Using Native Grasses for Ecological Restoration

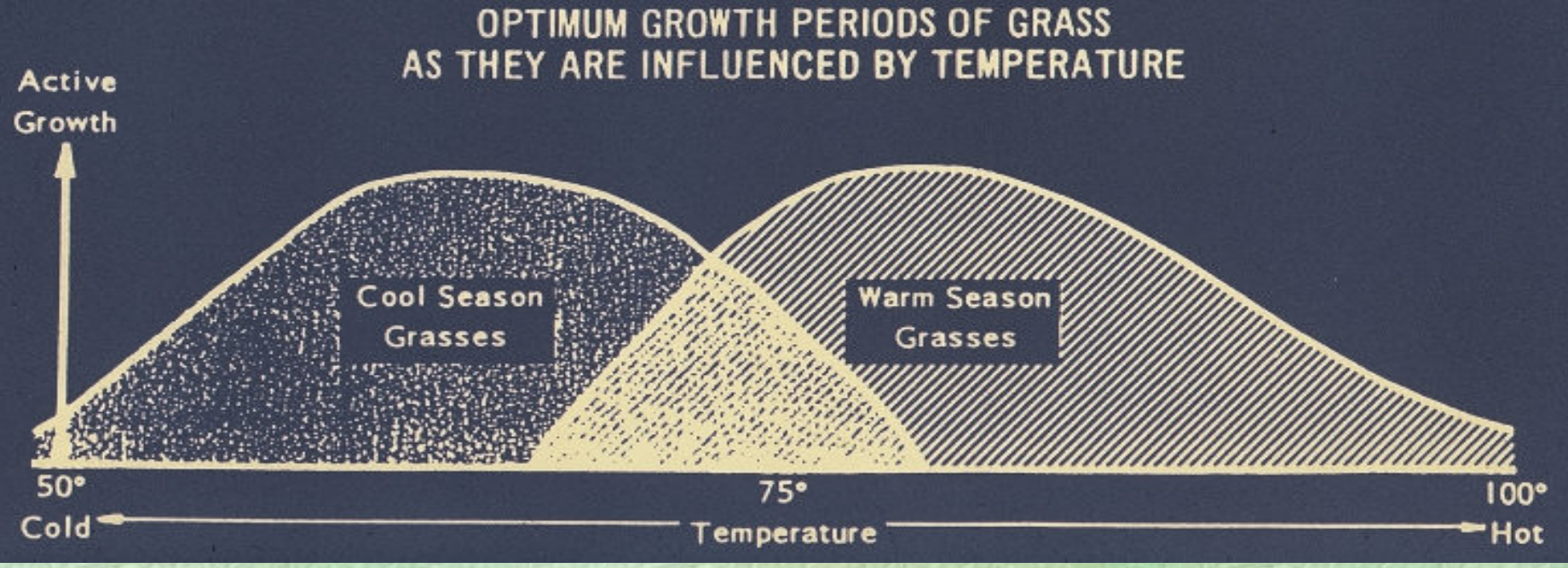
Selection, Establishment, and Maintenance of Native Cool/Warm Season Grasses

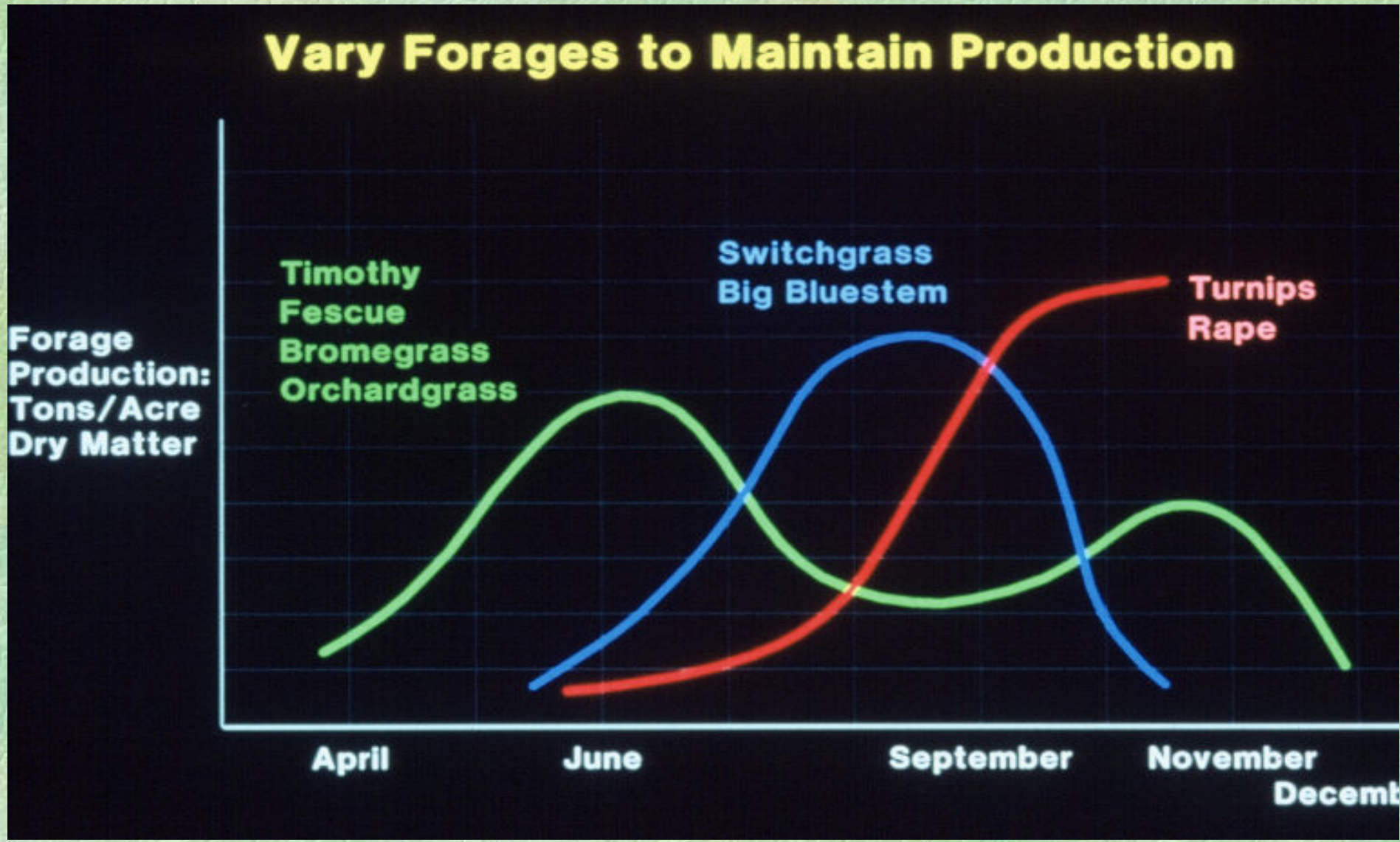
Cool vs Warm Season Grasses

- **Cool Season (C3)**
  - growth rate highest in spring & fall
  - water/nutrient needs moderate-high
  - utilize only 15%-30% of incoming sunlight (shade tolerance)
  - rapid establishment
- **Warm Season (C4)**
  - growth rate highest in midsummer
  - efficient use of water & nutrients
  - utilize 80 % of incoming sunlight
  - slow establishment-roots develop initially

Cool-season grasses grow in the winter, early spring or late fall. In extremely cold climate, they are forced into dormancy by cold weather. In the more temperate climates, where moisture conditions are favorable, they grow during the cool season of the year and go dormant during the summer months, thus the name cool-season. For this group of plants 40-42 degrees F. are considered as the minimum temperatures for active shoot growth.

Warm-season grasses make their active growth during the summer months. Growth doesn't usually start until the minimum daily temperature reaches 60 to 65 degrees. They go into dormancy in the fall and winter months.




Vary Forages to Maintain Production
Forage Production: Tons/Acre Dry Matter
Timothy
Fescue
Bromegrass
Orchardgrass
Switchgrass
Big Bluestem
Turnips
Rape
April
June
September
November
Decemb

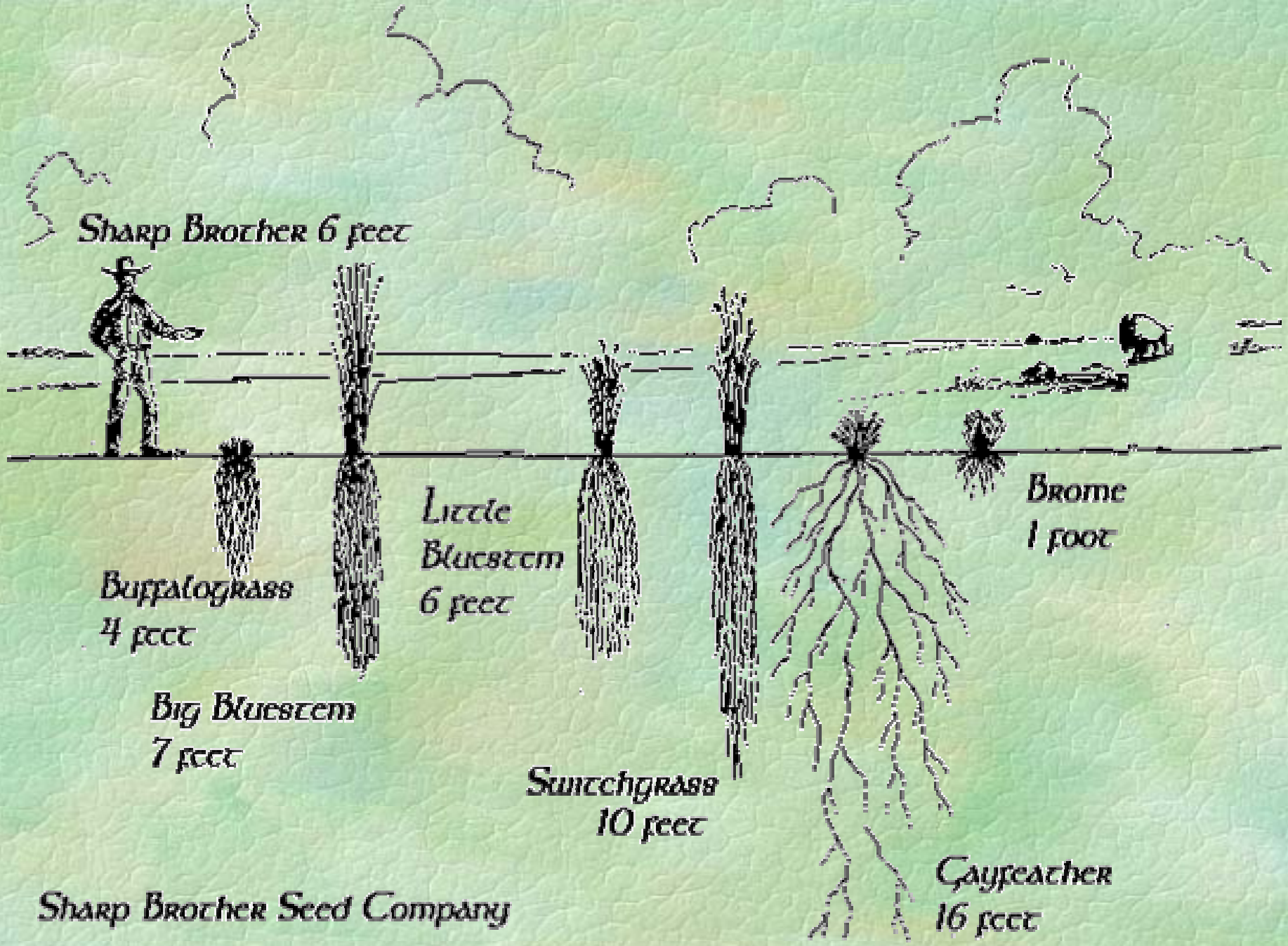
Native Grasses
for
Landscaping & Restoration

- **Cool-season**
  - Am. beachgrass *(Ammophila breviligulata)*
  - Fescues/Ryegrasses/Bluegrasses
  - Orchardgrass/Timothy/Reed canarygrass
  - Redtop *(Agrostis gigantea)*
  - Canada Bluejoint *(Calamagrostis canadensis)*
  - Crinkled Hairgrass *(Deschampsia flexuosa)*
  - Fowl meadowgrass *(Poa palustris)*
  - Poverty Oatgrass *(Danthonia spicata)*
  - Wildryes *(Elymus virginicus/canadensis)*
  - Wood reedgrass *(Cinna arundinacea)*

- **Warm-season**
  - Big bluestem *(Andropogon gerardii)*
  - Indiangrass *(Sorghastrum nutans)*
  - Switchgrass *(Panicum virgatum)*
  - Coastal panicgrass *(Panicum amarulum)*
  - Little bluestem *(Schizachyrium scoparium)*
  - Broomsedge (*Andropogon virginicus*)
  - Sideoats grama *(Bouteloua curtipendula)*
  - Purpletop *(Tridens flavus)*
  - Eastern gamagrass *(Tripsacum dactyloides)*
  - Deertongue *(Dichanthelium clandestium)*

Native Warm Season Grasses

- Indigenous to Eastern U.S. in coastal plain/barrier islands, serpentine/pine barrens, along major river systems & right of ways and in frequently burned areas.
- Evolved in and adapted to fire ecology
- Deep-rooted, drought & sterile soil tolerant
- Require little-no fertilizer for establishment
- Grow best in full sun conditions


Sharp Brother 6 feet
Buffalograss
4 feet
Big Bluestem
7 feet
Little
Bluestem
6 feet
Switchgrass
10 feet
Brome
1 foot
Gayfeather
16 feet
Sharp Brother Seed Company

Warm Season Grasses-Seed Characteristics

- Why the hype about native grasses?
  - Seed Production-low seed yield, high seed shatter
  - Poor seed quality - high dormancy, low vigor
  - Result: Difficult to produce & establish
- Answer: Perceived “problems” are evolutionary and advantageous for long-term sustainability.
- Native grasses have the “competitive edge.” (Especially if global warming is occurring)

Switchgrass
(Panicum virgatum)

- **Natural Habitat:** Dry to wet, sterile and acid, sandy soil. Upper edges of salt marshes and stream banks.
- **Description:** A moderately tall (3-6 ft.) perennial, warm season bunchgrass which produces a large amount of leaf biomass. A distinguishing characteristic is the fine fringe of hairs present in the leaf axils. The large, spreading inflorescence casts a purple tinge when flowering. Flowers and seed are borne singly at the ends of the flowering branches. This plant is a prolific seed producer. These smooth, shiny seeds mature from September-October.
- **Uses: erosion control, forage, wildlife, ornamental**

Switchgrass

Coastal Panicgrass *(Panicum amarulum)*

- **Natural Habitat:** Dry to moist, sterile and acid, sandy soil. Back dunes and upper edges of salt marshes.
- **Description:** A moderately tall (3-6 ft.) perennial, warm season bunchgrass which produces a large amount of leaf biomass. A distinguishing characteristic is the fine fringe of hairs present in the leaf axils. The large, closed panicle-type inflorescence casts a purple tinge when flowering. Flowers and seed are borne singly at the ends of the flowering branches. This plant is a prolific seed producer. These smooth, shiny seeds mature from September-October.
- **Uses: erosion control, forage, wildlife, ornamental**

Big Bluestem
(Andropogon gerardii)

- **Natural Habitat:** Dry, sterile, acid soils of old fields, roadsides, and well-drained floodplain terraces. Serpentine barrens.
- **Description:** A tall (3-6 ft.), perennial, warm season bunchgrass. The foliage is blue-green with long, thin hairs on the stem and upper leaf surfaces. The inflorescences have a characteristic turkey-foot branching arrangement. The color of the plant changes with the stage of growth. In flower, the inflorescence varies from bronze to steely gray-blue; later the whole plant turns shades of red, brown, and purple. Seeds mature in September-October.
- **Uses: upland restoration, erosion control, wildlife, screen, ornamental**

Big Bluestem

Indiangrass
(Sorghastrum nutans)

- **Natural Habitat:** Moist or dry, sterile fields, roadsides and river banks. Serpentine barrens.
- **Description:** A tall (3-9 ft.), perennial, warm season bunchgrass. In flower, the open inflorescence has a striking, golden hue. After flowering, the inflorescence contracts to form what looks like a spike-type seed head. The papery thin ligule at the base of the leaf blade has a “rifle-sight” notch in the center. Seeds mature in October-November.
- **Uses: upland restoration, wildlife, ornamental, screen, forage**


Indiangrass

Little Bluestem
(Schizachyrium scoparium)

- **Natural Habitat:** Dry, sterile, acid soil of old fields, thin woods and waste places. Serpentine barrens
- **Description:** A perennial, warm season bunchgrass with silvery-white hairs extending from the flower scales. The flowering branches, lined in groups along much of the stem, extend out beyond the leaves. Little “bluestem” only looks blue when the first shoots arise in the early summer. During and after flowering its color is a rich mixture of tan, brown, and wine-red. Seeds mature September-October.
- **Uses: upland restoration, wildlife, erosion control, ornamental**

Broomsedge/Bushy Beardgrass
(Andropogon virginicus/A. glomeratus)

- **Natural Habitat:** Broomsedge- dry, sterile, acid soil of fields, roadsides, and upper pond edges. Bushy beardgrass- wet, open soil
- **Description:** Both are perennial, warm season bunchgrasses which have silvery white appendages attached to the flower scales. Flower stalks are tucked inside the leafy bracts along the stem on broomsedge, but are gathered in bunches on beardgrass. Both turn a yellowish-tan color when dormant. Seeds mature September-October.
- **Uses: upland/wetland restoration, wildlife, ornamental**

•Andropogon species

•*virginicus*

•*glomeratus*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Sideoats grama *(Bouteloua certipendula)*

- **Natural Habitat:** Dry, sterile, acid soil of old fields, thin woods and waste places. Serpentine barrens. Uncommon in the Northeast
- **Description:** A perennial, warm season bunchgrass which grows 1-3 foot tall. Seedlings have relatively good vigor. This grass is especially adapted to drought once established. Small oat-like seeds develop suspended on one side of the rachis (seed stalk) and mature September-October. Most compatible with little bluestem.
- **Uses: upland restoration, wildlife, erosion control, ornamental**

Eastern Gamagrass *(Tripsacum dactyloides)*

- **Natural Habitat:** Moist to wet, tidal brackish to freshwater shorelines, drainage ditches.
- **Description:** A native, perennial, warm season grass typically 3-4 feet tall but can reach 10 ft. Seed is corn-like and matures in late fall.Tolerates a wide range of conditions from drought to extended periods of flooding; Related to corn.
- **Uses: wetland restoration, shoreline stabilization forage, ornamental screen**

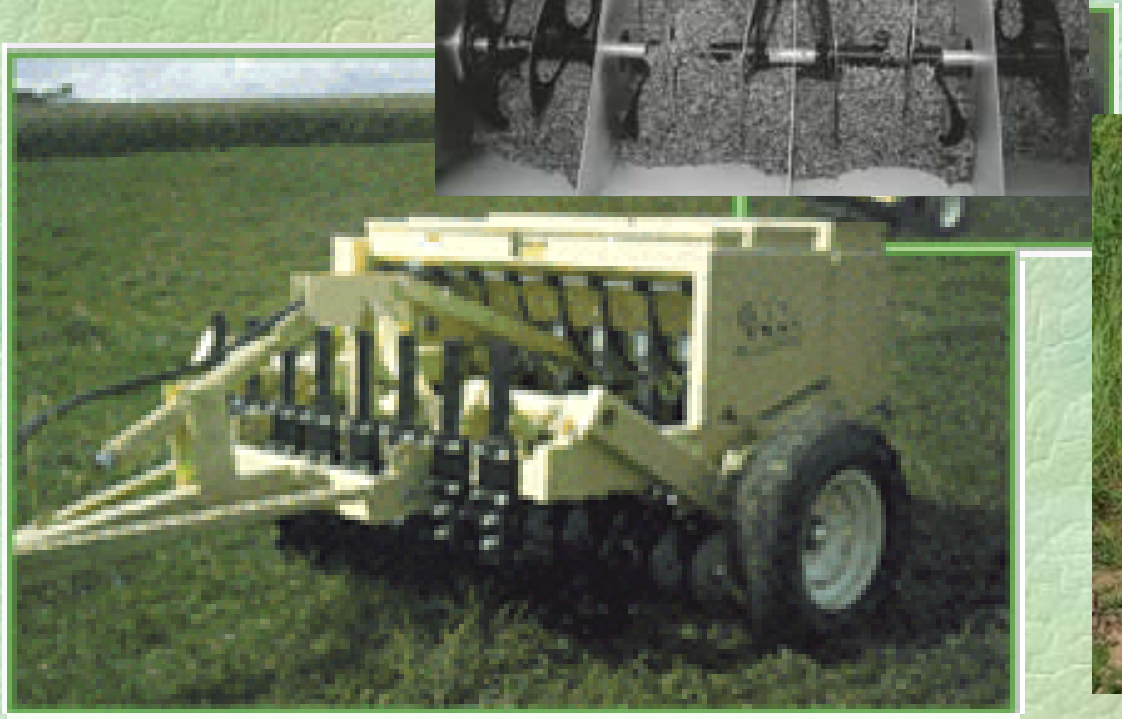
Deertongue
(Dichanthelium clandestinum)

- **Natural Habitat:** Moist or dry, acid sandy soil of shaded wood edges, pond/lake shores, floodplains, and waste places.
- **Description:** A perennial, warm season grass which has characteristic “deer’s tongue” shaped leaves. The plant ranges from 2-4 ft. in height and often forms clumps of stiff leaves. It begins flowering in May; much earlier than most other warm season grasses. Seeds form at the end of the panicle branches and mature from late June to September.
- **Uses: wildlife, erosion control, restoration, ornamental**

Purpletop
(Tridens flavus)

- **Natural Habitat:** Dry, open fields and roadsides. Often found intermixed with cool season turfgrasses.
- **Description:** A perennial, warm season grass typically reaching 2.5-4 ft. in height. Short, thin leaves result in a lack of leaf biomass. A small tuft of hairs is present in the leaf axil. The drooping, panicle-type inflorescence is “greasy” to the touch and exhibits a purple hue in flower. It flowers from late summer to early fall. The seeds mature in September-October
- **Uses: upland restoration, ornamental, forage (?)**

Seeding Native Grasses



- **Native grass drill**
- **Truax, Tye, Grasslander**

Broadcast/Track/Mulch

Hydroseed/Track/Mulch

PHOTO: CHARLES MASSIE, MASSIE RECLAMATION INC.

Native Grass Stand Establishment

COMPETITION.... COMPETITION.... COMPETITION

- **Coarse-textured soils (sand, loamy sand, sandy loam)**
  (Little or no weed control may be necessary)

  - drill or broadcast and track (or cultipack), late fall/ early spring
  - apply 20-40 pounds of N/ac. after seedling emergence
  - apply phosphorus and potassium to moderate soil test levels
  - apply one-half typical mulching rate (1000 lbs./ac.)

Native Grass Stand Establishment

- Finer-textured soils (silt loams and clays)

  (may require intensive weed control)

  - no-till drill into throughly killed vegetation where weed pressure is heavy (may begin weed control prior season)
  - conventional till, drill, and cultipack in late spring to early summer
  - no nitrogen fertilization until late summer or following spring. (40-80 lbs./ac N)
  - apply phosphorus and potassium as above.
  - little-no mulch (unless no-till)

Native Grass Stand Establishment

- Weed Control/Management
  - **chemical control**
    - broadleaf weeds with 2,4-D or dicamba (no forbs in mix)
    - cool-season grasses with Roundup in fall or early spring
    - Plateau.. new pre/post emergent labeled for use with most forbs and warm-season grasses
  - **burning** in late winter/early spring (green up) releases nutrients and kills some weed seeds.
  - **mechanical:** mow 2-3 times in establishment year/1x/yr. after establishment in late winter/early spring.

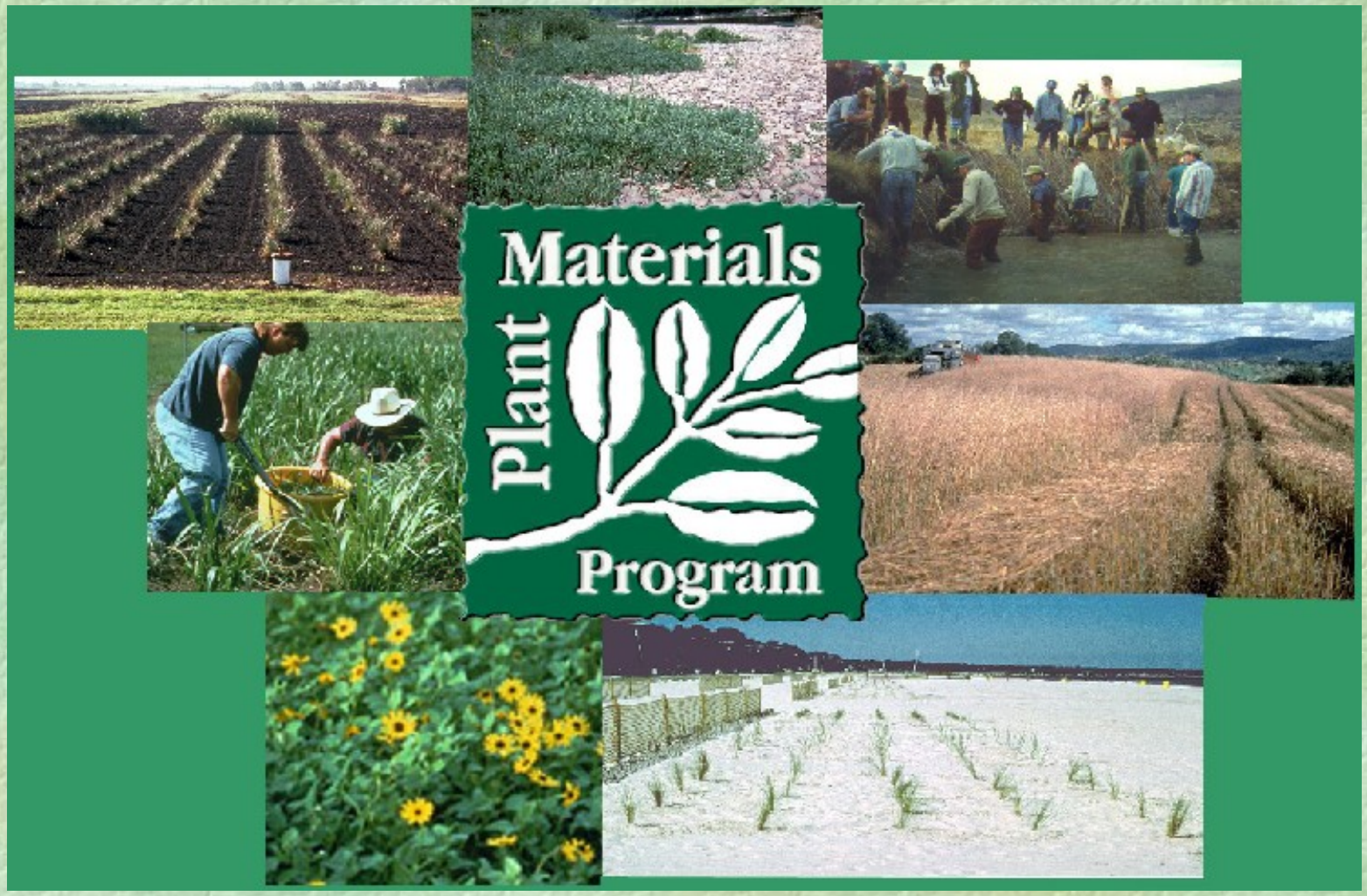
Native Grass Stand Establishment

- **Companion (Nurse) Crop -** use when erosion control is an issue

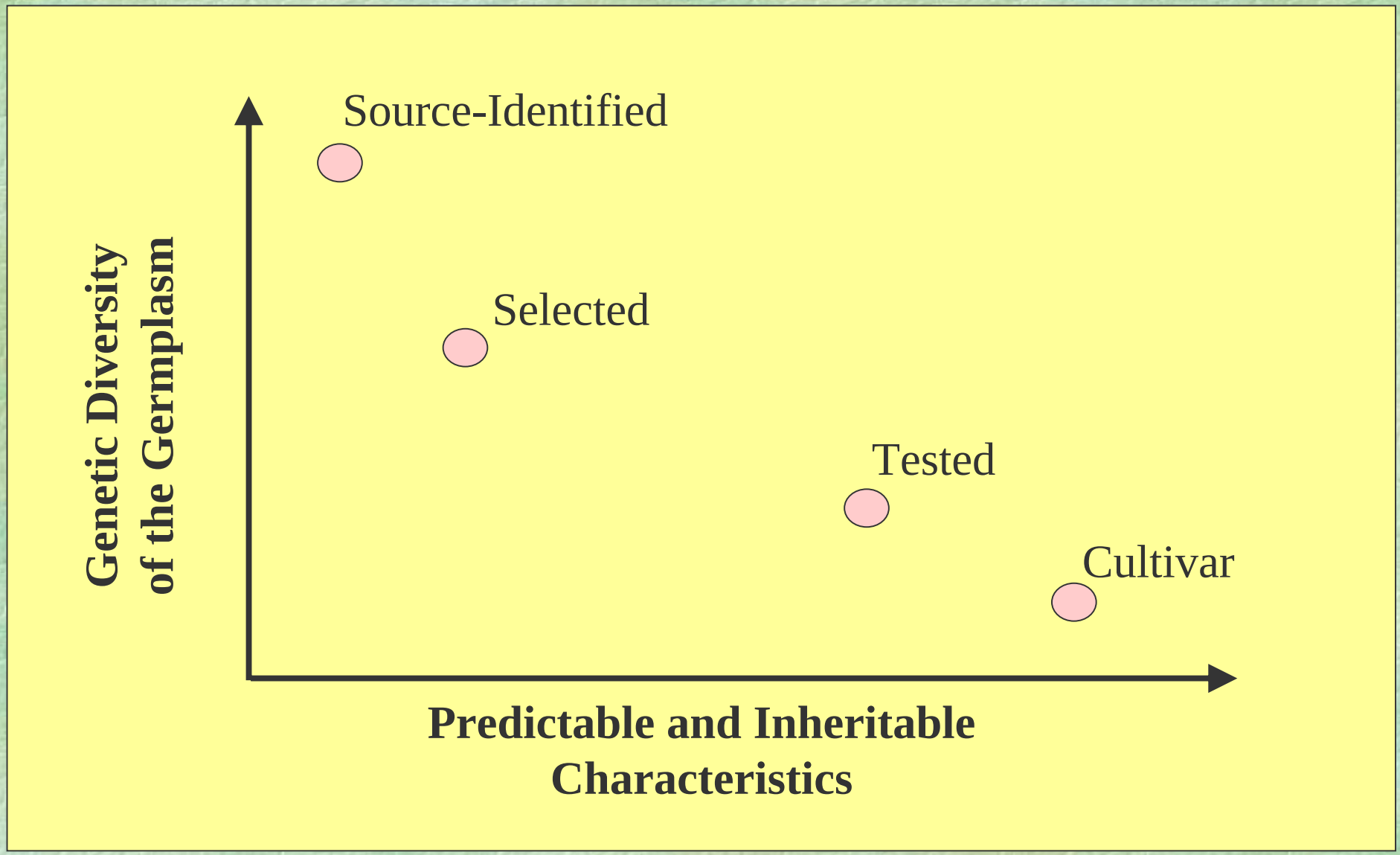
- Use an annual such as oats (30 lbs./ac.) or annual ryegrass at 10-15 lbs./ac. and/or a non-competitive perennial cool-season grass such as redtop at 1 lb./ac., Canada wildrye at 5 lbs./ac. or a fine fescue (creeping red, hard, chewings, sheeps) at 10-15 lbs./ac.

Cool season / warm season mixtures

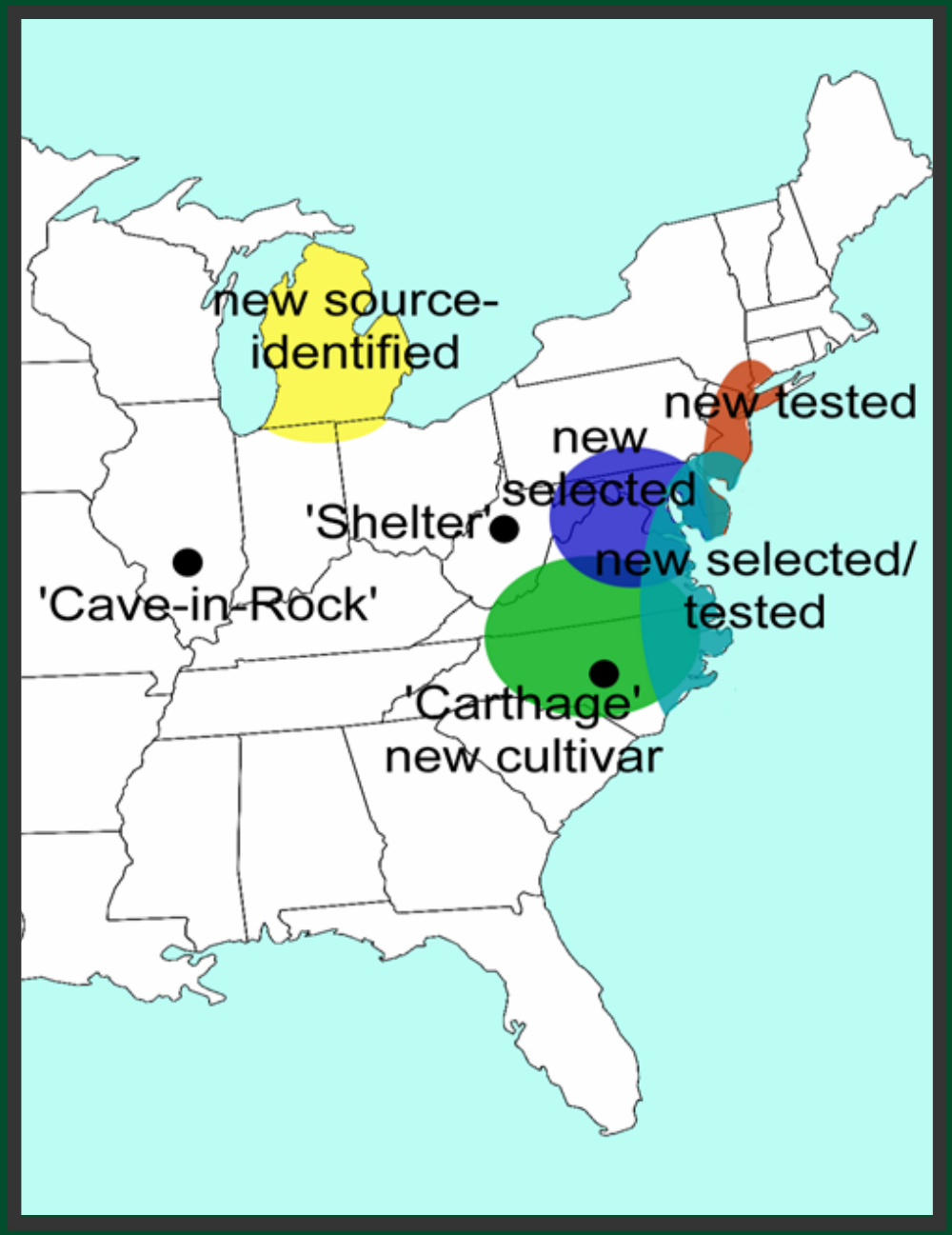
The USDA-NRCS
Plant Materials Program



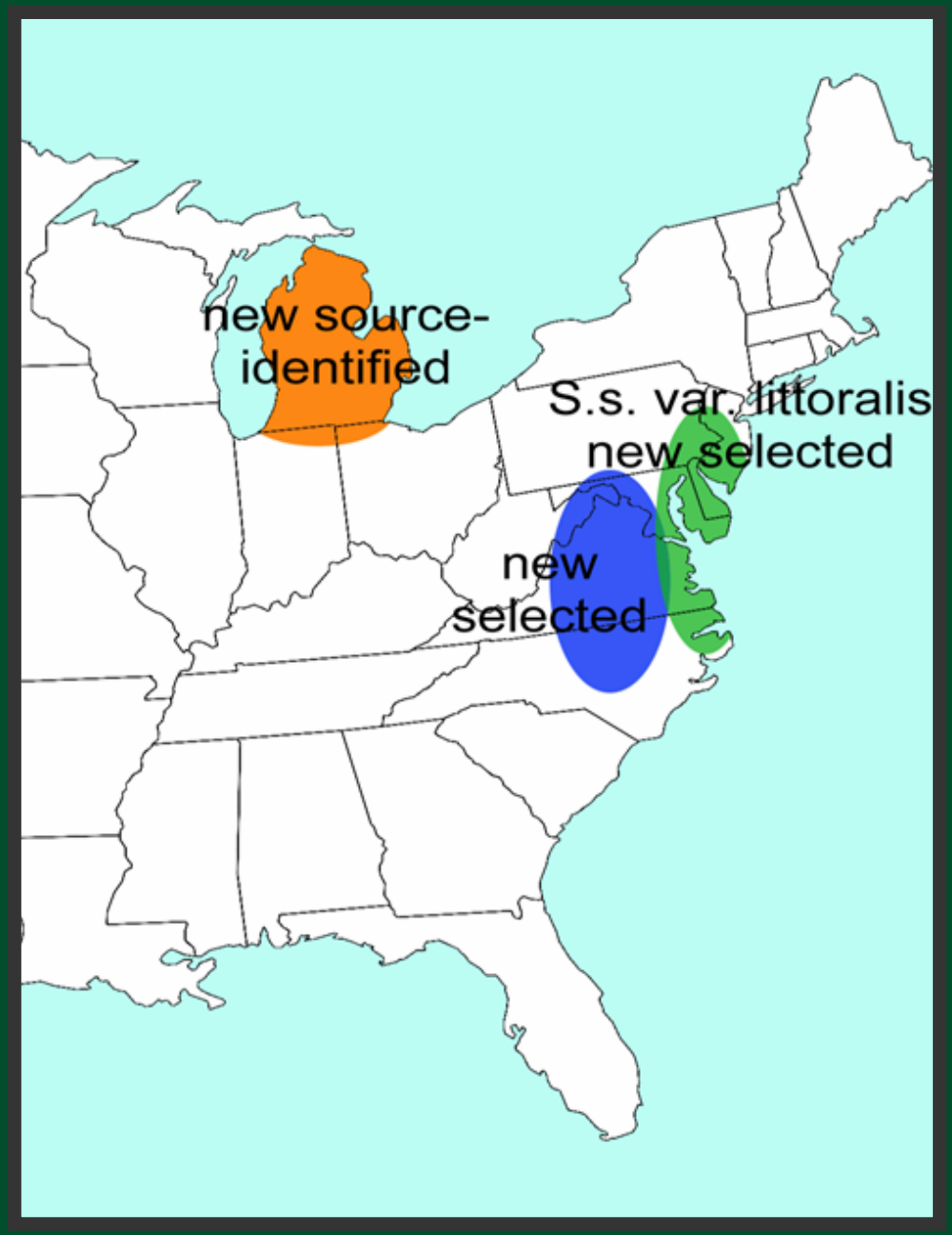
Plant Development = New Plant Releases



Panicum virgatum
switchgrass



Schizachyrium scoparium
little bluestem



Criteria for Designing a Seed Mix

- Site Conditions (Full sun, Dry to moist soils, etc.)
- Planting Objectives (erosion control, wildlife, forage)
- Grass:Forb ratio (Prairie-60:40, Meadow-40:60)
- Eco-Behavior of each species (sustainability)
- Seeding Technique (drill, broadcast, hydroseed)
- Planting Season (early spring or summer, late fall)
- Budget (seed:$3.50-$18.00/lb.) ($50-$225/ac.)

Species Selection Matrix

		Soil	Drainage	Class	
Species	ED	WD	MWD	SWP	PD
Switchgrass	X	X	X	X	*
Coastal panicgrass	X	X	X	*	
Indiangrass	*	X	X		
Big bluestem	*	X	X	*	
Eastern gamagrass		*	X	X	*
Little bluestem	X	X			
Broomsedge	*	X	X	*	
Sideoats grama	X	X			
Deertongue	*	X	X	*	
Purpletop		X	X		

(X) optimum

(*) acceptable

Warm Season Seed Mix Development

- Pure Live Seed (PLS)=Germ. X Purity /100
  - Total of 10-15 PLS #/ac. = ~ 20-40 seeds/sq. ft.
  - Good establishment is 6-8 seedlings/sq. ft.
  - 1 mature warm-season grass plant may occupy 1-2 sq. ft. when mature.
  - Select species mix based on site and soil conditions rather than “shotgun” approach.

Evaluating a Native Grass Stand

- Find early seedlings as they emerge. Purplish to reddish in color initially. Germination starts at 14 days and continues to 35 days. Some seed may germ. Following spring.
- Concentrate within drill row, cultipacker row, or dozer cleat tracks.
- Dig up seedling to find attached seed. ID seed.
- After first frost, native grasses appear more yellowish than cool season grasses.
- Never give up after one growing season.

Compatible forbs/legumes

New Uses of WS Grasses

- Biofuels - switchgrass as a perennial, renewable resource
- Soil Improvement – ameliorate compaction (eastern gamagrass, prairie cordgrass)
- Carbon sequestration - capturing atmospheric carbon dioxide and converting to plant tissue (roots)

NRCS/ARS Root Physiology Study
Warm Season Grass Screening for Riparian Buffer Applications

- Compare NRCS warm season grass cultivars to determine root type and ability to grow into saturated soils.
- Species used: Switchgrass, Big bluestem, Little bluestem, Indiangrass, Eastern gamagrass, Prairie cordgrass.

TETHAFICID GAMMA


PETE
GAMMA
GRASS


Red River Spartina

OBSERVATIONS

- The rooting depth of the grasses was directly proportional to the top growth. (3 month growing season in the greenhouse; loam soil)

- Both Eastern gamagrass (*Tripsacum* dactyloides) cultivars and ‘Red River’ Prairie cordgrass (*Spartina pectinata*) extended roots to the bottom of the tubes in both the dry and saturated treatments.

OBSERVATIONS

- Most switchgrass (*Panicum virgatum*) cultivars consistently rooted into the capillary fringe above the saturated zone.

- Indiangrass (*Sorghastrum nutans*) and Big bluestem (*Andropogon gerardii*) rooting depths were highly variable by cultivar.


Plant Materials Program