Cogongrass, one of the most devastating weeds in the world, finally meets its match in Alabama.

ALABAMA FORESTRY COMMISSION

RECOVERY.GOV

Larson & McGowin Inc
FOREST MANAGERS & CONSULTANTS

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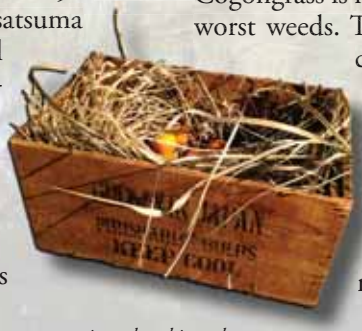
Cogongrass (*Imperata cylindrica*) is a perennial grass native to Southeast Asia and considered one of the world's worst weeds. It was introduced into the United States through the Mobile, Alabama area in 1912 as packing material for satsuma oranges from Japan. Initial efforts in Alabama, Louisiana, and Texas to use cogongrass as erosion control failed miserably, and the plant escaped in the 1920s. It began to spread rapidly in the 1950s as agricultural equipment and road systems evolved. While only a small problem initially, it has taken the country by storm. It is now a serious pest in a dozen states and knocking on the door of many more.



Cogongrass was introduced into the United States in a box as packing material for satsuma oranges from Japan. Photo courtesy Stephen Pecot.

With white, fluffy seed heads in the spring, robust blades often 3-5 feet tall, and a thick mat of creeping rhizomes (belowground stems, not really roots) in the top foot of soil, cogongrass rapidly makes its presence known. Being highly aggressive, cogongrass outcompetes many native plants, suppresses tree growth and may even release chemicals into the soil in a sort of plant warfare. However, the most severe impacts occur when cogongrass is set afire. Cogongrass burns at least 400 degrees hotter than any other native plant. It actually promotes itself through fire to the detriment of other plants, even those considered fire-tolerant such as longleaf pine. Wildlife impacts are negative; cogongrass is not a suitable food source due to its abrasive leaf margins and high silica content. It ruins wildlife habitat by overrunning native plants.

Cogongrass produces seed mainly in the spring. The white tufts are readily seen along roads. Photo courtesy Stephen Pecot.

Around the World

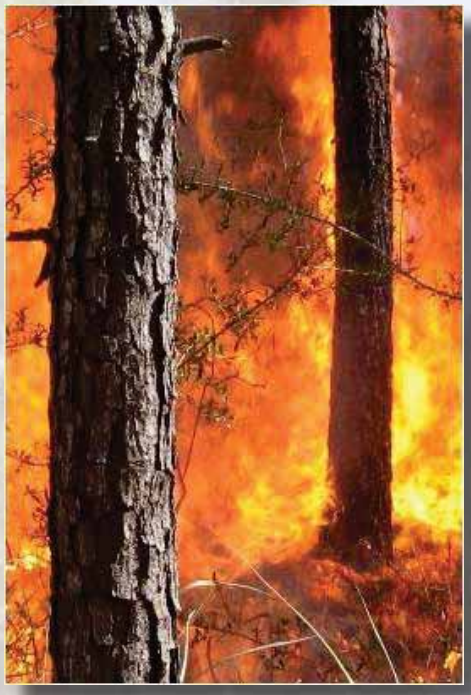
Cogongrass is in the top 10 of the world's worst weeds. To put this in perspective, consider that kudzu is not even close to making this unsettling list. It has decimated agricultural economies in Africa, taken over many native forests, raised wildfire risk, and raised management costs. It is found on every continent except Antarctica and covers 1.2 billion acres worldwide.

Around the US

In the US, cogongrass is listed as a noxious weed. With this distinction come federal restrictions on transportation and financial resources to control it. However, it continues to spread because of limited funding, lack of education, and the sale of noninvasive varieties (Japanese bloodgrass). Most cogongrass is located in the southeastern US, especially Mississippi, Alabama, and Florida. There are no reliable estimates of how much cogongrass is in the US, but there are at least several million acres affected.

Around Alabama

Cogongrass is found in over 75% of Alabama counties, but the majority of it is in the southwest corner of the state. Through federal funding and interactions with agencies and private entities, the Alabama Forestry Commission (AFC) has overseen the mapping of over 32,000 individual locations of cogongrass since 2007. Over half of all documented cogongrass in Alabama is in the 8 southwestern most counties.



Flames in a cogongrass fire can easily exceed 20 feet in height. Photo courtesy John McGuire.

Japanese bloodgrass, a variety of cogongrass, is sold in plant nurseries in many states. Some evidence indicates it may revert to the invasive form, which would significantly increase the cogongrass problem in the US. Photo courtesy John McGuire.

Cogongrass varies in appearance throughout the year (left to right). In the fall and winter the grass stays upright longer than other grasses. In the spring and summer cogongrass grows thick patches. Seen from an airplane, individual cogongrass infestations show as tiny circles; these may eventually converge into a mega-infestation. Photos courtesy Stephen Pecot and Alabama Forestry Commission.

How It Spreads

Though its seed can disperse naturally by the wind, seed viability is actually very small. In fact, most cogongrass is spread by humans. The worst culprits are grass mowers (especially along roads),

Documented cogongrass infestations, 2007-2012.

hay for livestock, vehicles, logging and farm machinery, and pine straw for landscaping. Contaminated equipment, if not cleaned properly, can quickly introduce cogongrass to new sites. The rhizomes, however, are easily transported in wheel wells, tire treads, vehicle grills, even boots and rakes.

Public and private partnerships fight the invasive plant on a scale never before seen.

Cogongrass has been a serious pest in the southeastern US for some time. Without adequate funding, education, and knowledge about its growth patterns there was no effective way to combat it. Research has focused on cogongrass since the 1970s, but cogongrass continues to spread. Momentum changed in 2007 when the AFC received a grant from the US Forest Service to begin mapping known locations of cogongrass statewide. From that grant the Alabama Cogongrass State Task Force (ACSTF) was formed. ACSTF is a group of experts that have provided the necessary leadership to coordinate a statewide effort. One of the positive impacts of the ACSTF was a Memorandum of Understanding signed by 22 representatives of state and federal agencies as well as private companies.

In 2009, the American Reinvestment and Recovery Act (ARRA) was signed into law. Over $1.15 billion was given to the US Forest Service (USFS). The USFS provided support to the AFC in the form of a 3-year, $6.28 million grant to design and implement a statewide cogongrass control program. The AFC leadership decided that a private company could best execute the grant's objectives. Among 8 applicants the AFC chose Larson & McGowin Inc., a private, Alabama-based company to coordinate the grant's operations. The functional name for the ARRA grant was called the Alabama Cogongrass Control Center (ACCC). Enrollment was opened in September 2009 to all private, non-industrial landowners in Alabama.

Grant Objectives

Being a stimulus grant, the primary objective was job creation. The goal was to create or save 75 jobs over the 3 years; this goal was reached a year ahead of schedule. The final number of jobs created through the grant was nearly double the original estimate. The other objectives centered on mapping all cogongrass on enrolled properties and treating cogongrass in high priority geographic areas. These areas, designated by the ACSTF, became the boundaries for six strategies.

Some of the original members of the Alabama Cogongrass State Task Force (ACSTF), circa 2009. Photo courtesy cogongrass.org.

Examples of how cogongrass is spread via contaminated equipment:

- Mowing rights-of-way
- Hay baling and distribution
- Salvage logging after hurricanes
- Logging, especially loading decks
- Hunters
- Food plot maintenance
- Tree planting

Just one of these rhizome fragments will make a new infestation 10 inches deep in only 2 years. Photo courtesy Nancy Loewenstein.

Cogongrass is unevenly distributed across Alabama and found on private and public property. Therefore, a plan of attack was created with the help of the ACSTF to slow or contain the spread. US Highway 80 was chosen as the dividing line between the outlier (north) and mitigation (south) zones. The program offered herbicide treatment services at no cost to selected landowners. Each participant was placed into 1 of 6 strategies, depending on the property's location and other factors.

In the outlier zone the ACCC attempted to treat all cogongrass infestations on eligible properties. The approach was similar to how spot fires are treated during a wildfire, extinguishing them before gathering momentum. Near the dividing line were infestations that constituted an "advancing front", whereby focused treatments would help slow the movement into the outlier zone. For the most prolific infestations found in the mitigation zone, properties were chosen to aid in isolation of greatly infested areas, setting the stage for work done with additional funding and education.

Technological Breakthroughs

The ACCC built upon the work by the AFC by creating a Geographic Information System (GIS) database. This database was customized to accommodate the reams of data that were collected over the 3-year grant. A GIS database enables the collection and management of data tagged to a specific location on Earth. In addition, GPS units were customized to collect detailed information for each patch of cogongrass. Thirty independent contractors, spread across the state, were

Program strategy boundaries for the ARRA grant.

Strategy	Location	Objective	Eligible landowners accepted	Maximum acreage sprayed
1	North of eradication line	Halt the spread north and westward into other states	All	25
2	State borders south of eradication line	Slow the spread into neighboring states	All	10
3	Pinpointed counties in central AL	Help underserved and limited income landowners	All	10
4	Within 5 miles south of eradication line	Slow the spread into the eradication zone	All	10
5	Statewide	Mitigate impacts on threatened or endangered species, communities	% based on enrollment	Varies
6	South of eradication line	Mitigate impacts within infested zone	% based on enrollment	10

Landowners were placed into one of six strategies, depending on the property location. Each strategy had unique objectives, probability of having cogongrass sprayed, and maximum acres treated through the ARRA grant.

provided these GPS units through grant funding. Being trained and armed with this technology gives the contractor a much needed business advantage once the grant is complete.

Cogongrass Documentation

Nearly 1,000 landowners enrolled in the program. Every property was visited in order to document cogongrass that could be considered for treatment. In many cases all the locations were documented on a property. On some larger properties or in highly infested areas only the total acreage of cogongrass eligible for treatment was documented. Each property varied greatly in size and configuration as well as in the amount and distribution of cogongrass. The contractor collected almost 30 pieces of data about an individual patch including when it was found, its size, what herbicide should be applied, and the type of cover in which it was located.

Property Selection

Depending on the strategy placement and other factors, landowners were selected for assistance through the ACCC. All properties assigned to strategies 1-4 were selected for treatment, subject to any strategy limitations. Properties in strategies 5-6 were selected based on enrollment and funding at a county level as well as an unbiased statistical score for each landowner. Once the contractor data was complete the treatment cost and landowner score was calculated. This score was based on information provided by the landowner in the enrollment form and infestation data collected by the contractor. Based on the amount of money allocated to a county, the properties with the highest scores were selected up to a set funding level for the county.

Cogongrass Treatment

Fifty-two percent of the enrolled properties were selected for treatment. At least one landowner in every county where cogongrass was documented was selected. In all, about 61% of documented patches were assigned for treatment by independent, insured, and licensed pesticide applicators.

The level of funding for cogongrass, while unprecedented, is still not adequate to fully address the problem. "We realized from the outset of this grant that not everyone was going to have their cogongrass treated. There simply is too much cogongrass, touching too many lives", said Stephen Pecot, Communications Director for the ACCC. Notwithstanding the cogongrass on private property, the majority of cogongrass is found along forest roads all the way to the interstate system. County roads are especially vulnerable, and since there is a tiny fraction of local tax money set aside for cogongrass eradication--if at all--landowners watch in horror and disgust as the cogongrass reclaims sites that were once cleared of it. One landowner described treating cogongrass on their property "like digging a hole at the beach...the water fills it right back up". "Six million dollars", Stephen Pecot added, "would not treat all the cogongrass in Mobile County south of I-10. But we had to do something to make a dent".

As not everyone was selected for treatment, it was decided that every participant should at least be armed with information. Every person who enrolled in the program would receive a professionally made map with latitude and longitude coordinates denoting the cogongrass that was documented on their property. By providing this information

A scout subcontractor documents cogongrass locations (left). GPS data collection was accomplished with a Trimble Juno SB (right) and Getac PS535F (far right).

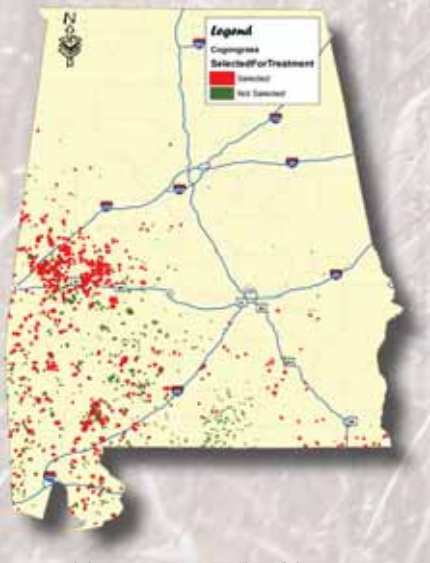
a landowner can give the map and list to a private contractor, greatly expediting the treatment process--and shaving 50% or more off the total cost.

Thirty spray crews were deployed statewide in 2009, 2010, 2011, and 2012 to conduct the herbicide treatment during the most effective treatment months (July to November). These contractors collected an additional set of data about the patch of cogongrass they were treating. Some of this information included the GPS location, herbicide and equipment used, how much was applied, soil type, rhizome depth, and weather conditions. "By compiling this information a great deal of knowledge about future success rates, potential changes to herbicide prescriptions, and predictive modeling to assess rate and direction of spread can be made," said Stephen Pecot.

An applicator subcontractor applies glyphosate to a selected cogongrass infestation in Greene County. Photo courtesy Will Autrey.

There are several effective ways to fight back against cogongrass.

Ask ten experts about the best cogongrass treatment plan, and you are likely to hear as many different opinions. It is true that in specific situations some herbicides work better than others. There is evidence that one herbicide will be fully effective on one soil type but not nearly so on other types. There is also some indication that genetic variation can play a significant role. What makes the task more daunting is the fact that any research results take several years to make it to the general public. This, coupled with the varying opinions, has made the fight against cogongrass a protracted effort.



A majority of the properties were selected for treatment under the program (red); a minority were not selected (green). All properties had cogongrass documented.

While there are many ways to fight back against cogongrass, there are 2 general methods that work best: mechanical and chemical. The first method involves plowing or discing the soil below the rhizome layer. This is usually only effective in young infestations and requires multiple treatments, spaced about 6 weeks apart over a growing season. Ernest Lovett, Project Coordinator for the ACCC, added: "This is why farmers only see it on the edges of tilled fields. The cogongrass is constantly being disturbed."

The second method involves targeted herbicide application directly on and around the cogongrass. The 2 herbicides that work best are glyphosate and imazapyr. Glyphosate (marketed under several names including Roundup®, made by Monsanto Company or Rodeo®, made by Dow AgriSciences) is *foliar* active, which means it is taken up through the leaves only. Glyphosate is best applied on cogongrass twice a year: in the early summer and again in the late summer/early fall. Only the cogongrass leaves must be treated. The grass will begin to brown up within a few days after application. It is extremely important to note that glyphosate will damage the plants of any foliage that it touches. So it is vital to only apply herbicide to target plants. Glyphosate is useful in areas where careful application is needed.

By contrast, imazapyr (multiple brands available by different manufacturers; the most common name is Arsenal®, made by BASF, Inc.) is *soil* active, which means it is taken up by the rhizomes and roots in the soil. Because of this activity imazapyr will damage non-target plants, even if the herbicide is not applied directly on them. Fortunately, cogongrass treated with imazapyr only needs one treatment

Part of the fight against cogongrass is getting the word out. Stephen Pecot, Communications Director for the ACCC, provides valuable insight to landowners in Hale County. Photo courtesy Will Autrey.

per year, applied in the late August-October time frame when rhizomes are most active. When applying imazapyr the cogongrass and a 6- to 10-foot swath surrounding the patch is sprayed. The grass browns up much slower with imazapyr because this herbicide kills the rhizomes first, which starves the leaves. Expect browning of leaves as much as 2 months post-application.

Effective Cogongrass Treatments

- **Discing – effective on young patches; disc below the rhizome layer every 6 weeks for at least one growing season or until gone; used if chemicals cannot or should not be applied; follow up with cover crop to reclaim site**
- **Glyphosate – foliar active (does not persist in the soil); apply in early summer and again in late summer/early fall 30 days prior to frost; repeat each year until gone**
- **Imazapyr – soil active (persists for some time in the soil); apply in late August-October 30 days prior to frost; repeat each year until gone; browning of leaves in 2 months**

Hardwoods in proximity to or within a runoff path may be damaged or killed by imazapyr. For example, it is wise to not use imazapyr in a cogongrass patch that is near or under a live oak, pecan orchard, or vegetable patch. But if cogongrass control is more important than protection of non-target plants, imazapyr is the best solution. "We talked to a lot of landowners who saw the removal of cogongrass as more important than corollary damage to hardwoods," said Will Autrey, Spray Supervisor for the ACCC. In those cases the landowner was more satisfied with dead cogongrass than a live pecan tree. This approach is not for everyone, and it is not without risk. While imazapyr is more expensive than glyphosate, labor costs are half that of glyphosate. Since labor makes up the majority of treatment costs, there is substantial savings overall by use of imazapyr.

With both herbicides it is important to repeat the annual plan for as long as the cogongrass persists. The biggest mistakes people make with cogongrass are assuming 1 or 2 treatments are enough and not following the label on the herbicide. Regardless of the treatment method chosen, several years of treatment are required to fully remove cogongrass from a site. Monitoring of treated areas should continue in perpetuity. See the specific recommendations in the back of this document, and always follow the label and information provided on the Material Safety Data Sheet (MSDS). There are other chemicals marketed for cogongrass treatment; however, these 2 herbicides have been found to be the most effective based on extensive research.

If you have any questions, call a local Registered Forester, your county forester, or a person who has a commercial pesticide applicator license. They have received the training necessary to best assess and treat cogongrass, among many other invasive species.

There are 3 sets of herbicide recommendations included at the end of this article. The first, written in conjunction with the ACSTF, is a key-based recommendation for treating cogongrass. By answering each question and following the directions the reader can be pointed to a specific solution. The ACCC used these recommendations for cogongrass treated with ARRA grant funding. The second recommendation, provided by the USFS and the AFC, is a detailed plan for readers that have more knowledge of herbicides and application. The third recommendation, also provided by the AFC, is specific to sites that contain longleaf pine. Again, it is imperative the label and all safety guidelines are always followed. The recommendations provided here are only used as a frame of reference and should not be assumed to be a tacit endorsement of specific herbicide use.

Financial Assistance

There are several landowner assistance programs that target invasive species control. The most popular programs are available through a local Natural Resources Conservation Service (NRCS) office and have specific requirements. Funding for these programs vary from year to year, so the reader is urged to check back with them often. There are also state programs that are funded, so it is wise to keep in contact with the appropriate state agencies.

A wealth of information is available to landowners that need help fighting cogongrass.

Alabama Cogongrass Control Center
(www.alabamacogongrass.com)

Alabama Forestry Commission
(forestry.alabama.gov)
334.240.9300

Alabama Cooperative Extension Service
(www.aces.edu)
334.844.4444

Natural Resources Conservation Service
(www.nrcs.usda.gov)
334.887.4500

Center for Invasive Species and Ecosystem Health
(www.cogongrass.org)
229.386.3298

Certified pesticide applicators undergo a rigorous examination process to ensure a thorough understanding of chemicals, mixing rates, and safety measures. Each state administers these credentials differently, so refer to your state's Department of Agriculture. Licensed applicators have the technical knowledge to assist landowners with treating cogongrass and many other invasive species. Photo courtesy Richard Davidson.

Herbicide Dichotomous Key
Alabama Cogongrass Control Center
Decision Tree to Guide Herbicide Choice and Rate

All applications and rates are calculated for applying 30 gallons of spray mix per acre. Spray pressures and nozzles should be selected to minimize drift. These guidelines are used at the reader's own risk. If you have any question about a particular patch, do not treat and contact a professional.

1. Are there Threatened or Endangered Plants or Animals within 50 feet of the infestation?

Yes. Do not treat without first referring to the US Fish and Wildlife Service website (www.fws.gov/endangered) to determine if there are regulations governing herbicide treatment.

No. Go to 2.

2. Is cogongrass growing within 50 feet on level topography (<20% slope) or within 200 feet on steep topography (>20% slope) of wet ditches, ponds, lakes, streams, or rivers, or where spray might be in runoff?

Yes. Apply a solution of Rodeo @ 4% volume to volume plus a non-ionic surfactant labeled for aquatic use @ 0.5% volume to volume. Caution: Direct application is not prohibited near water for irrigation, recreation, or domestic purposes. However, no application can be made within ½-mile of a municipal water supply.

No. Go To 3.

3. Are "valuable" non-target woody plants within 50 feet of treatment areas?

Yes. Apply a solution of Rodeo @ 4% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Care should be taken to limit spray contact with non-target species.

No. Go to 4.

4. Is cogongrass growing in a Forest Setting?

Yes. Go to Step 9

No. Go to Step 5

5. Is cogongrass growing in hay fields or pastures?

Yes. Go to Step 5A.

No. Go to Step 6.

5.A Yes. Is landowner willing to prevent grazing or hay cutting for 30 days following treatment? OR If grazing or hay cutting cannot be prevented, livestock will not be sold for slaughter for 30 days following treatment.

5.A.1 Yes. Apply a solution of Arsenal Powerline at 2% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Caution: Livestock should be prevented from grazing for 30 days following treatment and no hay cutting for 30 days following treatment, or if livestock are not removed, they should not be sold for slaughter for 30 days after treatment.

5.A.2. No. Go to 5.B

5.B. Is landowner willing to prevent grazing for 7 days following treatment and will only 10% of a given pasture be treated at any one time?

5.B.1 Yes. Apply a solution of Rodeo @ 4% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Caution: grazing should be prevented for 7 days after treatment and only 10% of a given pasture should be treated at any one time.

5.B.2 No. Go to 5.C.

5.C Landowner is not willing to observe grazing or slaughter restrictions for the area. Do Not Treat area.

6. Is cogongrass growing around the perimeter of an agricultural field currently being farmed?

Yes. Apply a solution of Rodeo @ 4% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. DO NOT USE any Arsenal product in or around agricultural fields or field edges where runoff could move the herbicide into the field. Most crops will be very susceptible to Arsenal soil residues. Care should be taken to limit exposure of crop species to herbicide overspray or drift. If cogongrass is growing inside an active agricultural field, Do Not Treat.

No. Go to Step 7.

7. Is cogongrass growing in Rights-of-Way or Waste area (unused land, vacant lot)?

Yes. Apply a solution of Arsenal Powerline at 2% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume.

No. Go to Step 8.

8. Is cogongrass growing in "Landscaped areas" or lawns?

Yes. Apply a solution of Rodeo @ 4% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Caution: Avoid spraying foliage and green woody stems of desirable plants and make certain that no drift occurs.

No. Go to Step 9.

9. Is cogongrass growing in a forest setting within 50 feet of crop or valuable hardwood species?

Yes. Apply a solution of Rodeo @ 4% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Caution: Avoid spraying any green bark or leaves of young hardwoods or shrubs if injury or kill cannot be tolerated.

No. Go to Step 10.

10. Is cogongrass growing on a site preparation area where planting of pine is anticipated but has not yet occurred?

Yes. Apply a solution of Arsenal Powerline at 2% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume.

No. Go to Step 11.

11. Is cogongrass growing under loblolly or Virginia pines less than 5 feet tall?

Yes. Apply a solution of Arsenal Powerline at 1% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Do not exceed 40 oz. of product per acre. Caution: Direct spray application toward the cogongrass and avoid direct application to the conifers.

No. Go to Step 12.

12. Is cogongrass growing under loblolly or Virginia pines greater than 5 feet tall?

Yes. Apply a solution of Arsenal Powerline at 2% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Direct spray solution toward the cogongrass and avoid direct application to the conifers, shrubs, and hardwoods that might also shade out cogongrass.

No. Go to Step 13.

13. Is cogongrass growing in longleaf, slash, or shortleaf pines less than 5 feet tall?

Yes. Apply a solution of Arsenal Powerline at 0.5% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Do not exceed 32 oz. of product per acre (10 gallons of solution/acre). Direct spray application toward the cogongrass and avoid direct application to the conifers, while spray on some lower limbs might be tolerated.

No. Go to Step 14.

14. Is cogongrass growing under longleaf, slash, or shortleaf pines greater than 5 feet tall?

Yes. Apply a solution of Arsenal Powerline at 2% volume to volume plus a high-quality, non-ionic surfactant @ 0.5% volume to volume. Direct spray application toward the cogongrass and avoid direct application to the conifers, shrubs, and hardwoods that might also shade out cogongrass.

No. Go to Step 15.

15. If the cogongrass infestation does not fit within the bounds of this decision tree, or if you have any questions or concerns... Stop! Do not treat and contact a natural resources or pesticide application professional.

Alabama Forestry Commission's
Cogongrass Control Recommendations
Dr. Jim Miller (retired), USDA Forest Service R&D, Auburn University and Dr. Stephen F. Enloe, Auburn University

Top growth of cogongrass is easy to kill or eliminate. It is the underground stems or rhizomes that are more difficult to control and must be the target of eradication-control treatments. Each 1-2 inch segment of the rhizome can send up a shoot when the top is eliminated by mowing, herbicide, or burning. Mowing and burning can be used to clear thatch and debris before other treatments begin, while burning can result in killing desirable plants and open adjoining lands for cogongrass invasion.

The difficulty of cogongrass control varies according to the depth and density of the rhizome mat. Young infestations are usually easier to control than older, well-established infestations with intertwining rhizome mats greater than 5 inches in depth. Centers of infestations will have deeper mats and will be harder to kill (the bull's eye effect), while rhizomes extending past the edges will emerge if the soil above is not treated (the halo effect).

Tillage Eradication for Pastures and Crop Areas
For newer patches, tillage can eliminate cogongrass from an area if continued during the course of a growing season. Tillage may not be an option on many sites such as steep slopes, established tree plantings, or around dwellings.

• The initial tillage should begin in the spring (March through May) with an implement that inverts the soil to a depth of at least 6 inches and below the rhizome mat. An option: After multiple tillage passes, planting a Roundup-resistant crop will permit oversprays of Roundup (glyphosate) herbicides at labeled rates during the growing season to eliminate sprouting cogongrass.

• Perform additional tillage with a disk harrow or other appropriate implement every 6 to 8 weeks. It is important to clean all equipment on site to prevent the spread by rhizomes. Dry periods will aid in the control of cogongrass.

• The area can be planted to a fall cover crop and then followed the next season with perennial or annual grass or broadleaf crops.

Dearl Sander's (LSU) Recommendations for Cogongrass in Pastures:
• Prepare a complete fall seedbed, utilizing a finishing tool with sweeps if possible to deposit crowns and rhizomes at the soil surface.
• Plant rye grass at a minimum of 30 lb/ac alone or in combination with other winter forages.
• Do not overgraze rye in infested areas.
• Allow rye in infested areas to naturally senesce, allowing full season competition before removal.
• Spray all fencerows and non-crop areas with glyphosate alone or in combination with sulfometuron (Oust, etc.) or imazapyr (Arsenal, etc.) where allowed.
• Practice good sanitation to prevent reinfestation.

Herbicide Eradication or Control
More treatments and the use of imazapyr herbicides will be required for old infestations with rhizome mats that fill the friable surface soils.

Only two active ingredients are consistently effective on cogongrass at this time:
• Glyphosate (as in Accord, Roundup, Glypro, Accord, etc) and
• Imazapyr (as in Arsenal, Arsenal AC, and Chopper Gen 2, etc.)

Glyphosate has no soil residual activity but can injure non-target plants when sprayed. Imazapyr has soil and foliar activity and can injure or kill sensitive non-target plants in the treatment area, or when planted too soon after treatment. Many herbicides have these ingredients and are sold as "brand name" (original manufacturer) or "generic" herbicides (see Table 1).

Herbicide Prescriptions that can be applied to new shoots at least 1 foot tall and then up to a month before frost.

For New Infestations and areas where no soil active herbicides can be used:
Glyphosate with 41% active ingredient (AI; stated on the label)
• 4 quarts applied in a 15-25 gal mix per acre (or 4-7% mix) or 15-27 ounces per 3-gal mix. Plus surfactant (see below).

Glyphosate with 50+% AI (stated on the label)
• 7 pints applied in a 15-25 gal mix per acre (or 3.5-6% mix) or 10-15 ounces per 3-gal mix. Plus surfactant (see below).

For Old Infestations and areas where soil active herbicides are used for fast control:
Imazapyr with 22% AI and Glyphosate with 41% AI
• 3 pints imazapyr plus 1 gallon glyphosate in a 15-25 gal mix per acre (or 1.5-2.5 % imazapyr plus 4-7% glyphosate) or 6-10 ounces imazapyr plus 15-27 ounces glyphosate per 3-gal mix. Plus surfactant (see below).

Imazapyr with 43% AI and Glyphosate with 41% AI
• 1.5 pints imazapyr plus 1 gallon glyphosate in a 15-25 gal mix per acre (0.75-1.25% imazapyr plus 4-7% glyphosate) or 3-5 ounces imazapyr plus 15-27 ounces glyphosate per 3-gal mix. Plus surfactant (see below).

Imazapyr with 22% AI and Glyphosate with 50+% AI
• 3 pints imazapyr plus 7 pints glyphosate in a 15-25 gal mix per acre (or 1.5-2.5 % imazapyr plus 3.5-6% glyphosate) or 6-10 ounces imazapyr plus 10-15 ounces glyphosate per 3-gal mix. Plus surfactant (see below).

Imazapyr with 43% AI and Glyphosate with 50+% AI
• 1.5 pints imazapyr plus 6 pints glyphosate in a 15-25 gal mix per acre (0.75-1.25% imazapyr plus 3.5-6% glyphosate) or 3-5 ounces imazapyr plus 10-15 ounces glyphosate per 3-gal mix. Plus surfactant (see below).

Spray the entire infestation and 10 feet past the edges for imazapyr to reach extending rhizomes plus add 0.5% surfactant (2 ounces per 3 gal, 10 ounces per 15 gal, and 16 ounces per 25 gal).

The Rehabilitation Phase
Rehabilitation is the most important phase of control and reclamation of land infested with cogongrass or other non-native invasive plants. The rehabilitation phase requires establishment or release of fast growing native or non- invasive plants that can outcompete and outlast any surviving cogongrass while stabilizing and protecting the soil. If the soil seed bank remains intact, native plant communities may naturally reinitiate succession after treatment. Light-seeded native species are usually present in the seed bank while heavier seeded plants will gradually be deposited on a site by birds and other animals. It is often necessary to establish fast-growing tree and shrub species after initial treatments to shade out surveying cogongrass. Reestablishing native and non-invasive grasses can also be seeded on roadsides and pastures to assist control. Grazing by livestock can also suppress young cogongrass growth. Constant surveillance, treatment of new unwanted arrivals, and finally, rehabilitation following control are critical to preventing reinfestation on a specific site.

Active Ingredient by surfactant and concentration	Herbicide Name	Company
Imazapyr (active ingredient)		
No Surfactant		
4 lb/gal - 43.3%	Arsenal AC	BASF
4 lb/gal - 42.9%	Imazapyr 4 SL	Vegetation Management LLC
4 lb/gal - 43.3%	Imazapyr E-Pro 4 - Forestry	Etigra LLC
4 lb/gal - 43.3%	Polaris AC Herbicide	Nufarm Turf & Specialty
2 lb/gal - 22.6%	Arsenal Herbicide	BASF
2 lb/gal - 22.6%	Habitat (aquatic)	BASF
2 lb/gal - 22.6%	Imazapyr 2 SL	Vegetation Management LLC
2 lb/gal - 23.4%	Imazapyr E-Pro 2 VM & Aquatic	Etigra LLC
2 lb/gal - 22.6%	Imazapyr E-Pro 2E Site Prep/Basal	Etigra LLC
2 lb/gal - 22.6%	Polaris AQ Herbicide (aquatic)	Nufarm Turf & Specialty
2 lb/gal - 22.6%	Polaris SP Herbicide	Nufarm Turf & Specialty
2 lb/gal - 22.6%	Stalker Herbicide	BASF
Surfactant		
2 lb/gal - 22.6%	Chopper	BASF
2 lb/gal - 21.8%	Chopper Gen2	BASF
2 lb/gal - 22.6%	Polaris RR Herbicide	Nufarm Turf & Specialty
Glyphosate (active ingredient)		
No Surfactant		
5.4 lb/gal - 53.6%	Accord XRT	Dow AgroSciences LLC
5.4 lb/gal - 53.8%	Accord Concentrate	Dow AgroSciences LLC
5.8 lb/gal - 53.8%	Aquamaster (aquatic)	Monsanto Company
5.8 lb/gal - 53.8%	Aquaneat Herbicide (aquatic)	Nufarm Turf & Specialty
5.4 lb/gal - 53.8%	Cinco	UAP-Loveland Products, Inc.
5.4 lb/gal - 53.8%	Foresters' Non-Selective Herbicide	Nufarm Turf & Specialty
5.4 lb/gal - 53.8%	Rodeo (aquatic)	Dow AgroSciences LLC
5 lb/gal - 52.3%	Touchdown Hitech	Syngenta Crop Protection, Inc / Riverdale Chemical Co.
4 lb/gal - 41%	Alecto 41 UL Buccaneer Buccaneer Herbicide	Ritter Chemical LLC
4 lb/gal - 41%	Buccaneer	TENKOZ, Inc.
4 lb/gal - 41%	Buccaneer Herbicide	TENKOZ, Inc.
4 lb/gal - 41%	Buccaneer Herbicide Plus	TENKOZ, Inc.
4 lb/gal - 41%	Cornerstone	Agriliance LLC
4 lb/gal - 41%	Credit®	Nufarm Americas, Inc.
4 lb/gal - 41%	FarmSaver Glyphosate 4	MANA - Makhteshim Agan of North America, Inc.
4 lb/gal - 41%	Gly Star Original	Albaugh, Inc./Agri Star
4 lb/gal - 41%	Gly-4 Plus	Universal Crop Protection Alliance LLC
4 lb/gal - 41%	Glyfos Herbicide	Cheminova, Inc.
4 lb/gal - 41%	Glyphogan Herbicide	MANA - Makhteshim Agan of North America, Inc.
4 lb/gal - 41%	Glyphomax	Dow AgroSciences LLC
4 lb/gal - 41%	Glyphosate 4	Vegetation Management LLC
4 lb/gal - 41%	Glyphosate 41%	Helm Agro US, Inc.
4 lb/gal - 41%	Glyphosate T&O	FarmSaver.com/Quali-Pro
4 lb/gal - 41%	Honcho Herbicide	Monsanto Company
4 lb/gal - 41%	Honcho Plus	Monsanto Company
4 lb/gal - 41%	Mirage Herbicide	UAP - Loveland Products, Inc.
4 lb/gal - 41%	Rattler Herbicide	Helena Chemical Company
4 lb/gal - 41%	Rattler Plus	Helena Chemical Company
4 lb/gal - 41%	Razor	Nufarm Turf & Specialty
4 lb/gal - 41%	Roundup Original	Monsanto Company
3.5 lb/gal - 36.5%	Touchdown Total	Syngenta Crop Protection, Inc.
3.64 lb/gal - 37.5%	Credit Duo	Nufarm Americas, Inc.
3 lb/gal - 28.3%	Touchdown Herbicide	Syngenta Crop Protection, Inc.
Surfactant		
5.5 lb/gal - 48.7%	Roundup Original Max	Monsanto Company
5.4 lb/gal - 53.6%	Durango	Dow AgroSciences LLC
5.4 lb/gal - 53.6%	Glyphomax XRT	Dow AgroSciences LLC
5 lb/gal - 50.2%	Roundup Pro Concentrate	Monsanto Company LLC
4 lb/gal - 41%	Accord SP	Dow AgroSciences LLC
4 lb/gal - 41%	Alecto 41HL	Ritter Chemical LLC
4 lb/gal - 41%	Alecto 41S	Ritter Chemical LLC
4 lb/gal - 41%	Cornerstone Plus	Agriliance LLC
4 lb/gal - 41%	Credit Extra	Nufarm Americas, Inc.
4 lb/gal - 41%	Gly Star Plus	Albaugh, Inc./Agri Star
4 lb/gal - 41%	Gly Star Pro	Albaugh, Inc./Agri Star
4 lb/gal - 41%	Glyfos X-Tra Herbicide	Cheminova, Inc.
4 lb/gal - 41%	Glyphomax Plus	Dow AgroSciences LLC
4 lb/gal - 41%	Glyphosate 41 Plus	Crop Smart LLC
4 lb/gal - 41%	Glyphosate Pro 4	PROKoZ, Inc.
4 lb/gal - 41%	Glyphosate Pro II	PROKoZ, Inc.
4 lb/gal - 41%	Makaze Herbicide	UAP - Loveland Products, Inc.
4 lb/gal - 41%	Ranger Pro	Monsanto Company
4 lb/gal - 41%	Rascal Plus 41% Glyphosate	Agriliance LLC
4 lb/gal - 41%	Razor Pro	Nufarm Turf & Specialty - Riverdale Chemical Company
4 lb/gal - 41%	Roundup Pro	Monsanto Company

COGONGRASS MANAGEMENT IN LONGLEAF PINE

Dr. Jim Miller (retired), USDA Forest Service R&D, Auburn University and Dr. Stephen F. Enloe, Auburn University

Cogongrass (*Imperata cylindrica*) infestations in areas where longleaf pine will be or is currently planted presents problems for landowners in that control measures may be marginal and expensive. Three different scenarios can be identified:

- Infestations in sites not yet planted;
- Infestations in sites with trees greater that average diameter of 5 inches DBH; and
- Infestations in sites with young longleaf pine seedlings.

PLEASE NOTE that the following information is based in large part on experience gained from establishing loblolly pine in bahiagrass and bermudagrass areas, efficacy of screening trials of herbicides on longleaf pine, and specifications on herbicide labels.

Situation 1. (site prep prior to planting)
Prescribe burn when possible in late winter prior to the growing season of treatments. Application for two consecutive years using the following mixture in August - October: imazapyr (Arsenal Applicators Concentrate) at 0.5 lb active ingredient per acre (1 pint product) plus a glyphosate herbicide at 4 lb active per acre (4/5 – 1 gallon) with surfactant when specified on the herbicide label . Plant in mid-December through mid- January. Imazapyr should not be applied within 4 months of planting. Treatments should be applied in 15 to 20 gallon of total spray solution by helicopter or 15 to 40 gallons per acre by ground equipment, assuring thorough coverage and overlapping spray swaths.

Situation 2. (Treatment in established trees with DBH of 5 inches or greater)
Prescribe burn when possible in late winter prior to the growing season of treatments, recognizing that cogongrass must be in a suppressed condition so that flame height and fire intensity does not damage sapling trees. NOTE that burning and herbicide applications can damage the shrub layer needed for cogongrass suppression in conjunction with a tree layer.
Apply a mixture of imazapyr at 0.5 lb active ingredient per acre (1 pint product per acre) plus a glyphosate herbicide at 4 lb active ingredient per acre (4/5 to 1 gallon product per acre) with surfactant in August to October. This must be applied by ground between tree rows and overlap must be avoided. Drift must be minimized to avoid tree damage. NOTE: no research is available to show that this treatment is economically beneficial to the landowner, but will be useful for controlling stands with new and developing infestations.

Situation 3. (Treatment of young longleaf seedlings for release)
NOTE: Cogongrass must be suppressed with site prep treatments prior to planting in order for this treatment to be effective. Seedlings should NOT be actively flushing and should be hardened off and shoots not actively elongating at application.
Apply imazapyr (Arsenal AC) at 0.125 lb active ingredient (4 ounces product per acre) over the top one time from June to September. Make a uniform application to the entire site with overlaps between rows. Use nozzles and setups that minimize application over seedling rows. Apply in 15 to 40 gallons of total solution per acre for tractor and backpack application. DO NOT USE A SURFACTANT WITH THIS TREATMENT.

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