



MARK WILLIAMS
COMMISSIONER

DOUG HAYMANS
DIRECTOR

OCT 25 2018
Eamonn Leonard
Wildlife Resource Division
One Conservation Way
Brunswick, GA 31520

Re: Letter of Permission (LOP), Tamarisk (Salt Cedar) Treatment, Altamaha River Delta, McIntosh County, Georgia

Dear Mr. Leonard:

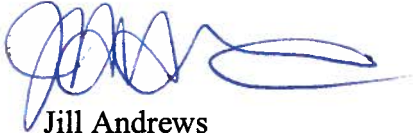
This Letter of Permission (LOP) is in response to your request, dated June 28, 2017, for the treatment of salt cedar (*tamarix cannariensis*) on former dredge spoil islands along the Intercoastal Waterway (ICW) in McIntosh County. This is a restoration project to remove large areas of invasive salt cedar from the mouth of the Altamaha River. These areas are thought to be the source population for many of the salt cedars found in the surrounding areas and are located on Rockdedundy Island and other adjacent sites. The approximate GPS coordinates of the project sites are as follows: 31.379851°N, 81.337312°W, 31.366052°N, 81.338016°W, 31.347120°N, 81.333671°W, 31.342426°N, 81.331103°W, 31.338290°N, 81.331441°W, and 31.318444°N, 81.342311°W. The salt cedar will be treated with an herbicide spray from a helicopter. The herbicide combination to be used is Habitat (Imazapyr) and AquaPro. The total acreage to be sprayed is approximately 176 acres and identified in the attached drawing. The treatments will be applied in such a way that there will be an approximate 20-foot area of non-targeted vegetation within coastal marshlands along the targeted areas that could be impacted by the treatment. The herbicide treatment will not be applied unless certain weather conditions are present that will reduce drift (i.e. wind speed and chance of rain). The salt cedar treatment as described above will begin no sooner than 15 days from the date of this letter and will be completed no later than six (6) months from the date of this letter.

The Department authorizes the salt cedar treatment in McIntosh County, as depicted in the attached description and drawing, and has no objection to the action, provided Best Management Practices (BMP's) are used. **No unauthorized equipment, materials, or debris may be placed, disposed of, or stored in jurisdictional areas.** Any incidental damage to coastal marshlands will require restoration to be coordinated through this office. This LOP is valid for the above referenced project. Any change in the use, location, dimensions, or configuration of the approved project, without prior notification and approval from this office could result in revocation of this permission and in the required removal of the related structures. At the conclusion of the authorized project, a report must be submitted to the Department identifying the areas treated and any areas within coastal marshlands in need of restoration due to the treatment.

OCT 25 2018

This authorization does not relieve you from obtaining any other required federal, state, or local permits. If you have any further questions or concerns in regards to this or any other projects, please feel free to contact Jordan Dodson at (912) 262-3109.

Sincerely,



Jill Andrews
Chief, Coastal Management Section

Enclosures: Project Description, Drawing, and Supplemental Information
File: LOP20170148

Dodson, Jordan

From: Leonard, Eamonn
Sent: Friday, October 5, 2018 1:14 PM
To: Dodson, Jordan
Subject: RE: Salt Cedar Control_McIntosh County
Attachments: 2018_Treatment_Tamarisk.pdf; Tamarisk_Treat_2018.cpg; Tamarisk_Treat_2018.dbf; Tamarisk_Treat_2018.prj; Tamarisk_Treat_2018.sbn; Tamarisk_Treat_2018.sbx; Tamarisk_Treat_2018.shp; Tamarisk_Treat_2018.shp.xml; Tamarisk_Treat_2018.shx; Tamarisk2018_20buffer.cpg; Tamarisk2018_20buffer.dbf; Tamarisk2018_20buffer.prj; Tamarisk2018_20buffer.sbn; Tamarisk2018_20buffer.shp; Tamarisk2018_20buffer.shp.xml; Tamarisk2018_20buffer.shx

Jordan, the permissions still apply. After further research the northern most dredge island (5 acres) is under State of GA ownership. The southernmost island is also under State of GA and the individual who was claiming it has given up his claim. Robert Horan with Game Management has been in communication with him and he is was waiting till it cooled off to move the cows he has on the island off of it. If this does not happen before the herbicide application needs to be applied then we will drop that island (even though it really would have no effect on the cows).

I have attached a map of the treatment areas. As per communications last year with Chip Davis with Estate Management Services who would do the treatments they would be applying in a way to leave a 20ft buffer. The recommendation is just 15 feet. All the information from last year about wind conditions droplet size and precision of the application equipment still applies.

Let me know if you need further information. This project is being paid for out of a State Wildlife Grant that ends in Dec. with partial funding from a TERN (The Environmental Resources Network) that was awarded last year. Would be great to get these done before we have to give the money back.

The herbicide applicator communicated with me recently and he is trying to coordinate the application with work they are doing with the SC DNR this fall.

Thanks,

Eamonn Leonard
Wildlife Biologist II, Wildlife Conservation

Wildlife Resources Division
(912) 262-3150 | M: (912) 223-9852

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From: Dodson, Jordan
Sent: Monday, October 01, 2018 11:44 AM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Subject: Salt Cedar Control_McIntosh County

Eamonn,

I've spoken with Josh and have reviewed our previous correspondence. In order for us to move forward with processing your request, please address the following:

- Property Owner Permission;
 - Do the authorizations from the ACOE, July 26, 2017, and EPD, August 3, 2017, still stand for the proposed treatment?
 - In the email chain with William Bailey with the ACOE, on August 3, 2017, you stated that you will be removing the most northern and southern sites from the proposed project until property owner permission is obtained. Has property owner permission been obtained or are these areas still excluded from the current proposal?
- Please provide GIS exhibit/image depicting the area of targeted area of impacts and the potential secondary impact areas and their total acreage (targeted and secondary);
- Any site photos if available;

If you have any questions, please let me know.

Sincerely,

Jordan Dodson
Coastal Permit Coordinator
Coastal Resources Division
(912) 264-7218 | O: (912) 262-3109
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File: LOP20170148

Dodson, Jordan

From: Leonard, Eamonn
Sent: Thursday, August 9, 2018 4:22 PM
To: Dodson, Jordan
Subject: RE: Salt Cedar permit info - p

Jordan, I wanted to re-visit this project. I was hoping to conduct this work this fall as the grant I am using to fund this ends at the end of Dec. 2018. Ideally we would like to schedule this between now and October 31st.

Let me know if you need additional information beyond the original request and all the follow up clarification and support letters from EPD and the US ACE that were provided last year.

Thank you for your consideration

Eamonn Leonard
Wildlife Biologist II, Wildlife Conservation

Wildlife Resources Division

(912) 262-3150 | M: (912) 223-9852

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From: Dodson, Jordan
Sent: Monday, September 18, 2017 4:02 PM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Subject: RE: Salt Cedar permit info - p

Hi Eamonn,

My family fared okay for the most part. Thank you for asking. As I'm sure you may have heard, CRD has initiated Emergency Orders #1 and #2, due to Hurricane Irma, which places a moratorium on nonessential construction/alteration within the jurisdiction of the CMPA and SPA in order to be responsive to Hurricane Irma impacts. This moratorium is effective immediately and will be in place until further notice. A call center has been activated to gather information about impacts to beach front property, private docks, bank stabilizations, marinas, commercial docks, or other structures within coastal waters, marshlands, or along barrier island beaches. Once the call center closes, work will continue as usual. I will let you know when this occurs. Until then, I apologize for the delay in this pending request. If you have any questions, please let me know. I hope you, your pets, family and friends stayed safe through the storm.

Sincerely,

Jordan Dodson

Coastal Permit Coordinator

Coastal Resources Division

(912) 262-3109 | M: (912) 266-0642

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From: Leonard, Eamonn
Sent: Monday, September 18, 2017 11:32 AM
To: Dodson, Jordan <jordan.dodson@dnr.ga.gov>
Subject: RE: Salt Cedar permit info - p

Jordan, Hope you and your family fared well during the storm. I am going to be in Alabama all week. I know everyone's priorities have shifted but just found out the contractor is still looking to be in the area spraying for Robert Horan at the Altamaha Waterfowl Impoundments soon. If there is a way to coordinate with the Salt Cedar work at the same time that would be great. Otherwise I will probably have to wait till fall of 2018 to schedule the work.

Thanks,

From: Dodson, Jordan
Sent: Tuesday, August 29, 2017 3:16 PM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Subject: RE: Salt Cedar permit info - p

Hi Eamonn,

I have reviewed the information you have supplied, and do not have any questions at this time. Once I have discussed with Karl how to process this request moving forward, I will let you know. Also, thank you for your patience while we process this request. You should hear back from us soon.

Have a wonderful day,

Jordan Dodson
Coastal Permit Coordinator
Coastal Resources Division
(912) 262-3109 | M: (912) 266-0642
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From: Leonard, Eamonn
Sent: Thursday, August 24, 2017 4:31 PM
To: Dodson, Jordan <jordan.dodson@dnr.ga.gov>
Subject: RE: Salt Cedar permit info - p

Jordan, I just wanted to check back in with you to see if you needed any additional information. I got an e-mail today from the aerial applicator that they will have a crew in the area possibly the week of Sept. 11th. I am working with Game Management staff to coordinate the work with some of their vegetation control needs at the same time. I have field work in the morning but should be back in the office by mid-day tomorrow.

Thanks,

Eamonn

From: Dodson, Jordan
Sent: Tuesday, July 25, 2017 8:08 AM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Subject: RE: Salt Cedar permit info - p

Good Morning Eamonn,

No worries. I'll review all the additional material and get back to you soon.

Have a good day,

Jordan Dodson

Coastal Permit Coordinator

Coastal Resources Division

(912) 262-3109 | M: (912) 266-0642

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From: Leonard, Eamonn
Sent: Monday, July 24, 2017 5:02 PM
To: Dodson, Jordan <jordan.dodson@dnr.ga.gov>
Subject: FW: Salt Cedar permit info - p

Jordan, Sorry to flood you with e-mails but I wanted to make sure we addressed the buffer concerns. This is their answer below. I will be in the office tomorrow but out (will still check my e-mail) from July 26th – August 1st. Let me know if there are other information needs or concerns.

Thanks,

Eamonn

From: Chip Davis [<mailto:jmdavisiv@gmail.com>]
Sent: Monday, July 24, 2017 4:51 PM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Subject: Re: Salt Cedar permit info - p

? I agree with your recommendation for a small buffer zone. With their boom configuration, the aerial applicators can target the chemical drop with great precision. If it will make them feel better, I would say a 20 foot buffer would suffice.

Chip

Chip Davis
Director, Contract Services
jmdavisiv@gmail.com
843-872-1522

On Mon, Jul 24, 2017 at 4:41 PM, Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov> wrote:

Ok great thanks, do you think their concerns about the need of a buffer are warranted? If you think a buffer could be done how wide would that be? If there is some potential edge kill of species on the perimeter of the spray area is there a general width of that area that would be expected?

Eamonn

From: Chip Davis [mailto:jmdavisiv@gmail.com]
Sent: Monday, July 24, 2017 4:37 PM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>

Subject: Re: Salt Cedar permit info - p

Eamonn,

That looks good. FYI, the aerial applicators utilize an 800 micron Accuflow nozzle for their Habitat applications. It provides a large droplet stream, with no drift. Also, as per label, Habitat should not be applied in winds in excess of 10 mph or less than 3 mph.

Thanks,

Chip



Virus-free. www.avast.com

Chip Davis

Director, Contract Services

[**jmdavisiv@gmail.com**](mailto:jmdavisiv@gmail.com)

[**843-872-1522**](tel:843-872-1522)

On Mon, Jul 24, 2017 at 3:58 PM, Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov> wrote:

Thank you all for taking looking. That is a good point about the application not hitting the understory species. I think one of the permitting folks biggest concerns is collateral damage to the surrounding salt marsh species and aquatic species in the surrounding waterbodies. Today they asked for additional information. I have pasted below the additional questions from them and my answers in red. Do you have info on desired weather conditions and other practices that are conducted to reduce drift?

From: Dodson, Jordan
Sent: Monday, July 24, 2017 10:00 AM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Subject: RE: Salt Cedar permit info

Good Morning Eamonn,

After further discussion, below are a few other questions that have unfolded from others:

- ? Will the treatment be applied via helicopter or a fixed wing plane? **Helicopter**
 - o Your project description states a helicopter, but the letter from Estate Management Services, Inc. just describes an aerial application and does not specify the mode of aerial application (helicopter or fixed wing plane).
- ? Has this type of treatment application been utilized in Georgia or nearby states in or near salt marsh areas? If so, what are the know impacts to the salt marsh? **This is a very common treatment method for vegetation control. We have used this same method for 5 years in controlling the invasive Phragmites. Which is an invasive wetland grass species. I have attached a photo a month or so after treatment (100 0351) and another photo (CommonReed_assesment_airboat) a couple years after treatment of one of our control sites in pool 3 of Rhett's Island on the Altamaha Waterfowl Management area. The images show that the treatment was very targeted (treatment area is brown in first pic, you can see some strips where the helicopter missed, then open water in second pic). This herbicide is used to treat Spartina alterniflora in California where it is an invasive species. But the applicator will not apply unless certain weather conditions are present that would reduce drift (wind speed, chance of rain). They also use a certain droplet size that minimizes drift. We have also used this method to control water hyacinth in the waterfowl impoundments. Game Management sometimes uses this method to control other vegetation in the impoundments to maintain open water habitat. In the draft response to your previous e-mail I have attached a guide to the management of Salt Cedar that describes this using the same method of control that we are proposing.**
- ? Are there any alternatives proposed for this project area? **Right now this is the only viable option that is feasible due to the remote location, size of area to be treated, and effectiveness of this particular treatment.**

- ? Will the same chemical mixture proposed for the aerial treatment be used in the follow up treatment, if any? – our follow up will hopefully be prescribed fire. With hand treatments using the same herbicide mixture.
- ? Is there a buffer zone between the proposed treatment area and the marsh vegetation? If so, what is the size? I am waiting to hear from the applicator about the buffer zone. For control efficacy I would rather have a very small buffer so we don't have mature Salt Cedar that will drop seed and compromise the recolonization of the site by nearby native species.
- ? Will wind conditions along with other environmental conditions such as humidity and temperature be optimal during treatment application to minimize drift? Yes the applicator has to follow certain parameters when apply by helicopter (applicator should have info on desired conditions)

If you have any questions concerning the above, please let me know. You will be notified if any other concerns or questions arise.

Sincerely,

Jordan Dodson

Coastal Permit Coordinator

Coastal Resources Division

[\(912\) 262-3109](tel:(912)262-3109) | M: [\(912\) 266-0642](tel:(912)266-0642)

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From: Chip Davis [mailto:jmdavisiv@gmail.com]

Sent: Monday, July 24, 2017 3:31 PM

To: Dodson, Jordan <jordan.dodson@dnr.ga.gov>; Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>; John Crabb <Jcrabb37@gmail.com>

Subject: Re: Salt Cedar permit info - p

All,

Sorry for the delay in getting back to you. I was attending the APMS conference last week in Daytona. The requested information you provided is very thorough and well written. One point to consider, as noted by

John, in treating the canopy you will reduce the potential for chemical to reach the understory and adversely impact desirable plants.

Thanks,

Chip

Chip Davis

Director, Contract Services

jmdavisiv@gmail.com

[843-872-1522](tel:843-872-1522)

On Tue, Jul 18, 2017 at 6:09 PM, John Crabb <jcrabb37@gmail.com> wrote:

Looks good to me. One thing is with aerial the overstory of salt cedar would limit the non target plants effected. Don't think much will get to the soil? Will you respond to him.

Sent from my iPhone

Begin forwarded message:

From: "Wendy Tassie" <admin@ponds.org>
Date: July 18, 2017 at 4:03:26 PM EDT
To: "'John Crabb'" <jcrabb37@gmail.com>
Subject: FW: Salt Cedar permit info - p

Printed and placed in your office.

From: Leonard, Eamonn [<mailto:Eamonn.Leonard@dnr.ga.gov>]
Sent: Tuesday, July 18, 2017 3:56 PM
To: 'admin@ponds.org'
Subject: RE: Salt Cedar permit info

Could you forward this to Mr. Crabb? This is pertaining to the Saltcedar treatment project. Below is my draft response to the permitting folks at GA DNR Coastal Resources Division. Could you let me know if what I have stated below about the herbicide application and the information I am referencing sounds reasonable? I am hopeful that I can get them all the pertinent information so we don't have to delay this project too much longer.

Thanks,

Eamonn

Jordan, I have attached an additional document from 2010 that discusses management of Salt Cedar. I have pulled out a few excerpts that mirror the control method we are proposing (in attached word document). I have also pulled out some text (inserted below) from a study by The Nature Conservancy on the environmental effects of Habitat (Imazapyr) and a similar document that looks at the effects of Accord (AquaPro or Glyphosate). As well as the herbicide labels for both. As noted in the treatment proposal by the herbicide applicator they "... propose to apply 64 ounces of Habitat (Imazapyr) blended with 32 ounces of AquaPRO (Glyphosate) per acre. [They] will apply aerial at a 15 gpa rate."

I have addressed each bullet below in red.

From: Dodson, Jordan
Sent: Tuesday, July 11, 2017 11:23 AM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Cc: Burgess, Karl <Karl.Burgess@dnr.ga.gov>; Stockel, Skye <Skye.Stockel@dnr.ga.gov>
Subject: RE: Salt Cedar permit info

Hi Eamonn,

As proposed, this request will take a little longer to process due to the scope of the project, and the current timeline may not be feasible. The initial review of staff has revealed additional information/items necessary for continued review (see below).

- What is the chance of potential exposure to the surrounding environment? What are the anticipated incidental impacts (acreage)? The herbicides recommended are broad spectrum and would exhibit control on all plant species present in the spray area. “Because imazapyr can affect a wide range of plants and can remain available, care must be taken during application to prevent accidental contact with non-target species.” (Weed Control Methods Handbook, The Nature Conservancy, Tu et al., 2001). We are asking the aerial herbicide applicator to meet the specifications laid out in the “Field Guide to Managing Saltcedar(2010)” to minimize drift into surrounding non-target salt marsh habitat. As well as follow the recommendations of the Weed Control Methods Handbook, The Nature Conservancy, Tu et al., 2001 “To avoid injury to desirable trees, do not apply imazapyr within twice the drip line (tree canopy).” (*Is this realistic?*) Even with following the best management practices we anticipate the impacts to the surrounding non-target vegetation could create an zone of control of about 5m. (*does this sound reasonable?*)
- What is the range of acceptance for affecting non-target/non-invasive plants? While the stands to be treated are dominated by saltcedar there are some native species interspersed. With-in these areas we anticipate complete control of all the plants present (native and non-native alike). Non-target/native vegetation outside the treatment stands we would like zero to minimal impacts. As stated in bullet 1: even with following the best management practices we anticipate the impacts to the surrounding non-target vegetation could create an zone of control of about 5m.
- How long does it take for these chemicals to break down in the environment? “The half-life of imazapyr in soil ranges from one to five months. In aqueous solutions, imazapyr may undergo photodegradation with a half-life of two days. Imazapyr is not highly toxic to birds and mammals, ... Studies indicate imazapyr is excreted by mammalian systems rapidly with no bioaccumulation. It has a low toxicity to fish, and algae and submersed vegetation are not affected.” (Weed Control Methods Handbook, The Nature Conservancy, Tu et al., 2001). For Glyphosate (AquaPro or Accord) “Research done with laboratory animals shows that glyphosate is poorly absorbed when ingested. What little is absorbed is rapidly eliminated, resulting in minimal tissue retention. Feeding studies with chickens, cows, and pigs have shown extremely low to no residues in meat and fat following repetitive exposure. Negligible residues have also been reported in wild animals such as voles, chipmunks, hares, and moose after feeding in treated areas. A series of bioaccumulation studies done to determine if glyphosate concentrated in the edible portions of fish and game, indicted that it did not accumulate in the food chain. In addition numerous lab and field studies with the active ingredient in Accord XRT II and Rodeo (AquaPro) have been conducted on non-target species such as birds, deer, mice, voles, chipmunks, and various aquatic organisms. Based on an extensive review, the EPA has determined that the effects of the active ingredient in Accord XRT II and Rodeo (AquaPro) on birds, mammals, fish and invertebrates are minimal.” (excerpt from Dow AccordXRTII document attached with internal references to specific studies).
- Are there any restoration/rehabilitation plans in the event that there is a significant amount of incidental impacts? If so, is there funding available if this is needed? If there are significant affects to surrounding non-target vegetation we would pursue replanting any jurisdictional marsh species that were negatively affected and that do not display the capacity to regenerate naturally. We have \$5000 from a TERN (The Environmental Resources Network) grant that could be applied towards purchasing restoration species.

- Has there been any other coordination outside of this Department on this project? **Yes with Game Management, with USFWS on adjacent Wolf Island that has scattered saltcedar, with TERN, and the two agencies listed below.**
- If you haven't already coordinated with EPD, Bruce Foisy would be a good point of contact due to the potential water and air impacts associated with this project. His email is bruce.foisy@dnr.ga.gov. Please copy us on any correspondence with EPD. **Yes, got an initial response but not a final judgement from EPD yet.**
- These areas are old dredge spoil sites of the Army Core of Engineers (ACOE), the project is located on tracts 29-B, 30-A, 32-A, and 36-A. Permission will need to be obtained from the ACOE. Kelie Moore has suggested Bill Bailey as a point of contact for the ACOE. His contact information is [\(912\) 652-5781](tel:9126525781) and william.g.bailey@USACE.army.mil. Please copy us on any correspondence. **Yes, I got an initial response but not a final permission yet.**
- Is there a management plan for the areas post treatment? **We intend to practice an adaptive management approach adjusting follow-up management in order to achieve final desired conditions. These desired conditions would be complete control of saltcedar on these sites and a stable native species composition. If aerial herbicide application is applied in late summer / fall 2017 we intend to follow up with a prescribed fire either in winter 2017/2018 or 2018/2019 if conditions are right. Game management staff would write the burn plan for these areas. We will also conduct pre and post herbicide treatment monitoring via drone. We will continue drone monitoring of site vegetation composition until a stable native community is achieved. Periodic future monitoring will be conducted to insure salt cedar does not recolonize these sites. There are adjacent marsh hammocks managed by the USFWS on Wolf Island NWR that we will coordinate hand treatment of to achieve control of this species in the entire area.**
- Will this treatment affect commercial and recreational fishing in the area? If so, how will the public be notified? **No. See The Weed Control Methods Handbook, The Nature Conservancy, Tu et al., 2001 and excerpt from bullet 3.**

Once this additional information has been provided and reviewed, you will be notified if any additional information/items are needed. If you have any questions or comments, please let me know. We can schedule a meeting to discuss things further if need be.

Sincerely,

Jordan Dodson

Coastal Permit Coordinator

Coastal Resources Division

[\(912\) 262-3109](tel:9122623109) | M: [\(912\) 266-0642](tel:9122660642)

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From: Leonard, Eamonn
Sent: Thursday, June 29, 2017 3:47 PM
To: Dodson, Jordan <jordan.dodson@dnr.ga.gov>
Cc: Stockel, Skye <Skye.Stockel@dnr.ga.gov>
Subject: RE: Salt Cedar permit info

I just got a call from the aerial applicator and he is looking at a window of spraying that is earlier than initially thought. We are shooting for mid-to late July. This is due to other spraying that they are coordinating with Game Management in the area.

Eamonn

From: Dodson, Jordan
Sent: Wednesday, June 28, 2017 3:33 PM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Cc: Stockel, Skye <Skye.Stockel@dnr.ga.gov>
Subject: RE: Salt Cedar permit info

Hi Eamonn,

Thank you for getting us this information so quick. We will start a historical review on similar projects, and may need to coordinate with Karl on this when he returns to the office. If you have any other questions, please let us know.

Sincerely,

Jordan Dodson
Coastal Permit Coordinator
Coastal Resources Division
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From: Leonard, Eamonn
Sent: Wednesday, June 28, 2017 2:45 PM
To: Dodson, Jordan <jordan.dodson@dnr.ga.gov>; Stockel, Skye <Skye.Stockel@dnr.ga.gov>
Subject: Salt Cedar permit info

Skye & Jordan, There are several areas (former dredge spoil islands) along the ICW in McIntosh County that have the invasive Tamarisk (or Salt Cedar – *Tamarix cannariensis*) on them that I would like to manage. I have contacted a contractor who would ideally spray these from a helicopter this Fall or late summer. Attached is the estimate from the applicator with the herbicide prescription. They suggest using an aquatic rated herbicide combo of Habitat (Imazapyr) and AquaPro. I have also attached the herbicide label for both of these. I am potentially increasing the acreage from the 142 acres in the proposal to 176 acres. While the applicator has a certain parameters like wind and herbicide application droplet size to reduce drift and collateral damage there is will likely be some native marsh edge species that will be initially affected. The Tamarisk tends to grow in these communities and crowds out the native species component anyways.

This is a restoration project to remove these large patches of invasive species from the mouth of the Altamaha River. These are the source population for many of the Tamarisk we are seeing in the area. We would ideally monitor these site post treatment and adjusting our follow up management in order to get these areas free of Tamarisk and eventually colonized by native species. I believe these islands were created in the 60's to early 70's from what I can gather from historical photos. With the exception of Cow Island which looks like fresh dredge material in a 1942 aerial photo dataset.

Let me know if you need more information from me to obtain the correct permit so we can move forwards.

Eamonn Leonard
Natural Resources Biologist, Nongame Conservation

Wildlife Resources Division
[\(912\) 262-3150](tel:(912)262-3150) | M: [\(912\) 223-9852](tel:(912)223-9852)

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Dodson, Jordan

From: Vick, Alice
Sent: Thursday, August 3, 2017 12:16 PM
To: Leonard, Eamonn; Dodson, Jordan
Subject: RE: Pesticide Permit question from EPD

Yes, That's what I wanted to hear.

From: Leonard, Eamonn
Sent: Thursday, August 03, 2017 12:14 PM
To: Dodson, Jordan; Vick, Alice
Subject: RE: Pesticide Permit question from EPD

Alice, does this satisfy the GA EPD requirements?

From: Chip Davis [<mailto:jmdavisiv@gmail.com>]
Sent: Tuesday, July 25, 2017 4:46 PM
To: Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov>
Cc: Dodson, Jordan <jordan.dodson@dnr.ga.gov>; John Crabb <Jcrabb37@gmail.com>; Vick, Alice <Alice.Vick@dnr.ga.gov>
Subject: Re: Pesticide Permit question from EPD

Eamonn,

I assume you are referring to the NPDES pesticide discharge permit. Yes, Estate Management does have an NPDES permit filed with the state of Georgia. We can provide a copy if requested.

Chip

On Tue, Jul 25, 2017 at 3:24 PM Leonard, Eamonn <Eamonn.Leonard@dnr.ga.gov> wrote:

Chip, I have a question from the GA EPD folks. They just want to make sure that Estate Management Services has a pesticide permit to apply in state waters since the application of herbicide will be on the upland and banks adjacent to salt marsh. I have copied them in this e-mail.

Thanks,

Eamonn

--

Chip Davis
Director, Contract Services
jmdavisiv@gmail.com
843-872-1522

Dodson, Jordan

From: Leonard, Eamonn
Sent: Thursday, August 3, 2017 12:23 PM
To: BAILEY, William G CIV USARMY CESAS (US)
Cc: Dodson, Jordan; Lafond, Roger E Jr CIV USARMY CESAS (US); Dayan, Nathan S CIV USARMY CESAS (US)
Subject: RE: Salt Cedar treatments on Altamaha R

Great thank you. We have contacted the McIntosh Tax Assessors office and they list both the Northern and Southern parts as State of Georgia. We knew the southern portion was being claimed by a private individual and our legal dept. is working on that. We will remove those two sites from our proposed spraying operations until we can get the ownership issues resolved. If you have any records on either parcel that you could share I would appreciate it.

Thanks,

Eamonn

From: BAILEY, William G CIV USARMY CESAS (US) [mailto:William.G.Bailey@usace.army.mil]
Sent: Wednesday, July 26, 2017 8:05 AM
To: Leonard, Eamonn
Cc: Dodson, Jordan ; Lafond, Roger E Jr CIV USARMY CESAS (US) ; Dayan, Nathan S CIV USARMY CESAS (US)
Subject: RE: Salt Cedar treatments on Altamaha R

The most northern and the southern sites that you identified are owned by private individuals. You would need approval from those land owners to treat vegetation at those properties (5-acre site at the north and 28-acre site at south).

Savannah District approves your use of herbicides to kill tamarisk on the four middle sites that you identified (38-acre, 73-acre, 7-acre, and 27-acre). The treatment would support USACE's easements for dredged material placement on those sites.

William Bailey
Chief, Planning Branch

From: Leonard, Eamonn [mailto:Eamonn.Leonard@dnr.ga.gov]
Sent: Tuesday, July 25, 2017 3:07 PM
To: BAILEY, William G CIV USARMY CESAS (US) <William.G.Bailey@usace.army.mil>
Cc: Dodson, Jordan <jordan.dodson@dnr.ga.gov>
Subject: [Non-DoD Source] RE: Salt Cedar treatments on Altamaha R

Bill, I wanted to see if there was an update on this project? Our Bird biologist Tim Keyes in the coastal DNR Nongame office works with the USACE and has an MOU with the Corps using the same methods to control vegetation in the bird island in the Brunswick Harbor. He is going to send me the MOU when he is back in the office tomorrow and can forward that on if it would help.

Thanks,

Eamonn

From: Leonard, Eamonn [<mailto:Eamonn.Leonard@dnr.ga.gov>]
Sent: Wednesday, July 12, 2017 11:15 AM
To: BAILEY, William G CIV USARMY CESAS (US) <William.G.Bailey@usace.army.mil>
Cc: Dodson, Jordan <jordan.dodson@dnr.ga.gov>
Subject: [Non-DoD Source] Salt Cedar treatments on Altamaha R

Bill, I am a plant biologist with GA DNR Nongame Conservation and mainly work on invasive species projects. I am proposing to treat several large areas of Salt Cedar (*Tamarix cannariensis*) on former dredge spoil islands in the mouth of the Altamaha River (see attached map). I am working with the GA DNR CRD permitting staff to make sure I have everything in order before we move forward. Since these are old dredge spoil sites of the US Army Core of Engineers it is my understanding that I need permission from the USACE before we can move forward. I would be working with a licensed aerial herbicide applicator. They propose to apply 64 ounces of Habitat blended with 32 ounces of AquaPRO per acre. Both are aquatic rated herbicides. Let me know if you need additional information from me on this project.

Thanks,

Eamonn Leonard
Natural Resources Biologist, Nongame Conservation

Wildlife Resources Division

(912) 262-3150 | M: (912) 223-9852

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2018 Tamarisk Treatment Altamaha R. Delta



5 acres

37 acres

Wolf Island NWR



73 acres

Rockdedundy Island

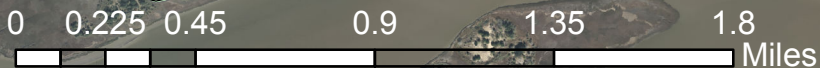
7 acres

26 acres

Cow Island 26 acres

 Tamarisk Treated area
 Tamarisk Treated area + 20'buffer


GEORGIA
 DEPARTMENT OF NATURAL RESOURCES
WILDLIFE RESOURCES DIVISION



AquaPro®

Herbicide

SPECIMEN



GROUP 9 HERBICIDE

For control of annual and perennial weeds and woody plants in natural and production (plantations), forests for site preparation, mid-rotation release treatments, timber stand improvement activities, noncrop sites including industrial sites, rights-of-way (including roadsides, electric utility and communication transmission lines, pipelines, railroads, airports), irrigation and drainage ditches, canals, reservoirs, natural areas (including wildlife management areas, wildlife openings, wildlife habitats and refuges, parks and recreational areas, campgrounds, trailheads and trails), rangeland, and in and around aquatic sites and wetlands; also for perennial grass release, and grass growth suppression and grazed areas on these sites.

Active Ingredient:

glyphosate ¹ N-(phosphonomethyl)glycine, isopropylamine salt.....	53.8%
Other Ingredients.....	46.2%
Total.....	100.0%

¹Contains 5.4 lb per gallon glyphosate, isopropylamine salt (4 lb per gallon glyphosate acid).

Keep Out of Reach of Children
CAUTION

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Produced for: SePRO Corporation - 11550 N. Meridian St. - Ste. 600 - Carmel, IN 46032

EPA Reg. No. 62719-324-67690

FPL20160325

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

CAUTION

Harmful If Inhaled

Avoid breathing spray mist. Remove contaminated clothing and wash before reuse. Wash thoroughly with soap and water after handling.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

ENGINEERING CONTROLS

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

USER SAFETY RECOMMENDATIONS

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

FIRST AID

If inhaled:	<ul style="list-style-type: none"> • Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for further treatment advice.
--------------------	---

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call **INFOTRAC at 1-800-535-5053.**

ENVIRONMENTAL HAZARDS

Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

In case of leak or spill, soak up and remove to a landfill.

PHYSICAL OR CHEMICAL HAZARDS

Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined steel containers.

Do not mix, store or apply this product or spray solutions of this product in galvanized steel or unlined steel (except stainless steel) containers or spray tanks. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas, which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying.

This is an end-use product. SePRO Corporation does not intend and has not registered it for reformulation.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Coveralls
- Chemical-resistant gloves made of any waterproof material
- Shoes plus socks

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries or greenhouses. Keep people and pets off treated areas until spray solution has dried.

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STORAGE AND DISPOSAL

Do not contaminate water, food, feed or seed by storage or disposal.

Pesticide Storage: Store above 10°F (-12°C) to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68°F (20°C) for several days to redissolve and roll or shake container or recirculate in mini-bulk containers to mix well before using.

Pesticide Disposal: Wastes resulting from use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, state or local procedures.

Nonrefillable containers 5 gallons or less:

Container Handling: Nonrefillable container. Do not reuse or refill this container.

Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Nonrefillable containers 5 gallons or larger:

Container Handling: Nonrefillable container. Do not reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Product Information

This product is a broad spectrum, systemic, postemergent herbicide with no soil residual activity. It is intended for control of annual and perennial weeds and woody plants and brush. It is formulated as a water soluble liquid.

Time to Symptoms: The active ingredient in this product moves through the plant from the point of foliage contact to and into the root system. Visible effects are a gradual wilting and yellowing of the plant that advances to complete browning of above ground growth and deterioration of underground plant parts. Visible effects on most annual weeds occur within two to four days, but on most perennial weeds visible effects may not occur for seven days or more. Extremely cool or cloudy weather following treatment may slow the activity of this product and delay development of visual symptoms.

Stage of Weeds: Annual weeds are easiest to control when they are small. Best control of most perennial weeds is obtained when treatment is made at late growth stages approaching maturity. Refer to the annual, perennial and woody brush and trees rate tables for specific weeds. Always use the higher rate within the rate range for heavy or dense weed growth or when weeds are growing in an undisturbed (noncultivated) area. When treating weeds with disease or insect damage, weeds heavily covered with dust, or weeds under poor growing conditions, reduced weed control may result.

Cultural Considerations: Reduced control may result when applications are made to annual or perennial weeds that have been mowed, grazed, or cut, and have not been allowed to regrow to the specified stage for treatment.

Rainfastness: Heavy rainfall soon after application may wash off this product from the foliage and a repeat application may be required for adequate control.

Spray Coverage: For best results, spray coverage should be uniform and complete.

Mode of Action: The active ingredient in this product inhibits an enzyme. This enzyme is found only in plants and microorganisms that are essential to forming specific amino acids.

No Soil Activity: Weeds must be emerged at the time of application to be controlled by this product. Weeds germinating from seed after application will not be controlled. Unemerged plants arising from unattached underground rhizomes or rootstocks of perennials will not be affected by the herbicide and will continue to grow.

Biological Degradation: Degradation of this product is primarily a biological process carried out by soil microbes.

Maximum Application Rates: The maximum application rates specified in this label are given in units of volume, either fluid ounces, pints or quarts, of this product per acre. The maximum allowed application rates apply to this product combined with the use of any and all other glyphosate- or sulfosate-containing herbicides, either applied separately or in a tank mix, on the basis of total pounds of glyphosate (acid equivalents) per acre. If more than one glyphosate- or sulfosate-containing product is applied to the same site within the same year, ensure that the total of pounds acid equivalent glyphosate does not exceed the maximum allowed.

Do not apply more than 8 quarts of this product (8 lb glyphosate acid) per acre per year for all use sites listed on this label.

IMPORTANT: When using this product, unless otherwise specified, mix with a surfactant, such as a nonionic surfactant containing 80% or greater active ingredient. For conifer release (pine release) use only surfactants that are approved for conifer release and specified on the surfactant label as safe for use in conifer release (pine release). Use of this product without surfactant will result in reduced herbicide performance. Ammonium sulfate, drift control additives, or dyes and colorants may be used. See Mixing Directions and the surfactant manufacturer's label for more information.

Grazing Restrictions: This product may be used to treat undesirable vegetation in utility rights-of-way that pass through pastures, rangeland, and forestry sites that are being grazed. For tank mix applications, comply with all restrictions appearing on the tank mix product label.

Except for lactating dairy animals there are no grazing restrictions following the labeled applications of this product.

For lactating dairy animals there are no grazing restrictions for the following labeled applications of this product:

- Where the spray can be directed onto undesirable woody brush and trees, including in handgun spray to wet or low volume directed spray treatments.
- For tree injection of frill applications and for cut stump treatments.

For broadcast applications, observe the following restrictions for lactating dairy animals:

- For application rates between 4.5 and 7.5 quarts per acre, no more than 15 percent of the available grazing area may be treated.
- For application rates less than 4.5 quarts per acre, no more than 25 percent of the available grazing area may be treated.

These restrictions do not apply to pastures, rangeland or forestry sites outside of utility rights-of-way.

Herbicide Resistance Management

Glyphosate, the active ingredient in this product, is a group 9 herbicide (inhibitor of EPSP synthase). Some naturally occurring weed biotypes that are tolerant (resistant) to glyphosate may exist due to genetic variability in a weed population. Where resistant biotypes exist, the repeated use of herbicides with the same mode of action can lead to the selection for resistant weeds. Certain agronomic practices reduce the likelihood that resistant weed populations will develop, and can be utilized to manage weed resistance once it occurs.

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To delay the selection for glyphosate resistant weeds, use the following practices:

- Scout fields before and after application to detect weed escapes or shifts in weed species.
- Start with a clean field by applying a burndown herbicide or by tillage.
- Control weeds early when they are small.
- Add other herbicides, including a selective and/or a residual herbicide, and cultural practices, including tillage or crop rotation, where appropriate.
- Use the application rate for the most difficult to control weed in the field. Do not tank mix with other herbicides that reduce this product's efficacy through antagonism or with ones that encourage application rates of this product below those specified on this label.
- Control weed escapes and prevent weeds from setting seeds.
- In situations where resistant weeds are a problem, before moving from one site to another, clean equipment to minimize the spread of weed seeds or plant parts.
- Use new commercial seed that is as free of weed seed as possible.
- Report any incidence of repeated non-performance of this product against a particular weed species to the local retailer, county extension agent, or SePRO Corporation representative.

The following good agronomic practices are recommended to reduce the spread of confirmed glyphosate-resistant biotypes:

- Tank mix this product or apply it sequentially with an appropriately labeled herbicide with a different mode of action to achieve control if a naturally occurring resistant biotype is present in the site.
- Cultural and mechanical control practices, including crop rotation or tillage, may also be used.
- To control weed escapes, including resistant biotypes, before they set seed, scout treated sites after applying this product.
- Thoroughly clean equipment before leaving any site known to contain resistant biotypes.

Because the presence of glyphosate resistance in weed populations is difficult to detect prior to use, SePRO Corporation accepts no liability for any losses that may result from the failure of this product to control glyphosate-resistant weeds.

Attention

Avoid contact of herbicide with foliage, green stems, exposed non-woody roots or fruit of crops, desirable plants and trees, because severe injury or destruction may result.

AVOID DRIFT. Use extreme care when applying this product to prevent injury to desirable plants and crops.

Do not allow the herbicide solution to mist, drip, drift or splash onto desirable vegetation since minute quantities of this product can cause severe damage or destruction to the crop, plants or other areas on which treatment was not intended. The likelihood of injury occurring from the use of this product increases when winds are gusty, as wind velocity increases, when wind direction is constantly changing, or when there are other meteorological conditions that favor spray drift. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) which are likely to drift. **Avoid applying at excessive speed or pressure.**

NOTE: Use of this product in any manner not consistent with this label may result in injury to persons, animals or crops, or other unintended consequences. Keep container closed to prevent spills and contamination.

Spray Drift Management

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment- and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions. The following drift management requirements must be followed to avoid off-target drift movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications, public health uses or to applications using dry formulations.

- The distance of the outermost nozzles on the boom must not exceed $\frac{3}{4}$ the length of the wingspan or rotor.
- Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

Where states have more stringent regulations, they must be observed.

The applicator must be familiar with and take into account the information covered in the Aerial Drift Reduction Advisory.

Aerial Drift Reduction Advisory

This section is advisory in nature and does not supersede the mandatory label requirements.

Importance of Droplet Size: The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent adverse effects from drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

Controlling Droplet Size:

- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Do not exceed the nozzle manufacturer's recommended pressures. Use the lower spray pressures for the nozzle. Higher pressure reduces droplet size and does not improve canopy penetration. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- **Number of Nozzles** - Use the minimum number of nozzles that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is parallel to the airstream produces larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

Boom Length: For some use patterns, reducing the effective boom length to less than $\frac{3}{4}$ of the wingspan or rotor length may further reduce drift without reducing swath width.

Application Height: Applications must not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

Swath Adjustment: When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance must increase with increasing drift potential (higher wind, smaller drops, etc.).

Wind: Drift potential is lowest between wind speeds of 2 to 10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Do not apply this product when wind speed is below 2 mph due to variable wind direction and high inversion potential. Note: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

Temperature and Humidity: When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

Temperature Inversions: Do not apply this product during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a connected cloud (under low wind conditions) indicates an inversion, while smoke that moves upwards and rapidly dissipates indicates good vertical air mixing.

Sensitive Areas: Apply this pesticide only when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

Mixing Directions

Use only clean, stainless steel, fiberglass, plastic or plastic-lined steel containers to mix, store and apply spray solutions of this product. Do not mix, store or apply this product or spray solutions of this product in

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galvanized steel or unlined steel, except stainless steel, containers or spray tanks.

Eliminate any risk of siphoning the contents of the tank mix back into the carrier source while mixing. Use approved anti-back-siphoning devices where required by state or local regulations.

Note: Reduced results may occur if water containing soil is used, including visibly muddy water or water from ponds and ditches that is not clear.

AquaPro – Alone

This product mixes readily with water. Mix spray solutions of this product as follows:

1. Fill the mixing or spray tank with the required amount of clean water.
2. Add the specified amount of this product and nonionic surfactant near the end of the filling process and mix well.
3. During mixing and application, foaming of the spray solution may occur. To prevent or minimize foaming, avoid the use of mechanical agitators, terminate by-pass and return lines at the bottom of the tank and, if needed, use an approved anti-foam or defoaming agent.

AquaPro – Tank Mix

This product does not provide residual weed control. For residual weed control or an alternate mode of action, tank mix this product with other herbicides. Read and carefully observe the precautionary statements and all other information appearing on the labels of all herbicides used. Use according to the most restrictive label directions for each product in the mixture.

Under certain conditions, at certain growth stages, and/or under other circumstances, some tank mix products have the potential to cause injury. Read all labels for products used in the tank mix prior to using them to determine the potential for crop injury.

Tank mixing with other herbicides, insecticides, fungicides, micronutrients or foliar fertilizers may result in reduced weed control or injury. Do not use these products in applications with this product unless otherwise noted in this label. Buyer and all users are responsible for all loss or damage in connection with the use or handling of mixtures of this product with herbicides or other materials that are not expressly specified in this labeling. Mixing this product with herbicides or other materials not specified on this label may result in reduced performance.

The user is responsible for ensuring that the specific application being made is included on the label of the product used in the tank mix when a tank mixture with a generic active ingredient, including 2,4-D, atrazine, dicamba, diuron, or pendimethalin, is used.

Read all individual product labels for all products in the tank mix and observe all precautions and restrictions on the label. Use according to the most restrictive directions for each product in the tank mix. Always predetermine the compatibility of all tank mix products, together in the carrier, by mixing small proportional quantities in advance of mixing and applying them to the use site. Add the tank mix product to the tank as directed by the label. Maintain agitation and add the required amount of this product.

Maintain good agitation at all times until the contents in the tank are sprayed. If the mixture is allowed to settle, thorough agitation is required to resuspend the mixture before spraying resumes. Keep the bypass line on or near the bottom of the tank to minimize foaming. The screen size in the nozzle or line strainers must be no finer than 50 mesh.

Note: If tank mixing with Garlon® 3A herbicide, ensure that Garlon 3A is well mixed with at least 75 percent of the total spray volume before adding this product to the spray tank to avoid incompatibility.

Hand-Held Sprayers

Prepare the desired volume of spray solution by mixing the amount of this product in water as shown in the following table:

Nonionic Surfactant

When using this product, unless otherwise specified, mix with a surfactant, including a nonionic surfactant containing 80% or more active ingredient. For conifer release (pine release), use only surfactants that are approved for conifer release and specified on the surfactant label as safe for use in conifer release. Using this product without surfactant will result in reduced herbicide performance.

Colorants or Dyes

Agriculturally-approved colorants or marking dyes may be added to this product. Colorants or dyes used in spray solutions of this product may reduce performance, especially at lower rates or dilutions. Use colorants or dyes according to the manufacturer's directions.

Drift Control Additives

Drift control additives may be used with all equipment types except wiper applicators, sponge bars and CDA equipment. When a drift control additive is used, read and carefully observe the precautionary statements and all other information appearing on the additive label.

Application Equipment and Application Methods

Chemigation: Do not apply this product through any type of irrigation system.

Apply spray solutions in properly maintained and calibrated equipment capable of delivering desired volumes.

This product may be applied with the following application equipment and application methods.

Aerial Application

Equipment: Fixed wing and helicopter

Do not apply this product using aerial spray equipment except under conditions as specified within this label.

Avoid drift. Do not apply when winds are gusty or under any other condition which favors drift. Drift may cause damage to any vegetation contacted to which treatment is not intended. To prevent injury to adjacent desirable vegetation, maintain appropriate buffer zones.

Do not directly apply to any body of water.

Use the specified rates of this herbicide in 3 to 25 gallons of water per acre unless otherwise specified on this label. Refer to the specific use directions of this label for volumes and application rates.

Coarse sprays are less likely to drift; therefore, do not use nozzles or nozzle configurations that dispense spray as fine spray droplets. Do not angle nozzles forward into the airstream and do not increase spray volume by increasing nozzle pressure. A drift control additive may be used. When a drift control additive is used, carefully read and observe the precautionary statements and all other information specified on the additive label.

Ensure uniform application. To avoid streaked, uneven or overlapped application, use appropriate marking devices.

Aerial Application Restrictions in California Only

AVOID DRIFT: Do not apply when winds are gusty or under any other condition which favors drift. Drift may cause damage to any vegetation contacted to which treatment is not intended. To prevent injury to adjacent desirable vegetation, appropriate buffer zones must be maintained.

Do not aerially apply this product in a tank mix with dicamba in California.

Make aerial applications with helicopter only. To ensure uniform application, avoid streaking, uneven, or overlapped application, and use appropriate marking devices.

Use the following guidelines when aerial applications are made near crops or desirable perennial vegetation after budbreak and before total leaf drop, and/or near other desirable vegetation or annual crops:

- Do not apply this product using aerial equipment in residential areas.
- Do not apply within 100 feet of all desirable vegetation or crop(s).
- If wind up to 5 miles per hour is blowing toward desirable vegetation or crop(s), do not apply within 500 feet of the desirable vegetation or crop(s).
- Winds blowing from 5 to 10 miles per hour toward desirable vegetation or crop(s) may require buffer zones in excess of the 500-foot minimum buffer.
- Do not apply when winds are in excess of 10 miles per hour or when inversion conditions exist.

Use only coarse sprays to minimize drift. Do not use nozzles or nozzle configurations that dispense spray as fine spray droplets. Do not angle nozzles forward into the airstream and do not increase spray volume by increasing nozzle pressure above the manufacturer's directions.

Thoroughly wash aircraft, especially landing gear, after each day of spraying to remove residues of this product accumulated during spraying or from spills. Prolonged exposure of this product to uncoated steel surfaces may result in corrosion and possible failure of the part. Landing gear is most susceptible. The maintenance of an organic coating (paint) which meets aerospace specification MIL-C-38413 may prevent corrosion.

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Additional Limitations For Aerial Application In Fresno County, California Only

Always read and follow the label directions and precautionary statements for all products used in the aerial application.

The following information applies only from February 15 through March 31 within the following boundaries of Fresno County, California:

North: Fresno County line
 South: Fresno County line
 East: State Highway 99 West

Observe the following directions to minimize off-site movement during aerial application of this product. Minimization of off-site movement is the responsibility of the grower, Pest Control Advisor and aerial applicator.

Written Directions

Written directions MUST be submitted by or on behalf of the applicator to the Fresno County Agricultural Commissioner 24 hours prior to the application. These written directions MUST state the proximity of surrounding crops and that conditions of each manufacturer's product label and this label have been satisfied.

Aerial Applicator Training and Equipment

Aerial application of this product is limited to pilots who have successfully completed a Fresno County Agricultural Commissioner and California Department of Pesticide Regulation approved training program for aerial application of herbicides. All aircraft must be inspected, critiqued in flight and certified at a Fresno County Agricultural Commissioner approved fly-in. Test and calibrate spray equipment at intervals sufficient to insure that proper rates of herbicides and adjuvants are being applied during commercial use. Applicator must document such calibrations and testing. Demonstration of performance at Fresno County Agricultural Commissioner approved fly-ins constitutes such documentation, or other written records showing calculations and measurements of flight and spray parameters acceptable to the Fresno County Agricultural Commissioner.

Applications at Night – Do not apply this product by air earlier than 30 minutes prior to sunrise and/or later than 30 minutes after sunset without prior permission from the Fresno County Agricultural Commissioner.

To report known or suspected misuse of this product, call 1-800-332-3111.

For additional information on the proper aerial application of this product in Fresno County, call 916-784-1718.

Aquatic and Noncrop Sites

When this product is applied under the conditions described, it controls or partially controls the labeled weeds growing in the following industrial, recreational, and public areas or other similar sites.

Aquatic sites includes all bodies of fresh and brackish water that may be flowing, nonflowing, or transient including lakes, rivers, streams, ponds, seeps, irrigation and drainage ditches, canals, reservoirs, estuaries and similar sites.

If aquatic sites are present in the noncrop area and are part of the intended treatment, read and observe the following directions:

- This product does not control plants that are completely submerged or have a majority of their foliage under water.
- There is no restriction on the use of treated water for irrigation, recreation, or domestic purposes.
- Consult local and state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.
- To make aquatic applications around and within ½ mile of active potable water intakes, the water intake must be turned off for a minimum period of 48 hours after the application. The water intake may be turned on prior to 48 hours if the glyphosate level in the intake water is below 0.7 parts per million as determined by laboratory analysis. These aquatic applications may be made only in those cases where there are alternative water sources or holding ponds that would permit the turning off of an active potable water intake for a minimum period of 48 hours after the application.

Restrictions:

- Do not apply this product within ½ mile upstream of an active potable water intake in flowing water (i.e., river stream, etc.), or within ½ mile of an active potable water intake in a standing body of water, such as a lake, pond, or reservoir.

Ground Application

Equipment: Boom or boomless systems, pull-type sprayer, floaters, pick-up sprayers, spray coupes and other ground broadcast equipment.

Use the specified rates of this product in 3 to 40 gallons of water per acre as a broadcast spray unless otherwise specified on this label. As density of weeds increases, increase the spray volume within the rate range to ensure complete coverage. Carefully select proper nozzles to avoid spraying a fine mist. For best results with ground application equipment, use flat fan nozzles. Check for even distribution of spray droplets.

Broadcast Application for Control of Undesirable Competitive Vegetation in Larch (*Larix* spp.) Plantations in Maine

Apply this product to control or reduce competition from undesirable vegetation in Larch (*Larix* spp.) plantations in the state of Maine.

Application Timing

Apply only after lignification has occurred in 50% or more of the current year's terminal growth.

Application Directions

Broadcast Spray: Use 1 to 3 quarts of this product per acre. Apply in a total spray volume of 10 to 60 gallons per acre using ground equipment or 5 to 15 gallons per acre if applied aerially. Up to 30 fl oz of Entry II surfactant may be added.

Directed Sprays: This product may be applied as a directed spray for competitive release of larch. Avoid contact of spray drift, mist or drips with foliage, green bark or non-woody surface roots of desirable plants. See Application Equipment and Application Methods of the product label.

Injury to larch may occur, especially where spray patterns overlap or higher rates of this product or surfactant were applied. Damage can be accentuated if application is made when larch is actively growing or is under stress. Make applications only if some level of injury to larch is acceptable.

Hand-Held and High-Volume Including Backpack Application

Equipment: Knapsack and backpack sprayers, pump up pressure sprayers, handguns, hand wands, mistblowers, lances, and other hand-held and motorized spray equipment used to direct the spray onto weed foliage. Note: This product is not registered in Arizona or California for use in mistblowers.

Apply to foliage of vegetation to be controlled. Do not spray to the point of runoff for applications made on a spray to wet basis. Use coarse sprays only. For best results, cover the top half of the plant and at least half of the total foliage. To ensure adequate spray coverage, spray both sides of large or tall woody brush and trees, when foliage is thick and dense, or where there are multiple sprouts.

High Volume Sprays: Prepare a ¼ to 2 percent solution of this product in water, add a nonionic surfactant and apply to foliage of vegetation to be controlled. For specific rates of application and instructions for control of various annual and perennial weeds, see the Weeds Controlled section.

Make applications on a spray to wet basis with uniform and complete spray coverage. Do not spray to point of runoff.

Low Volume Directed Sprays: This product may be used as a 5 to 10 percent solution in low volume directed sprays for spot treatment of trees and brush. This treatment method is most effective in areas where there is a low density of undesirable trees or brush. If a straight stream nozzle is used, start the application at the top of the targeted vegetation and spray from top to bottom in a lateral zigzag motion. Ensure that at least 50 percent of the leaves are contacted by the spray solution. For flat fan and cone nozzles and with hand-directed mist blowers, mist the application over the foliage of the targeted vegetation. Treat small, open-branched trees only from one side. If the foliage is thick or there are multiple root sprouts, apply from several sides to ensure adequate spray coverage. Prepare the desired volume of spray solution by mixing the amount of this product in water as shown in the following table.

Spray Solution:

Desired Volume	Amount of This Product								
	0.5	0.75	1	1.25	1.5	2	5	8	10
1 gal	½ fl oz	1 fl oz	1½ fl oz	1¾ fl oz	2 fl oz	2½ fl oz	6½ fl oz	10¼ fl oz	13 fl oz
25 gal	1 pt	1½ pt	1 qt	1¼ qt	1½ qt	2 qt	1¼ gal	2 gal	2½ gal
100 gal	2 qt	3 qt	1 gal	1¼ gal	1½ gal	2 gal	5 gal	8 gal	10 gal

2 Tablespoons = 1 fl oz

For best results when using knapsack sprayers, mix the specified amount of product with water in a larger container. Fill the knapsack sprayer with the solution and add the correct amount of surfactant.

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Selective Equipment

Equipment: Recirculating sprayers, shielded and hooded sprayers, wiper applicators and sponge bars.

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Do not contact desirable vegetation with herbicide. Droplets, mist, foam, or splatter of the herbicide settling on desirable vegetation is likely to result in discoloration, stunting or destruction.

Better results are obtained when more of the weed is exposed to the herbicide solution. Weeds not contacted by the herbicide solution will not be affected. This may occur in dense clumps, severe infestations, or when the height of weeds varies so that not all weeds are contacted. If this occurs, repeat treatment may be necessary.

Shielded and Hooded Applicators: A shielded or hooded applicator directs the herbicide solution onto weeds while shielding desirable vegetation from the herbicide. Use nozzles that provide uniform coverage within the treated area. Keep shields on these sprayers adjusted to protect desirable vegetation. **Exercise extreme care to avoid contact of the herbicide with desirable vegetation.**

Wiper Applicators: Wiper applicators are devices that physically wipe appropriate amounts of this product directly onto the weed. Equipment must be designed, maintained and operated to prevent the herbicide solution from contacting desirable vegetation.

Adjust wiper applicators used over the top of desirable vegetation so that the wiper contact point is at least 2 inches above the desirable vegetation. Better results are obtained when more of the weed is exposed to the herbicide solution. Weeds should be a minimum of 6 inches above the desirable vegetation. Adjust the applicator height to ensure adequate contact with weeds as weeds not contacted by the herbicide solution will not be affected. Poor contact may occur when weeds are growing in dense clumps, in severe weed infestations, or when weed height varies dramatically. If this occurs, repeat treatment may be necessary.

Operate this equipment at ground speeds no more than 5 mph. Performance may be improved by reducing speed in areas of heavy weed infestations to ensure adequate wiper saturation. Better results may be obtained if two applications are made in opposite directions.

Droplets, mist, foam, or splatter of the herbicide settling onto desirable vegetation may result in discoloration, stunting or destruction. Avoid leakage or dripping onto desirable vegetation. Adjust height of applicator to ensure adequate contact with weeds. Keep wiping surfaces clean. Be aware that on sloping ground the herbicide solution may migrate, causing dripping on the lower end and drying of the wicks on the upper end of a wiper applicator.

Do not use wiper equipment when weeds are wet.

Mix only the amount of solution to be used during a one-day period as reduced activity may result from use of leftover solutions. Clean wiper parts by thoroughly flushing with water immediately after using this product.

For best results, use a nonionic surfactant at a rate of 10 percent by volume of total herbicide solution for all wiper applications.

Injection Systems

Equipment: Aerial or ground injection sprayers.

This product may be used in aerial or ground injection spray systems. It may be used as a liquid concentrate or diluted prior to injecting into the spray stream. Do not mix this product with the concentrate of other products when using injection systems.

Controlled Droplet Applicator (CDA)

Equipment: Hand-held or boom-mounted applicators that produce a spray consisting of a narrow range of droplet sizes.

The rate of this product applied per acre by vehicle-mounted CDA equipment must not be less than the amount specified on this label when applied by conventional broadcast equipment. For vehicle-mounted CDA equipment, apply 3 to 15 gallons of water per acre.

For the control of annual weeds with hand-held CDA units, apply a 20 percent solution of this product at a flow rate of 2 fl oz per minute and a walking speed of 1.5 mph (1½ pints of product per acre). For control of perennial weeds, apply a 20 to 40 percent solution of this product at a flow rate of 2 fl oz per minute and a walking speed of 0.75 mph (3 to 6 pints of product per acre).

CDA equipment produces a spray pattern that is not easily visible. Exercise extreme care to avoid spray or drift contacting the foliage or any other green tissue of desirable vegetation as damage or destruction may result.

Use Sites

Use this product in noncrop areas, including airports, apartment complexes, aquatic sites, Christmas tree farms, commercial sites, Conservation Reserve Program (CRP) areas, ditch banks, driveways, dry ditches, dry canals, fencerows, golf courses, greenhouses, habitat management, industrial areas, lumber yards, manufacturing sites, municipal sites, natural areas, office complexes, ornamentals, parking areas, parks, pastures, petroleum tank farms and pumping installations, plant nurseries, public areas, railroads, rangeland, recreation areas, utility rights-of-way, roadsides, shadehouses, sod or turf seed farms, sports complexes, storage areas, substations, turfgrass areas, utility sites, warehouse areas, wildlife habitat management areas, and in grazed areas on these sites.

Aquatic Sites

This product may be applied to emerged weeds in all bodies of fresh and brackish water that may be flowing, nonflowing or transient including lakes, rivers, streams, ponds, estuaries, rice levees, seeps, irrigation and drainage ditches, canals, reservoirs, wastewater treatment facilities, wildlife habitat restoration and management areas and similar sites.

If aquatic sites are present in the noncrop area and are part of the intended treatment, read and observe the following directions:

- This product does not control plants that are completely submerged or have a majority of their foliage under water.
- There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.
- Consult local and state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.
- To make aquatic applications around and within 1/2 mile of active potable water intakes, the water intake must be turned off for a minimum period of 48 hours after the application. The water intake may be turned on prior to 48 hours if the glyphosate level in the intake water is below 0.7 parts per million as determined by laboratory analysis. These aquatic applications may be made only in those cases where there are alternative water sources or holding ponds which would permit the turning off of an active potable water intake for a minimum period of 48 hours after the application.
- For treatments after draw down of water or in dry ditches, allow 7 days or more after treatment before reintroduction of water to achieve maximum weed control. Apply this product within 1 day after draw down to ensure application to actively growing weeds.
- Floating mats of vegetation may require retreatment. Avoid wash off of sprayed foliage by spray boat or recreational boat backwash or by rainfall within 6 hours of application. Do not re-treat within 24 hours following the initial treatment.
- Applications made to moving bodies of water must be made while traveling upstream to prevent concentration of this herbicide in water. When making any bankside applications, do not overlap more than 1 foot into open water. Do not spray in bodies of water where weeds do not exist. The maximum application rate of 7 ½ pints per acre must not be exceeded in any single broadcast application that is being made over water.
- When emerged infestations require treatment of the total surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in fish kill.

Restrictions:

- Do not apply this product directly to water within ½ mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.), or within ½ mile of an active potable water intake in a standing body of water, such as a lake, pond or reservoir. This restriction does not apply to intermittent inadvertent overspray of water in terrestrial use sites.

Wetland Sites

This product may be applied to undesirable vegetation in and around water (aquatic areas) and wetlands found in forestry, utility rights-of-way sites or other site listed on the label, including where these sites are adjacent to or surrounding domestic water supply reservoirs, supply streams, lakes and ponds.

If wetland sites are present, read and observe the following directions:

- There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.
- Consult local public water control authorities before applying this product in and around public water. Permits may be required to treat such areas.

Restrictions:

- Do not apply this product directly to water within 1/2 mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.), or within 1/2 mile of an active potable water intake in a standing body of water, such as a lake, pond or reservoir. This restriction does not apply to intermittent inadvertent overspray of water in terrestrial use sites.
- Do not spray open bodies of water where woody brush, trees and herbaceous weeds do not exist. Do not apply more than 3 3/4 quarts per acre in a single over water broadcast application except in stream crossings in utility right-of-way or where applications will result in less than 20 percent of the total water area being treated. In either of these locations, any specified rate may be applied:

Christmas Tree Plantations

Broadcast Application (Oregon and Washington Only)

Broadcast apply this product over the established Christmas tree species Douglas fir (*Pseudotsuga menziesii*), fir species (*Abies* spp.), pine species (*Pinus* spp.) (except eastern white, loblolly, longleaf, shortleaf, slash), and spruce species (*Picea* spp.). Use 1 quart of this product per acre in 5 to 30 gallons of water per acre. For best results, add up to 10 fl oz of Entry II surfactant per acre. If using a different surfactant, follow the manufacturer's directions for use and ensure conifer safety has been adequately tested for that surfactant. Apply after trees have completed at least a full growing season since planting or transplanting.

Apply only in the fall after the formation of the final conifer resting buds or in the spring prior to initial bud swell. Final resting buds must be fully hardened and in the dormant stage. Applying this product at any other time may result in unacceptable injury to the Christmas trees. Avoid spray pattern overlap as injury may occur.

In some areas, 1 to 2 quarts of this product per acre may be used. Consult your local representative for specific use instructions if rates greater than 1 quart per acre are required.

For best results, do not use drift control additives as they may increase injury to Christmas trees.

Precautions and Restrictions:

- **Preharvest Interval:** Do not apply within 1 full year prior to tree harvest.
- Ensure that adequate buffers are maintained to prevent drift onto nearby desirable crops or vegetation.

Cut Stump

Treat cut stumps in any noncrop site listed on this label. This product will control regrowth of freshly cut stumps and resprouts of many types of woody brush and tree species, some of which are listed below. Apply this product using suitable equipment to ensure coverage of the entire cambium. Cut trees or resprouts close to the soil surface. Apply a 50 to 100 percent solution of this product to freshly cut surface immediately after cutting. Delays in application may result in reduced performance. For best results, make applications during periods of active growth and full leaf expansion.

When used according to directions for cut stump application, this product will control, partially control or suppress most woody brush and tree species, some of which are listed below:

Common Name	Scientific Name
alder	<i>Alnus</i> spp.
coyotebrush ¹	<i>Baccharis pilularis</i>
dogwood ¹	<i>Cornus</i> spp.
eucalyptus	<i>Eucalyptus</i> spp.
hickory ¹	<i>Carya</i> spp.
madrone, Pacific	<i>Arbutus menziesii</i>
maple ¹	<i>Acer</i> spp.
oak	<i>Quercus</i> spp.
peppertree, Brazilian	<i>Schinus terebinthifolius</i>
Australian-pine,	<i>Casuarina equisetifolia</i>
poplar ¹	<i>Populus</i> spp.
reed, giant	<i>Arundo donax</i>
saltcedar	<i>Tamarix ramosissima</i>
sweetgum ¹	<i>Liquidambar styraciflua</i>
sycamore ¹	<i>Platanus occidentalis</i>
tan oak	<i>Lithocarpus densiflorus</i>
willow	<i>Salix</i> spp.

¹ Do not use this product on these species in the state of California.

Precautions and Restrictions:

- Do not make cut stump applications when the roots of desirable woody brush or trees may be grafted to the roots of the cut stump. Some sprouts, stems, or trees may share the same root system.

- Adjacent trees that are of a similar age, height and spacing may indicate shared roots.
- Injury is likely to occur to non-treated stems or trees when one tree or more that shares a common root is treated.

Injection and Frill (Woody Brush and Trees)

Woody vegetation may be controlled by injection or frill application of this product. Apply this product using suitable equipment that penetrates into the living tissue. Apply the equivalent of 1 mL of this product per each two to three inches of trunk diameter at breast height (DBH). This is best achieved by applying 50 to 100 percent concentration of this product either to a continuous frill around the tree or as cuts evenly spaced around the tree below all branches. As tree diameter increases in size, better results are achieved by applying diluted material to a continuous frill or more closely spaced cuttings. Do not make any applications that allow runoff to occur from frilled or cut areas in species that exude sap freely. In species such as this, make frill or cuts at an oblique angle to produce a cupping effect and use a 100 percent undiluted concentration of this product. For best results, apply during periods of active growth and full leaf expansion.

This product controls the following woody species:

Common Name	Scientific Name
oak	<i>Quercus</i> spp.
poplar	<i>Populus</i> spp.
sweetgum	<i>Liquidambar styraciflua</i>
sycamore	<i>Platanus occidentalis</i>

This product suppresses the following woody species:

Common Name	Scientific Name
blackgum ¹	<i>Nyssa sylvatica</i>
dogwood	<i>Cornus</i> spp.
hickory	<i>Carya</i> spp.
maple, red	<i>Acer rubrum</i>

¹ Do not use this product on these species in the state of California.

Forestry Site Preparation

This product is for the control or partial control of woody brush, trees, and herbaceous weeds in forestry. This product is also for use in preparing or establishing wildlife openings within these sites and maintaining logging roads.

In forestry sites, use this product in site preparation prior to planting any tree species including Christmas trees, eucalyptus, hybrid tree cultivars and silvicultural nursery sites. Unless otherwise specified, make applications of this product for control or partial control of herbaceous weeds, woody brush and trees listed in the Weeds Controlled section.

Application Rates

Method of Application	Rate	Spray Volume (gal/acre)
Broadcast		
aerial	1.5 - 7.5 qt/acre	5 - 30
ground		10 - 60
Spray to Wet		
handgun, backpack	0.75 - 2%	spray to wet
mistblower	by volume	
Low Volume Directed Spray¹		
handgun, backpack	5 - 10%	partial coverage
mistblower	by volume	

¹ For low volume directed spray applications, coverage should be uniform with at least 50% of the foliage contacted. For best results, coverage of the top one-half of the plant, including the growing tip, is important (over the top and down coverage) To ensure adequate spray coverage, spray all sides of large or tall woody brush and trees, when foliage is thick and dense, or where there are multiple sense or tall sprouts.

Use a higher rate in the rate range for control or partial control of woody brush, trees and hard to control perennial herbaceous weeds. For best results, apply to actively growing woody brush and trees after full leaf expansion and before leaf drop. Use increased rates within the rate range to control perennial herbaceous weeds from emergence up to the appearance of seedheads, flowers or berries. Use a lower rate in the rate range to control annual herbaceous weeds and actively growing perennial herbaceous weeds after seedheads, flowers or berries appear. Apply to foliage of actively growing annual herbaceous weeds anytime after emergence.

This product has no herbicidal or residual activity in the soil. Where repeat applications are necessary, do not apply more than 8 quarts per acre per year.

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Tank Mixes

This product may be used in tank mix combination with other herbicide products to broaden the spectrum of vegetation controlled. When tank mixing, read and observe applicable use directions, precautions and limitations on the respective product labels. Use according to the most restrictive precautionary statements for each product in the mixture. Any specified rate of this product may be used in a tank mix.

Note: For forestry site preparation, make sure the tank mix product is approved for use prior to planting the desired species. Observe planting interval restrictions.

Any specified rate of this product may be used in a tank mix with the following products for forestry site preparation:

Product	Method of Application	Rate	
Milestone VM ¹	broadcast ³	5 – 7 fl oz/acre	
Garlon 3A ²		1 – 4 qt/acre	
Garlon 4			
Arsenal Applicators Concentrate			2 – 16 fl oz/acre
Escort			½ – 1½ oz/acre
Chopper			4 – 32 fl oz/acre
Oust XP	1 – 4 oz/acre		
Arsenal Applicators Concentrate	spray to wet	½ – 1½% by volume	
Arsenal Applicators Concentrate	low volume directed spray	¼ – ½% by volume	

¹ Use Milestone VM only in those states that have a Special Local Need label for use in forestry.

² Ensure that Garlon 3A is thoroughly mixed with water before adding this product. Agitation is required while mixing this product with Garlon 3A to avoid compatibility problems.

³ When using a tank mix partner, up to the maximum labeled rate for a treatment site may be applied in combination with this product.

For control of herbaceous weeds, use the lower specified tank mixture rates. For control of dense stands or difficult to control woody brush and trees, use the higher specified rates.

Aerial Application

Aerially apply this product by helicopter only in forestry sites. See Aerial Application in Application Equipment and Application Methods for more details.

Ground Application

Apply this product using suitable ground equipment for broadcast applications in forestry sites. See Ground Application in Application Equipment and Application Methods for more details. Unless otherwise specified, apply the specified rates of this product as a broadcast spray in sufficient spray volume to provide complete and uniform coverage of plant foliage. Check for even distribution throughout the spray pattern.

Hand-Held and Backpack Application

Apply this product using handgun and backpack equipment in forestry sites. See Hand-Held and Backpack Application in Application Equipment and Application Methods for more details. For spray to wet applications, coverage should be uniform and complete, but not to the point of runoff.

This product may be used for low volume directed sprays for spot treatment of trees and brush. It is most effective in areas where there is a low density of undesirable trees or brush. For flat fan and cone nozzles, spray the foliage of the targeted vegetation. Small, open branched trees need only be treated from one side. If the foliage is thick or there are multiple root sprouts, apply from several sides to ensure adequate spray coverage.

Forestry Conifer and Hardwood Release

Directed Sprays and Selective Equipment

Apply this product as a directed spray or with selective equipment in forestry conifer and hardwood sites, including Christmas tree plantations and silvicultural nurseries. A surfactant must be used with this product. Use only surfactants approved for conifer release and specified on the surfactant label as safe for use in conifer release (pine release). Using this product without a surfactant will result in reduced herbicide performance. See Mixing Directions and Application Equipment and Application Methods sections.

Avoid contact of spray drift, mist or drips with foliage, green bark or non-woody surface roots of desirable plant species.

Tank Mixes: When tank mixing, read and observe applicable use directions, precautions and limitations on the respective product labels.

Use according to the most restrictive precautionary statements for each product in the mixture.

Broadcast Application Outside Area of Southeastern United States

Apply this product as a broadcast application for release of Douglas fir (*Pseudotsuga menziesii*), fir (*Abies* species), hemlock (*Tsuga* species), pines (*Pinus* species) (includes all species except loblolly, longleaf, shortleaf, or slash), and California redwood (*Sequoia* species) outside the area of the southeastern United States. Apply this product as a broadcast application only after formation of final conifer resting buds in the fall or prior to initial bud swelling in the spring. Note: Except where specified, make broadcast applications of this product only where conifers have been established for more than one year.

Injury may occur to conifers treated for release, especially where spray patterns overlap or the higher rates are applied. Damage can be accentuated if applications are made when conifers are actively growing, are under stress from drought, flood water, improper planting, insects, animal damage or diseases.

Apply ¼ to 1½ quarts per acre as a broadcast spray. Apply ¼ to 1½ quarts of this product per acre to release Douglas fir, pine and spruce species at the end of the first growing season (except California). Ensure all conifers are well hardened off.

A surfactant must be used with this product for optimum weed control. Use only surfactants approved for use in over the top release applications. Using this product without a surfactant will result in reduced herbicide performance. For best results, do not use a surfactant for release of hemlock species or California redwood. In mixed conifer stands, injury to these species may result if a surfactant is used. See Mixing Directions and Application Equipment and Application Methods sections.

For release of Douglas fir, a nonionic surfactant for over the top foliar spray may be used. To avoid possible conifer injury, use nonionic surfactants at 2 fl oz per acre at elevations above 1500 feet, or 1 fl oz per acre in the coastal range or at elevations below 1500 feet. Using a higher rate of surfactant may result in unacceptable conifer injury. Ensure the nonionic surfactant has been adequately tested for safety to Douglas fir before using.

Tank Mixes with Oust XP: Apply ¼ to 1½ quarts of this product with 1 to 3 oz of Oust XP per acre to release jack pine and white. Use 1 to 1½ oz of Oust XP per acre with this product to release white pine. Make applications to actively growing weeds as a broadcast spray over the top of established conifers. Make applications after formation of conifer resting buds in the late summer or fall.

Tank Mixes with Arsenal Applicators Concentrate: Apply ¼ to 1 ¼ quarts of this product with 2 to 6 fl oz of Arsenal Applicators Concentrate per acre to release Douglas fir. Apply 1½ quarts of this product with 1 to 2½ fl oz of Arsenal Applicators Concentrate per acre to release balsam fir and red spruce.

In **Maine** and **New Hampshire**, apply up to 2 ¼ quarts of this product per acre to control or suppress difficult to control hardwood species. For the release of red pine, balsam fir, red spruce, white spruce, Norway spruce, and black spruce with dense tough to control brush, and where maples make up a large component of the undesirable trees, this product may be tank mixed with 1 to 2 ½ fl oz of Arsenal Applicators Concentrate and 1 to 3 oz of Oust XP per acre. Apply this mix as a broadcast spray.

Broadcast Application in Southeastern United States

Apply this product as a broadcast application for release of loblolly pine (*Pinus taeda*), eastern white pine (*Pinus strobus*), shortleaf pine (*Pinus echinata*), slash pine (*Pinus elliottii*), Virginia pine (*Pinus virginiana*), and longleaf pine (*Pinus palustris*) in the southeastern United States.

Apply 1¼ to 1½ quarts of this product per acre as a broadcast spray during late summer or early fall after the conifers have hardened off. For applications at the end of the first growing season, use ¼ quart of this product alone or in a tank mix.

Tank Mixes with Arsenal Applicators Concentrate: For conifer release, apply ¼ to 1½ quarts of this product with 2 to 16 fl oz of Arsenal Applicators Concentrate per acre as a broadcast spray. Use only on conifer species that are labeled for over the top spray for both products. Use the higher specified rates for dense tough to control wood brush and trees.

Herbaceous Release

When applied as directed, this product plus listed residual herbicides provide postemergence control of the annual weeds and control or suppression of the perennial weeds listed in this label, and residual

control of the weeds listed in the residual herbicide label. Make applications to actively growing weeds as a broadcast spray over the top of labeled conifers.

Use a surfactant labeled for use in over the top herbaceous release applications. Using this product without a surfactant will result in reduced herbicide performance. See Mixing Directions and Application Equipment and Application Methods sections on this label.

Weed control may be reduced if spray solution water volumes exceed 25 gallons per acre for these treatments.

Tank Mixes with Oust XP: Apply 12 to 18 fl oz of this product with 2 to 4 oz of Oust XP per acre to release loblolly pines. Apply 9 to 12 fl oz of this product with 2 to 4 oz of Oust XP per acre to release slash pines.

Tank Mix with Atrazine: Apply ¼ quarts of this product with 4 lb ai of atrazine per acre to release Douglas fir. Apply only over Douglas fir that has been established for at least one full growing season. Apply in the early spring, usually mid-March through early April. Injury will occur if applications are made after bud swell in the spring. For this use, do not add surfactant to the tank mix.

In **Maine** and **New Hampshire**, for release of red pine, balsam fir, red spruce, white spruce, Norway spruce, and black spruce with heavy grass and herbaceous weeds infesting the site, up to 2 ¼ quarts of this product per acre may be tank mixed with 1 to 3 oz of Oust XP to control grass, herbaceous weeds and woody brush. Apply this mix as a broadcast spray.

Mid-Rotation Conifer Release and Spot Treatments for Crop Tree Release and Timber Stand Improvement

This product is applied as a ground broadcast or directed spray application for mid-rotation release applications under the canopy of pines (and other conifers) and hardwoods. Make applications using application techniques that prevent or minimize direct contact to the foliage of crop trees (including in stands of pine, other conifers, or hardwood). This may be accomplished using directed sprays and ground equipment with nozzles oriented to target only undesirable understory vegetation below the crop tree canopy. This product is applied as a spot, individual plant treatment for woody and herbaceous weeds (see Hand-Held and Backpack Application in Application Equipment and Application Methods section). When making spot applications, do not allow spray to contact the foliage of desirable crop trees.

Noncrop Areas and Industrial Sites

See the rate tables in the Annual Weeds, Perennial Weeds, and Woody Brush and Trees sections for specific application rates. This product has no herbicidal or residual activity in the soil. Where repeat applications are necessary, do not apply more than 8 quarts of this product per acre per year.

Use a higher rate in the rate range for control or partial control of woody brush, trees, and hard to control perennial herbaceous weeds. For best results, apply to actively growing woody brush and trees after full leaf expansion and before fall color and leaf drop. Use increased rates within the rate range for difficult to control species, where dense stands occur, or where conditions for control are not ideal and to control perennial herbaceous weeds from emergence up to the appearance of seedheads, flowers or berries. Use a lower rate in the rate range to control annual herbaceous weeds and actively growing perennial herbaceous weeds after seedheads, flowers or berries appear. Apply to foliage of actively growing annual herbaceous weeds anytime after emergence.

Tank Mixing for Noncrop Areas

This product may be used in tank mix combination with other herbicide products to broaden the spectrum of vegetation controlled. When tank mixing, read and observe applicable use directions, precautions and limitations on the respective product labels. Use according to the most restrictive precautionary statements for each product in the mixture. Any specified rate of this product may be used in a tank mix.

Maintain good agitation at all times during the mixing process and application. Ensure that the tank mix product(s) is well mixed with the spray solution before adding this product. Mix only the amount of spray solution that will be used during the same day. Reduced weed control may result if a tank mixture is allowed to stand overnight. If the spray mix is allowed to settle, thorough agitation is required to resuspend the mixture before spraying is resumed.

Weed Control, Trim and Edge, and Bare Ground

This product may be used in general noncrop and non-food areas. It may be applied with any application equipment described in this label. This product may be used to trim and edge around objects in noncrop sites,

and to eliminate unwanted weeds growing in established shrub beds or ornamental plantings. This product may be used prior to planting an area to ornamentals, flowers, turfgrass (sod or seed), or prior to laying asphalt or beginning construction projects.

To maintain bare ground, repeated applications of this product may be used.

This product provides control of emerged annual weeds and control or partial control of emerged perennial weeds, woody brush and trees when applied in a tank mix to bare ground.

Turfgrass Renovation, Seed or Sod Production

This product controls most existing vegetation prior to renovating turfgrass areas or establishing turfgrass grown for seed or sod. For maximum control of existing vegetation, delay planting or sodding to determine if any regrowth from escaped underground plant parts occurs. When repeat treatments are necessary, sufficient regrowth must be attained prior to application. For warm season turfgrass, including bermudagrass, summer or fall applications provide the best control. Where existing vegetation is growing under mowed turfgrass management, apply this product after omitting at least one regular mowing to allow sufficient growth for good interception of the spray.

Do not disturb soil or underground plant parts before treatment. Delay tillage or renovation techniques, including vertical mowing, coring, or slicing, for seven days after application to allow translocation into underground plant parts.

Desirable turfgrass may be planted following the above procedures.

Hand-held equipment may be used for spot treatment of unwanted vegetation growing in existing turfgrass. Broadcast or hand-held equipment may be used to control sod remnants or other unwanted vegetation after sod is harvested.

Do not feed or graze turfgrass grown for seed or sod production for eight weeks following application.

Ornamentals and Plant Nurseries

Post-Direct and Trim and Edge

This product may be used as a post-directed spray around established woody ornamental species, including arborvitae, azalea, boxwood, crabapple, euonymus, fir, Douglas fir, jojoba, hollies, lilac, magnolia, maple, oak, privet, pine, spruce and yew. This product may also be used to trim and edge around trees, buildings, sidewalks and roads, potted plants and other objects in a nursery setting.

Desirable plants may be protected from the spray solution by using shields or coverings made of cardboard or other impermeable material. Do not use this product for any over the top broadcast spray in ornamentals. Exercise care to avoid contact of spray, drift or mist with foliage or green bark of established ornamental species.

Site Preparation

This product may be used prior to planting any ornamental, nursery or Christmas tree species.

Greenhouse/Shadehouse

This product may be used to control weeds growing in and around greenhouses and shadehouses. Desirable vegetation must not be present during application and air circulation fans must be turned off.

Wildlife Habitat Management

This product may be used to control exotic and other undesirable vegetation in habitat management and natural areas, including rangeland and wildlife refuges. Apply to allow recovery of native plant species, prior to planting desirable native species, and for broad spectrum vegetation control. Apply spot treatments to selectively remove unwanted plants for habitat enhancement.

Wildlife Food Plots

This product may be used as a site preparation treatment to control annual and perennial weeds prior to planting wildlife food plots. Any wildlife food species may be planted after applying this product, or native species may be allowed to repopulate the area. If tillage is needed to prepare a seedbed, wait 7 days after application before tilling to allow translocation into underground plant parts.

Hollow Stem Injection

Apply this product to control giant knotweed (*Polygonum sachalinense*), Japanese knotweed (*Polygonum cuspidatum*), or other invasive knotweeds using individual stem treatment. Use a hand-held injection device that delivers the specified amount of this product into these hollow stem plants.

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Make a hole through both sides of the stem about 6 inches above the ground, just below a node, using an awl or other pointed tool. Inject 5 mL of undiluted product directly into this hole in the hollow stem. Treat each stem of the knotweed plant.

Restrictions:

- Do not apply more than a total of 8 quarts of this product per acre for all treatments combined. At 5 mL per stem, 8 quarts will treat approximately 1420 stems per acre.

Parks, Recreational and Residential Areas

Use this product in parks, recreational and residential areas. Apply it with any application equipment described in this label. Use this product to trim and edge around trees, fences, paths, around buildings, sidewalks, and other objects in these areas. This product may be used for spot treatment of unwanted vegetation, eliminate unwanted weeds growing in established shrub beds or ornamental plantings, and prior to planting an area to ornamentals, flowers, turfgrass (sod or seed), or prior to laying asphalt or beginning construction projects.

All of the label instructions apply to park and recreational areas.

Railroads

All of the instructions in the Noncrop Areas and Industrial Sites and Roadside sections apply to railroads.

Bare Ground, Ballast and Shoulders, Crossings, and Spot Treatment

Use this product to maintain bare ground on railroad ballast and shoulders. Repeat applications of this product may be used as weeds emerge to maintain bare ground. Use this product to control tall growing weeds to improve line of sight at railroad crossings and reduce the need for mowing along rights-of-way.

Brush Control

Apply 3 to 8 quarts of this product per acre as a broadcast spray, using boom-type or boomless nozzles. Applications up to 80 gallons of spray solution per acre may be used. Apply a ¼ to 1.5 percent solution of this product when using high volume spray to wet applications. Apply a 5 to 10 percent solution of this product when using low volume directed sprays for spot treatment.

Roadsides

All of the instructions in the Noncrop Areas and Industrial Sites and Railroads sections apply to roadsides.

Shoulder Treatments

Use this product on road shoulders. Apply it with boom sprayers, shielded boom sprayers, high volume off-center nozzles, OC nozzle clusters, manifold nozzle systems, hand-held equipment, and similar equipment, and under-deck mowing plus herbicide systems..

Guardrails and Other Obstacles to Mowing

Use this product to control weeds growing under guardrails and around signposts and other objects along the roadside.

Spot Treatment

Use this product as a spot treatment to control unwanted vegetation growing along roadsides.

Tank Mixes: This product may be used in tank mix combination with other herbicide products to broaden the spectrum of vegetation controlled and for residual weed control. Follow applicable use directions, precautions and limitations on the respective product labels. Use according to the most restrictive precautionary statements for each product in the mixture. Any specified rate of this product may be used in a tank mix.

Chemical Mowing

Perennials: This product suppresses perennial grasses listed in this section to serve as a substitute for mowing. Use 4.5 fl oz of this product per acre when treating Kentucky bluegrass, tall fescue, fine fescue, orchardgrass, or quackgrass. Apply 12 fl oz of this product per acre when treating bermudagrass. Apply 4.5 to 8 fl oz of this product per acre when treating bahiagrass. Use the higher rates when grass is under heat stress. Apply 3 pints of this product per acre when treating torpedograss or paragrass. Apply treatments in 10 to 20 gallons of spray solution per acre.

Annuals: For growth suppression of some annual grasses, including annual ryegrass, wild barley and wild oats growing in coarse turfgrass on roadsides or other industrial areas, apply 3 to 3.75 fl oz of this product in 10 to 40 gallons of spray solution per acre. Apply when annual grasses are actively growing and before the seedheads are in the boot stage of development. Treatments may cause injury to the desired grasses.

Release of Dormant Bermudagrass or Bahiagrass

Apply 6 to 48 fl oz of this product per acre in 10 to 40 gallons of water per acre. Use only in areas where bermudagrass or bahiagrass are desirable groundcovers and where some temporary injury or discoloration can be tolerated. Treatments of more than 12 fl oz per acre may result in injury or delayed greenup in highly maintained areas, including golf courses and lawns.

For best results on winter annuals, treat when weeds are in an early growth stage (less than 6 inches in height) after most have germinated. For best results on tall fescue, treat when fescue is in or beyond the 4- to 6-leaf stage.

Tank Mixes: This product may be used in tank mix combination with other herbicide products to broaden the spectrum of vegetation controlled and for residual weed control. When tank mixing, read and follow all applicable use directions, precautions, and limitation on the respective product labels. Use according to the most restrictive precautionary statements for each product in the mixture. Any specified rate of this product may be used in a tank mix.

Actively Growing Bermudagrass

Use this product to control or partially control many annual and perennial weeds for effective release of actively growing bermudagrass. Use only in areas where some temporary injury or discoloration can be tolerated. Use only on well-established bermudagrass. Bermudagrass injury may result from the treatment, but regrowth will occur under moist conditions. Repeat applications of the tank mix in the same season are not specified since severe injury may occur.

Apply up to 2.25 pints of this product in 10 to 40 gallons of spray solution per acre. Use the lower rate when treating annual weeds less than 6 inches in height (or runner length). Use the higher rate as weeds increase in size or as they approach flower or seedhead formation.

Actively Growing Bahiagrass

For suppression of vegetable growth and seedhead inhibition of bahiagrass for approximately 45 days, apply 4.5 fl oz of this product in 10 to 40 gallons of water per acre. Apply one to two weeks after full greenup or after mowing to a uniform height of 3 to 4 inches. Make this application prior to seedhead emergence. For suppression up to 120 days, apply 3 fl oz of this product per acre, followed by an application of 1.5 to 3 fl oz per acre about 45 days later. Make no more than two applications per year.

Tank Mixes: This product may be used in tank mix combination with other herbicide products to broaden the spectrum of vegetation controlled and for residual weed control. When tank mixing, read and follow all applicable use directions, precautions, and limitation on the respective product labels. Use according to the most restrictive precautionary statements for each product in the mixture. Any specified rate of this product may be used in a tank mix.

Utility Sites

Use this product for control of brush, tree, and weed control and side trimming in areas including electrical power, pipeline and telephone rights-of-ways, and other sites associated with these rights-of-ways including substations, roadsides, and railroads. this product may be applied with any application equipment or method described on this label unless specifically prohibited.

Tank Mixes: This product may be used in tank mix combination with other herbicide products to broaden the spectrum of vegetation controlled and for residual weed control. When tank mixing, read and follow all applicable use directions, precautions, and limitation on the respective product labels. Use according to the most restrictive precautionary statements for each product in the mixture. Any specified rate of this product may be used in a tank mix.

Rangelands

Use this product to control or suppress many annual weeds growing in perennial cool and warm season grass rangelands. Preventing weed seed production is critical to the successful control of annual grassy weeds invading these perennial grass sites. Eliminate most of the viable seeds with follow up applications in sequential years. Delay grazing of treated areas to encourage growth of desirable perennials. Allowing desirable perennials to flower and reseed in the treated area will encourage successful transition.

Bromus: Use this product to control or suppress downy brome/ cheatgrass (*Bromus tectorum*), Japanese brome (*Bromus japonicus*), soft chess (*Bromus mollis*), cheat (*Bromus secalinus*), cereal rye and jointed goatgrass. Apply 6 to 12 fl oz of this product per acre as a broadcast treatment.

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For best results, coincide treatments with early seedhead emergence of the most mature plants. Delaying the application until this growth stage maximizes the emergence of other weedy grass flushes. Make applications to the same site each year until seed banks are depleted and the desirable perennial grasses become established on the site.

Medusahead: Apply 12 fl oz of this product per acre to control or suppress medusahead at the 3-leaf stage when plants are actively growing. Delaying applications beyond this stage results in reduced or unacceptable control. Repeat applications in subsequent years to eliminate the seed bank before reestablishing desirable perennial grasses. Apply in the fall or spring.

Apply by ground or air. Make aerial applications for these uses with fixed wing or helicopter equipment. For aerial applications, apply in 2 to 10 gallons of water per acre. For ground applications, apply in at least 10 to 20 gallons of water per acre.

Spot Treatment and Wiper Application

Apply this product in rangeland, pastures, or industrial sites as a spot treatment or over the top of desirable grasses using wiper applicators to control tall weeds. See Wiper Application section for specific instructions. Make repeat applications in the same area at 30-day intervals.

The entire site or any portion of it may be treated when using 2.25 quarts or less

of this product per acre for spot treatments or wiper applications. No more than

10 percent of the total site may be treated at any one time when using more than 2.25 quarts of this product per acre for spot treatments or wiper applications. To achieve maximum performance, remove domestic livestock before application and wait 7 days after application before grazing livestock or harvesting for feed.

Pastures

Type of Pastures: Bahiagrass, bermudagrass, bluegrass, brome, fescue, orchardgrass, ryegrass, timothy, wheatgrass, alfalfa, clover

Spot Treatment and Wiper Application

This product may be applied as a spot treatment or as a wiper application. Make applications in the same area at 30-day intervals. See Wiper Application section for specific instructions.

Precautions and Restrictions:

- For spot treatment and wiper applications, the entire field or any portion of it may be treated when using a rate of 2.25 quarts or less per acre.
- Do not treat more than 10 percent of any acre at one time if applying more than 2.25 quarts per acre as a spot treatment or wiper application.
- To achieve maximum performance, remove domestic livestock before application and wait 14 days after application before grazing livestock or harvesting.

Preplant, Preemergence, and Pasture Renovation

Apply this product prior to planting or emergence of forage grasses and legumes. In addition, this product may be used to control perennial pasture species listed on this label prior to re-planting.

Precautions and Restrictions:

- If the application rates total 2.25 quarts or less per acre, there is no waiting period between treatment and feeding or livestock grazing is required.
- If the application rates total more than 2.25 quarts per acre, remove domestic livestock before application and wait eight weeks after application before grazing or harvesting.
- Crops listed for treatment in this label may be planted into the treated area at any time. Wait 30 days between application and planting for all other crops.

Bamboo

Use this product on roadside rights-of way to control or suppress bamboo. Use the higher rate in the rate range for dense stands and larger plants. Mow or cut bamboo and allow it to resprout to have sufficient foliage in order for the spray solution to completely cover the foliage. Optimum control or suppression of bamboo is achieved when this product is applied between August and October (prior to frost). One application of this product plus a surfactant will not eradicate bamboo. Several mowings and applications are required to completely control bamboo.

Apply the specified rate plus a surfactant (¼ to ½% v/v), such as a nonionic surfactant containing 80% active ingredient or more. Using this product without a surfactant results in reduced performance.

Application Method	Rate	Spray Volume (gal/acre)
ground broadcast	1.5 – 7.5 qt/acre	10 - 60
handgun spray to wet	0.75 – 2%	spray to wet
handgun or backpack low volume directed spray	4 – 10%	spray to cover

Restrictions:

- Do not apply more than a total of 8 quarts of this product per acre per year.

Annual Weeds, Perennial Weeds, and Woody Brush and Trees

Annual Weeds

Apply 24 fl oz of this product per acre if weeds are less than 6 inches in height or runner length. Use 1.25 to 3 quarts of this product per acre if weeds are more than 6 inches in height or runner length or when weeds are growing under stressed conditions. Use a higher rate in the rate range for tough to control species regardless of the size of the weed at the time of application. Treat tough to control weeds when they are relatively small. Tank mix this product with only those products that are labeled for application at the target site. Refer to the label of the tank mix partner for use sites and application rates.

Apply a 0.4 percent solution of this product as a spray to wet application to weeds less than 6 inches in height or runner length. Use a 0.7 to 1.5 percent solution for annual weeds more than 6 inches tall or for smaller weeds growing under stressed conditions. Use the higher concentration for tough to control species or for weeds more than 24 inches tall. Apply prior to seedhead formation in grass or bud formation in broadleaf weeds.

Use a 4 to 7 percent solution of this product for low volume directed spray applications. Spray coverage should be uniform with at least 50 percent of the foliage contacted. For best results, cover the top one-half of the plant. To ensure adequate spray coverage, spray both sides of large or tall weeds when foliage is thick and dense or where there are multiple sprouts.

Common Name

- anoda, spurred
- balsamapple¹
- barley
- barnyardgrass
- bassia, fivehook
- bittercress
- bluegrass, annual
- bluegrass, bulbous
- brome, downy/cheatgrass
- brome, Japanese
- buttercup
- Carolina foxtail
- Carolina geranium
- castorbean
- chamomile, mayweed
- cheat
- chervil
- chickweed
- cocklebur, common
- coreopsis, plains
- corn, volunteer
- crabgrass
- dwarfandelion, Virginia
- eastern mannagrass
- eclipta
- falsedandelion
- falseflax, smallseed
- fiddleneck
- field pennycress
- feabane, annual
- feabane, hairy
- feabane, rough
- Florida pusley
- foxtail
- goatgrass, jointed
- goosegrass
- groundsel, common
- henbit
- horseweed/marestail
- itchgrass
- johnsongrass
- jungerlice
- knotweed
- kochia²
- lambquarters, common
- mallow, little

Scientific Name

- Anoda cristata*
- Momordica charantia*
- Hordeum vulgare*
- Echinochloa crus-galli*
- Bassia hyssopifolia*
- Cardamine* spp.
- Poa annua*
- Poa bulbosa*
- Bromus tectorum*
- Bromus japonicus*
- Ranunculus* spp.
- Alopecurus carolinianus*
- Geranium carolinianum*
- Ricinus communis*
- Anthemis cotula*
- Bromus secalinus*
- Anthriscus cerefolium*
- Cerastium vulgatum*
- Xanthium strumarium*
- Coreopsis tinctoria*
- Zea mays*
- Digitaria* spp.
- Krigia virginica*
- Glyceria* spp.
- Eclipta prostrata*
- Pyrrhopappus carolinianus*
- Camelina microcarpa*
- Amsinckia* spp.
- Thlaspi arvense*
- Erigeron annuus*
- Conyza bonariensis*
- Erigeron strigosus*
- Richardia scabra*
- Setaria* spp.
- Aegilops cylindrica*
- Eleusine indica*
- Senecio vulgaris*
- Lamium amplexicaule*
- Conyza canadensis*
- Rottboellia cochinchinensis*
- Sorghum halepense*
- Echinochloa colona*
- Polygonum* spp.
- Kochia scoparia*
- Chenopodium album*
- Malva parviflora*

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Common Name
 medusahead
 morningglory
 mustard, blue
 mustard, tumble
 mustard, wild
 oats, wild
 panicum, fall
 pigweed, redroot
 pigweed, smooth
 prickly lettuce
 puncturevine
 purslane, common
 ragweed, common
 ragweed, giant
 rocket, London
 Russian-thistle
 rye, cereal
 ryegrass, Italian³
 sandbur, field
 sesbania, hemp
 shattercane
 shepherd's-purse
 sicklepod
 signalgrass, broadleaf
 smartweed, Pennsylvania
 sowthistle, annual
 Spanishneedles³
 speedwell, corn
 speedwell, purslane
 sprangletop
 spurge, annual
 spurge, prostrate
 spurge, spotted
 spurry, umbrella
 stinkgrass
 sunflower, common
 tansymustard, pinnate
 teaweed/sida, prickly
 Texas panicum
 velvetleaf
 Virginia pepperweed
 wheat
 witchgrass
 woolly cupgrass
 yellow rocket

¹ Partial control.

² Partial control in southeastern states.

³ Not for use in California

Perennial Weeds

Best results are obtained when perennial weeds are treated after they reach the reproductive stage of growth (seedhead initiation in grasses and bud formation in broadleaves). Best results are obtained when non-flowering plants are treated when they reach a mature stage of growth. In many situations, applications are required prior to these growth stages. Under these conditions, use a higher rate in the rate range.

When using spray to wet treatments with hand-held equipment, ensure thorough coverage of the plant. For best results, use a 1.5 percent solution on harder to control perennials including bermudagrass, dock, field bindweed, hemp dogbane, milkweed and Canada thistle.

Use a 4 to 7 percent solution of this product in low volume directed spray applications. Spray coverage should be uniform with at least 50 percent of the foliage contacted. For best results, cover the top one-half of the plant. To ensure adequate spray coverage, spray both sides of large or tall weeds when foliage is thick and dense or where there are multiple sprouts.

Allow 7 days or more after application before tillage.

Common Name
 alfalfa
 alligatorweed¹
 anise/fennel
 artichoke, Jerusalem
 bahiagrass
 beachgrass, European
 bentgrass
 bermudagrass
 bindweed, field

Scientific Name
Taeniatherum caput-medusae
Ipomoea spp.
Chorispora tenella
Sisymbrium altissimum
Sinapis arvensis
Avena fatua
Panicum dichotomiflorum
Amaranthus retroflexus
Amaranthus hybridus
Lactuca serriola
Tribulus terrestris
Portulaca oleracea
Ambrosia artemisiifolia
Ambrosia trifida
Sisymbrium irio
Salsola tragus
Secale cereale
Lolium perenne
Cenchrus spinifex
Sesbania herbacea
Sorghum bicolor
Capsella bursa-pastoris
Senna obtusifolia
Urochloa platyphylla
Polygonum pensylvanicum
Sonchus oleraceus
Bidens bipinnata
Veronica arvensis
Veronica peregrina
Leptochloa spp.
Chamaesyce spp.
Chamaesyce humistrata
Chamaesyce maculata
Holosteum umbellatum
Eragrostis cilianensis
Helianthus annuus
Descurainia pinnata
Sida spinosa
Panicum spp.
Abutilon theophrasti
Lepidium virginicum
Triticum aestivum
Panicum capillare
Eriochloa villosa
Barbarea vulgaris

Scientific Name
Medicago sativa
Alternanthera philoxeroides
Foeniculum vulgare
Helianthus tuberosus
Paspalum notatum
Ammophila arenaria
Agrostis spp.
Cynodon dactylon
Convolvulus arvensis

Common Name
 bluegrass, Kentucky
 blueweed, Texas
 brackenfern
 brome, smooth
 bursage, woollyleaf
 canarygrass, reed
 cattail
 clover, red
 clover, white
 cogongrass
 cordgrass
 cutgrass, giant¹
 dallisgrass
 dandelion
 dock, curly
 dogbane, hemp
 fescue
 fescue, tall
 German ivy
 guineagrass
 horsenettle
 horseradish
 iceplant, crystalline
 johnsongrass
 kikuyugrass
 knapweed, Russian
 lantana, largeleaf
 lespedeza, common
 lespedeza, sericea
 loosestrife, purple
 lotus, American
 maidencane
 milkweed
 muhly, wirestem
 mullein, common
 napiergrass
 nightshade, silverleaf
 nutsedge, purple
Panicum spp.
 orchardgrass
 pampasgrass
 paragrass
 phragmites²
 poison-hemlock
 quackgrass
 reedvine
 reed, giant
 ryegrass, perennial
 smartweed, swamp
 sowthistle, perennial
 spatterdock
 starthistle, yellow
 sweet potato, wild¹
 thistle, artichoke
 thistle, Canada
 timothy
 torpedograss¹
 trumpetcreeper
 tules, common
 vaseygrass
 velvetgrass
 water fern³
 waterhyacinth
 waterlettuce
 waterprimrose
 wheatgrass, western

¹ Partial control

² Partial control in southeastern states.

³ Not for use in California

Woody Brush and Trees

Apply this product after full leaf expansion unless otherwise directed. Use the higher rate for larger plants and/or dense areas of growth. On vines, use the higher rate for plants that have reached the woody stage of growth. Best results are obtained when application is made in late summer or fall after fruit formation.

In arid areas, best results are obtained when applications are made in the spring or early summer when brush species are at high moisture content and are flowering.

Scientific Name
Poa pratensis
Helianthus ciliaris
Pteridium aquilinum
Bromus inermis
Ambrosia grayi
Phalaris arundinacea
Typha spp.
Trifolium pratense
Trifolium repens
Imperata cylindrica
Spartina spp.
Zizaniopsis miliacea
Paspalum dilatatum
Taraxacum officinale
Rumex crispus
Apocynum cannabinum
Festuca spp.
Lolium arundinaceum
Senecio mikanoides
Urochloa maxima
Solanum carolinense
Armoracia rusticana
Mesembryanthemum crystallinum
Sorghum halepense
Pennisetum clandestinum
Acroptilon repens
Lantana camara
Kummerowia striata
Lespedeza cuneata
Lythrum salicaria
Nelumbo lutea
Panicum hemitomon
Asclepias spp.
Muhlenbergia frondosa
Verbascum thapsus
Pennisetum purpureum
Solanum elaeagnifolium
Cyperus rotundus
Cyperus esculentus
Dactylis glomerata
Cortaderia selloana
Urochloa mutica
Phragmites spp.
Conium maculatum
Elymus repens
Brunnichia ovata
Arundo donax
Lolium perenne
Polygonum amphibium
Sonchus arvensis
Nuphar lutea
Centaurea solstitialis
Ipomoea pandurata
Cynara cardunculus
Cirsium arvense
Phleum pratense
Panicum repens
Campsis radicans
Scirpus acutus
Paspalum urvillei
Holcus spp.
Salvinia spp.
Eichornia crassipes
Pistia stratiotes
Ludwigia spp.
Pascopyrum smithii

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Ensure thorough coverage when using hand-held equipment.

See Low Volume Directed Spray Application section of label. Spray coverage should be uniform with at least 50 percent of the foliage contacted. For best results, cover the top half to 2/3 of the plant foliage. Spray both sides of large or tall woody brush and trees to ensure adequate spray coverage when foliage is thick and dense or where there are multiple sprouts. Symptoms may not appear prior to frost or senescence with fall treatments.

Allow seven days or more after application before tillage, mowing or removal. Repeat treatments may be necessary to control plants regenerating from underground parts or seed. Some autumn colors on undesirable deciduous species are acceptable provided no major leaf drop has occurred. Reduced performance may result if fall treatments are made following a frost.

Note: If brush has been mowed or tilled, or trees have been cut, do not treat until regrowth has reached the specified stage of growth.

This product will control, partially control, or suppress the following woody brush and trees.

Common Name

alder
ash¹
aspen, quaking
bearclover, bearmat
beach
birch
bittercherry
blackberry
blackgum
blue gum, Tasmanian
brackenfern
broom, French
broom, Scotch
buckwheat, California¹
cascara¹
catclaw-vine¹
ceanothus
chamise
cherry
cherry, black
cherry, pin
copperleaf, hophornbeam
coyotebrush
deer vetch
dewberry, southern
dogwood
elderberry
elm¹
gorse
hasardia¹
hawthorn
hazel
hickory
holly, Florida
honeysuckle
hornbeam, American
kudzu
locust, black¹
madrone, Pacific
manzanita
maple
maple, red¹
maple, sugar
maple, vine¹
monkeyflower¹
oak
oak, black¹
oak, pin
oak, post
oak, red
oak, southern red
oak, white¹
peppertree, Brazilian
persimmon¹
pine
poison-ivy, eastern
poison-oak
poison-sumac¹

Scientific Name

Alnus spp.
Fraxinus spp.
Populus tremuloides
Ceanothus prostratus
Fagus spp.
Betula spp.
Prunus emarginata
Rubus spp.
Nyssa sylvatica
Eucalyptus globulus
Pteridium aquilinum
Genista monspessulana
Cytisus scoparius
Eriogonum fasciculatum
Frangula purshiana
Macfadyena unguis-cati
Ceanothus spp.
Adenostoma fasciculatum
Prunus spp.
Prunus serotina
Prunus pensylvanica
Acalypha ostryifolia
Baccharis pilularis
Lotus unifoliolatus
Rubus trivialis
Cornus spp.
Sambucus nigra
Ulmus spp.
Ulex europaeus
Haplopappus squamosus
Crataegus spp.
Corylus spp.
Carya spp.
Schinus terebinthifolius
Lonicera spp.
Carpinus caroliniana
Pueraria montana
Robinia pseudoacacia
Arbutus menziesii
Arctostaphylos spp.
Acer spp.
Acer rubrum
Acer saccharum
Acer circinatum
Mimulus guttatus
Quercus spp.
Quercus kelloggia
Quercus palustris
Quercus stellata
Quercus rubra
Quercus falcata
Quercus alba
Schinus terebinthifolius
Diospyros spp.
Pinus spp.
Toxicodendron radicans
Toxicodendron spp.
Toxicodendron vernix

Common Name

prunus
raspberry
redbud, eastern
rose, multiflora
Russian-olive
sage,: black, white
sagebrush, California
salmonberry
saltcedar¹
saltbush, sea myrtle
sassafras
sourwood¹
sumac, smooth¹
sumac, dwarf¹
sweetgum
swordfern¹
tallowtree, Chinese
oak, tanbark resprouts
thimbleberry, western
tobacco, tree¹
trumpet creeper
Virginia-creeper¹
waxmyrtle, southern¹
willow
yellow-poplar ¹
yerba santa

¹Partial control

Scientific Name

Prunus spp.
Rubus spp.
Cercis canadensis
Rosa multiflora
Elaeagnus angustifolia
Salvia spp.
Artemisia californica
Rubus spectabilis
Tamarix ramosissima
Baccharis halimifolia
Sassafras albidum
Oxydendrum arboreum
Rhus glabra
Rhus copallinum
Liquidambar styraciflua
Polystichum munitum
Triadica sebifera
Lithocarpus densiflorus
Rubus parviflorus
Nicotiana glauca
Campsis radicans
Parthenocissus quinquefolia
Myrica cerifera
Salix spp.
Liriodendron tulipifera
Eriodictyon californicum

TERMS AND CONDITIONS OF USE

If terms of the following Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. Otherwise, to the extent permitted by law, use by the buyer or any other user constitutes acceptance of the terms under Warranty Disclaimer, Inherent Risks of Use and Limitations of Remedies.

WARRANTY DISCLAIMER

SePRO Corporation warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. TO THE EXTENT PERMITTED BY LAW, SePRO Corporation MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

INHERENT RISKS OF USE

It is impossible to eliminate all risks associated with use of this product. Crop injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of SePRO Corporation or the seller. To the extent permitted by law, all such risks shall be assumed by buyer.

LIMITATION OF REMEDIES

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at SePRO Corporation's election, one of the following:

- (1) Refund of purchase price paid by buyer or user for product bought, or
- (2) Replacement of amount of product used.

TO THE EXTENT PERMITTED BY LAW, SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such loss or damage in writing. To the extent permitted by law, in no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies cannot be varied by any written or verbal statements or agreements. No employee or sales agent of SePRO Corporation or the seller is authorized to vary or exceed the terms of the Warranty Disclaimer or Limitation of Remedies in any manner.

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SPECIMEN

Habitat[®]

herbicide

Applications may only be made for the control of undesirable emergent and floating aquatic vegetation in and around standing and flowing water, including estuarine and marine sites. Applications may be made to control undesirable wetland, riparian and terrestrial vegetation growing in or around surface water when applications may result in inadvertent applications to surface water.

Active ingredient:

Isopropylamine salt of Imazapyr (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid)*	28.7%
Inert ingredients	<u>71.3%</u>
Total	100.0%

* Equivalent to 22.6% 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid or 2 pounds acid per gallon.

EPA Reg. No. 241-426

U.S. Patent No. 4,798,619

EPA Est. No.

**KEEP OUT OF REACH OF CHILDREN.
CAUTION/PRECAUCIÓN**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

**In case of an emergency endangering life or property involving this product, call day or night,
800-832-HELP.**

See Next Page for Additional Precautionary Statements

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BASF Corporation
26 Davis Drive
Research Triangle Park, NC 27709

 **BASF**
The Chemical Company

FIRST AID	
If on skin or clothing	<ul style="list-style-type: none"> • Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
If in eyes	<ul style="list-style-type: none"> • Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If inhaled	<ul style="list-style-type: none"> • Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
HOT LINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact BASF Corporation for emergency medical treatment information: 1-800-832-HELP (4357).	

PRECAUTIONARY STATEMENTS
HAZARD TO HUMANS
CAUTION!

Avoid contact with skin, eyes or clothing. Avoid breathing spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

PERSONAL PROTECTIVE EQUIPMENT (PPE):

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category A on an EPA chemical-resistant category selection chart.

Applicators and other handlers must wear:

- Long-sleeve shirt and long pants
- Chemical-resistant gloves, Category A
- shoes plus socks

Follow manufacturer's instructions for cleaning and maintaining PPE. If no such instructions are given for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

PHYSICAL AND CHEMICAL HAZARDS

Spray solutions of **HABITAT® herbicide** should be mixed, stored and applied only in stainless steel, fiberglass, plastic and plastic-lined steel containers.

DO NOT mix, store or apply **HABITAT** or spray solutions of **HABITAT** in unlined steel (except stainless steel) containers or spray tanks.

ENVIRONMENTAL HAZARDS

DO NOT apply to water except as specified in this label. Treatment of aquatic weeds may result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss may cause the suffocation of some aquatic organisms. Do not treat more than one half of the surface area of the water in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms to move into untreated areas. Do not contaminate water when disposing of equipment washwaters or rinsate.

This pesticide is toxic to vascular plants and should be used strictly in accordance with the drift precautions on the label.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

HABITAT should be used only in accordance with recommendations on the leaflet label attached to the container. Keep containers closed to avoid spills and contamination.

STORAGE AND DISPOSAL

DO NOT contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: DO NOT store below 10° F.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL:

Nonrefillable Container. DO NOT reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying; then offer for recycling, if available, or reconditioning, if appropriate, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures approved by state and local authorities.

Triple rinse containers small enough to shake (capacity ≤ 5 gallons) as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

Triple rinse containers too large to shake (capacity > 5 gallons) as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Repeat this procedure two more times.

Pressure rinse as follows: Empty the remaining contents into application equipment or mix tank. Hold container upside down over application equipment or mix tank, or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

IMPORTANT

DO NOT use on food crops. **DO NOT** apply this product within one-half mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.) or within one-half mile of an active potable water intake in a standing body of water, such as a lake, pond or reservoir. **DO NOT** apply to water used for irrigation

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except as described in **APPLICATION TO WATERS USED FOR IRRIGATION** section of this label. Keep from contact with fertilizers, insecticides, fungicides and seeds. **DO NOT** drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the treated soil may be washed or moved into contact with their roots. **DO NOT** use on lawns, walks, driveways, tennis courts, or similar areas. **DO NOT** side trim desirable vegetation with this product unless severe injury and plant death can be tolerated. Prevent drift of spray to desirable plants.

Clean application equipment after using this product by thoroughly flushing with water.

GENERAL USE PRECAUTIONS AND RESTRICTIONS

Applications may only be made for the control of undesirable emergent and floating aquatic vegetation in and around standing and flowing water, including estuarine and marine sites. Applications may be made to control undesirable wetland, riparian and terrestrial vegetation growing in or around surface water when applications may result in inadvertent applications to surface water.

Do not apply more than 6 pints of product (1.5 lbs. acid equivalent) per acre per year.

Aerial application is restricted to helicopter only.

Application of **HABITAT® herbicide** can only be made by federal or state agencies, such as Water Management District personnel, municipal officials and the U.S. Army Corps of Engineers, or those applicators who are licensed or certified as aquatic pest control applicators and are authorized by the state or local government.

Treatment to other than non-native invasive species is limited to only those plants that have been determined to be a nuisance by a federal or state government entity.

Applications to private waters: Applications may be made to private waters that are still, such as ponds, lakes and drainage ditches where there is minimal or no outflow to public waters.

Application to public waters: Applications may be made to public waters such as ponds, lakes, reservoirs, marshes, bayous, drainage ditches, canals, streams, rivers, and other slow-moving or quiescent bodies of water for control of aquatic weeds or for control of riparian and wetland weed species.

Consult local state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.

Recreational Use of Water in Treatment Area: There are no restrictions on the use of water in the treatment area for recreational purposes, including swimming and fishing.

Livestock Use of Water in/from Treatment Area: There are no restrictions on livestock consumption of water from the treatment area.

Precautions for Potable Water Intakes: Do not apply **HABITAT** directly to water within one-half mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.) or within one-half mile of an active potable water intake in a standing body of water such as lake, pond or reservoir. To make aquatic applications around and within one-half mile of active potable water intakes, the water intake must be turned off during application and for a minimum of 48 hours after the application. These aquatic applications may be made only in the cases where there are alternative water sources or holding ponds, which would permit the turning off of an active potable water intake for a minimum period of 48 hours after the applications. Note: Existing potable water intakes which are no longer in use, such as those replaced by connections to wells or a municipal

water system, are not considered to be active potable water intakes. This restriction does not apply to intermittent, inadvertent overspray of water in terrestrial use sites.

APPLICATION TO WATERS USED FOR IRRIGATION

Water treated with **HABITAT** may not be used for irrigation purposes for 120 days after application or until **HABITAT** residue levels are determined by laboratory analysis, or other appropriate means of analysis, to be 1.0 ppb or less.

Seasonal Irrigation Waters: **HABITAT** may be applied during the off-season to surface waters that are used for irrigation on a seasonable basis, provided that there is a minimum of 120 days between **HABITAT** application and the first use of treated water for irrigation purposes or until **HABITAT** residue levels are determined by laboratory analysis, or other appropriate means of analysis, to be 1.0 ppb or less.

Irrigation Canals/Ditches: DO NOT apply **HABITAT** to irrigation canals/ditches unless the 120-day restriction on irrigation water usage can be observed or **HABITAT** residue levels are determined by laboratory analysis, or other appropriate means of analysis, to be 1.0 ppb or less. DO NOT apply **HABITAT** to dry irrigation canals/ditches.

Quiescent or Slow Moving Waters: In lakes and reservoirs DO NOT apply **HABITAT** within one (1) mile of an active irrigation water intake during the irrigation season. Applications less than one (1) mile from an inactive irrigation water intake may be made during the off-season, provided that the irrigation intake will remain inactive for a minimum 120 days after application or until **HABITAT** residue levels are determined by laboratory analysis, or other appropriate means of analysis, to be 1.0 ppb or less.

Moving water: DO NOT apply within one-half mile downstream of an active irrigation water intake. When making applications upstream from an active irrigation water intake, the intake must be turned off for a period of time sufficient to allow the upstream portion of treated water to completely flow past the irrigation intake before use can resume. Shut off time will be determined by the speed of water flow and the distance and length of water treated upstream from the intake. Consult local, state and/or federal authorities before making any applications upstream from an active irrigation water intake.

GENERAL INFORMATION

Use Sites: **HABITAT** is an aqueous solution to be mixed with water and a surfactant and applied as a spray solution to control floating and emergent undesirable vegetation (see **AQUATIC WEEDS CONTROLLED** section and the **ADDITIONAL WEEDS CONTROLLED BY HABITAT** section) in or near bodies of water which may be flowing, non-flowing, or transient. **HABITAT** may be applied to aquatic sites that include lakes, rivers, streams, ponds, seeps, drainage ditches, canals, reservoirs, swamps, bogs, marshes, estuaries, bays, brackish water, transitional areas between terrestrial and aquatic sites and seasonal wet areas. See **AQUATIC USE** section of this label for precautions, restrictions, and instructions on aquatic uses.

Read and observe the following directions if aquatic sites are present in terrestrial noncrop areas and are part of the intended treatment area:

Herbicidal Activity: **HABITAT** will control most annual and perennial grasses and broadleaf weeds in addition to many brush and vine species with some residual control of undesirable species that germinate above the waterline. **HABITAT** is readily absorbed through emergent leaves and stems and is translocated rapidly throughout the plant, with accumulation in the meristematic regions. Treated plants stop growing soon after spray application. Chlorosis appears first in the newest leaves, and necrosis spreads from this point. In perennials, the herbicide is translocated and kills, underground or submerged storage organs, which

prevents regrowth. Chlorosis and tissue necrosis may not be apparent in some plant species until two or more weeks after application. Complete kill of plants may not occur for several weeks. Applications of **HABITAT® herbicide** are rainfast one hour after treatment.

HABITAT does not control plants which are completely submerged or have a majority of their foliage under water.

Application Methods: **HABITAT** must be applied to the emergent foliage of the target vegetation and has little to no activity on submerged aquatic vegetation. **HABITAT** concentrations resulting from direct application to water are not expected to be of sufficient concentration or duration to provide control of target vegetation. Application should be made in such a way as to maximize spray interception by the target vegetation while minimizing the amount of overspray that enters the water. For maximum activity, weeds should be growing vigorously at the time of application and the spray solution should include a surfactant (See **ADJUVANTS** section for specific recommendations). **HABITAT** may be selectively applied by using low-volume directed application techniques or may be broadcast-applied by using ground equipment, watercraft or by helicopter. In addition, **HABITAT** may also be used for cut stump, cut stem and frill and girdle treatments within aquatic sites (see **AERIAL APPLICATIONS** and **GROUND APPLICATIONS** sections for additional details).

HABITAT should be applied with surface or helicopter application equipment in a minimum of 5 gallons of water per acre. When applying by helicopter, follow directions under the **AERIAL APPLICATIONS** section of this label, otherwise refer to section on **GROUND APPLICATIONS** when using surface equipment.

Applications made to moving bodies of water should be made while traveling upstream to prevent concentration of this herbicide in water. DO NOT apply to bodies of water or portions of bodies of water where emergent and/or floating weeds do not exist.

When application is to be made to target vegetation that covers a large percentage of the surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in the suffocation of some sensitive aquatic organisms. Do not treat more than one half of the surface area of the water in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms to move into untreated areas.

Avoid wash-off of sprayed foliage by spray boat or recreational boat backwash for one hour after application.

Apply **HABITAT** at 2 to 6 pints per acre depending on species present and weed density. DO NOT exceed the maximum label rate of 6 pints per acre (1.5 lb ai/A) per year. Use the higher labeled rates for heavy weed pressure. Consult the **AQUATIC WEEDS CONTROLLED** section and the **ADDITIONAL WEEDS CONTROLLED BY HABITAT HERBICIDE** section of this label for specific rates.

HABITAT may be applied as a draw down treatment in areas described above. Apply **HABITAT** to weeds after water has been drained and allow 14 days before reintroduction of water.

PRECAUTIONS FOR AVOIDING INJURY TO NON-TARGET PLANTS

Untreated desirable plants can be affected by root uptake of **HABITAT** from treated soil. Injury or loss of desirable plants may result if **HABITAT** is applied on or near desirable plants, on areas where their roots extend, or in locations where the treated soil may be washed or moved into contact with their roots. When making applications along shorelines where desirable plants may be present, caution should be exercised to avoid spray contact with their foliage or spray application to the soil in which they are

rooted. Shoreline plants that have roots that extend into the water in an area where **HABITAT** has been applied generally will not be adversely affected by uptake of the herbicide from the water.

If treated vegetation is to be removed from the application site, DO NOT use the vegetative matter as mulch or compost on or around desirable species.

MANAGING OFF-TARGET MOVEMENT

Spray Drift: Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment- and weather-related factors determines the potential for spray drift. The applicator and the entity authorizing spraying are responsible for considering all these factors when making decisions.

Spray drift from applying this product may result in damage to sensitive plants adjacent to the treatment area. Only apply this product when the potential for drift to these and other adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, or non-target crops) is minimal. Do not apply when the following conditions exist that increase the likelihood of spray drift from intended targets: high or gusty winds, high temperatures, low humidity, temperature inversions.

To minimize spray drift, the applicator should be familiar with and take into account the following drift reduction advisory information. Additional information may be available from state enforcement agencies or the Cooperative Extension on the application of this product.

The best drift management strategy and most effective way to reduce drift potential are to apply large droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see **WIND, TEMPERATURE AND HUMIDITY, and TEMPERATURE INVERSIONS**).

CONTROLLING DROPLET SIZE

- Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- Pressure - Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- Number of Nozzles - Use the minimum number of nozzles that provide uniform coverage.
- Nozzle Orientation - Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is recommended practice. Significant deflection from the horizontal will reduce droplet size and increase drift potential.
- Nozzle Type - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift. Do not use nozzles producing a mist droplet spray.

APPLICATION HEIGHT

Making applications at the lowest possible height (helicopter, ground driven spray boom) that is safe and practical reduces exposure of droplets to evaporation and wind.

SWATH ADJUSTMENT

When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the treatment area, the applicator must compensate for this displacement by adjusting the path of the application

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equipment (e.g. aircraft, ground) upwind. Swath adjustment distance should increase with increasing drift potential (higher wind, smaller droplets, etc.).

WIND

Drift potential is lowest between wind speeds of 3-10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Application should be avoided below 3 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

TEMPERATURE INVERSIONS

Drift potential is high during a temperature inversion. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud, which can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

WIND EROSION

Avoid treating powdery dry or light sandy soils when conditions are favorable for wind erosion. Under these conditions, the soil surface should first be settled by rainfall or irrigation.

AERIAL APPLICATION METHODS AND EQUIPMENT HELICOPTERS ONLY

Water Volume: Use 2 or more gallons of water per acre. The actual minimum spray volume per acre is determined by the spray equipment used. Use adequate spray volume to provide accurate and uniform distribution of spray particles over the treated area and to avoid spray drift.

Managing spray drift from aerial applications: Applicators must follow these requirements to avoid off-target drift movement: 1) boom length - the distance of the outermost nozzles on the boom must not exceed $\frac{3}{4}$ the length of the rotor, 2) nozzle orientation - nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees, and 3) application height - without compromising helicopter safety, applications should be made at a height of 10 feet or less above the crop canopy or tallest plants. Applicators must follow the most restrictive use cautions to avoid drift hazards, including those found in this labeling as well as applicable state and local regulations and ordinances.

GROUND APPLICATION (BROADCAST)

Water Volume: Use 5 or more gallons of water per acre. The actual minimum spray volume per acre is determined by the spray equipment used. Use adequate spray volume to provide accurate and uniform distribution of spray particles over the treated area and to avoid spray drift.

ADJUVANTS

Postemergence applications of **HABITAT® herbicide** require the addition of a spray adjuvant. Only spray adjuvants that are approved or appropriate for aquatic use should be utilized.

Nonionic Surfactants: Use a nonionic surfactant at the rate 0.25% v/v or higher (see manufacturer's label) of the spray solution (0.25% v/v is equivalent to 1 quart in 100 gallons). For best results, select a nonionic surfactant with a HLB (hydrophilic to lipophilic balance) ratio between 12 and 17 with at least 70% surfactant in the formulated product (alcohols, fatty acids, oils, ethylene glycol or diethylene glycol should not be considered as surfactants to meet the above requirements).

Methylated Seed Oils or Vegetable Oil Concentrates: Instead of a surfactant, a methylated seed oil or vegetable-based seed oil concentrate may be used at the rate of 1.5 to 2 pints per acre. When using spray volumes greater than 30 gallons per acre, methylated seed oil or vegetable based seed oil concentrates should be mixed at a rate of 1% of the total spray volume, or alternatively use a nonionic surfactant as described above. Research indicates that these oils may aid in **HABITAT** deposition and uptake by plants under moisture or temperature stress.

Silicone Based Surfactants: See manufacturer's label for specific rate recommendations. Silicone-based surfactants may reduce the surface tension of the spray droplet, allowing greater spreading on the leaf surface as compared to conventional nonionic surfactants. However, some silicone-based surfactants may dry too quickly, limiting herbicide uptake.

Invert emulsions: **HABITAT** can be applied as an invert emulsion. The spray solution results in an invert (water-in-oil) spray emulsion designed to minimize spray drift and spray run-off, resulting in more herbicide on the target foliage. The spray emulsion may be formed in a single tank (batch mixing) or injected (in-line mixing). Consult the invert chemical label for proper mixing directions.

Other: An antifoaming agent, spray pattern indicator or drift reducing agent may be applied at the product labeled rate if necessary or desired.

TANK MIXES

HABITAT may be tank-mixed with other aquatic use herbicides for the control of emergent and floating aquatic vegetation.

Consult manufacturer's labels for specific rates and weeds controlled. Always follow the more restrictive label when making an application involving tank-mixes.

AERIAL APPLICATIONS

All precautions should be taken to minimize or eliminate spray drift. Helicopters can be used to apply **HABITAT**; however, DO NOT make applications by helicopter unless appropriate buffer zones can be maintained to prevent spray drift out of the target area, or when spray drift as a result of helicopter application can be tolerated. Aerial equipment designed to minimize spray drift, such as a helicopter equipped with a Microfoil™ boom, Thru-Valve™ boom or raindrop nozzles, must be used and calibrated. Except when applying with a Microfoil boom, a drift control agent may be added at the recommended label rate. To avoid drift, applications should not be made during inversion conditions, when winds are gusty, or any other conditions which allow drift. Side trimming is not recommended with **HABITAT** unless death of treated tree can be tolerated.

Uniformly apply the recommended amount of **HABITAT** in 5 to 30 gallons of water per acre; include in the spray solution a nonionic surfactant or methylated seed oil or manufacturer's label rate of a silicone-based surfactant (See the **Adjuvants** section of this label for specific recommendations). A foam reducing agent may be added at the recommended label rate, if needed.

IMPORTANT: Thoroughly clean application equipment, including landing gear, immediately after use of this product. Prolonged exposure of this product to uncoated (e.g. galvanized stainless steel) surfaces may result in corrosion and failure of

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the exposed part. The maintenance of an organic coating (paint) may prevent corrosion.

GROUND APPLICATIONS

FOLIAR APPLICATIONS

Low Volume Foliar:

Use equipment calibrated to deliver 5 to 20 gallons of spray solution per acre. To prepare the spray solution, thoroughly mix in water 0.5 to 5% **HABITAT® herbicide** plus surfactant (see the **ADJUVANTS** section of this label for specific recommendations). A foam reducing agent may be applied at the recommended label rate, if needed. For control of difficult species (see **AQUATIC WEEDS CONTROLLED** section and the **ADDITIONAL WEEDS CONTROLLED BY HABITAT** section for relative susceptibility of weed species), use the higher concentrations of herbicide and/or spray volumes but do not apply more than 6 pints of **HABITAT** per acre. Excessive wetting of foliage is not recommended. See the **MIXING GUIDE** below for some suggested volumes of **HABITAT** and water.

For low volume, select proper nozzles to avoid over-application. Proper application is critical to ensure desirable results. Best results are achieved when the spray covers the crown and approximately 70 percent of the plant. The use of an even flat fan tip with a spray angle of 40 degrees or less will aid in proper deposition.

Recommended tip sizes include 4004E, or 1504E. For a straight stream and cone pattern, adjustable cone nozzles such as 5500 X3 or 5500 X4 may be used. Attaching a rollover valve onto a Spraying Systems Model 30 gunjet or other similar spray guns allows for the use of both a flat fan and cone tips on the same gun.

Moisten, but do not drench target vegetation causing spray solution to run off.

Low Volume Foliar with Backpacks:

For low-growing species, spray down on the crown, covering crown and penetrating approximately 70% of the plant.

For target species 4 to 8 feet tall, swipe the sides of target vegetation by directing spray to at least two sides of the plant in smooth vertical motions from the crown to the bottom. Make sure to cover the crown whenever possible.

For target species over 8 feet tall, lace sides of the target vegetation by directing spray to at least two sides of the target in smooth zigzag motions from crown to bottom.

Low Volume Foliar with Hydraulic Handgun Application Equipment:

Use same technique as described above for **Low Volume with Backpacks**.

For broadcast applications, simulate a gentle rain near the top of target vegetation, allowing spray to contact the crown and penetrate the target foliage without falling to the understory. Herbicide spray solution which contacts the understory may result in severe injury or death of plants in the understory.

SPRAY SOLUTION MIXING GUIDE FOR LOW-VOLUME FOLIAR APPLICATIONS

AMOUNT OF SPRAY SOLUTION BEING PREPARED	DESIRED CONCENTRATION (fluid volume)				
	0.5%	0.75%	1%	1.5%	5%
	(amount of HABITAT to use)				
1 gallon	0.6 oz.	0.9 oz.	1.3 oz.	1.9 oz.	6.5 oz.
3 gallons	1.9 oz.	2.8 oz.	3.8 oz.	5.8 oz.	1.2 pint
4 gallons	2.5 oz.	3.8 oz.	5.1 oz.	7.7 oz.	1.6 pint
5 gallons	3.2 oz.	4.8 oz.	6.5 oz.	9.6 oz.	2 pints
50 gallons	2 pints	3 pints	4 pints	6 pints	10 quarts
100 gallons	4 pints	6 pints	8 pints	6 quarts	5 gallons

2 tablespoons = 1 fluid ounce

High Volume Foliar:

For optimum performance when spraying medium to high-density vegetation, use equipment calibrated to deliver up to 100 gallons of spray solution per acre (GPA). Spray solutions exceeding 100 GPA may result in excessive spray run-off, causing increased ground cover injury, and injury to desirable species. To prepare the spray solution, thoroughly mix **HABITAT** in water and add a surfactant (see **ADJUVANT** section for specific recommendations and rates of surfactants). A foam-reducing agent may be added at the recommended label rate, if needed. For control of difficult species (see **AQUATIC WEEDS CONTROLLED BY HABITAT** section and the **ADDITIONAL WEEDS CONTROLLED BY HABITAT** section for relative susceptibility of weed species), use the higher concentrations of herbicide and/or spray volumes, but do not apply more than 6 pints of **HABITAT** per acre. Uniformly cover the foliage of the vegetation to be controlled but do not apply to run-off. Excessive wetting of foliage is not recommended.

Side Trimming:

DO NOT side trim with **HABITAT** unless severe injury or death of the treated tree can be tolerated. **HABITAT** is readily translocated and can result in death of the entire tree.

CUT SURFACE TREATMENTS

HABITAT may be used to control undesirable woody vegetation by applying the **HABITAT** solution to the cambium area of freshly cut stump surfaces or to fresh cuts on the stem of the target woody vegetation. Applications can be made at any time of the year except during periods of heavy sap flow in the spring. Do not overapply solution causing run-off from the cut surface.

Injury may occur to desirable woody plants if the shoots extend from the same root system or their root systems are grafted to those of the treated tree.

CUT SURFACE APPLICATIONS WITH DILUTE AND CONCENTRATE SOLUTIONS:

HABITAT may be mixed as either a concentrated or dilute solution. The dilute solution may be used for applications to the cut surface of the stump or to cuts on the stem of the target woody vegetation. Concentrated solutions may be used for applications to cuts on the stem. Use of the concentrated solution permits application to fewer cuts on the stem, especially for large diameter trees. Follow the application instructions to determine proper application techniques for each type of solution.

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- To prepare a dilute solution, mix 8 to 12 fluid ounces of **HABITAT® herbicide** with one gallon of water. The use of a surfactant or penetrating agent may improve uptake through partially callused cambiums.
- To prepare a concentrated solution, mix 2 quarts of **HABITAT** with no more than 1 quart of water.

Cut stump treatments:

- Dilute Solution- spray or brush the solution onto the cambium area of the freshly cut stump surface. Insure that the solution thoroughly wets the entire cambium area (the wood next to the bark of the stump).

Cut stem (injection, hack & squirt) treatments:

- Dilute Solutions- Using standard injection equipment, apply 1 milliliter of solution at each injection site around the tree with no more than one-inch intervals between cut edges. Insure that the injector completely penetrates the bark at each injection site.
- Concentrate Solutions- Using standard injection equipment, apply 1 milliliter of solution at each injection site. Make at least one injection cut for every 3 inches of Diameter at Breast Height (DBH) on the target tree. For example, a 3-inch DBH tree will receive 1 injection cut and a 6-inch DBH tree will receive 2 injection cuts. On trees requiring more than one injection site place the injection cuts at approximately equal intervals around the tree.

Frill or girdle treatments:

- Using a hatchet, machete, or chainsaw, make cuts through the bark and completely around the tree to expose the cambium. The cut should angle downward extending into the cambium enough to expose at least two growth rings. Using a spray applicator or brush, apply a 25% to 100% solution of **HABITAT** into each cut until thoroughly wet. Avoid applying so much herbicide that runoff to the ground or water occurs.

IMAZAPYR

Herbicide Basics

Chemical formula: (\pm) -2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid

Herbicide Family:

Imidazolinone

Target Species: grasses, broadleaves, vines, brambles, shrubs and trees, riparian and emerged aquatics

Forms: acid & salt

Formulations: SL, GR

Mode of Action: Amino acid synthesis inhibitor

Water Solubility: 11,272 ppm

Sorption potential: low

Primary degradation mech: Slow microbial metabolism and photolysis

Average Soil Half-life: 25-141 days

Mobility Potential: high

Dermal LD50 for rabbits: >2,000 mg/kg

Oral LD50 for rats: >5,000 mg/kg

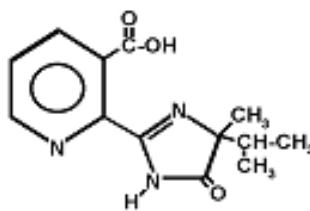
LC50 for bluegill sunfish: >100 mg/L

Trade Names: Arsenal[®], Habitat[®], Chopper[®], and Stalker[®]

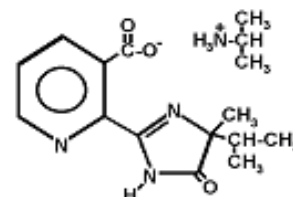
Manufacturer: BASF (previously American Cyanamid Company)

Synopsis

Imazapyr is a non-selective herbicide used for the control of a broad range of weeds including terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It controls plant growth by preventing the synthesis of branched-chain amino acids. Because imazapyr is a weak acid herbicide, environmental pH will determine its chemical structure, which in turn determines its environmental persistence and mobility. Below pH 5 the adsorption capacity of imazapyr increases and limits its movement in soil. Above pH 5, greater concentrations of imazapyr become negatively charged, fail to bind tightly with soils, and remain available (for plant uptake and/or microbial breakdown). In soils imazapyr is degraded primarily by microbial metabolism. It is not, however, degraded significantly by photolysis or other chemical reactions. The half-life of imazapyr in soil ranges from one to five months. In aqueous solutions, imazapyr may undergo photodegradation with a half-life of two days. Imazapyr is not highly toxic to birds and mammals, but some formulations (for instance, the inert ingredients in Chopper[®] and Stalker[®]) can cause severe, irreversible eye damage. Studies indicate imazapyr is excreted by mammalian systems rapidly with no bioaccumulation. It has a low toxicity to fish, and algae and submersed vegetation are not affected. Because imazapyr can affect a wide range of plants and can remain available, care must be taken during application to prevent accidental contact with non-target species. Further, a few studies have reported that imazapyr may be actively exuded from the roots of legumes (such as mesquite), likely as a defense mechanism by those plants. This exudate and the ability of imazapyr to move via intertwined root grafts may therefore adversely affect the surrounding desirable vegetation with little to no control of the target species.



Imazapyr acid



Imazapyr isopropylamine salt

Herbicide Details

Chemical Formula: (\pm) -2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-pyridinecarboxylic acid

Trade Names: Arsenal[®], Chopper[®], and Stalker[®]. As of September 2003, imazapyr has received an EPA aquatic registration for Habitat[®].

Manufacturer: BASF (previously by American Cyanamid Company, which was purchased by BASF in 2000)

Use Against Natural Area Weeds: Imazapyr is a broad-spectrum herbicide that controls terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It can be used where total vegetation control is desired or in spot applications. Imazapyr is relatively slow acting, does not readily break down in the plant, and is therefore particularly good at killing large woody species. Imazapyr can control saltcedar (*Tamarix ramossissima*), privet (*Ligustrum vulgare*), blackberries (*Rubus* spp.), field bindweed (*Convolvulus arvensis*), bahiagrass (*Paspalum notatum*), and downy brome (*Bromus tectorum*) (American Cyanamid 1986). Caution should be used when applying imazapyr, as a few reports to TNC from the field indicate that imazapyr might be exuded from the roots of target species. Some legume species, such as mesquite, may actively exude imazapyr (J. Vollmer pers. comm.). Imazapyr herbicide can be mobile within roots and transferred between intertwined root systems (root grafts) of many different plants and/or to several species. Movement of imazapyr via root grafts or by exudates (which is a defense mechanism of those plants) may therefore adversely affect the surrounding vegetation. This movement of herbicide may also be compounded when imazapyr is incorrectly overapplied. Movement of soil particles that contains imazapyr can also potentially cause unintended damage to desirable species.

Imazapyr is effective for creating openings for wildlife use. It can be applied pre-emergent, but is most effective when applied as a post-emergent herbicide. Care should be taken in applying it around non-target species, as it is readily adsorbed through foliage and roots, and therefore, could be injurious by drift, runoff, or leaching from the roots of treated plants. To avoid injury to desirable trees, do not apply imazapyr within twice the drip line (tree canopy).

On TNC preserves in Texas, imazapyr provided good control of saltcedar (*Tamarix* spp.) and Chinese tallow tree (*Sapium sebiferum*). In North Carolina preserves, it was effective against oriental bittersweet (*Celastrus orbiculata*), cut-stumps of Chinese privet (*Ligustrum sinense*), and tree-of-heaven (*Ailanthus altissima*). Recent work in California demonstrated that foliar applications of imazapyr effectively controlled jubatagrass and pampasgrass (*Cortaderia jubata* and *C. selloana*) (DiTomaso et al. 1999; Drewitz 2000), and experimental studies in Washington showed that imazapyr provided excellent control of smooth cordgrass (*Spartina alterniflora*) in tidal estuarine habitats (Patten 2002).

Mode of Action: Imazapyr is absorbed quickly through plant tissue and can be taken up by roots. It is translocated in the xylem and phloem to the meristematic tissues, where it inhibits the enzyme

acetohydroxy acid synthase (AHAS), also known as acetolactate synthase (ALS). ALS catalyzes the production of three branched-chain aliphatic amino acids, valine, leucine, and isoleucine, required for protein synthesis and cell growth. The rate of plant death usually is slow (several weeks) and is likely related to the amount of stored amino acids available to the plant. Only plants have ALS and produce these three amino acids, and therefore, imazapyr is of low toxicity to animals (including fish and insects). Animals need these three branched chain aliphatic amino acids, but obtain them by eating plants or other animals.

Dissipation Mechanisms:

Summary: Imazapyr is degraded in soils primarily by microbial metabolism. It will quickly undergo photodegradation in aqueous solutions (photohydrolysis), but there is little to no photodegradation of imazapyr in soil, and it is not readily degraded by other chemical processes. Imazapyr does not bind strongly with soil particles, and depending on soil pH, can be neutral or negatively charged. When negatively charged, imazapyr remains available in the environment.

Volatilization

Imazapyr does not volatilize readily when applied in the field (T. Lanini, pers. obs.). The potential to volatilize, however, increases with increasing temperature, increasing soil moisture, and decreasing clay and organic matter content (Helling et al. 1971).

Photodegradation

Imazapyr is rapidly degraded by sunlight in aquatic solutions. In soils, however, there is little or no photodegradation of imazapyr (WSSA 1994). The half-life of imazapyr due to photodegradation in aqueous solution is approximately two days, and decreases with increasing pH (Mallipudi et al. 1991, Mangels 1991a).

Microbial Degradation

Microbial degradation is the primary mechanism of imazapyr degradation in soils (WSSA 1994). American Cyanamid (1986) reported that the half-life of imazapyr in soils typically ranged from one to seven months, depending on soil type, temperature, and soil moisture (Mangels 1991b). The half-life of imazapyr is shorter at cooler soil temperatures (25° C versus 35° C) and in sandier soils (sandy loam versus clay loam) (American Cyanamid 1986). Degradation rates are decreased in anaerobic soil conditions (WSSA 1994).

In studies of the related compound imazaquin, microbial degradation rates increased with increasing soil moisture content (between 5-75% of field capacity) and increasing soil temperatures (from 15° C to 30° C) (Mangels 1991b). Microbial degradation additionally, was more rapid in soils that did not bind the herbicide strongly. Imazapyr that is bound strongly to soil particles may be unavailable for microbial degradation.

Adsorption

The adsorption of imazapyr to soil particles is generally weak, but can vary depending on soil properties (Mangels 1991b). Adsorption is reversible, and desorption occurs readily (WSSA 1994). Because the exact chemical form of the herbicide is determined by environmental pH, the adsorption capacity of imazapyr changes with soil pH. A decline in pH below 5 increases

adsorption of imazapyr to soil particles. Above pH 5, imazapyr becomes ionized, increasing its negative charge, and limiting its ability to bind with soils (Mangels 1991b). Vizantinopoulos and Lolos (1994) found that adsorption decreased with increasing soil temperature, and Dickens and Wehtje (1986) found that adsorption increased with time and decreased soil moisture. In general, imidazolinone herbicides show an increase in soil adsorption capacity with an increase in soil clay content and organic matter, but studies of imazapyr have been conflicting (Dickens and Wehtje 1986, Wehtje et al. 1987, Mangels 1991b, McDowell et al. 1997, Pusino et al. 1997, El Azzouzi et al. 1998).

Chemical Decomposition

Imazapyr changes form readily with changes in pH, but is not necessarily degraded in this process. It does not readily undergo hydrolysis (Mangels 1991a), and no other chemical degradation mechanisms have been reported.

Behavior in the Environment

Summary: Imazapyr is slowly degraded by microbial metabolism and can be relatively persistent in soils. It has an average half-life in soils that range from one to five months. At pH above 5, it does not bind strongly with soil particles and can remain available (for plant uptake) in the environment. In water, imazapyr can be rapidly degraded by photolysis with a half-life averaging two days. There have been a few reports from the field of unintended damage to desirable, native plants when imazapyr has either exuded out of the roots of treated plants into the surrounding soil, or when intertwined roots transfer the herbicide to non-target plants. Make sure to not overapply imazapyr, and also confirm that soil particles with imazapyr are not moved in-contact with desirable species.

Soils

Depending on environmental conditions, imazapyr has an average half-life in soils of several months (Vizantinopoulos and Lolos 1994, El Azzouzi et al. 1998). El Azzouzi et al. (1998) reported half-lives between > 58 to 25 days in two Moroccan soils. In a laboratory study, the half-life of imazapyr ranged from 69-155 days, but factors affecting degradation rates were difficult to identify because the pH varied with temperature and organic content (McDowell et al. 1997). In a more extreme example, Vizantinopoulos and Lolos (1994) found that in loam and clay loam soils with pH 7-8, half-lives ranged up to 50 months. The manufacturer reports that persistence in soils is influenced by soil moisture, and that in drought conditions, imazapyr could persist for more than one year (Peoples 1984).

Lee et al. (1991) reported that imazapyr residues in soil following postemergent application increased eight days after initial application and continued to increase until a peak of 0.23 ppm at day 231 post-treatment. The authors attributed these increases to runoff of residues from plant surfaces following rainfall and to the release of residues from decaying plant matter.

Under most field conditions imazapyr does not bind strongly to soils and can be highly available in the environment. Above pH 5, the herbicide will take on an ionized form, increasing the risk of herbicide runoff. McDowell et al. (1997) found that heavy rainfall caused significant movement

of the herbicide (or more likely, moved the soil particles that the imazapyr was adsorbed to), and leaching up to 50 cm deep in soils have been reported (WSSA 1994).

Water

Despite its potential mobility, imazapyr has not been reported in water runoff, and we found no reports of imazapyr contamination in water. If it enters the water column, imazapyr can be photodegraded by sunlight with an average half-life of two days (Mallipudi et al. 1991).

Vegetation

Because imazapyr kills a wide variety of plants and can be relatively persistent and remain available in soils, damage to desirable non-target plants is possible. When imazapyr is applied in high rates, directly to soil, it can result in season-long soil activity. Plant species that are resistant to imazapyr apparently metabolize it to an immobile form that cannot be translocated to the meristematic tissues (Shaner & Mallipudi 1991).

Environmental Toxicity

Birds and Mammals

Imazapyr is of relatively low toxicity to birds and mammals. The LD50 for rats is > 5,000 mg/kg, and for bobwhite quail and mallard ducks is >2,150 mg/kg (WSSA 1994). American Cyanamid reports that studies with rats indicate that imazapyr was excreted rapidly in the urine and feces with no residues accumulating in the liver, kidney, muscle, fat, or blood (Miller et al. 1991). Imazapyr has not been found to cause mutations or birth defects in animals, and is classified by the U.S. EPA as a Group E compound, indicating that imazapyr shows no evidence of carcinogenicity.

Aquatic Species

Imazapyr is of low toxicity to fish and invertebrates. The LC50s for rainbow trout, bluegill sunfish, channel catfish, and the water flea (*Daphnia magna*) are all >100 mg/L (WSSA 1994). As of September 2003, imazapyr (tradename Habitat[®]) is registered for use in aquatic areas, including brackish and coastal waters, to control emerged, floating, and riparian/wetland species. A recent study from a tidal estuary in Washington showed that imazapyr, even when supplied at concentrations up to 1600 mg/L, did not affect the osmoregulatory capacity of Chinook salmon smolts (Patten 2003). Similarly, the Washington State Department of Agriculture reported that the 96-hour LC50 for rainbow trout fry to be 77,716 mg/L (ppm) -22,305 ppm of the active ingredient- which represents a greater concentration of imazapyr than found in commercially-sold containers (J. Vollmer, pers. comm.).

Other Non-Target Organisms

Limited information was found on the effects of imazapyr on other non-target organisms such as soil bacteria and fungi. The manufacturers report that Arsenal[®] is non-mutagenic to bacteria (Peoples 1984).

Application Considerations:

Imazapyr is a slow acting herbicide that is not readily metabolized in plants. It can be very effective against woody species. Due to its persistence in the environment, it may be preferable to

apply imazapyr directly to vegetation (using a low-volume backpack, cut-stump, or basal bark application) instead of using a broadcast spray method. When using a cut-stump application, be careful to avoid overapplication of imazapyr on the stump, as this may lead to excess imazapyr to be transferred between root grafts or movement by soil particles. When completing a cut-stump treatment, apply imazapyr only to the outer cambium layer of the stump (versus applying herbicide to the entire cut-stump), and this should sufficiently kill the tree (J. Vollmer, pers. comm.).

A study of wipe-on applications to the reed *Phragmites australis*, however, found that this method provided some suppression of reeds in the short-term, but failed to control them in the long term (Kay 1995). Malefy and Quakenbush (1991) reported better results when imazapyr was applied at 21° C rather than 32° C. Rainfall is considered important for good activity following soil application (Malefy and Quakenbush 1991) but can increase movement of imazapyr in the soil column. A non-ionic surfactant can improve the efficacy of imazapyr.

Safety Measures:

Some formulations of imazapyr can cause severe irreversible eye damage. Care should be taken to prevent accidental splashing or other exposure of eyes to the herbicide.

Human Toxicology

Imazapyr is of relatively low toxicity to mammals, and shows no mutagenic or teratogenic potential. It can be an eye and skin irritant, but is not a dermal sensitizer (American Cyanamid 1986; Cyanamid Ltd. 1997).

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AQUATIC SPECIES CONTROLLED

HABITAT® herbicide will control the following target species as specified in the BASF RECOMMENDATION section of the table. Rate recommendations are expressed in terms of product volume for broadcast applications and as a % solution for directed applications including spot treatments. **For % solution applications, DO NOT apply more than the equivalent of 3 quarts of HABITAT per acre.**

COMMON NAME	SCIENTIFIC NAME	BASF RECOMMENDATION
Floating Species		
*Duckweed	<i>Lemna minor</i>	2-3 pints/acre (1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Duckweed, Giant	<i>Spirodela polyriza</i>	2-3 pints/acre (1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Frogbit	<i>Limnobium spongia</i>	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Spatterdock	<i>Nuphar luteum</i>	Apply a tank-mix of 2-4 pints/acre HABITAT + 4 to 6 pints/acre glyphosate (0.5% HABITAT + 1.5% glyphosate) in 100 GPA water for best control. Ensure 100% coverage of actively growing, emergent foliage.
*Water Hyacinth	<i>Eichhornia crassipes</i>	1-2 pints/acre (0.5% solution) applied in 100 GPA water to actively growing foliage.
*Water Lettuce	<i>Pistia stratiotes</i>	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
Emerged Species		
*Alligatorweed	<i>Alternanthera philoxeroides</i>	1 to 4 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing emergent foliage. Tank-mix with glyphosate is NOT recommended, and may reduce alligatorweed control, requiring higher HABITAT rates.
*Arrowhead, Duck-potato	<i>Sagittaria spp.</i>	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Bacopa, lemon	<i>Bacopa spp.</i>	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Parrot feather	<i>Myriophyllum aquaticum</i>	Must be foliage above water for sufficient HABITAT uptake. Apply 2 - 4 pints to actively growing emergent foliage.
*Pennywort	<i>Hydrocotyle spp.</i>	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Pickerelweed	<i>Pontederia cordata</i>	2-3 pints/acre (1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Taro, wild; Dasheen; Elephant's Ear; Coco Yam	<i>Colocasia esculentum</i>	4-6 pints/acre (1.5% solution) applied in 100 GPA with a high quality 'sticker' adjuvant. Ensure good coverage of actively growing, emergent foliage.
*Water lily	<i>Nymphaea odorata</i>	2-3 pints/acre (1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Water primrose	<i>Ludwigia uruguayensis</i>	4-6 pints/acre (1.5% solution), ensure 100% coverage of actively growing, emergent foliage. Tank-mix with glyphosate is NOT recommended and may reduce water primrose control.

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AQUATIC SPECIES CONTROLLED *(continued)*

COMMON NAME	SCIENTIFIC NAME	BASF RECOMMENDATION
Terrestrial/Marginal		
*Soda Apple, aquatic; Nightshade	<i>Solanum tampicense</i>	2 pts./acre applied to foliage
*Bamboo, Japanese	<i>Phyllostachys spp.</i>	3 to 4 pints/acre applied to the foliage when plant is actively growing. Before setting seed head. More foliage will result in greater herbicide uptake, resulting in greater root kill.
Brazilian Pepper; Christmasberry	<i>Schinus terebinthifolius</i>	2 - 4 pints/acre applied to foliage
Cattail	<i>Typha spp.</i>	2-4 pints (1% solution) applied to actively growing, green foliage after full leaf elongation. Lower rates will control cattail in the north; higher rates are needed in the south.
Chinese Tallow Tree	<i>Sapium sebiferum</i>	16 to 24 oz applied to foliage
Cogon Grass	<i>Imperata cylindrica</i>	Burn foliage, till area, that fall spray 2 qt./acre HABITAT® herbicide + MSO applied to new growth.
Cordgrass, prairie	<i>Spartina spp.</i>	4-6 pints applied to actively growing foliage
*Cutgrass	<i>Zizaniopsis miliacea</i>	4-6 pints applied to actively growing foliage
*Elephant Grass; Napier Grass-	<i>Pennisetum purpureum</i>	3 pts./acre applied to actively growing foliage
*Flowering rush	<i>Butumu typha</i>	2-3 pints applied to actively growing foliage
Giant Reed, Wild Cane	<i>Arundo donax</i>	4 to 6 pints/acre applied in spring to actively growing foliage
*Golden Bamboo	<i>Phyllostachys aurea</i>	3 to 4 pints/acre applied to the foliage when plant is actively growing. Before setting seed head. More foliage will result in greater herbicide uptake, resulting in greater root kill.
Junglerice	<i>Echinochloa colonum</i>	3-4 pints applied to actively growing foliage
Knapweeds	<i>Centaurea species</i>	Russian Knapweed - 2 to 3 pints + 1 qt./acre MSO fall applied after senescence begins
Knotweed, Japanese (see Fallopia japonica)	<i>Polygonum cuspidatum</i>	3 to 4 pts./acre applied postemergence to actively growing foliage
Melaleuca; Paperbark Tree	<i>Melaleuca quinquenervia</i>	For established stands, apply 6 pints/acre HABITAT + 6 pints/acre glyphosate + spray adjuvant. For best results use 4 qt./A methylated seed oil as an adjuvant. For ground foliar application, uniformly apply to ensure 100% coverage. For broadcast foliar control, apply aerially in a minimum of two passes at 10 gallons/acre applied cross treatment. For spot treatment use a 25% HABITAT + 25% solution of + glyphosate + 1.25% MSO in water applied as a frill or stump treatment.
*Nutgrass; Kili'p'opu	<i>Cyperus rotundus</i>	2 pints HABITAT + 1 qt./acre MSO applied early postemergence
*Nutsedge	<i>Cyperus spp.</i>	2 to 3 pints postemergence to foliage or pre-emergence incorporated, non-incorporated preemergence application will not control.

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GA DNR *(continued)*

AQUATIC SPECIES CONTROLLED (continued)

COMMON NAME	SCIENTIFIC NAME	BASF RECOMMENDATION
Terrestrial/Marginal (Cont.)		
Phragmites; Common Reed	<i>Phragmites australis</i>	4 to 6 pints/acre applied to actively growing, green foliage after full leaf elongation, ensure 100% coverage. If stand has a substantial amount of old stem tissue, mow or burn, allow to regrow to approximately 5' tall before treatment. Lower rates will control phragmites in the north; higher rates are needed in the south.
*Poison Hemlock	<i>Conium maculatum</i>	2 pints HABITAT® herbicide + 1 qt./acre MSO applied preemergence to early postemergence to rosette, prior to flowering
Purple Loosestrife	<i>Lythrum salicaria</i>	1 pint/acre applied to actively growing foliage
Reed canarygrass	<i>Phalaris arundinacea</i>	3 to 4 pints/acre applied to actively growing foliage
Rose, swamp	<i>Rosa palustris</i>	2 to 3 pts./acre applied to actively growing foliage
Russian-Olive	<i>Elaeagnus angustifolia</i>	2 to 4 pints/acre or a 1% solution, applied to foliage
Saltcedar; Tamarisk	<i>Tamarix species</i>	Aerial apply 2 qts. HABITAT + 0.25%v/v NIS applied to actively growing foliage during flowering. For spot spraying use 1% solution of HABITAT + 0.25%v/v NIS and spray to wet foliage. After application wait at least two years before disturbing treated saltcedar. Earlier disturbance can reduce overall control.
Smartweed	<i>Polygonum spp.</i>	2 pints/acre applied early postemergence
Sumac	<i>Rhus spp.</i>	2 to 3 pts./acre applied to foliage
* Swamp Morning Glory; Water Spinach; Kangkong	<i>Ipomoea aquatica</i>	1 to 2 pints/acre HABITAT + 1 qt./acre MSO applied early postemergence
Torpedo Grass	<i>Panicum repens</i>	4 pints/acre (1 - 1.5% solution), ensure good coverage to actively growing foliage.
*White Top; Hoary Cress	<i>Cardaria draba</i>	1 to 2 pints/acre applied in spring, to foliage, during flowering.
Willow	<i>Salix spp.</i>	2 to 3 pts./acre HABITAT applied to actively growing foliage, ensure good coverage.

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ADDITIONAL WEEDS CONTROLLED BY HABITAT HERBICIDE

In terrestrial sites, **HABITAT** will provide preemergence or postemergence control with residual control of the following target vegetation species at the rates listed. Residual control refers to control of newly germinating seedlings in both annuals and perennials. In general, annual weeds may be controlled by preemergence or postemergence applications of **HABITAT**. **For established biennials and perennials postemergence applications of HABITAT are recommended.**

The rates shown below pertain to broadcast applications and indicate the relative sensitivity of these weeds. The relative sensitivity should be referenced when preparing low volume spray solutions (see "Low Volume" section of "Ground Applications"); low volume applications may provide control of the target species with less **HABITAT** per acre than is shown for the broadcast treatments. **HABITAT** should be used only

in accordance with the recommendations on this label and the leaflet label.

The relative sensitivity of the species listed below can also be used to determine the relative risk of causing non-target plant injury if any of the below listed species are considered to be desirable within the area to be treated.

Resistant Biotypes: Naturally occurring biotypes (a plant within a given species that has a slightly different, but distinct genetic makeup from other plants of the same species) of some weeds listed on this label may not be effectively controlled. If naturally occurring resistant biotypes are present in an area, **HABITAT** should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control.

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GRASSES

COMMON NAME	SPECIES	GROWTH HABIT ²
Apply 2-3 pints per acre¹		
Annual bluegrass	<i>(Poa annua)</i>	A
Broadleaf signalgrass	<i>(Brachiaria platyphylla)</i>	A
Canada bluegrass	<i>(Poa compressa)</i>	P
Downy brome	<i>(Bromus tectorum)</i>	A
Fescue	<i>(Festuca spp.)</i>	A/P
Foxtail	<i>(Setaria spp.)</i>	A
Italian ryegrass	<i>(Lolium multiflorum)</i>	A
Johnsongrass	<i>(Sorghum halepense)</i>	P
Kentucky bluegrass	<i>(Poa pratensis)</i>	P
Lovegrass	<i>(Eragrostis spp.)</i>	A/P
*Napier grass	<i>(Pennisetum purpureum)</i>	P
Orchardgrass	<i>(Dactylis glomerata)</i>	P
Paragrass	<i>(Brachiaria mutica)</i>	P
Quackgrass	<i>(Agropyron repens)</i>	P
Sandbur	<i>(Cenchrus spp.)</i>	A
Sand dropseed	<i>(Sporobolus cryptandrus)</i>	P
Smooth brome	<i>(Bromus inermis)</i>	P
Vaseygrass	<i>(Paspalum urvillei)</i>	P
Wild oats	<i>(Avena fatua)</i>	A
Witchgrass	<i>(Panicum capillare)</i>	A

Apply 3-4 pints per acre¹

Barnyardgrass	<i>(Echinochloa crus-gali)</i>	A
Beardgrass	<i>(Andropogon spp.)</i>	P
Bluegrass, Annual	<i>(Poa annua)</i>	A
*Bulrush	<i>(Scirpus validus)</i>	P
Cheat	<i>(Bromus secalinus)</i>	A
Crabgrass	<i>(Digitaria spp.)</i>	A
Crowfootgrass	<i>(Dactyloctenium aegyptium)</i>	A
Fall panicum	<i>(Panicum dichotomiflorum)</i>	A
Goosegrass	<i>(Eleusine indica)</i>	A
Itchgrass	<i>(Rottboellia exaltata)</i>	A
Lovegrass	<i>(Eragrostis spp.)</i>	A
*Maidencane	<i>(Panicum hemitomon)</i>	A
Panicum, Browntop	<i>(Panicum fasciculatum)</i>	A
Panicum, Texas	<i>(Panicum texanum)</i>	A
Prairie threeawn	<i>(Aristida oligantha)</i>	P
Sandbur, Field	<i>(Cenchrus incertus)</i>	A
Signalgrass	<i>(Brachiaria platyphylla)</i>	A
Wild barley	<i>(Hordeum spp.)</i>	A
Wooly Cupgrass	<i>(Eriochloa villosa)</i>	A

Apply 4-6 pints per acre¹

Bahiagrass	<i>(Paspalum notatum)</i>	P
Bermudagrass ³	<i>(Cynodon dactylon)</i>	P
Big bluestem	<i>(Andropogon gerardii)</i>	P
Dallisgrass	<i>(Paspalum dilatatum)</i>	P
Feathertop	<i>(Pennisetum villosum)</i>	P
Guineagrass	<i>(Panicum maximum)</i>	P
Saltgrass ³	<i>(Distichlis stricta)</i>	P
Sand dropseed	<i>(Sporobolus cryptandrus)</i>	P

GRASSES (CONT)

COMMON NAME	SPECIES	GROWTH HABIT ²
Sprangletop	<i>(Leptochloa spp.)</i>	A
Timothy	<i>(Phleum pratense)</i>	P
Wirestem muhly	<i>(Muhlenbergia frondosa)</i>	P

BROADLEAF WEEDS

COMMON NAME	SPECIES	GROWTH HABIT ²
Apply 2-3 pints per acre¹		
Burdock	<i>(Arctium spp.)</i>	B
Carpetweed	<i>(Mollugo verticillata)</i>	A
Carolina geranium	<i>(Geranium carolinianum)</i>	A
Clover	<i>(Trifolium spp.)</i>	A/P
Common chickweed	<i>(Stellaria media)</i>	A
Common ragweed	<i>(Ambrosia artemisiifolia)</i>	A
Dandelion	<i>(Taraxacum officinale)</i>	P
Dog fennel	<i>(Eupatorium capillifolium)</i>	A
Filaree	<i>(Erodium spp.)</i>	A
Fleabane	<i>(Erigeron spp.)</i>	A
Hoary vervain	<i>(Verbena stricta)</i>	P
Indian mustard	<i>(Brassica juncea)</i>	A
Kochia	<i>(Kochia scoparia)</i>	A
Lambsquarters	<i>(Chenopodium album)</i>	A
*Lespedeza	<i>(Lespedeza spp.)</i>	P
Miners lettuce	<i>(Montia perfoliata)</i>	A
Mullein	<i>(Verbascum spp.)</i>	B
Nettleleaf goosefoot	<i>(Chenopodium murale)</i>	A
Oxeye daisy	<i>(Chrysanthemum leucanthemum)</i>	P
Pepperweed	<i>(Lepidium spp.)</i>	A
Pigweed	<i>(Amaranthus spp.)</i>	A
Puncturevine	<i>(Tribulus terrestris)</i>	A
Russian thistle	<i>(Salsola kali)</i>	A
Smartweed	<i>(Polygonum spp.)</i>	A/P
Sorrell	<i>(Rumex spp.)</i>	P
Sunflower	<i>(Helianthus spp.)</i>	A
Sweet clover	<i>(Melilotus spp.)</i>	A/B
Tansymustard	<i>(Descurainia pinnata)</i>	A
Western ragweed	<i>(Ambrosia psilostachya)</i>	P
Wild carrot	<i>(Daucus carota)</i>	B
Wild lettuce	<i>(Lactuca spp.)</i>	A/B
Wild parsnip	<i>(Pastinaca sativa)</i>	B
Wild turnip	<i>(Brassica campestris)</i>	B
Woollyleaf bursage	<i>(Franseria tomentosa)</i>	P
Yellow woodsorrel	<i>(Oxalis stricta)</i>	P

Apply 3-4 pints per acre¹

Broom snakeweed ⁴	<i>(Gutierrezia sarothrae)</i>	P
Bull thistle	<i>(Cirsium vulgare)</i>	B
Burclover	<i>(Medicago spp.)</i>	A
Chickweed, Mouseear	<i>(Cerastium vulgatum)</i>	A
Clover, Hop	<i>(Trifolium procumbens)</i>	A
Cocklebur	<i>(Xanthium strumarium)</i>	A

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BROADLEAF WEEDS (CONT)

COMMON NAME	SPECIES	GROWTH HABIT ²
Cudweed	(<i>Gnaphalium</i> spp.)	A
Desert Camelthorn	(<i>Alhagi pseudalhagi</i>)	P
Dock	(<i>Rumex</i> spp.)	P
Fiddleneck	(<i>Amsinckia intermedia</i>)	A
Goldenrod	(<i>Solidago</i> spp.)	P
Henbit	(<i>Lamium aplexicaule</i>)	A
Knotweed, prostrate	(<i>Polygonum aviculare</i>)	A/P
Pokeweed	(<i>Phytolacca americana</i>)	P
Purslane	(<i>Portulaca</i> spp.)	A
Pusley, Florida	(<i>Richardia scabra</i>)	A
Rocket, London	(<i>Sisymbrium irio</i>)	A
Rush skeletonweed ⁴	(<i>Chondrilla juncea</i>)	B
Saltbush	(<i>Atriplex</i> spp.)	A
Shepherd's-purse	(<i>Capsella bursa-pastoris</i>)	A
Spurge, Annual	(<i>Euphorbia</i> spp.)	A
Stinging nettle ⁴	(<i>Urtica dioica</i>)	P
Velvetleaf	(<i>Abutilon theophrasti</i>)	A
Yellow starthistle	(<i>Centaurea solstitialis</i>)	A

Apply 4-6 pints per acre¹

Arrowwood	(<i>Pluchea sericea</i>)	A
Canada thistle	(<i>Cirsium arvense</i>)	P
Giant ragweed	(<i>Ambrosia trifida</i>)	A
Grey rabbitbrush	(<i>Chrysothamnus nauseosus</i>)	P
Little mallow	(<i>Malva parviflora</i>)	B
Milkweed	(<i>Asclepias</i> spp.)	P
Primrose	(<i>Oenothera kunthiana</i>)	P
Silverleaf nightshade	(<i>Solanum eleagnifolium</i>)	P
Sowthistle	(<i>Sonchus</i> spp.)	A
Texas thistle	(<i>Cirsium texanum</i>)	P

VINES AND BRAMBLES

COMMON NAME	SPECIES	GROWTH HABIT ²
Apply 1 pint per acre		
Field bindweed	(<i>Convolvulus arvensis</i>)	P
Hedge bindweed	(<i>Calystegia sepium</i>)	A
Apply 2-3 pints per acre¹		
Wild buckwheat	(<i>Polygonum convolvulus</i>)	P
Apply 3-4 pints per acre¹		
Greenbriar	(<i>Smilax</i> spp.)	P
Honeysuckle	(<i>Lonicera</i> spp.)	P
Morningglory	(<i>Ipomoea</i> spp.)	A/P
Poison ivy	(<i>Rhus radicans</i>)	P
Redvine	(<i>Brunnichia cirrhosa</i>)	P
Wild rose	(<i>Rosa</i> spp.)	P
Including:		
Multiflora rose	(<i>Rosa multiflora</i>)	P
McCartney rose	(<i>Rosa bracteata</i>)	P
Apply 4-6 pints per acre¹		
*Kudzu ³	(<i>Pueraria lobata</i>)	P
Trumpetcreeper	(<i>Campsis radicans</i>)	P
Virginia creeper	(<i>Parthenocissus quinquefolia</i>)	P
Wild grape	(<i>Vitis</i> spp.)	P

BRUSH SPECIES

COMMON NAME	SPECIES	GROWTH HABIT ²
Apply 4-6 pints per acre¹		
American beech	(<i>Fagus grandifolia</i>)	P
Ash	(<i>Fraxinus</i> spp.)	P
Bald cypress	(<i>Taxodium distichum</i>)	P
Bigleaf maple	(<i>Acer macrophyllum</i>)	P
Black locust ⁵	(<i>Robinia pseudoacacia</i>)	P
Black gum	(<i>Nyssa sylvatica</i>)	P
Box elder	(<i>Acer negundo</i>)	P
Cherry	(<i>Prunus</i> spp.)	P
Chinaberry	(<i>Melia azadarach</i>)	P
Dogwood	(<i>Cornus</i> spp.)	P
Elm ⁶	(<i>Ulmus</i> spp.)	P
Hawthorn	(<i>Crataegus</i> spp.)	P
Hickory	(<i>Carya</i> spp.)	P
Honeylocust ⁵	(<i>Gleditsia triacanthos</i>)	P
Maple	(<i>Acer</i> spp.)	P
Mulberry	(<i>Morus</i> spp.)	P
Oak	(<i>Quercus</i> spp.)	P
Persimmon	(<i>Diospyros virginiana</i>)	P
*Pine ⁵	(<i>Pinus</i> spp.)	P
Poplar	(<i>Populus</i> spp.)	P
Privet	(<i>Ligustrum vulgare</i>)	P
Red Alder	(<i>Alnus rubra</i>)	P
Red Maple	(<i>Acer rubrum</i>)	P
Russian Olive	(<i>Eleagnus angustifolia</i>)	P
Sassafras	(<i>Sassafras albidum</i>)	P
Sourwood	(<i>Oxydendrum arboreum</i>)	P
Sweetgum	(<i>Liquidambar styraciflua</i>)	P
*Water willow	(<i>Justica americana</i>)	P
Willow	(<i>Salix</i> spp.)	P
Yellow poplar	(<i>Liriodendron tulipifera</i>)	P

¹ The higher rates should be used where heavy or well-established infestations occur.

² Growth Habit - A = Annual, B = Biennial, P = Perennial

³ Use a minimum of 75 GPA - Control of established stands may require repeat applications.

⁴ For best results early postemergence applications are required.

⁵ Tank mix with glyphosate or triclopyr.

⁶ Tank-mix with with glyphosate.

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United States
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**Southwestern
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Field Guide for Managing Saltcedar



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Saltcedar (*Tamarix spp.*)

Tamarisk family (Tamaricaceae)

Saltcedar is an invasive plant common to southwestern states and has been listed as a noxious weed in New Mexico. This field guide is intended to serve as the U.S. Forest Service's recommendations for management of saltcedar in forests, woodlands, riparian areas, and rangelands associated with the Forest Service's Southwestern Region. The region consists of 11 national forests in Arizona and New Mexico together with 3 national grasslands in New Mexico, Oklahoma, and Texas.

Description

Tamarix is one of four genera in the Tamaricaceae and is represented by 54 species worldwide. *Tamarix* taxonomy is somewhat disputed, and authors can have nomenclatures different from each other. The common names of tamarisk and saltcedar have been applied to many species of the genus; however, these terms usually refer to *T. chinensis* or *T. ramosissima* in the southwestern United States. Although these species can hybridize, many taxonomists consider them to be the same species since they are indistinguishable from one another; in which case, *T. chinensis* is the proper taxonomic name.

Growth Characteristics

- Perennial, deciduous, small shrub or tree, 5 to 25 feet tall.
- Shallow, lateral rhizomes and deep roots can penetrate to a depth of 30 feet or more. Sprouting commonly occurs from disturbed root crowns or from stems or roots lying near the soil surface.
- Small, scaly, bluish-green flat leaves resemble evergreen "needles."
- Reddish-brown branches are smooth, slender, and flexible but snap off easily. Bark becomes furrowed and ridged with age.
- Flowers March through October. Thousands of tiny, pink-to-white flowers with five petals produce extremely small seeds that resemble pepper. Tips of

short-lived seeds have tufts of hair that aid in wind and animal dispersal.

Ecology

Impacts/threats – Saltcedar alters the ecology and hydrology of native riparian systems and generally diminishes habitat quality. Leaf drop increases soil salinity and lessens microbial activity. Evapotranspiration rates for saltcedar are higher than for native riparian species which may reduce streamflows. Soils become drier under dense saltcedar stands; however, saltcedar can provide nesting for birds and may be an important pollen source for honeybees.

Location – Found throughout most of the United States except for parts of New England, Middle Atlantic States, and the Midwest. Common along disturbed and undisturbed streams, riverbanks, desert springs, flood plains, drainages, and irrigation waterways. Seedlings require saturated soil to establish.

Spread – Rapid colonization and expansion most commonly occurs with flood events or water inundation. Seeds float on water and require damp soil moisture for germination and seedling survival.

Contributing Factors – The saltcedar root system is dominated by a root crown that lies 12 to 18 inches below the soil surface. Buds on the root crown and shallow lateral roots will sprout new stems rapidly when aerial portions of the plant are removed.

Management

Saltcedar may be managed to enhance downstream waterflow, recreation, fire prevention, grazing, flood control, and aesthetics. Strategies to control saltcedar often vary depending on specific management objectives and location within a watershed. For example, an eradication strategy in headwater areas may be used to prevent the downstream spread of saltcedar along waterways. In transitional zones, such as river edges or riparian areas, saltcedar may be removed to enhance waterflow and channel characteristics.

In depositional or flood plain areas, goals for saltcedar control can vary widely and may include enhancing wildlife habitat, minimizing potential fire hazard, regenerating native riparian communities, or meeting other multiple-use needs.

Saltcedar potentially serves as nesting habitat for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) which is protected under the Endangered Species Act of 1973. To avoid harm to this species, information should be obtained from the U.S. Fish and Wildlife Service (Arizona, phone (602) 242-0210; New Mexico, phone (505) 248-6920) before implementing treatment of saltcedar stands of a quarter acre or more in riparian or wetland areas. A formal survey for flycatcher

nesting habitat by a surveyor with a scientific permit may be required for a saltcedar site prior to treatment if the nesting status of the site is undetermined. Within occupied or suitable flycatcher habitat, saltcedar treatment operations (including ground or aerial herbicide spraying) should not occur during the flycatcher nesting period of April 15 to August 30. Other migratory birds also nest from April through August, and saltcedar treatment during this period should be avoided if possible. When nesting habitat of the southwestern willow flycatcher is present, a quarter mile buffer surrounding the nest(s) is necessary.

Control and restoration of saltcedar infested areas over the long term requires an integrated management approach. Selection of effective control methods depends on specific

Table 1. Control Decisions

Site Factor	Physical Control	Cultural Control	Biological Control ¹	Chemical Control
Goal is to eradicate or provide high mortality.	Excavation, grubbing, and root plowing/raking.	NA	NA	Targeted application with a lethal herbicide. Methods include cut stump, foliage spray, and aerial application.
Goal is to suppress.	Mowing, shredding, mulching, scraping, and fire.	Grazing by goats or other livestock.	NA	Sublethal herbicide application that defoliates but does not kill the tree.
Site is easily accessible and targeted control is needed.	Excavation and grubbing.	NA	NA	Cut stump method, IPT ² foliage spray, aerial application by helicopter.
Site is difficult to access and targeted control is needed.	NA	NA	NA	Cut stump, IPT foliage spray, aerial application by helicopter.
Open areas on a flood plain.	Excavation, grubbing, and root plowing/raking.	NA	NA	Aerial application.
Protection of other resources (cultural resources, wildlife, endangered species, etc.) is necessary.	Hand removal or selective mechanical removal.		NA	Cut stump method, IPT foliage spray.
Emergent seedlings are on tillable land.	Shallow disking.	Prolonged flooding	NA	Low volume broadcast spray.
Sparse to moderate stands of young saltcedar or re-growth.	Excavation and grubbing.	Grazing with goats	NA	IPT or broadcast foliage spray.
Older growth, dense uniform stands.	Large-scale clearing (root plowing/raking).	NA	NA	Aerial application by helicopter or fixed-wing aircraft.

¹ Although saltcedar leaf beetles (*Diorhabda elongata*) have been released as biological control agents in portions of the western U.S., the beetle species currently cannot be released in Arizona or New Mexico pending review of regulations by the U.S. Fish and Wildlife Service.

² IPT – Individual plant treatment

stand and site characteristics. The methods are based either on individual plant treatment (IPT) or stand treatment. Control methods that target and destroy the root system are the only techniques that provide complete plant control. Methods that damage or remove aboveground growth without destroying the root crown will suppress saltcedar but will not kill the plant. Aboveground control methods include fire, mowing, grazing with goats or other livestock, defoliating herbicides, foliage feeding insects, etc. Since saltcedar is difficult to eradicate completely, saltcedar control programs should be based on the degree of control necessary to achieve management objectives. The control decision table (table 1) summarizes approaches for many common situations.

Physical Control

Manual Methods

Hand removal by hoeing or digging can be used to target individual plants in relatively small areas. Some commercially available hand implements are practical for uprooting small saltcedar plants; however, a shovel or hoe is most commonly used. The root crown and associated layered roots must be entirely removed from the soil. Uprooted material should be stacked into piles and dried before burning or mulching.

Mechanical Methods

Mechanical methods to treat saltcedar range in scale from individual plant excavation (from hand-operated equipment to excavators) to broad scale clearing (from tillers to bulldozers). Clearing saltcedar stands with a mechanical method often requires repeated applications.

Grubbing with a tractor mounted implement is particularly useful for control of scattered individual trees. A grubbing tool mounted on a tractor's hydraulic system drives a blade into the soil to sever roots below the root crown and force the root crown onto the surface. To prevent re-rooting, grubbed saltcedar should be piled, dried, and then burned or mulched rather than left on the surface.

Excavating can be used to remove individual trees selectively. Operators of excavating equipment must be skilled in placing the extracting bucket beneath the root crown of the target plant and grasping the tree with an opposing hydraulic arm so that it can be pulled directly upward in a vertical motion. Extracting the tree vertically rather than sideways minimizes excessive breakage of the root material at or near the ground surface.

Mulching and excavating can be used in combination by first eliminating top growth of saltcedar quickly through mulching and then using excavation to destroy the remaining root system. Mulching requires mobile, high horsepower machinery to operate a high speed rotating drum equipped with cutting teeth. The mulching equipment mows saltcedar top growth to ground level and simultaneously grinds it into fine segments. Mulching by itself may be used to reduce fuel loading for fires by clearing significant acreage of saltcedar in a relatively short period of time. Mulching operations leave the roots intact; therefore, saltcedar will re-sprout when growth conditions become favorable and will typically reach 2 to 5 feet in height within the first or second season after mulching. A track mounted excavator may be employed to remove the remaining live root crowns and layered roots as indicated by the re-sprouting.

Root plowing and raking is a combined mechanical treatment designed to clear large, mature saltcedar stands on relatively level areas. A 2-phase approach is generally followed. In the first phase, aerial trunks and stems are cut at the soil surface and piled using a D-7 or D-8 class bulldozer equipped with a front-mounted brush blade. An articulated loader equipped with a brush rake working in tandem with a bulldozer may be used to facilitate piling. Piles should be allowed to dry for a month or longer prior to burning. The work may be accomplished during winter months to avoid over-heating of equipment and summer nesting of birds. The second phase of control should occur during hot and dry summer months (usually May and June) when root material will dry out after removal from the soil. A 12-foot-wide root plow pulled by a bulldozer (e.g., D-7 class) can be used to sever the root crown from the remaining root system about

12 to 18 inches below the soil surface depending on the maturity of the saltcedar stand. Root material near the soil surface can then be raked by a bulldozer (e.g., D-8 class) equipped with a 21-foot-wide hydraulic root rake containing teeth that are 4 feet in length and are spaced 15 inches apart. The material can then be windrowed and piled using an articulated loader. The piles are subsequently burned.

Prescribed Fire

Prescribed fire as a single control method is not recommended for long-term saltcedar management since saltcedar is fire adapted and re-grows rapidly. Natural or prescribed fires in mature or decadent stands of saltcedar are hazardous as flame lengths in these fires can be extremely high, and crown fires can be difficult to stop with standard fire-fighting methods. However, burning may be useful or necessary to remove brush piles or dead saltcedar left standing after herbicide spraying.

Cultural Control

Education and monitoring can be important components to saltcedar control. Some nurseries still stock saltcedar as a decorative plant which could serve as sources of escaped stock in non-invaded areas.

Biological Control

Grazing

Livestock will browse saltcedar, but the foliage has little nutritional value and is usually not preferred. Grazing with goats may be used to suppress re-sprouting after other treatments have been made.

Classical Biological Agents

Saltcedar is typically damaged by a number of organisms in its native Mediterranean and Asian habitat. The saltcedar leaf beetle

(*Diorhabda elongata*) is a host-specific species currently under study as an option for saltcedar control (see table 2). Different subspecies of this beetle with specific requirements for climate and day length have been released in the U.S. according to their corresponding needs. Four other insect species feed on saltcedar (including the cicadellid leafhopper, *Opsiis stactogalus*) but have not been observed to cause more than minimal damage. Currently, further releases of *Diorhabda* beetles have been suspended pending review of regulations for release by the U.S. Fish and Wildlife Service.

Chemical Control

Herbicides are a primary method of saltcedar control and can be applied by a number of methods including fixed-wing aircraft, helicopter, tractor, truck or ATV-mounted boom sprayers, power sprayers, backpack sprayers, and carpet rollers. Treatment success depends on care taken during herbicide application. Most compounds available for saltcedar control have post-emergence activity and provide limited pre-emergence control (see “Table 3. Herbicide Recommendation Table”).

Herbicide Control Methods

IPT basal bark treatment can be made on individual saltcedar plants by using herbicide mixed with oil and an adjustable nozzle (X0 to X1 orifice size) to deliver a mist spray from the base of the stem up to 6 inches above the ground. Triclopyr ester herbicide should be mixed with

Table 2. Classical Biological Agents

Species	Type of Agent	Site of Attack	Impact/ Availability	Considerations for Release
<i>Diorhabda elongata</i>	beetle	Larvae and adults feed on foliage.	Varies by <i>D. elongata</i> subspecies but has been released in Nevada, Utah, Colorado, California, and Texas.	Potentially impacts saltcedar habitat of endangered southwestern willow flycatcher. Presently, these insects cannot be released in accordance with regulations of the U.S. Fish and Wildlife Service.

crop oil in a 50:50 v/v (volume to volume) ratio. Imazapyr may also be used for this application. Although basal bark treatment provides fair control, it is very tedious and time consuming, especially when the saltcedar is multistemmed. Applications on older stems with thick, furrowed bark should be avoided since success may be limited. Basal bark treatments are more easily made in winter when foliage is shed; however, summer treatment is recommended in Texas.

IPT cut stump treatment is often used in areas where mechanical treatments or foliar applied herbicide spraying are restricted due to logistical considerations or when there is a need to be highly selective and protect non-target vegetation. The treatment involves hand cutting or chain sawing the saltcedar trunk or stems as close to the ground surface as reasonable, and then applying herbicide to the cut stump surface by paintbrush, hand-held spray bottle, or backpack sprayer. The cut surface should be horizontal to the ground to minimize runoff, and any residual sawdust over the cut surface should be removed prior to herbicide application. A solution of triclopyr ester or imazapyr mixed with bark or crop oil must be immediately applied within 15 minutes. The herbicide:oil mixture ratio can vary from 33:67 to 50:50 v/v depending on the number and size of plants to be treated and the application technique used. The lower ratio is typically used when applications are made with a low volume backpack sprayer or hand-held spray bottle, whereas the higher ratio can be used when the solution is brushed directly onto the cut stump. Cut surfaces of plants with less than 4 inches diameter must be thoroughly wetted with herbicide to kill the roots; however, the herbicide should be applied to the cambial layer just inside the bark ring if the diameter of the saltcedar stump exceeds 4 inches. A blue indicator dye should be added to the spray mixture to show prior treatment of stumps. Disposal of trunks, limbs, and other top growth should follow acceptable practices (e.g., stack piles or chips).

Mortality rates from cut-stump treatments are directly related to care taken when treating cut surfaces. Control can be 60 to 80 percent under optimal conditions, but plant kills

may be less than 40 percent due to difficulties associated with this method. Therefore, followup treatment using ground-based foliar applications should be anticipated.

IPT foliar spray may be used to control small saltcedar that is less than 5 feet in height and is relatively small in acreage. Saltcedar foliage should be completely covered and the terminal ends of all branches, including blooms, should be wetted without allowing dripping to occur. The interior of the plant should then be laced with the spray solution to complete treatment. Ground application of 1 percent imazapyr solution by volume to saltcedar foliage can be made with a variety of sprayers including hand-held pump-up or backpack sprayers; cattle or trailer sprayers; or ATV-mounted low and high powered sprayer systems. An adjustable cone nozzle (X6 to X8 orifice size) can be used to deliver a coarse spray (large droplets). A nonionic surfactant (0.25 percent by volume) and a blue indicator spray dye should be added to the mixture. Since absorption of herbicide into the foliage is relatively slow, chemical penetration into the plant should be increased by spraying during weather conditions of low wind, high relative humidity, and low air temperature. After spraying, the top growth should remain undisturbed for at least 2 years after treatment. Although plants may appear dead (i.e., completely defoliated) in the first growing season after spraying, the plant is still trying to grow. If branches (top growth) are removed too early after spraying, saltcedar will shift stored carbohydrate reserves toward apical root buds and will re-sprout.

Airplane or helicopter applications can be used to spray saltcedar successfully if the aircraft is equipped with the proper spray system. Helicopters can spray “tight,” difficult areas that require precision application such as edges of meandering rivers or saltcedar stands interspersed with nontarget vegetation. Fixed-wing aircraft are better for spraying large, monotypic blocks of saltcedar where an overlapping spray pattern can be delivered at a lower operational cost than by a helicopter. Aircraft should be equipped with a satellite guidance system, a variable rate flow meter, and an onboard GIS display system for spraying

in wildland situations. Areas to be sprayed should be premapped, and the onboard computer spray system should be preprogrammed to apply herbicide only on defined treatment areas. Swaths should be overlapped to prevent streaking whereby plants are left untreated or slightly damaged.

For aerial applications, the spray volume should be sufficiently high to insure maximum spray coverage. Spray nozzles should be fitted to deliver moderate to large sized droplets ranging from 450 to 1,200 µm. As indicated by table 3, a spray mixture may include 2 quarts of imazapyr or a 1.5 quart imazapyr plus 1.5 quart glyphosate mixture applied in water. A nonionic surfactant (0.25 percent by volume) and a drift control agent (0.07 percent by volume) should be added to the mixture. For optimum plant control, an aerial application should leave the entire saltcedar canopy glistening with spray liquid long after spraying has occurred. This can partially be accomplished by

equipping the aircraft with the correct spray system and by spraying under optimal environmental conditions. Moderate temperatures (60 to 80 °F), high relative humidity (65 to 90 percent), and light winds (3 to 7 mph) are ideal to maximize herbicide activity. Late summer (August through September) is usually the best time to spray saltcedar by aircraft. Plants to be sprayed should be in a healthy state with full foliage that has not been stressed by drought, damaged by hail, or is beginning to turn yellow late in the season.

Control Strategies

Numerous research and practical integrated approaches have been developed to manage saltcedar. Successful long-term management programs (typically more than 5 years) usually include a combination of mechanical, fire, and chemical control methods. A combination of methods is particularly necessary if the primary objective is to achieve long-term native plant stability.

Table 3. Herbicide Recommendations

Common Chemical Name	Product Example ¹	Product Example Rate per Acre	Individual Plant Treatment (IPT)	Time of Application	Remarks
Triclopyr ester	Garlon 4	NA	50:50 mixture of triclopyr and crop oil with a blue indicator dye	Anytime	For cut stump treatment, apply to fresh cut stump within 15 minutes of cutting.
Imazapyr	Arsenal	2 quart	1 percent mixture for foliage spray (1 gallon per 100 gallons of water with 0.25 percent surfactant and a blue indicator dye)	Late summer to early fall when plants are taking up nutrients —plants should be healthy and not stressed.	For IPT, spray to wet all foliage especially the terminal ends of branches. For aerial broadcast spraying, add 0.25 percent nonionic surfactant. Use a high spray volume; 15 gallons per acre total solution when applied by helicopter. Allow two full growing seasons before followup treatment.
Imazapyr + glyphosate	Arsenal + Rodeo	1.5 quarts + 1.5 quarts	1/2 to 1 gallon + 1/2 to 1 gallon (1 to 2 pounds + 2 to 4 pounds per 100 gallons of water with 0.25 percent surfactant and a blue indicator dye)	Same as imazapyr.	Same as imazapyr.

¹Trade names for products are provided for example purposes only, and other products with the same active ingredient(s) may be available. Individual product labels should be examined for specific information and appropriate use with saltcedar.

Assessing revegetation potential is a critical first step before proceeding with saltcedar control. Costs for saltcedar control and revegetation are expensive, and careful selection of areas with a high potential for re-establishment is necessary to provide sustainable saltcedar control in the long term. In some situations, a treated area will recover naturally after aerial spraying without revegetation. In other situations, artificial plantings or seeding may be necessary. Sites that have dense saltcedar stands, poor hydrologic integrity, elevated salinity, or related conditions may have limited revegetation potential. A soil survey may be used to determine the soil texture, ground water depth, salinity levels, and other related factors that ultimately influence replacement of the vegetation community.

The literature provides many examples of integrated saltcedar management and restoration programs. The herbicide-burn-mechanical control program, for example, has emerged as a practical strategy for controlling saltcedar in large, monotypic tracts on valley bottoms and flood plains. The initial intervention step is to apply herbicide aerially which typically provides 70 to 90 percent saltcedar mortality. After 2 years, prescribed burning is used to remove dead aerial trunks and stems. When prescribed burning cannot be done, then mechanical treatments such as chaining, cabling, bulldozing, or roller chopping may be used to drop standing dead debris. Surviving saltcedar plants can be removed in the fourth or fifth year after spraying with an excavator, grubber, or root plow and raking. In some instances, IPT foliage spraying may be used to control saltcedar re-sprouting.

Once saltcedar has been removed, aggressive revegetation is often required. Managers should be cognizant of subsequent restoration processes and/or revegetation requirements when selecting a control strategy. Without special planning and care, treated areas may be rapidly re-invaded by saltcedar or other invasive species. In such instances, sustainable control over the long term is best accomplished by planting competitive native plants that have a high exclusionary ability. Native riparian woody

species such as cottonwood (*Populus deltoides*), Goodings willow (*Salix gooddingii*), and coyote willow (*S. exigua*) have a rapid growth potential under conditions of low environmental stress and are good candidate species for plantings.

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The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.



CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

Accord® XRT II and Rodeo® specialty glyphosate herbicides from Dow AgroSciences

The EPA has set a maximum contaminant level (MCL) of 700µg/L for this active ingredient in drinking water. A recent model calculated that the average concentration that might be expected in surface and groundwater to be 0.063µg/L and 0.0011µg/L. In Europe, where thousands of drinking water samples are routinely screened for pesticides, there has never been a confirmed, reproducible detection of glyphosate exceeding the 0.1µg/L limit for pesticides.⁵

Volatility

The active ingredient in Accord XRT II and Rodeo herbicides is non-volatile.⁶ That means they do not produce vapors that could move into the air and cause unreasonable adverse effects to non-target vegetation or odors to disturb the public.

Effects on Animals/Wildlife

Research done with laboratory animals shows that glyphosate is poorly absorbed when ingested. What little is absorbed is rapidly eliminated, resulting in minimal tissue retention.³ Feeding studies with chickens, cows, and pigs have shown extremely low to no residues in meat and fat following repetitive exposure. Negligible residues have also been reported in wild animals such as voles, chipmunks, hares, and moose after feeding in treated areas. A series of bioaccumulation studies done to determine if glyphosate concentrated in the edible portions of fish and game, indicated that it did not accumulate in the food chain.⁷

In addition numerous lab and field studies with the active ingredient in Accord XRT II and Rodeo have been conducted on non-target species such as birds, deer, mice, voles, chipmunks, and various aquatic organisms. Based on an extensive review, the EPA has determined that the effects of the active ingredient in Accord XRT II and Rodeo on birds, mammals, fish and invertebrates are minimal.³

Dow AgroSciences believes the overwhelming conclusion of these studies is clear: aside from the intended removal of target vegetation, glyphosate-based end-use products have little, if any, unreasonable adverse impact on terrestrial and aquatic animals or on ecosystems in which the animals live.⁷

For additional information, consult the appropriate federal and state labels, supplemental labels, and Material Safety Data Sheets for Accord XRT II and Rodeo herbicides.

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 - ¹¹ Dow AgroSciences. www.dowagro.com. Labels and MSDS.
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State restrictions on the sale and use of Accord XRT II apply. Consult the label before purchase or use for full details. Always read and follow label directions.
V01-000-167 010-50829 DAS (3/11)

General Information

Accord XRT II and Rodeo are part of the Dow AgroSciences portfolio of aquatic, vegetation management and forestry products.

Accord XRT II and Rodeo herbicides are registered for the broad-spectrum control of a wide variety of undesirable woody, broadleaf and grass species on rights-of-ways, aquatic and forestry sites across the United States. These vegetation management tools are formulated to meet the special needs of professional vegetation managers and foresters.

The active ingredient in Accord and Rodeo herbicides, glyphosate, is one of the most widely used in the world. It is registered for use by farmers, homeowners and industrial vegetation managers and is sold in more than 130 countries.

Product Characteristics

Accord XRT II, like Accord Concentrate and Rodeo are post emergent products that are most often applied to the foliage of target vegetation. Each of these products contains 5.4 pounds of glyphosate per gallon. Glyphosate is harmless to most plants once in the soil because it is quickly adsorbed to soil particles, and even when free, it is not readily absorbed by plant roots.¹

Accord XRT II features a patented 3rd generation dimethylamine (DMA) salt that delivers proven, consistent broad-spectrum control in a less viscous, easier-to-handle formulation. This formulation contains a unique and proprietary blend of surfactants that helps deliver superior performance. Rodeo is formulated with flexibility in mind and does not contain a surfactant. It is well-suited for instances where custom mixing of herbicide products is desired. It is registered for use in and around water. Rodeo is fully labeled for use in all aquatic sites. It does not contain a surfactant.

Glyphosate is formulated as a water-soluble salt to meet a wide variety of weed control needs. It was developed by Monsanto Company in the early 1970s. In 2001, Dow AgroSciences licensed the trademarks for Accord and Rodeo herbicide products.

In the environment and in the plant, the salt formulation converts to the biologically active acid form. For this reason, active ingredient concentration is commonly expressed as the acid equivalent (ae) in pounds per gallon or grams per liter. The term acid equivalent refers to the part of the formulation that can be converted to the acid.

Mode of Entry

In order for an herbicide to control plants, it must first be absorbed by the plant. The active ingredient in Accord XRT II, and Rodeo is absorbed by green growing foliage of target plants. Prior to use, Accord XRT II, and Rodeo are diluted with water to facilitate coverage. In most cases the actual spray solution is approximately 98% water.

Foliar applications generally achieve maximum efficacy when applied after full leaf extension, before foliage colors in the fall, and when soil moisture is adequate for normal plant growth.

These products can also be applied directly to the cambium of a cut stump.

Mode of Action

When Accord XRT II or Rodeo are broadcast onto target weeds and brush, the droplets land on the surface of the leaf. Within a few hours, they are absorbed through the cuticle of the leaf into the plant. Because their active ingredient has a structure similar to the naturally occurring plant amino acid glycine, target plants have trouble telling glyphosate and glycine apart. As a result, glyphosate travels with glycine as it moves through the plant vascular system toward the actively growing roots and shoots.

When Accord XRT II or Rodeo arrive at these meristematic regions, they block the shikimic acid pathway, thereby inhibiting the production of EPSP synthase. This enzyme is vital to the production of three aromatic amino acids essential for protein synthesis. This metabolic pathway is found only in plants.

As protein production stops, the plant begins to die. Accord XRT II and Rodeo herbicides also inhibit chlorophyll synthesis which causes the leaves to lose color. Actual absorption time may depend on the weather. On average, one to three hours are required for sufficient herbicide to enter the plant to ensure good vegetation control.

It takes one to two weeks for most herbaceous weeds to show symptoms of exposure to Accord XRT II and Rodeo. Yellowing of leaves is followed by wilting and finally necrosis. In woody plants, the symptoms may take a month or more to appear. Visible effects include gradual wilting or yellowing, followed by complete browning, deterioration of plant tissue and ultimate decomposition of the underground roots and rhizomes. Late summer application results are often not apparent until the following spring. These include failure to break bud and small, deformed leaves. In addition, the upper portion of the stem or leaders may be pale in color, dry, and brittle.

Registration and Testing

Before pesticides can be sold or distributed in the United States, they must be registered by the U.S. Environmental Protection Agency (EPA). Initial pesticide registrations require a minimum of 120 tests that can take companies up to 15 years to complete at a cost of up to \$50 million dollars. The EPA requires that these studies be conducted on each pesticide to demonstrate if the pesticide can be used without posing unreasonable adverse effects to humans or the environment.

Accord XRT II and Rodeo, and their active ingredient, have one of the most extensive worldwide health and environmental effects databases ever completed. The EPA, state agencies and other regulatory bodies throughout the world have reviewed more than 1,000 separate studies.

General Information on Toxicity

All substances can be toxic. It is the dose level or amount, and conditions of exposure, that make their effect toxic or harmful.

Toxicological testing with laboratory animals serves as a model for evaluating the potential of a substance to cause adverse effects in humans. Toxicology studies measure the effects of direct and indirect exposure to the substance. Toxicologists divide the toxicity of a substance into four categories: acute, sub acute, subchronic and chronic.

Acute toxicity results from a single dose of the substance through ingestion, inhalation, skin, or eye exposure. Results from single-exposure oral, dermal and inhalation tests are expressed as LD50 or LC50 values. These values refer to the "lethal dose" or "lethal concentration" necessary to kill 50 percent of a test population. In the case of Accord XRT II and Rodeo, the LC50 exceeds the amount of herbicide used in a typical application. These tests are done with a product's active ingredient as well as with the end-use formulation.

Sub-acute, sub-chronic and chronic toxicity result from repeated exposure to a chemical for a period of time. Sub-acute toxicity is based on repeated exposure for one month or less, sub-chronic for one to three months, and chronic for more than three months. It is not uncommon for the toxic effects of repeated exposure to differ from those produced by a single exposure.

In addition to these standard toxicology tests, numerous studies are also conducted on other non-target species such as birds, small and large mammals, and aquatic organisms. These diverse tests focus on specifics such as how the product affects birds' ability to lay eggs and the ability of the eggs to survive. Other studies examine the impact of the chemical on habitat change and bacteria in the soil.

When reviewing the results of these tests, it is important to keep in mind that in many of these tests the EPA requires exposure rates well above any that would be expected under normal use conditions or labeled use rates.

Active Ingredient Studies

Acute Toxicity

The EPA classifies acute toxicity of pesticides by placing results of different laboratory tests into categories with Toxicity Category I being the most toxic and Toxicity Category IV being the least toxic. Categories are based on the dosage at which the toxic effect was observed. The active ingredient in Accord XRT II, Accord Concentrate, and Rodeo herbicides is rated a Category IV compound for acute exposure. See Table 1.

Table 1. Acute (single) Exposure Studies with the Active Ingredient in Accord XRT II, and Rodeo.²

Exposure Route	Species	Toxicity	EPA Category
Glyphosate			
Oral LD50	Rat	5,600 mg/kg1	IV
Dermal	Rabbit	>5,000 mg/kg	IV
Inhalation LC50	Rat	Non-volatile2	—
Eye Irritation	Rabbit	Slight	IV
Skin Irritation	Rabbit	Non-Irritating	IV

¹Milligram test substance per kilogram of body weight.

²Will not vaporize enough to inhale.

Long-Term Toxicity Studies

Long-term toxicological studies have been conducted to determine the effects of prolonged exposure to the active ingredient in Accord XRT II, Accord Concentrate, and Rodeo herbicides. High doses were administered on a daily basis for the average lifetime (two years) of rats and mice and one year for dogs. Few effects were observed in the rat and mice studies. These effects were present only at high levels of exposure well beyond those expected in actual use situations. No effects were seen at any dose in the dog study.³ Z

Carcinogenicity

The EPA classifies the carcinogenic potential of pesticides by placing the results of laboratory evaluations into categories ranging from Category A to Category E, based on a thorough review of results from toxicological testing required by and submitted to the agency. Accord XRT II, Accord Concentrate, and Rodeo are classified as Category E. This category is the designation given to a compound that demonstrates no evidence for carcinogenicity in at least two animal tests in different species.³

Mutagenicity

Extensive tests designed to look for gene mutations, chromosome aberrations, and DNA damage and repair from exposure to the active ingredient in Accord XRT II, Accord Concentrate, and Rodeo were conducted. Results of studies demonstrate that glyphosate does not cause mutations.³

Reproductive Tests

Studies show that the active ingredient in Accord XRT II, Accord Concentrate, and Rodeo does not cause birth defects or reproductive problems in laboratory animals³. In a study where the ingredient was fed continuously over two generations, weight reductions were seen only at a very high dose level. Low dose levels in this study and in a three-generation study did not affect the offspring. Nor were any adverse effects observed on the ability of those offspring to develop into normal adults.³

Environmental Fate Studies

Additional tests were conducted with the active ingredient in Accord XRT II and Rodeo to determine how an herbicide behaves in the environment.

Soil Degradation

The active ingredient in Accord XRT II and Rodeo herbicides in soil is degraded over time by microorganisms to carbon dioxide³. Studies show that this degradation process does not harm the microorganisms naturally present in the soil. Microbial degradation occurs under both aerobic (with air) and anaerobic (without air) conditions. The average half-life of glyphosate is less than 45 days in soil and less than eight days in natural water. There are many factors affecting half-life such as soil pH, soil temperature, and soil moisture. For instance, higher soil temperatures will decrease the half-life which means the amount of active ingredient in the soil will breakdown faster as the half-life decreases. It does not accumulate in soil, even after repeated applications.⁴

Excerpt from Field Guide to Managing Saltcedar (2010)

Chemical Control

Herbicides are a primary method of saltcedar control and can be applied by a number of methods including fixed-wing aircraft, helicopter, tractor, truck or ATV-mounted boom sprayers, power sprayers, backpack sprayers, and carpet rollers. Treatment success depends on care taken during herbicide application. Most compounds available for saltcedar control have post-emergence activity and provide limited pre-emergence control (see "Table 3. Herbicide Recommendation Table").

Airplane or helicopter applications can be used to spray saltcedar successfully if the aircraft is equipped with the proper spray system. Helicopters can spray "tight," difficult areas that require precision application such as edges of meandering rivers or saltcedar stands interspersed with nontarget vegetation. Fixed-wing aircraft are better for spraying large, monotypic blocks of saltcedar where an overlapping spray pattern can be delivered at a lower operational cost than by a helicopter. Aircraft should be equipped with a satellite guidance system, a variable rate flow meter, and an onboard GIS display system for spraying in wildland situations. Areas to be sprayed should be premapped, and the onboard computer spray system should be preprogrammed to apply herbicide only on defined treatment areas. Swaths should be overlapped to prevent streaking whereby plants are left untreated or slightly damaged.

For aerial applications, the spray volume should be sufficiently high to insure maximum spray coverage. Spray nozzles should be fitted to deliver moderate to large sized droplets ranging from 450 to 1,200 μm . As indicated by table 3, a spray mixture may include 2 quarts of imazapyr or a 1.5 quart imazapyr plus 1.5 quart glyphosate mixture applied in water. A nonionic surfactant (0.25 percent by volume) and a drift control agent (0.07 percent by volume) should be added to the mixture. For optimum plant control, an aerial application should leave the entire saltcedar canopy glistening with spray liquid long after spraying has occurred. This can partially be accomplished by equipping the aircraft with the correct spray system and by spraying under optimal environmental conditions. Moderate temperatures (60 to 80 °F), high relative humidity (65 to 90 percent), and light winds (3 to 7 mph) are ideal to maximize herbicide activity. Late summer (August through September) is usually the best time to spray saltcedar by aircraft. Plants to be sprayed should be in a healthy state with full foliage that has not been stressed by drought, damaged by hail, or is beginning to turn yellow late in the season.

Control Strategies

Numerous research and practical integrated approaches have been developed to manage saltcedar. Successful long-term management programs (typically more than 5 years) usually include a combination of mechanical, fire, and chemical control methods. A combination of methods is particularly necessary if the primary objective is to achieve long-term native plant stability.

Prescribed Fire

Prescribed fire as a single control method is not recommended for long-term saltcedar management since saltcedar is fire adapted and re-grows rapidly. Natural or prescribed fires in mature or decadent stands of saltcedar are hazardous as flame lengths in these fires can be extremely high, and crown fires can be difficult to stop with standard fire-fighting methods. **However, burning may be useful or necessary to remove brush piles or dead saltcedar left standing after herbicide spraying.**

Table 3. Herbicide Recommendations

Common Chemical Name	Product Example	Product Example Rate per Acre	Individual Plant Treatment (IPT)	Time of Application	Remarks
Triclopyr ester	Garlon 4	NA	50:50 mixture of triclopyr and crop oil with a blue indicator dye	Anytime	For cut stump treatment, apply to fresh cut stump within 15 minutes of cutting.
Imazapyr	Arsenal	2 quart	1 percent mixture for foliage spray (1 gallon per 100 gallons of water with 0.25 percent surfactant and a blue indicator dye)	Late summer to early fall when plants are taking up nutrients—plants should be healthy and not stressed.	For IPT, spray to wet all foliage especially the terminal ends of branches. For aerial broadcast spraying, add 0.25 percent nonionic surfactant. Use a high spray volume; 15 gallons per acre total solution when applied by helicopter. Allow two full growing seasons before followup treatment.
Imazapyr + glyphosate	Arsenal + Rodeo	1.5 quarts + 1.5 quarts	1/2 to 1 gallon + 1/2 to 1 gallon (1 to 2 pounds + 2 to 4 pounds per 100 gallons of water with 0.25 percent surfactant and a blue indicator dye)	Same as imazapyr.	Same as imazapyr.