
Appendix Section 3: Grasses and Forages for Agroforestry

In this chapter:

- **Identifying the Proper Grasses and Forages for Agroforestry**
- **Design and Management**



Shade Trials: Learning about the shade tolerance of plant species is important to the Center for Agroforestry. Here mulches and forage crops are tested to identify their potential for planting under trees.

Agroforestry combines trees, shrubs, forages, grasses, livestock and crops in innovative, flexible combinations tailored to the landowner's needs. Through their integration with farm practices, production and conservation benefits can occur simultaneously. However, because the same resources are often used by all the plants in a given area, competition can pose some challenges to productivity.

What makes a Forage/Grass appropriate?

The answer will likely vary according to each landowner's specific interest and goals. That said, many trees and shrubs can be planted in configurations or densities that will also enhance the production of select forages and/or grasses.

In fact, the University of Missouri Center for Agroforestry has researched and identified many cool season grasses and legumes that produce better or the same under 50% shade as compared to full sun.

The following pages may be used as a general reference and guide for the selection of an appropriate forage/grass for your agroforestry practice.

As a component of a farm system, the properly designed and implemented agroforestry practice will help:

- Increase crop production
- Diversify products and farm income
- Improve soil quality and reduce erosion
- Improve water quality and reduce damage due to flooding
- Enhance wildlife habitat and improve biodiversity
- Reduce pest management inputs.

Design and Management

Planting design and management of an agroforestry practice depends on existing site conditions and the goals of the landowner. (You may also refer to the section on each specific practice for more information on design considerations) Many forages/grasses will do quite well under partially shaded conditions. The following table outlines some of the forages/grasses that the University of Missouri Center for Agroforestry has identified for use in partially shaded environments, and what can be expected from their productivity in shaded environments. In all cases, consider the products you wish to produce, any conservation or wildlife benefits desired, on-farm equipment and the needs of companion crops when planning the planting design.

When you decide on the appropriate forage/grass for your agroforestry practice, you should then seek out specific information on how to manage or establish that specific forage/grass species. Some considerations that will have a significant influence on the success of the forage/grass of choice include:

- Soil pH
- Time of seeding
- The use of companion or nurse crops
- Seeding method (broadcast vs. drilling)
- The use of herbicides to control undesirable/competing species
- Seeding rates
- The need for Inoculation
- Seed bed preparation
- Soil fertility

Each of the above mentioned establishment and management considerations can have a significant impact on both growth and productivity of a forage/grass stand. For more on establishing forages and seeding of a variety of forages common to Missouri, please reference:

Forage and Grass Recommendations for Agroforestry

Following is a table of forage and grass species suitable for agroforestry practices in Missouri. Included in the table are recommendations on practice applicability, potential uses and general site recommendations. Forages and grasses are listed in alphabetical order by common name. Consult with your regional agronomy specialist, or check with your University Extension personnel, to identify specifics on the appropriateness of a forage or grass to your region.

The following list is not exhaustive, but rather a starting point. All species listed may not be suited to all sites or regions within the State.

Identifying the proper forages and grasses

When selecting a forage/grass species, consider compatibility with the site. The selected species should be capable of providing the products and services desired by the landowner. Depending on the agroforestry practice selected, other forage/grass considerations may include:

- *Level of shade tolerance*
- *Season of production (example, warm vs. cool season grasses)*
- *Productivity capacity for a given site. For example: is it drought-tolerant, or capable of growing on a wet site that is known to flood periodically?*
- *Compatibility with end use (example: is the forage for livestock, or is the grass intended for erosion control and other conservation needs?)*
- *What species already exist on the site and can a natural forage/grass stand be enhanced?*

Common Grass and Legume Forages for Agroforestry Practices in Missouri

Common Name Scientific Name	Agroforestry Application	Valued for ...	Growth Characteristics	Site Requirements	NOTES:
Alfalfa <i>Medicago sativa</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture 	<ul style="list-style-type: none"> • Hay 	<ul style="list-style-type: none"> • Perennial • Cool-season • Legume • Persists 5-8 years • Flood intolerant 	<ul style="list-style-type: none"> • Best on well drained soils • Does best in full sun • Soil pH above 6.0 	<ul style="list-style-type: none"> • Excellent hay • High maintenance • Low to moderate - tree competition
Alsike clover <i>Trifolium hybridum</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control 	<ul style="list-style-type: none"> • Perennial • Cool-season • Legume 	<ul style="list-style-type: none"> • Low, wet areas on a variety of soil types • Higher tolerance to soil acidity than Alfalfa 	<ul style="list-style-type: none"> • Sometimes utilized for forage and hay production in mixtures with red clover and grasses
Annual lespedeza <i>Kummerowia stipulacea</i> or <i>striata</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture 	<ul style="list-style-type: none"> • Wildlife benefits 	<ul style="list-style-type: none"> • Annual • Warm-season • Legume • Tolerates lower pH than other legumes • Tolerates high temperature 	<ul style="list-style-type: none"> • Productive on shallow, infertile soils • Best growth on well-drained soils 	<ul style="list-style-type: none"> • Allow to reseed in late summer • Best used in pastures and most effective when grown in grass sod
Annual ryegrass <i>Lolium multiflorum</i>	<ul style="list-style-type: none"> • Silvopasture 	<ul style="list-style-type: none"> • Forage 	<ul style="list-style-type: none"> • Annual • Cool-season 	<ul style="list-style-type: none"> • Best under high fertility 	<ul style="list-style-type: none"> • Winter Annual
Bermudagrass <i>Cynodon dactylon</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture 	<ul style="list-style-type: none"> • Erosion control 	<ul style="list-style-type: none"> • Perennial • Warm-season • Not shade tolerant 	<ul style="list-style-type: none"> • Prefers deep, sandy loam or medium textured soils • Will grow on poorer soils with management 	<ul style="list-style-type: none"> • Grazing tolerant • May winter kill particularly in Northern Missouri
Big bluestem <i>Andropogon gerardii</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Warm-season • Not shade tolerant 	<ul style="list-style-type: none"> • Prefers deep, well-drained soils • Intolerant of continuously wet soils 	<ul style="list-style-type: none"> • If burned, care must be taken to protect trees • Native
Birdsfoot trefoil <i>Lotus corniculatus</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control 	<ul style="list-style-type: none"> • Perennial • Cool-season • Legume 	<ul style="list-style-type: none"> • Tolerates poorly-drained, droughty, infertile and acidic soils better than Alfalfa 	<ul style="list-style-type: none"> • Allow stand to naturally reseed every 2-3 years
Buffalograss <i>Buchloe dactyloides</i>	<ul style="list-style-type: none"> • Silvopasture 	<ul style="list-style-type: none"> • Erosion control 	<ul style="list-style-type: none"> • Perennial • Warm-season • Drought resistant • Sod forming 	<ul style="list-style-type: none"> • Avoid sandy soils 	<ul style="list-style-type: none"> • Withstands heavy grazing

Common Name Scientific Name	Agroforestry Application	Valued for . . .	Growth Characteristics	Site Requirements	NOTES:
Canada wildrye <i>Elymus canadensis</i>	<ul style="list-style-type: none"> • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control 	<ul style="list-style-type: none"> • Perennial • Cool-season 	<ul style="list-style-type: none"> • Grows in wet shaded areas 	<ul style="list-style-type: none"> • Native
Caucasian bluestem <i>Andropogon caucasia</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control 	<ul style="list-style-type: none"> • Perennial • Warm-season • Not shade tolerant • Long active growth period 	<ul style="list-style-type: none"> • Needs good drainage 	<ul style="list-style-type: none"> • Grazing tolerant • Don't need to burn
Creeping red fescue <i>Festuca rubra</i>	<ul style="list-style-type: none"> • Silvopasture • Riparian Buffer 	<ul style="list-style-type: none"> • Erosion control 	<ul style="list-style-type: none"> • Perennial • Cool-season 	<ul style="list-style-type: none"> • Grows best in well drained, infertile and droughty soils 	<ul style="list-style-type: none"> • Shade tolerant • Usually used for turf
Crownvetch <i>Coronilla varia</i>	<ul style="list-style-type: none"> • Alley cropping • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control 	<ul style="list-style-type: none"> • Perennial • Deep taproot • Spreads vegetatively • Legume 	<ul style="list-style-type: none"> • Best adapted to well-drained, fertile soils with pH 6.0 or greater 	<ul style="list-style-type: none"> • Does not tolerate grazing
Eastern gamagrass <i>Tripsacum dactyloides</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Warm-season • Slow to establish • Tolerates temporary flooding • Stiff upright stems • Forms large clumps or mounds • Not tolerant of shade 	<ul style="list-style-type: none"> • Deep soils in low areas 	<ul style="list-style-type: none"> • Excellent forage • Native
Hop clover <i>Trifolium agrarium</i>	<ul style="list-style-type: none"> • Silvopasture 		<ul style="list-style-type: none"> • Annual • Cool-season • Legume 	<ul style="list-style-type: none"> • Tolerates poorly-drained, droughty and infertile soils 	<ul style="list-style-type: none"> • Used mainly in Southern Missouri
Illinois bundleflower <i>Desmanthus illinoensis</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture 	<ul style="list-style-type: none"> • Wildlife benefits 	<ul style="list-style-type: none"> • Warm-season • Legume 	<ul style="list-style-type: none"> • Grows well on clay or limestone soils 	<ul style="list-style-type: none"> • Sometimes used in mix with warm-season grasses • Native
Indiangrass <i>Sorghastrum nutans</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control 	<ul style="list-style-type: none"> • Perennial • Warm-season • Not shade tolerant • grows 4-6 feet tall • 2-3 years to establish 	<ul style="list-style-type: none"> • Deep, moist soils 	<ul style="list-style-type: none"> • Native • If burned care must be taken to protect trees

Common Name Scientific Name	Agroforestry Application	Valued for ...	Growth Characteristics	Site Requirements	NOTES:
Kentucky bluegrass <i>Poa pratensis</i>	<ul style="list-style-type: none"> • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Weed suppression 	<ul style="list-style-type: none"> • Perennial • Cool-season 	<ul style="list-style-type: none"> • Grows on a variety of soil types 	<ul style="list-style-type: none"> • Usually used in mixes for grazing
Little bluestem <i>Schizachyrium scoparium</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control 	<ul style="list-style-type: none"> • Perennial • Warm-season 	<ul style="list-style-type: none"> • Droughty sites • Grows on a variety of soil types 	<ul style="list-style-type: none"> • Mix with warm-season grasses • Native
Orchardgrass <i>Dactylis glomerata</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Cool-season • Shade tolerant • Short lived • Not tolerant of overuse • Bunch grass 	<ul style="list-style-type: none"> • Tolerates moderately poor drained soils, yet is intolerant to flooding 	<ul style="list-style-type: none"> • Mixes well with legumes (alfalfa, ladino clover) • Matures yearly • Moderate - tree competition • Disease problems under some conditions
Red clover <i>Trifolium pratense</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Cool-season • Short lived • Legume • Easy to establish 	<ul style="list-style-type: none"> • Prefers fertile, well-drained medium to heavy textured soils 	<ul style="list-style-type: none"> • Requires reseedling • Best in grass/legume mixture • Common in pastures • Can crowd out grass in seeding year if planted too thick
Redtop <i>Agrostis gigantea</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Cover crop in orchards 	<ul style="list-style-type: none"> • Perennial • Cool-season • Long-lived • Sod forming 	<ul style="list-style-type: none"> • Will grow at lower pH and in wetter soils • Adapted to a wide range of soil conditions 	<ul style="list-style-type: none"> • Moderate - competition with trees • Use smooth bromegrass, redtop, alsike clover and ladino clover in filter strips
Reed canarygrass <i>Phalaris arundinacea</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Cool-season • Grows up to 6 feet tall and dense • Tolerant of wet and drought. • Mat forming - dense • Hard to establish 	<ul style="list-style-type: none"> • Grows well in wet or dry soil • Wet areas 	<ul style="list-style-type: none"> • Recommend low alkaloid variety • Too competitive with trees • Invasive in wet areas

Common Name <i>Scientific Name</i>	Agroforestry Application	Valued for . . .	Growth Characteristics	Site Requirements	NOTES:
Sideoats grama <i>Bouteloua curtipendula</i>	<ul style="list-style-type: none"> • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control 	<ul style="list-style-type: none"> • Perennial • Warm-season 	<ul style="list-style-type: none"> • Droughty sites • Grows on a wide variety of well-drained soils 	<ul style="list-style-type: none"> • Mix with other native warm-season grasses • Native
Smooth bromegrass <i>Bromus inermis</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Cool-season • Sod former with good fertility • Winter hardy 	<ul style="list-style-type: none"> • Best growth on deep, fertile soils 	<ul style="list-style-type: none"> • Weeds or companion crops may retard establishment from spring sowing
Sorghum-sudangrass <i>Sorghum</i> hybrids	<ul style="list-style-type: none"> • Alley cropping • Silvopasture 	<ul style="list-style-type: none"> • Hay 	<ul style="list-style-type: none"> • Annual • Warm-season 	<ul style="list-style-type: none"> • Requires high fertility and moisture 	<ul style="list-style-type: none"> • Tall growing, competitive
Sudangrass <i>Sorghum bicolor</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture 	<ul style="list-style-type: none"> • Hay 	<ul style="list-style-type: none"> • Annual • Warm-season 	<ul style="list-style-type: none"> • Requires high fertility and moisture 	<ul style="list-style-type: none"> • Tall growing, competitive
Sweetclover <i>Melilotus</i> sp.	<ul style="list-style-type: none"> • Alley cropping • Silvopasture 	<ul style="list-style-type: none"> • Soil improvement 	<ul style="list-style-type: none"> • Annual/Biennial • Legume • Drought tolerant • Winter hardy • Deep taproot 	<ul style="list-style-type: none"> • Not tolerant of acid soils 	<ul style="list-style-type: none"> • Improperly cured hay can contain the poison Dicoumarol
Switchgrass <i>Panicum virgatum</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Warm-season • Long lived • Grows 4-6 feet tall • Flood and herbicide tolerant • Good deep root filtering • Slow to establish (2-3 years) 	<ul style="list-style-type: none"> • Performs well in wet areas • Will grow where many grasses will not • Prefers fertile, well-drained sites 	<ul style="list-style-type: none"> • Plant thick to avoid weed competition • If burned, care must be taken to protect trees • Native
Tall fescue <i>Festuca arundinacea</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Hay • Seed 	<ul style="list-style-type: none"> • Perennial • Cool-season • Drought tolerant • Hardy 	<ul style="list-style-type: none"> • Tolerates many soil conditions 	<ul style="list-style-type: none"> • May be too competitive with trees • Endophyte free/friendly endophyte varieties recommended • Grazing tolerant • Good fall pasture

Common Name Scientific Name	Agroforestry Application	Valued for ...	Growth Characteristics	Site Requirements	NOTES:
Timothy <i>Phleum pratense</i>	<ul style="list-style-type: none"> • Alley cropping • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Erosion control • Hay 	<ul style="list-style-type: none"> • Perennial • Cool-season • Winter hardy • Short lived • Bunch grass 	<ul style="list-style-type: none"> • Prefers well-drained, moist soils • Not tolerant of droughty sites 	<ul style="list-style-type: none"> • Intolerant of overgrazing • Use in a mixture with other cool season grasses and legumes • Low - competition with tree
Virginia wildrye <i>Elymus virginicus</i>	<ul style="list-style-type: none"> • Riparian Buffer • Silvopasture 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control 	<ul style="list-style-type: none"> • Cool season • Perennial • Slow to get started 	<ul style="list-style-type: none"> • Grows in moist sandy soils • Prefers medium textured soils 	<ul style="list-style-type: none"> • Should be used in conjunction with other grasses
Western wheat grass <i>Pascopyrum smithii</i>	<ul style="list-style-type: none"> • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control 	<ul style="list-style-type: none"> • Perennial • Cool-season 	<ul style="list-style-type: none"> • Grows well on low, heavy soils 	<ul style="list-style-type: none"> • Produces an open but uniform sod
White/Ladino clover <i>Trifolium repens</i>	<ul style="list-style-type: none"> • Silvopasture • Riparian buffer 	<ul style="list-style-type: none"> • Wildlife benefits • Erosion control 	<ul style="list-style-type: none"> • Perennial • Cool-season • Legume • Not drought tolerant 	<ul style="list-style-type: none"> • Does best in wet soils and seasons • Performs poorly on shallow, droughty soils 	<ul style="list-style-type: none"> • Use in combination with grasses
GENERAL NOTE:					
<ul style="list-style-type: none"> • *Warm season grasses may need prescribed fire for management which may not be compatible with agroforestry 					

Additional Resources

Online:

- For a number of publications on specific forages and grasses, visit:
<http://muextension.missouri.edu/explore/agguides/crops/#Forages>
- Establishing Forages – <http://muextension.missouri.edu/explore/agguides/crops/g04650.htm>
- Seeding Rates, Dates and Depths for Common Missouri Forages – <http://muextension.missouri.edu/explore/agguides/crops/g04652.htm>
- USDA NRCS Plant Database – <http://www.plants.usda.gov/>
- University of Connecticut Plant Database of Trees, Shrubs and Vines – <http://www.hort.uconn.edu/plants/a/a.html>
- Grow Native – <http://www.grownative.org/>
- Native Plant Information – <http://www.grownative.org/index.cfm?fuseaction=plants.main>
- Silvics of North American Trees – http://www.na.fs.fed.us/spfo/pubs/silvics_manual/table_of_contents.htm
- MDC Private Lands Division – <http://www.mdc.mo.gov/landown>
- Missouri Flora Database – <http://www.missouriplants.com/>
- Arkansas Home and Garden Plant Database – http://www.arhomeandgarden.org/plantoftheweek/archives_a_d.htm
- Grasses of Iowa – <http://www.eeob.iastate.edu/research/iowagrasses/speciescn-nat.html>
- Kansas Wildflowers and Grasses – <http://www.lib.ksu.edu/wildflower/>
- USDA Forest Service Plant Database – <http://www.fs.fed.us/database/feis/plants/>
- The Right Tree Handbook - Minnesota Power – <http://www.mnpower.com/treebook/>