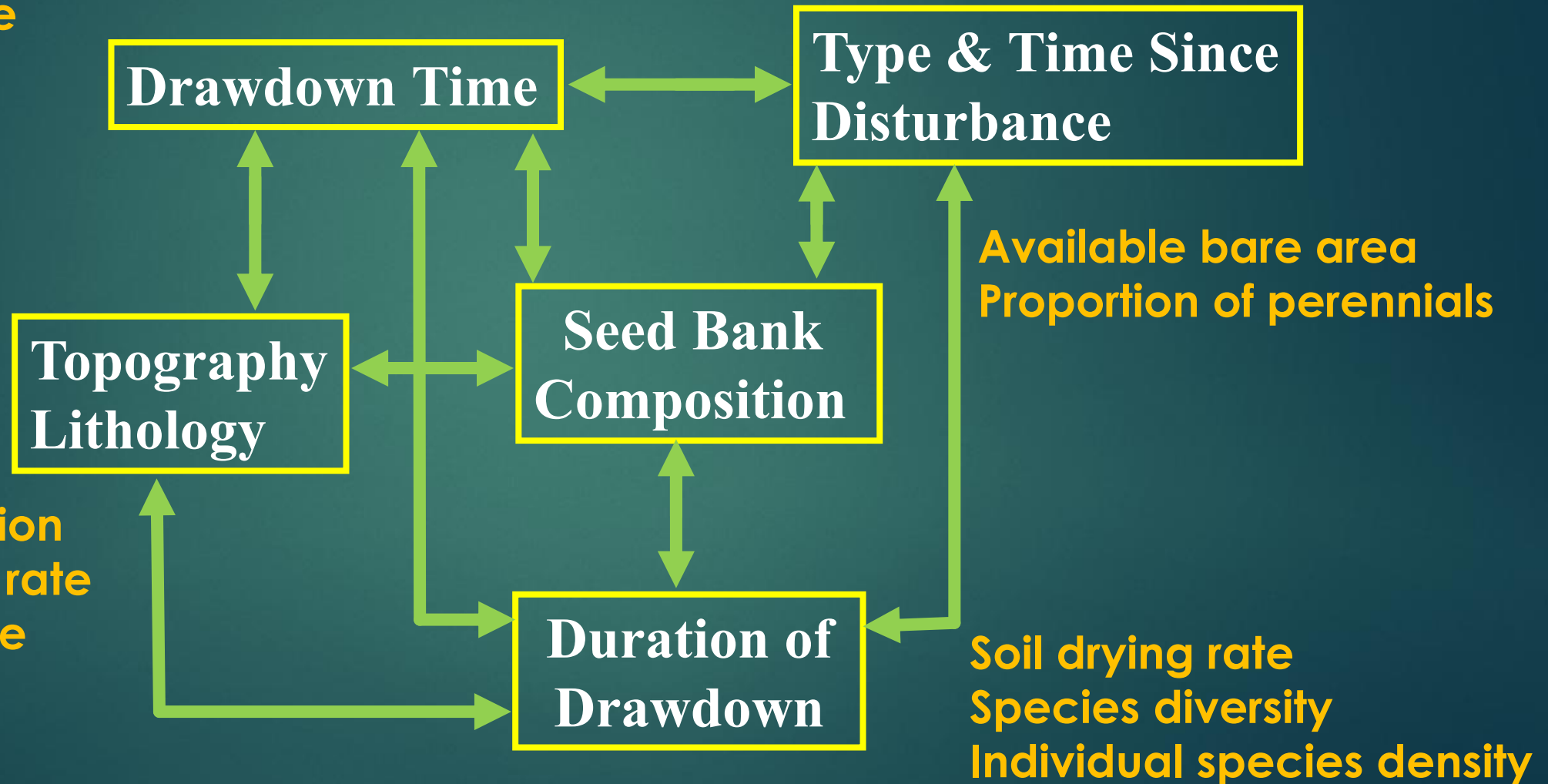
Wetland Management Techniques

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Grand Island, NE
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Review

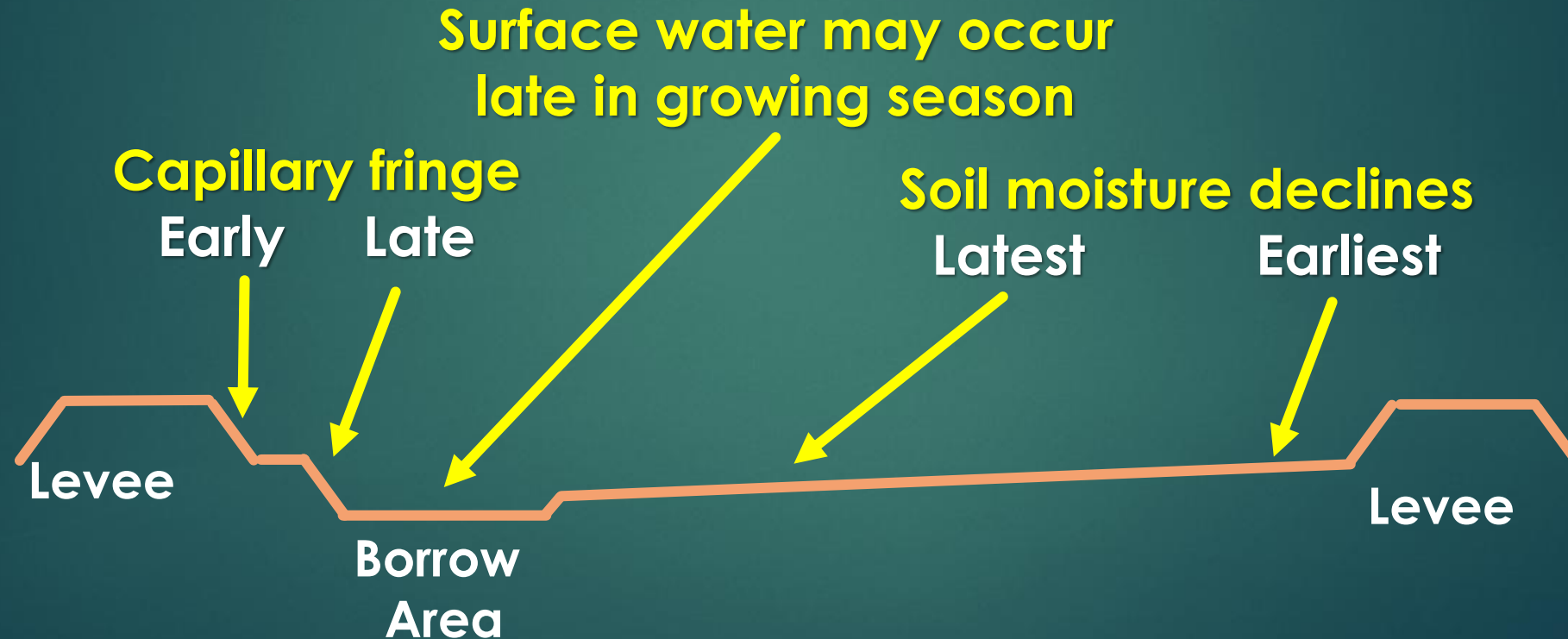
Seed dormancy/germination

Soil drying rate



Review

- Soil moisture (as well as temperature and photoperiod) can be influenced by gradient and aspect



Relative Germination Dates of Common Wetland Plants

Family/Species	Drawdown Date		
	Early	Mid	Late
Grasses			
Rice cutgrass	+++	+	
Sprangletop (Leptochloa)		+	+++
Crab grass (Digitaria)		+++	+++
Panic grass (Panicum)		+++	++
Barnyard grass (E. crusgalli)	+++	+	+
Barnyard grass (E. Walteri)	+	+++	
Barnyard grass (E. muricata)	+	+++	+
Sedges			
Red-rooted sedge (Cyperus)	+	+++	
Yellow nutsedge (Cyperus)	+++	+	
Spikerush (Eleocharis)	+++	++	+

Management Techniques (following initial germination)

► Type

- ❑ Soil & Plant
- ❑ Plant
- ❑ Various combinations

► Magnitude and Extent

- ❑ Duration (e.g., irrigation)
- ❑ Depth (e.g., re-flooding)

► Timing

- ❑ Annual (e.g., variable climate years)
- ❑ Intra-annual
 - Growing/non-growing season
 - Existing vegetation community (type, phenology)

Disturbance Type

Factor	Soil & Plant ¹			Plant		
	Disk	Finish disk	Cultipacker	Mowing	Fire	Herbicide
Amphibian mortality	High	High	High	Variable	Variable	Variable
Seedbank turnover	High	High	Medium	Low	Low	No affect
Eggbank reduction	High	High	High	Low	Medium-Low	Variable
Soil aggregate size	Large	Variable	Small	No affect	No affect	No affect
Seed size favored	Large	Variable	Small	No affect	No affect	No affect
Bare soil (+)	High	High	High	Low	High-Medium	Variable
Soil temp/light (+)	High	High	High	Low-medium	High	Medium
Decomposition rate (CPOM to FPOM)	Medium	Medium-High	High	Medium	High	Low
Water chemistry	Medium	Medium	Low-medium	Medium	High	Variable
Soil moisture						
Pre-treatment	Dry	Dry	Dry	Dry	Dry – Wet	Variable
Post (germination)	High	High	High	Low-Medium	Variable	Variable

¹ Other variations include cross-disk, multiple disk, etc.

Management Techniques

➤ Magnitude

❑ Depth of soil disturbance

- Increasing depth can increase seedbank turnover (deep burial)
- Increasing depth can bury detrital matter that slows decomposition and release of nutrients

❑ Extended drawdown (>1 year)

- Often required to achieve sufficient soil drying below root zone to control some obligate wetland plants
- Also allows broader application of other techniques

❑ Prolonged flooding (>1 Year)

- Often requires depths above plant height to control some obligate wetland plant species
- Not as effective as once reported (limited water, inadequate control)

Management Techniques

➤ Extent

❑ Treatment of plant stand

- Entire stand often required for better control (particularly species with extensive belowground storage structures)
- Partial treatment of stand retains residual vertical structure

❑ Partial drawdown & flooding (depends on objective)

- Improve soil moisture in limited area
- Stimulate new germination or promote growth of existing plants
- Provide habitat for target species (e.g., cover, egg attachment)

Management Techniques (above & belowground)

- **Timing must be considered in relation to**
 - ❑ **Plant ecology**
 - Germination or regrowth requirements
 - Time required to produce seeds
 - ❑ **Invertebrate ecology**
 - Decomposition rate / nutrient availability
 - Emergence
 - ❑ **Vertebrate ecology**
 - Chronology
 - Structure
 - Foods

Management Techniques

➤ Timing

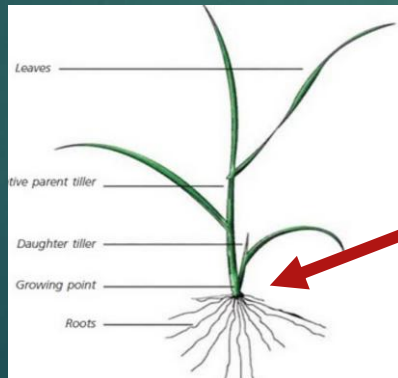
- Flooding some species (e.g., cocklebur) early in growth phase is more effective and cost-efficient than flooding mature plants
- Irrigating established plants to improve survival and seed production
- Treatment of robust perennials as individual seedlings is more effective than treatment of plants with connected rhizosphere
- Proper timing and height of mowing to favor growth of grasses and sedges

Management Techniques

(time of mowing)

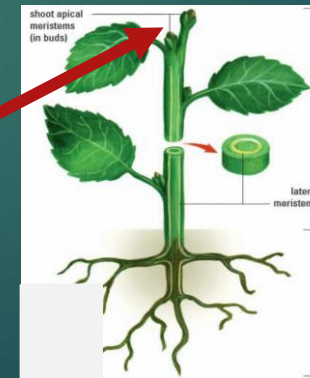
Monocot (grasses/sedges)

- ▶ One cotyledon (embryonic leaf)
- ▶ Flower parts in 3's
- ▶ Leaves narrow & parallel venation
- ▶ **Meristem at base (soil level)**



Dicot (forbs/trees)

- ▶ Two cotyledons
- ▶ Flower parts in 4's and 5's
- ▶ Leaves broad & net venation
- ▶ **Meristem at end of each shoot**

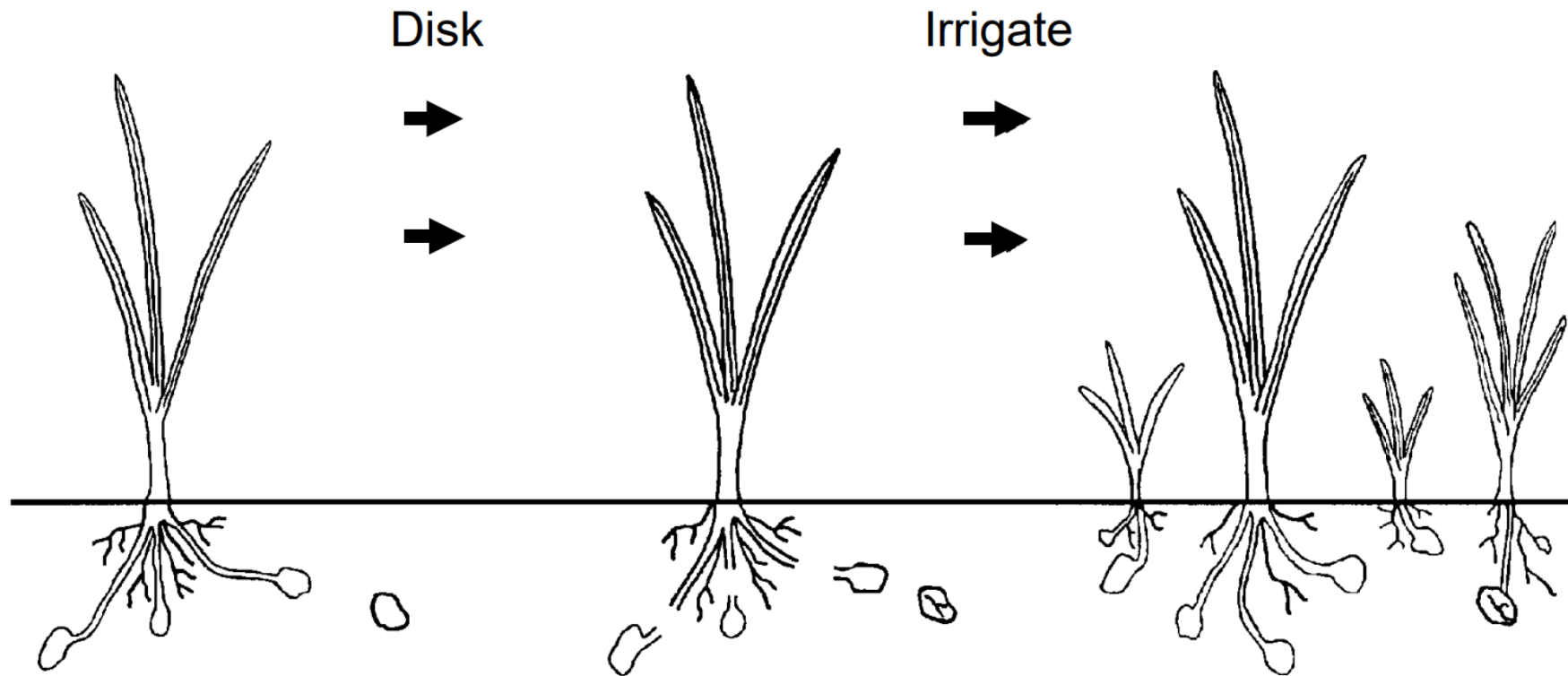


Growing point

Meristem is site of new cell production (also referred to as growth point)

Management Techniques

(time of disking)



Shallow disking and irrigation stimulate additional sprouting of active and dormant chufa tubers

Implementation Of Plant Control Actions

- Consider all potential impacts of management actions when making decisions to avoid costly ecological mistakes
 - Soil structure (e.g., sediment inputs & consolidation, aggregate size)
 - Decomposition and nutrient cycling (litter location & biomass)
 - Seed and invertebrate banks
 - Water chemistry (e.g., suspended sediments)

Implementation Of Plant Control Actions

- **Consider environmental factors necessary post-treatment to achieve intended objectives**
 - ❑ Bare mineral soil (e.g., germination)
 - ❑ Soil temperature and photoperiod adequate (e.g., germination)
 - ❑ Soil moisture
 - Adequate moisture for germination and/or seed production of target plants
 - Lack of soil moisture to prevent regrowth of controlled plant

Availability

Food Availability

- **Providing appropriate foods in proper location at correct time**
- **Complex because parameters change depending on**
 - ❑ Morphology (e.g., bill size)
 - ❑ Method (e.g., dabble, probe, sweep)
 - ❑ Habitat structure
 - ❑ Depth to food
 - ❑ Age (e.g., adult, immature)
 - ❑ Life-cycle event (e.g., breeding, migrating, wintering)
 - ❑ Juxtaposition of habitat types

Appropriate Food

Guild	Diet	Food items									
		Algae	Amp	Bird	Fish	Invert	Mam	Plant	Rep	Seed	Tuber
Herons, Egrets, Bitterns	Carnivore		X	X	X	X	X		X		
Cranes	Omnivore		X			X	X		X	X	X
Rails	Omnivore					X		X		X	
Ducks	Omnivore	X			Diver	X		X		X	X
Shorebirds	Carnivore				Large	X				X	
Aquatic Frogs Tadpole Adult	Herbivore	X						X			
	Carnivore					X					
Aquatic Turtles	Omnivore	X				X		X			

Avian Energetic Requirements

Activity	Estimated cost (x BMR)
Alert	1.5
Courtship	2.0
Dive	5.0
Egg laying	
Early follicular growth	16.7
Maximum	20.0+
Last egg	10.2
Fly	12.0
Swim	3.2

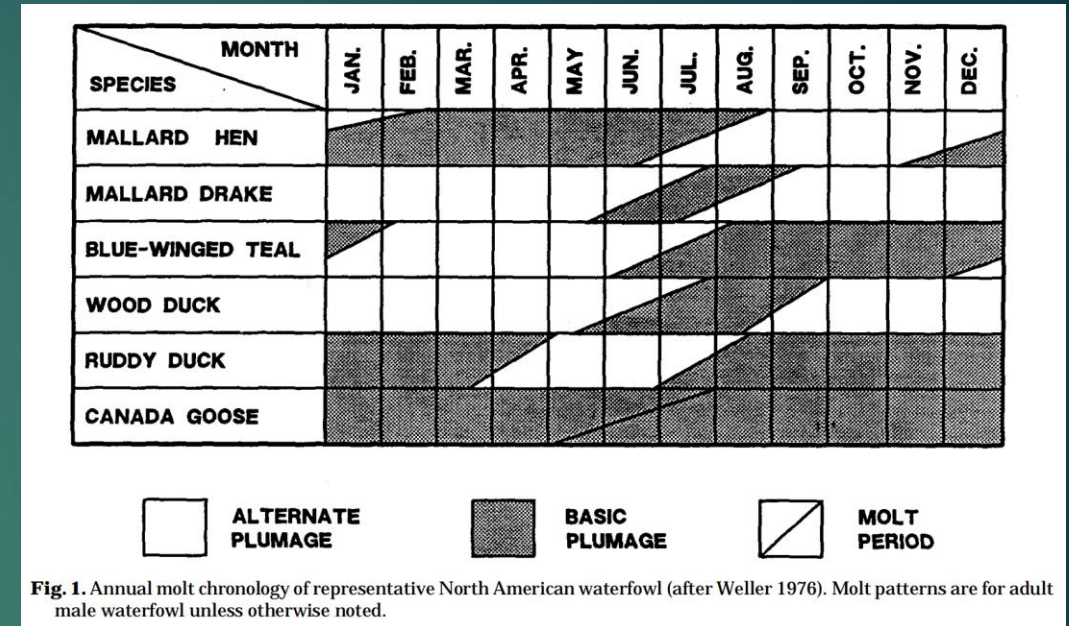
Protein Requirements

➤ Molt

- ❑ Adult waterfowl & shorebirds twice annually
 - Mallard requires 102 g protein for molt of body and tail feathers
- ❑ Adult geese once annually

➤ Egg production

- ❑ Dietary calcium & protein required varies among species
 - Amount of endogenous reserves used
 - Clutch size
 - Mallard requires 69 g protein for clutch of 11 eggs



Species	Energy (kcal/g)		Weight (%)				
	Gross	TME	Fat	Fiber	Ash	NFE	Protein
Backswimmer							64.4
Earthworm			7.7	0.4	19.4	12.3	60.2
Fairy shrimp			8.6	3.9		1.5	71.9
Midges (larvae)	4.30		5.8		9.2	14.9	66.4
Sideswimmer	4.02		5.9	8.4	22.2	16.5	47.0
Grass shrimp	3.32	2.02	1.2		6.7	11.7	46.8
Snail, Lymnaeid	0.92		0.7		64.2		16.9
Snail, Planorbid	1.02		1.1		73.3		12.2
Snail (w/o shell)			0.1	0.7		21.9	58.9
Waterflea			1.5	7.3		10.9	49.7
Beggarticks	5.17		15.0	19.7	7.2	27.5	25.0
Barnyardgrass	3.90	2.61	2.4	23.1	18.0	40.5	8.3
Chufa flatsedge (tubers)	4.26		6.9	9.0	2.5	55.4	6.7
Smartweed, Pennsylvania	4.32	1.08	2.3	21.8	4.9	65.3	9.0
Pin oak	5.06	2.60	18.9	14.7	1.6	58.6	6.4
Willow oak	5.30	2.60	20.6	14.0	1.7	55.3	5.1
Corn	4.44		3.8	2.3	1.5	79.8	10.8
Milo	4.23		3.1	6.0	3.5	72.2	10.2

Proper Location

Guild	Foraging Method			Habitat Structure	
	Mode	Type ¹	Loc ²	Height	Density
Herons	Wade	Visual	W,T	Short	Sparse
Bitterns	Wade, Walk	Visual	W,T	Tall	Dense
Cranes	Wade, Walk	Visual	W,T	Short	Medium/Sparse
Rails	Wade, Walk	Visual	B,W,T	Tall/Medium	Dense/Upright
Dabbling Ducks	Walk, Swim	Visual	B,W	Variable	Variable
Shorebirds	Walk, Wade, Swim	Visual, Tactile	B,W,T	Short/None	Sparse/None
Aquatic Frogs	Hop, Swim	Visual	W,T	Variable	Variable
Aquatic Turtles	Walk, Swim	Visual	W,T	Medium/Sparse	Medium/Sparse

¹ Visual = Gleaners (Avocet, Ducks) and Pickers (Plovers, Ibis);
Tactile = Probers (Dowitchers)

² B=benthos, W=water column, T=terrestrial



SHORT, SPARSE



WET MEADOW



**MID-HEIGHT,
SPARSE**



**OPEN,
SHALLOW WATER**



**OPEN,
DEEPER WATER**



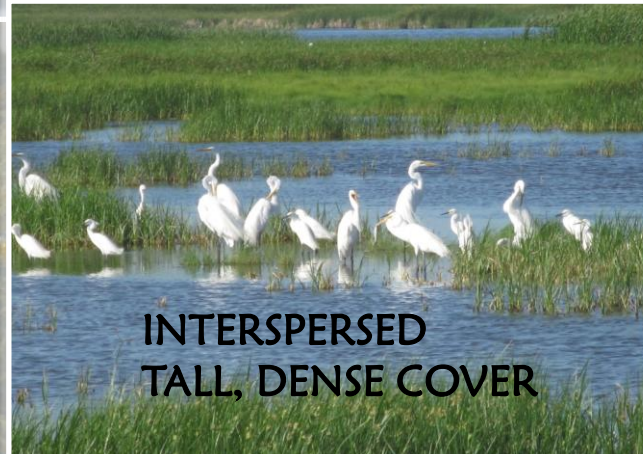
**MID-HEIGHT,
DENSE**



MUDFLAT



**SUBMERGED AQUATIC
VEGETATION**



**INTERSPERSED
TALL, DENSE COVER**

Food Availability

Vertebrate Species

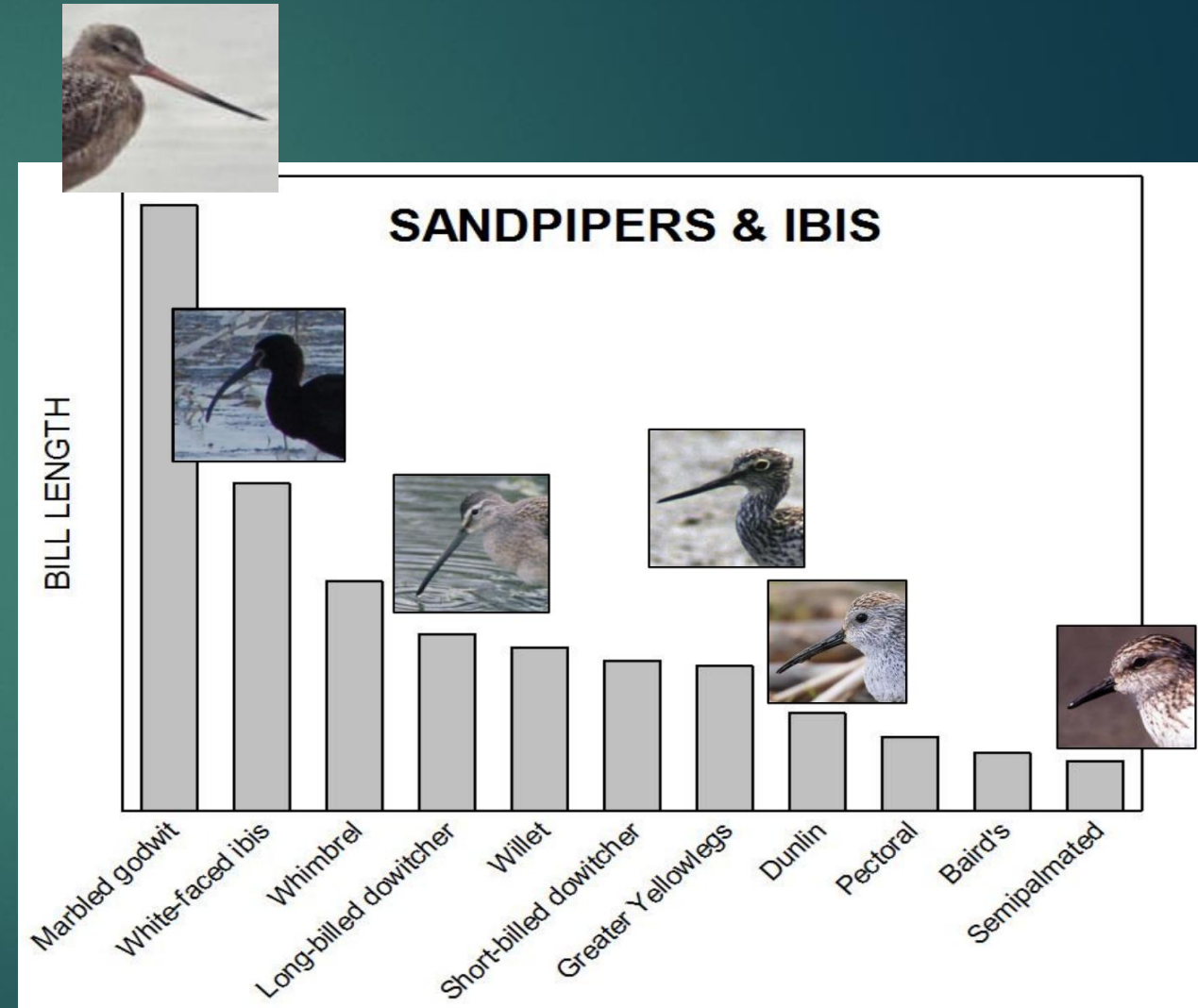
- Body size
 - Among species (e.g., tarsus length)
 - Within species (e.g., imm, ad)



Food Availability

Vertebrate Species

- Body size
 - Among species (e.g., tarsus length)
 - Within species (e.g., imm, ad)
- Foraging method
 - Birds (e.g., bill morphology)
 - Fish (e.g., mouth size)



Food Availability

Vertebrate Species

- Body size
 - Among species (e.g., tarsus length)
 - Within species (e.g., imm, ad)
- Foraging method
 - Birds (e.g., bill morphology)
 - Fish (e.g., mouth size)
- Specialized methods/behaviors
 - Use of vegetation
 - Platforms



Food Availability

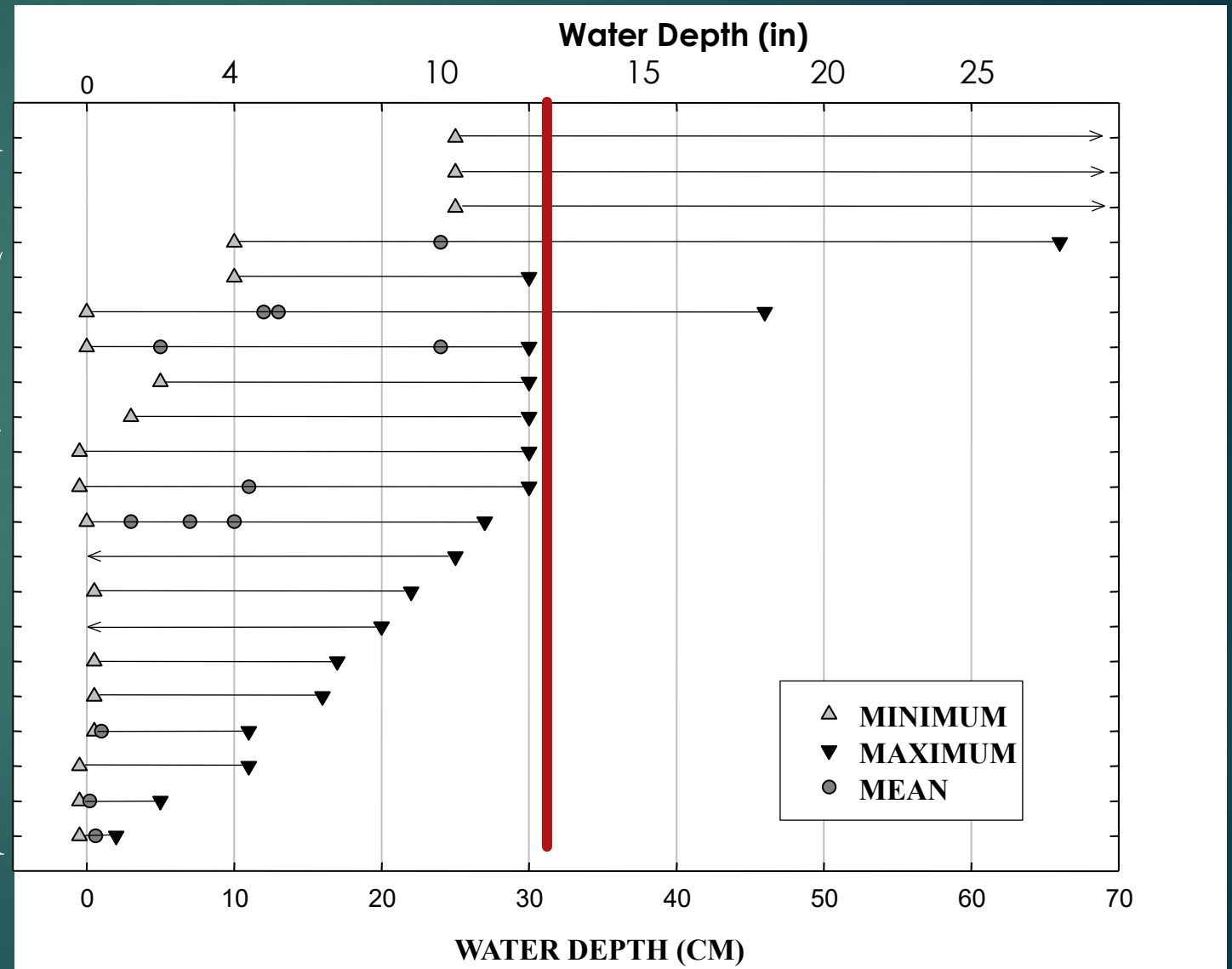
Food Location

- Benthos (in or on the surface)
 - ❑ Invertebrate (egg/larvae/nymph/adult)
 - ❑ Plant (seed, tuber, turion)
- Nekton (water column)
 - ❑ Invertebrate (egg/larvae/nymph/adult)
 - ❑ Plant (attached seed, stem, leaf)
 - ❑ Vertebrate (fish, amphibian)
- Water Surface
 - ❑ Invertebrate (egg, larvae/nymph/adult)
 - ❑ Plant (attached seed/drupelet, leaf)



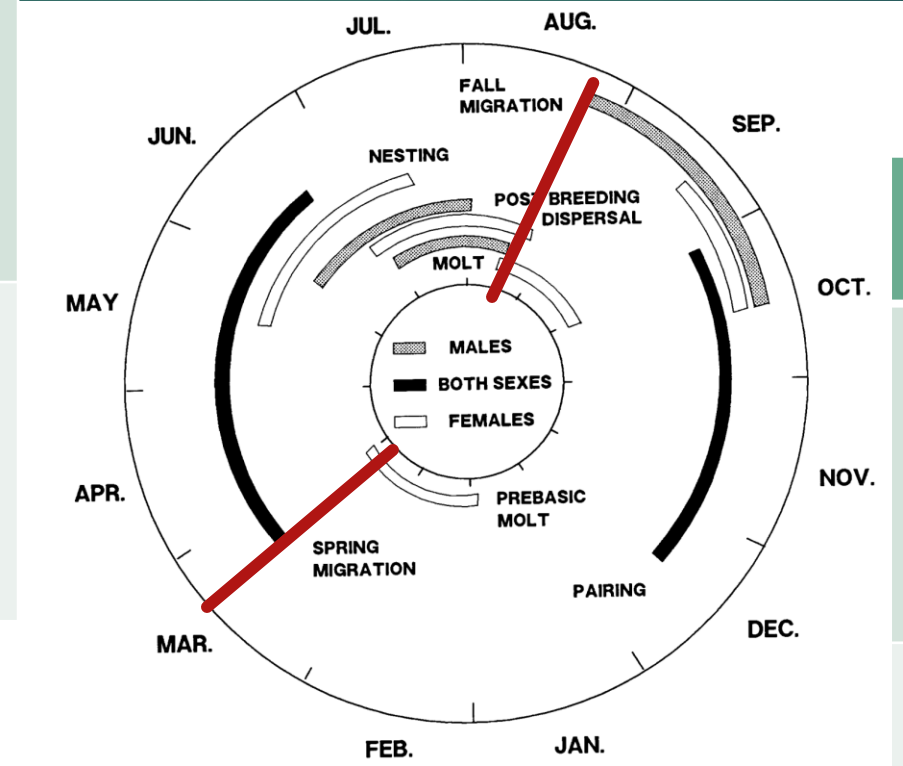
Foraging depth

RING-NECKED DUCK
 LESSER SCAUP
 PIE-BILLED GREBE
 GADWALL
 AMERICAN WIGEON
 SORA
 NORTHERN SHOVELER
 REDHEAD
 NORTHERN PINTAL
 MALLARD
 AMERICAN AVOCET
 VIRGINIA RAIL
 AMERICAN BITTERN
 WILSON'S PHALAROPE
 BLUE-WINGED TEAL
 MARBLED GODWIT
 LONG-BILLED DOWITCHER
 COMMON SNIFE
 UPLAND SANDPIPER
 KILLDEER
 SPOTTED SANDPIPER



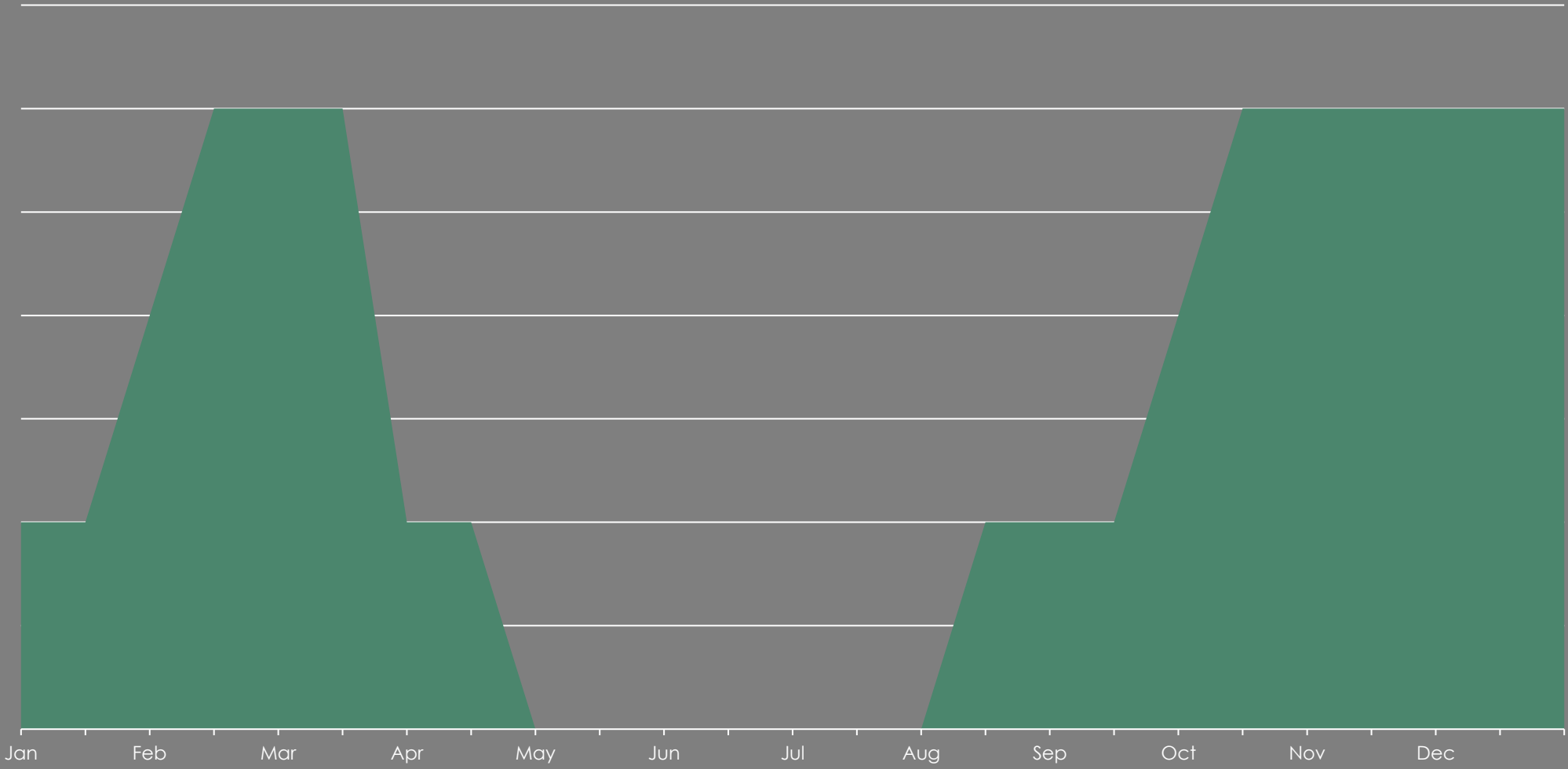
Correct Time (gadwall)

Spring & Summer	Example Food Items
Plant foods (54%)	Algae Widgeongrass Muskgrass Sago Elodea
Animal foods (46%)	Fairy shrimp Seed shrimp Waterflea Midge Beetle larvae



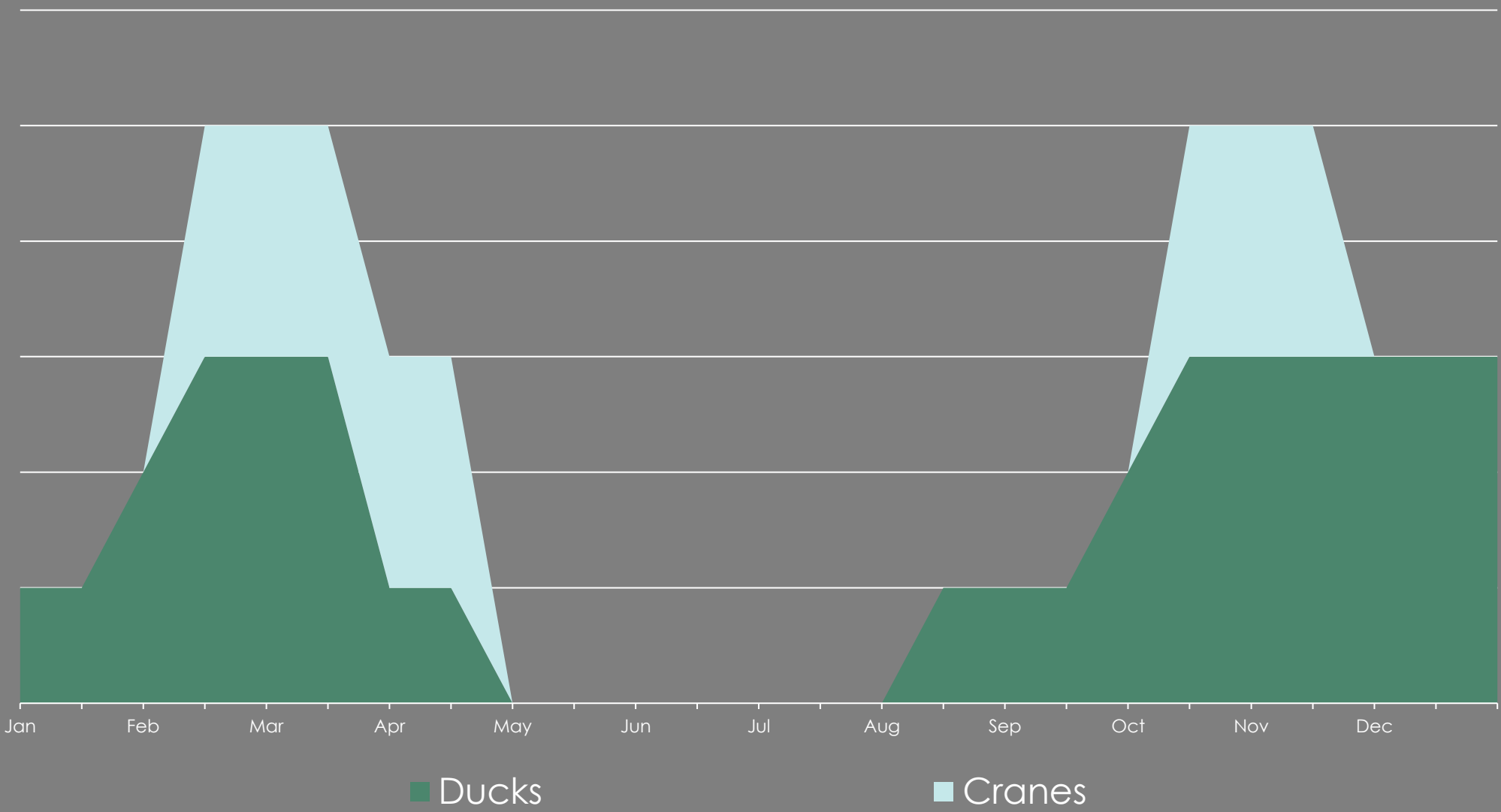
Fall & Winter	Example Food Items
Plant foods (95%)	Algae D. spikerush Widgeongrass B. pondweed Watermilfoil
Animal foods (5%)	Seed shrimp

Chronology of Use

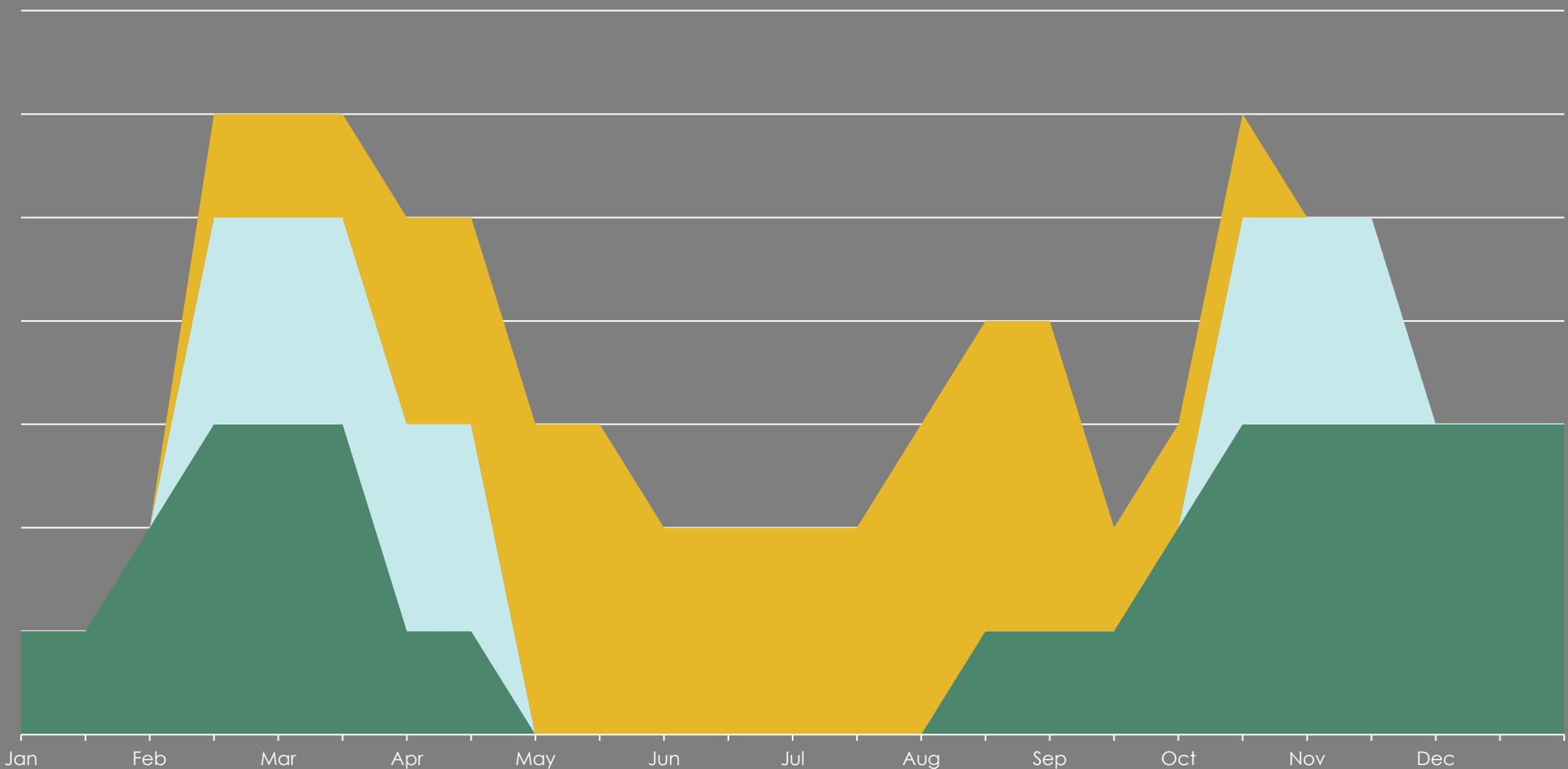


■ Ducks

Chronology of Use



Chronology of Use

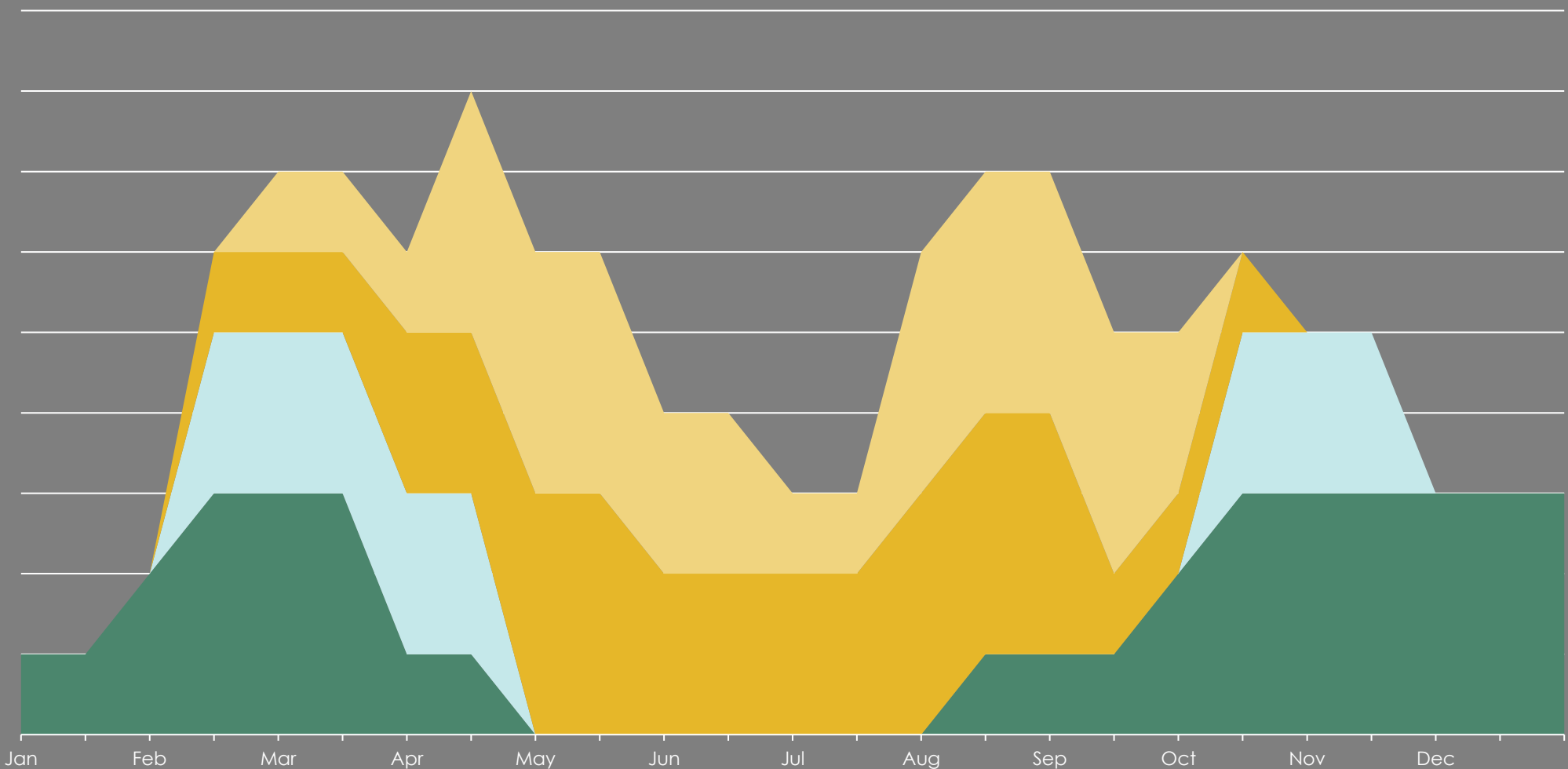


■ Ducks

■ Cranes

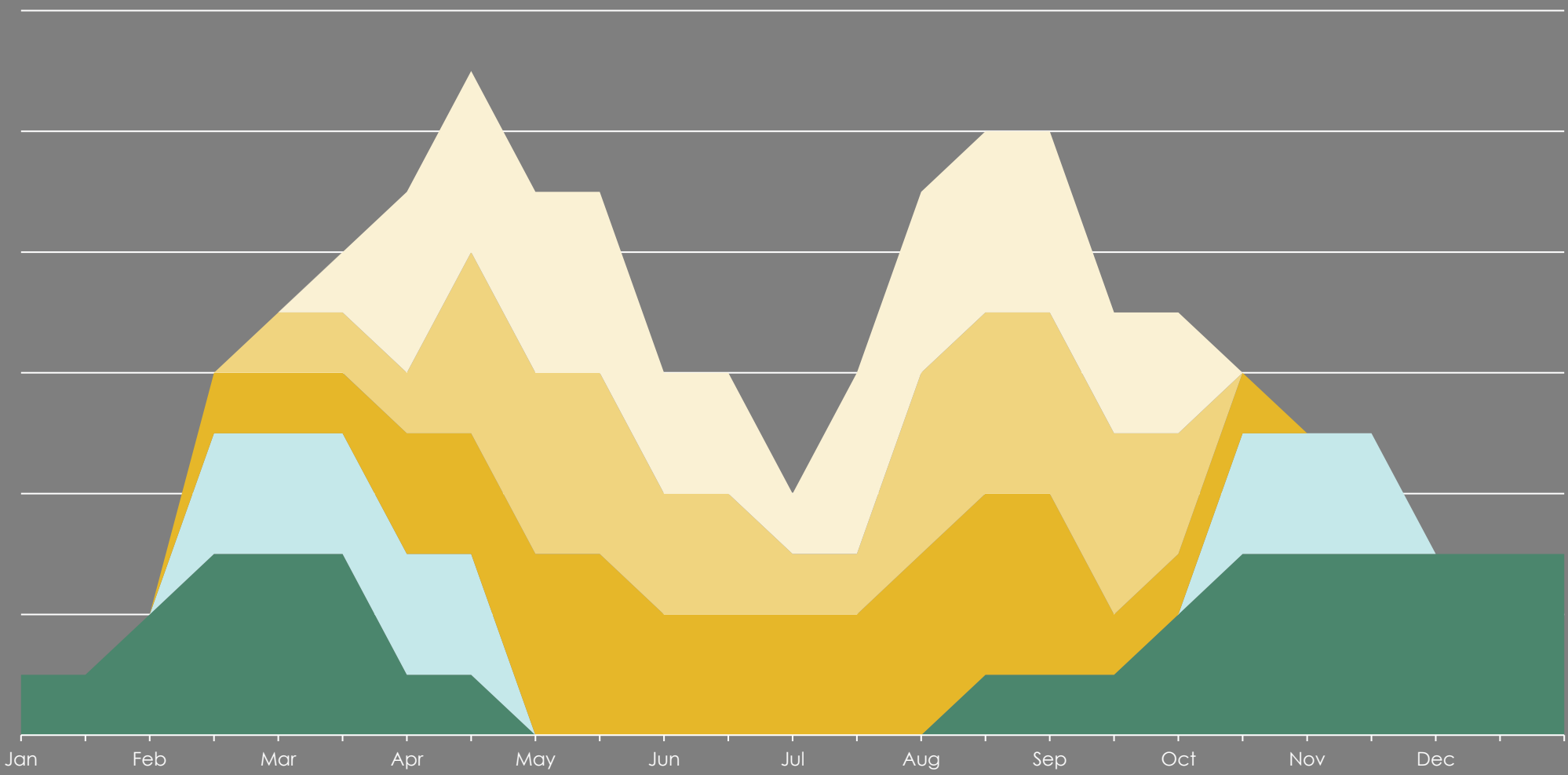
■ Plovers

Chronology of Use



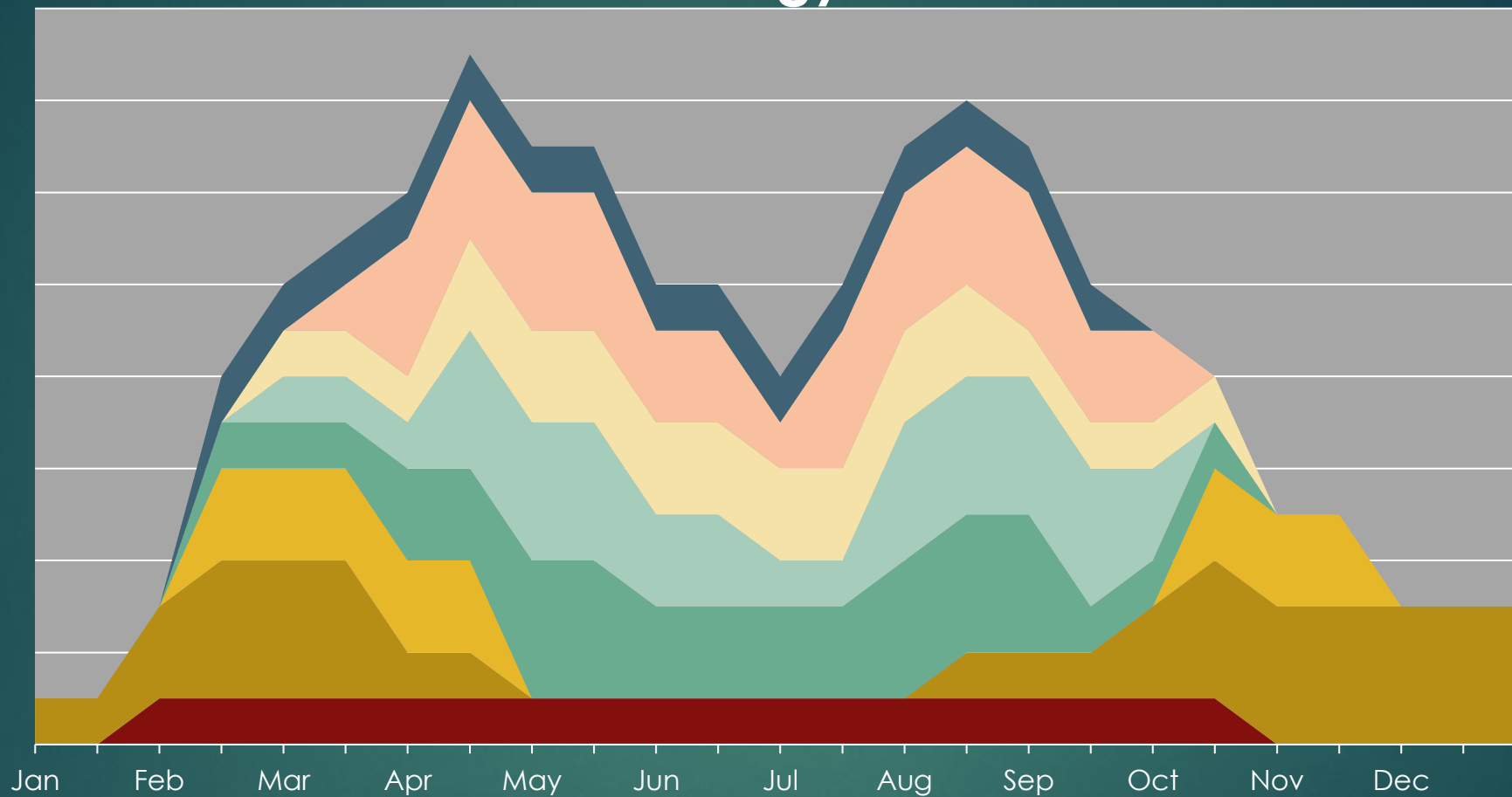
■ Ducks ■ Cranes ■ Plovers ■ Small/Medium Shorebirds

Chronology of Use



■ Ducks ■ Cranes ■ Plovers ■ Small/Medium Shorebirds ■ Large Shorebirds

Chronology of Use



■ Herons/Bitterns

■ Cranes

■ Small/Medium Shorebirds

■ Ducks

■ Plovers

■ Rail

Importance of a Wetland Complex

- No single wetland can provide all the resources required by the diversity of species present at any given time
- Attempts to repeatedly manage a single wetland in the same manner every year is a form of stabilization that reduces productivity



Flooding

➤ Time of flooding in relation to

- ❑ Arrival and departure time
- ❑ Chronology of life-cycle events

➤ Depth of water in relation to

- ❑ Species/guild
 - Mode, method, structure
- ❑ Food location
 - Benthos, nekton, surface
- ❑ Habitat
 - Location, structure, area

Table 5. *Deterioration of selected seeds after 90 days of flooding.*

Plant name	Decomposition (%)
Soybean	86
Barnyardgrass	57
Corn	50
Common buckwheat	45
Milo	42
Giant bristlegrass	22
Pennsylvania smartweed	21
Cultivated rice	19
Water oak (acorns)	4
Hemp sesbania	4
Horned beakrush	2
Saltmarsh bulrush	1

Flooding

➤ Rate of flooding

- ❑ Slow extends period of availability and may increase food diversity (e.g., terrestrial invertebrates)

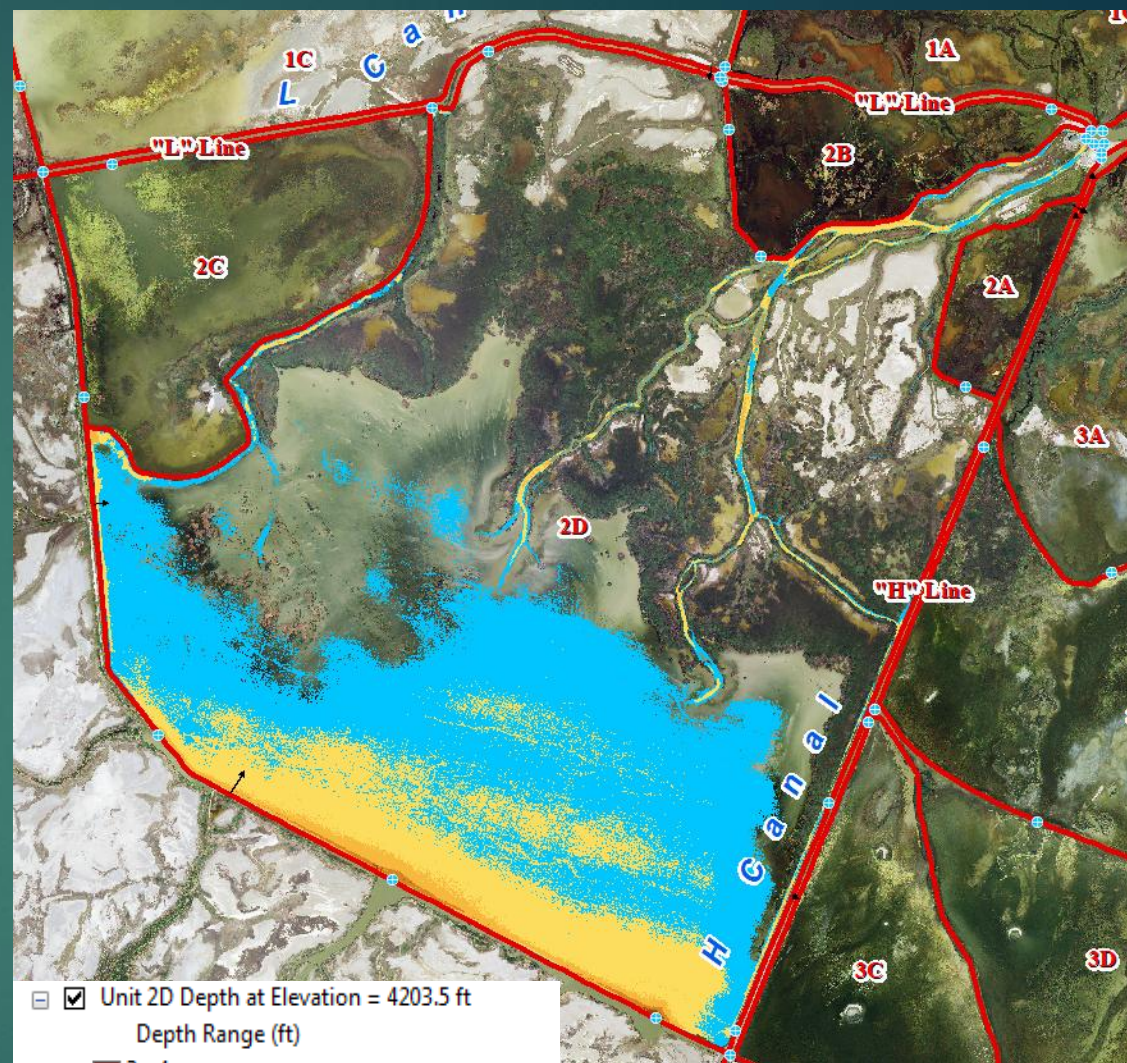
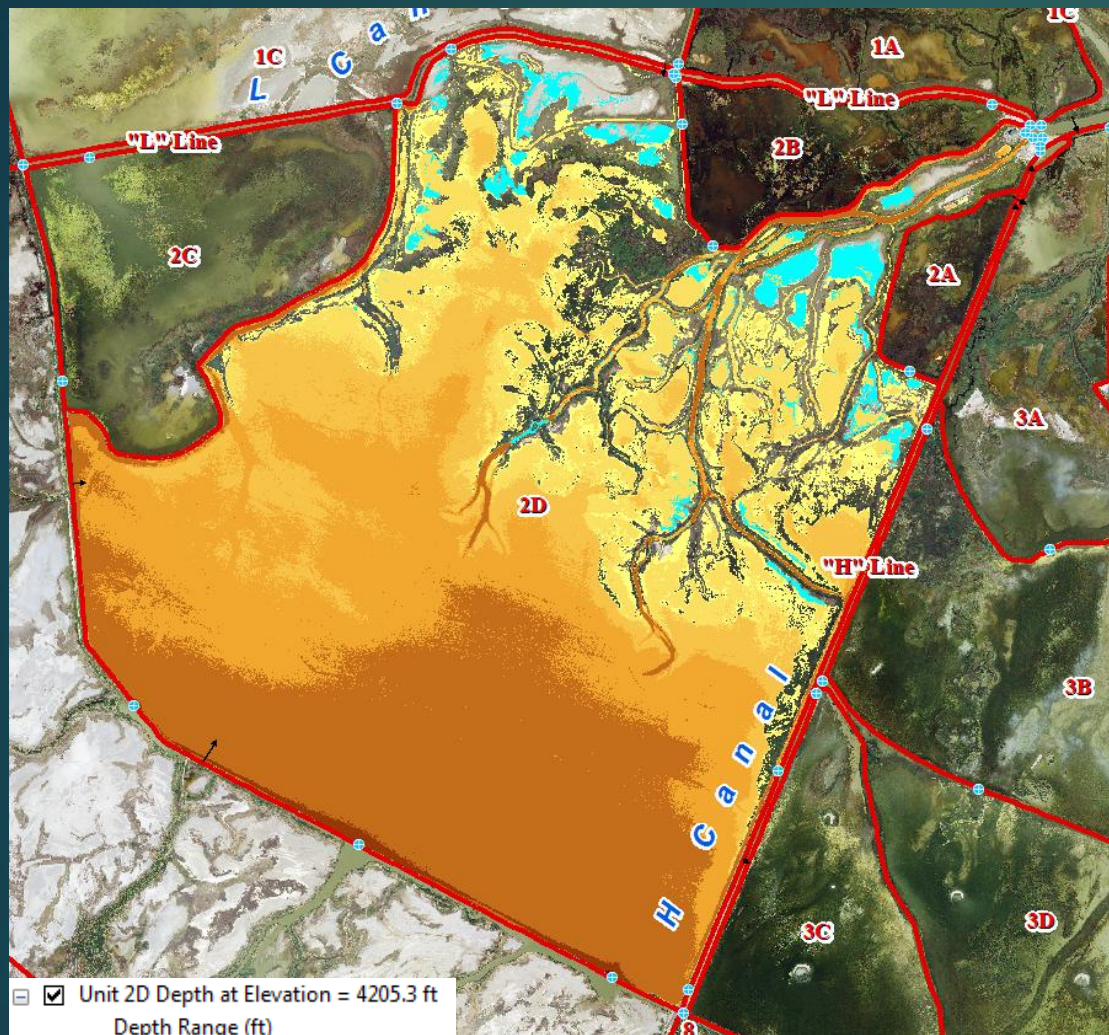
➤ Extent of flooding

❑ Partial

- Extend period of habitat and food availability
- Optimize resource availability for select species
- Allow provision of resources and also enable plant control

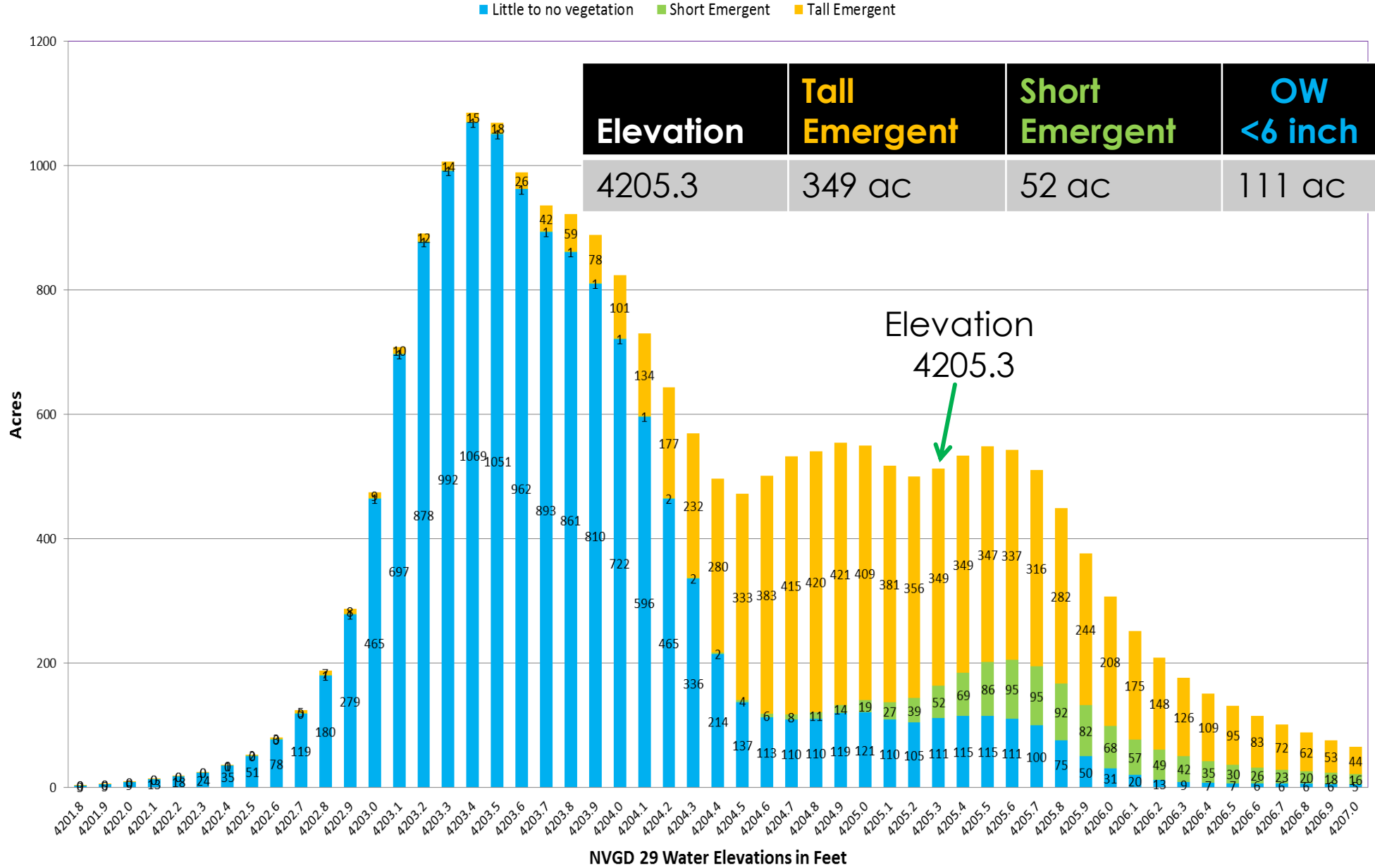
❑ Complete (based on levees)

- Maximize flooded area (but not necessarily foods)



Unit 2D

0 - 0.5 Feet Water Depth



Unit 2C

0 - 0.5 Feet Water Depth

