

INTEGRATED PEST MANAGEMENT PLAN

for

Flint Hills National Wildlife Refuge (Lyon and Coffey Counties, Kansas)

2004 through 2006

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INTRODUCTION

Integrated pest management encourages the use of a multi disciplinary approach to control pests through mechanical, biological, chemical, and cultural means. With sound ecological information on a species, weaknesses can be identified and exploited. "IWM [Integrated Weed Management] is species-specific, tailored to exploit the weaknesses of a particular weed species, site specific, and designed to be practical with minimal risk to organisms and their habitats (Colorado Integrated Weed Management Handbook, 2000)."

REFUGE BACKGROUND

Refuge Description

The Flint Hills National Wildlife Refuge is situated along the Neosho River floodplain. The refuge, established in 1966, consists of 18,463 acres located at the upstream end of the John Redmond Reservoir. The land is owned by the U.S. Army Corps of Engineers and is managed under a cooperative agreement. The refuge habitat consists of 4,900 acres of wetlands, 1,400 acres of open water, 3,589 acres of cropland, 3,200 acres of grassland, 2,400 acres of woodlands, 2,255 acres of brushlands, 599 acres along the Neosho River and associated creeks, and 120 acres of roadways.

When the Refuge was established in 1966, roughly 14,000 acres were being farmed. That number has decreased to the 3,589 acres being farmed today. The retired cropland has been converted to moist soil units, native grasses, and bottomland forests.

Because the refuge boundaries fall within the U.S. Army Corps of Engineers John Redmond Flood Control Project, 95% of the refuge can be under water at peak flood stage. This happened three times during the 1990s. Generally, 75% inundation occurs every 7 years, and 50% inundation averages once in four years. The frequency of flooding restricts land use on the refuge by reducing survival of grassland habitats, and transporting weed seeds across the refuge. The primary flood resistant cover types are bottomland hardwood trees, moist soil wetlands, and agricultural fields (crops can be replanted). More than half of the native tallgrass prairies did not survive the significant flood events in 1993, 1995, and 1998. Remaining tracts of native prairie occur above the high water line, around the perimeter of the refuge.

Soils are clayey and silty-clays with pH of 5.1-7.3 and soil organic matter content of 1-4%. The shallowest depth to groundwater is less than 10 feet. Bald eagles (*Haliaeetus leucocephalus*) occur at the Refuge from November through March, but not during the months when herbicides are applied. Flint Hills NWR is not within the range of Mead's milkweed. It has never been documented on the Refuge.

Refuge Land Management Goals

The Flint Hills Refuge is managed primarily to benefit migrating and wintering waterfowl in the Central Flyway. A variety of management practices are used on the refuge to meet wildlife needs. Feeding and resting areas for migratory birds are provided through aggressive moist soil and cropland management programs. In addition, prescribed burning and mowing are used to provide food and cover for resident wildlife species and migratory waterfowl. The refuge is

restoring riparian buffers along the Neosho River by planting them with native grasses, and through the natural regeneration of cottonwoods, ash, maples, and willow. Furthermore, the Refuge replants selected bottomlands with pecans and oaks.

WEED MANAGEMENT OBJECTIVES

Johnsongrass (*Sorghum halepense*) and sericea lespedeza (*Lespedeza cuneata*) are two persistent threats to the Refuge. Both are state and county listed noxious weeds. Eradicating sericea from the entire Refuge is not feasible because of the frequent floods. Flooding transports seeds from both Refuge and private lands and distributes them at the high water mark. Therefore, our sericea control focuses on eliminating sericea from the native tallgrass prairies. In an attempt to create a buffer, we attack large stands of sericea adjacent to native prairies. Our objective of eliminating sericea from prairies occupies most of our spraying time. Thus, some sericea in the non-critical areas of the Refuge goes untreated. Even after eliminating sericea from prairies, annual monitoring will be essential.

The Refuge objective for Johnson grass involves reducing its abundance in agricultural fields and along roads. As with sericea, complete elimination from the property is infeasible. We attempt to keep it under control in selected areas. The objective for Johnson grass is more difficult to define than for sericea, as Johnson grass does not present an immediate threat to our native habitats as sericea does. Therefore, we'll meet our objective if we remain vigilant and active with control along roads and within crop fields, the two primary sources of spread.

The cottonwoods and willows which invade our moist soil units could also be classified as pest species. They are a persistent problem, but one that we manage mechanically rather than chemically. We attempt to keep these woody species small enough in diameter (<2") that we're always able to mow them.

PEST BIOLOGY

Pest management on the refuge focuses primarily on noxious weeds in remnant prairies, along roadsides, and in agricultural fields. Sericea, native to Asia, was introduced in Kansas during the 1930s for erosion control on roadsides and forage in rangelands. In the 1980s, it was declared a problem species within the state. It was first sighted near the refuge in 1980. Three major floods in the 1990s transported seeds throughout the refuge, thereby greatly increasing the total number of invaded acres. Sericea outcompetes native prairie plants, and will gradually form monotypic stands.

Life history characteristics contribute to its spread and resistance to control: perennial 20-year lifespan, seed viability 15 to 20 years, drought resistance, stimulated by fire, production of up to 1,500 seeds per stem, seed dispersal by wind/water/animals. Sericea creates problems in pastures and prairies, but rarely in hay meadows or crop fields.

Johnsongrass, native to the Mediterranean region, was introduced to the U.S. as forage (Colorado

Integrated Weed Management Handbook 2000). Qualities that enhance its spread and resistance to control include: perennial growth, large quantities of seeds, reproduction through seeds or rhizomes, aggressive growth/spread/colonization/competition.

INVENTORY OF WEED SPECIES

Noxious weed inventories are systematically conducted on an annual basis, with the Refuge concentrating its inventory on the native prairie habitats. Pre-treatment monitoring involves walking through prairies in search of plants. Sericea expanded dramatically across the Refuge during the floods of the 1990s, because sericea occurs both on the Refuge, and on the surrounding private land. Flooding, a primary source of seed transport, is not preventable on this Refuge, so we spray sericea to prevent it from overtaking our native prairies.

Good progress was made on Johnsongrass control until the 1993 flood distributed seeds throughout the refuge. Floods in 1995 and 1998 only made problems worse. In the anticipation of future floods, the refuge limits Johnsongrass treatment to areas of high public use (roadways and adjacent parking areas).

MONITORING AND MAPPING

The Refuge maintains an ArcView GIS layer for noxious weed control. Documentation includes: areas infested, records of spraying, sites needing additional treatment. This layer is updated with each year's spraying and monitoring. We record the location of sprayed sericea plants with a Global Positioning System. This proves particularly useful on single plants within our native prairies. We can then return to check these locations the following year to ensure that treatment was effective. While searching for sericea, we also remain observant for new invasive species.

Cooperative farmers monitor crop pests. They spray for weeds and record their herbicide usage. No maps are created, because problems are addressed annually within the fields. Much of this document addresses Johnson grass and sericea because they pose the greatest threat to our native habitats. However, the majority of our herbicide usage occurs on agricultural fields to control Johnson grass, pigweed, and other broadleaved weeds.

PRIORITIES FOR MANAGEMENT

The Refuge prioritizes tallgrass prairie because it's such a rare ecosystem. All of our prairies receive equally high priority. We want to eliminate existing sericea plants and keep sericea from invading new sites. Johnsongrass receives similar priority from Refuge staff because it is very obvious and recognizable to the public. Along roads, mowing can keep it from seeding. Although not a threat to native habitats, Johnsongrass is of importance to cooperative farmers, as it can dramatically reduce yields. Therefore, within agricultural fields, herbicides are used to kill the plants.

MANAGEMENT ACTIONS

Prevention

Preventing sericea and Johnson grass from reaching the Refuge is impossible, because they are already here. Reintroduction is also impossible, because floods will occur again and redistribute seeds at the high water mark, 1068 feet. However, we can take action to prevent the spread to new sites within the Refuge. We do this by educating our staff to limit travel in sericea-infested locations at the time when sericea has gone to seed. Spraying is completed by this time, and generally these are not locations that we burn in the Fall.

Cooperative farmers practice crop rotation, and multicropping to reduce the amount of herbicides needed. Where possible, the farm fields are double cropped, with winter wheat and late beans grown within one year. Thus, weeds are reduced through increased tillage, and there's less need for herbicide. This chemical list has grown in recent years to provide better tools for combating agricultural weed problems.

Maintaining levees and water control structures requires heavy equipment work. The Refuge quickly replants disturbed areas with native grasses to reduce the chances of noxious weed invasion.

We don't graze livestock, so pathogen-free hay is not applicable.

Control Options

Sericea

Research on the control of sericea offers few promising results. Burning sericea increases the germination rate of the seed. As sericea accumulates tannins throughout the growing season, it becomes unpalatable. There are no known biocontrols. Annual haying may be effective before sericea goes to seed, but sericea readily resprouts. Therefore, chemical controls are most commonly recommended. Tordon and 2,4-D are ineffective. Remedy and Escort have shown positive results. Flint Hills NWR, in cooperation with the Coffey County Extension agent, has established plots to test the effectiveness of Escort.

The challenge in tallgrass prairies comes from treating sericea while minimizing effects to native species. One must consider the longevity of the herbicide, even when spraying in the fall. Remedy is faster acting, but may impact more forbs than Escort. Escort is easier on forbs, but its residues can last into the next growing season. Escort can have its greatest effect when applied late in the fall if forbs are dormant, but sericea is actively growing. However, a problem lies in the longevity of the seed bank. Retreatment may be required every two to three years. As research on Escort continues, the Refuge continues to effectively spray and eliminate sericea with Remedy.

Spraying sericea with Remedy in the native prairies has been the focus of treatment on the Refuge. Areas with continuous stands of sericea are typically treated with a broadcast nozzle sprayer. Then, we follow with spot spraying to minimize impact on non-target species. Other areas do not require broadcast spraying and may be kept in check with spot spraying alone. Spot spraying of sericea began on the Refuge in 1999. In the dry summer of 2000, no acres were

sprayed with Remedy, because sericea wasn't growing actively enough to make the chemical effective. In the summer of 2001, Refuge staff spot sprayed sericea on 100 acres of native prairie and restored grasslands. Locations spot sprayed in 1999 were relatively weed free, indicating the effectiveness of Remedy™ in sericea control.

No site restoration is necessary after spraying sericea. Native vegetation will fill in the gaps.

Johnson grass

Johnsongrass poses a problem in agricultural fields and along roadsides. Cooperative farmers have a variety of herbicides approved for use on Refuge croplands. Accent, Beacon, Blazer Exceed, Poast, Pursuit, Scepter, and Select all prove effective in Johnsongrass control. Along roads, mowing has been done in small areas. Locations along stream corridors are allowed to grow up into trees, which eventually shade out and eliminate Johnsongrass.

Johnsongrass has been treated with repeated mowing (2-3 times) in a single growing season. Mowing can be done before seed heads mature. However, because this must be repeated for many years to be effective, the repetition makes mowing impractical over large areas.

Roots and rhizomes die when exposed to cold, so repeated winter tilling can work in locations completely covered with Johnsongrass. Herbicides (glyphosate, fluzifop-P-butyl, and sulfometuron methyl) may work on small seedlings 2-18 inches tall.

Cottonwoods and Willows

We try not to keep our moist soil units either wet or dry during the 2-3 week period when the cottonwoods are dispersing seeds. Cottonwoods and willows invade our moist soil units. The Refuge employs a combination of disking, mowing, burning, and flooding to control these species. Many of the problems are addressed by the normal sequence of disking necessary to maintain the early successional vegetation. If units are drawn down, and precipitation is minimal, we can mow the trees when they're small enough that they won't damage our equipment. However, after several years of heavy rain, we may need to burn the moist soil units to kill the larger trees. This is generally done in the fall, as units are rarely dry enough in the spring to allow burning. Fall burns hold the potential of removing vegetative cover and food just before the coming waterfowl migration. However, some units can be burned to kill the invading trees while leaving the essential cover.

Agricultural Weeds

Cooperative farmers apply herbicides to Refuge agricultural fields. Some farm fields are double cropped with winter wheat and late season soybeans. Thus weeds are reduced through increased tillage, and there's less need for herbicide. Crop rotations are determined by the Refuge Manager. In addition to the crop rotation, multicropping, and other prevention tactics, cooperative farmers use Roundup to control agricultural weeds. Of the herbicides approved for use on the Refuge, Roundup offers the greatest coverage and is by far the most commonly used.

The chemical list has grown in recent years to provide better tools for combating weed problems. For example, common waterhemp (*Amaranthus rudis*) shows resistance to Beacon, Accent, Pursuit, and Scepter. The Refuge is interested in substituting modern chemicals for older ones. For example, Aim, Extreme and Valor are new proposals. Valor and Aim have minimal residual time. Aim can be used in all four crops grown on the Refuge: wheat, corn, soybeans, and milo. Valor is effective against waterhemp in soybeans. If Valor were approved, we could remove Scepter from the list in 2003. Similarly, Extreme could be substituted for Pursuit. The PUP list is bigger this year, but if we get the new herbicides approved we plan to remove some older ones. The Refuge adheres to an objective of reducing total pounds of chemicals used.

Insect Pests

Control options for insect pests within crop fields are limited because the Refuge does not allow pesticides. In 2001, an alfalfa field was invaded by insects. When crop died, the Refuge asked the cooperative farmer to plant winter wheat and then red clover for two growing seasons before the field is retired from farming and then reseeded to native grasses.

Application Methods and Timing

Sericea

Spot spraying with Remedy proves the most effective method for treating sericea within native prairies. The Refuge uses a 10 gallon tank mounted on the back of a 4X4 ATV. For smaller, less accessible locations, backpack sprayers and hand held sprayers are useful. Spot spraying can be accomplished with minimal overspray on surrounding vegetation. Large patches require a nozzle sprayer that tows behind a tractor. June, July, and August are the best months for treatment, because sericea is visible, actively growing, and it has not yet gone to seed.

Johnson grass

Within agricultural fields, Johnson grass is sprayed or wicked in the summer before it has seeded. Roundup is the most effective and most prevalent herbicide used for Johnson grass control. Refuge staff mows small patches along road sides.

Best Management Practices (Recommendations from Elaine Snyder-Conn 6/27/2002)

1. Do not apply any of the herbicides within 48 hours of forecasted rainfall, especially moderate or heavy rains.
2. Do not apply Extreme, Pursuit, Remedy, or Scepter within 150 feet of any wetland or water body, and don not apply Garlon 3A within 50 feet of wetlands or water bodies, except by wicking or wiping.
3. Except for wicking or wiping with Garlon 3A, do not apply any herbicide except glyphosate within 50 feet of wetlands or surface waters or where groundwater is less than 5 feet deep.
4. Except for wicking, or wiping, or backpack spot spraying, of individual plants, do not spray when wind velocities exceed 7 mph, or when inversions exists. Assess wind direction, wind speed, and inversion conditions using measurement devices such as anemometers, windsocks,

and smoke devices. Burning tires are not allowed. Smoke from existing burning activity or smokestacks may be used for assessing inversions if similar in elevation and within one mile of the application site.

5. When spraying, use nozzles with orifices of 1/16 inch diameter or greater operated at a boom pressure of 30 psi, or use Turbojet, Drift Guard, or equivalent low drift flat spray nozzles. As a best management practice, strive for pressures that produce droplets with median diameters no less than 250 microns, and ideally 500 microns and use the lowest possible pressure within the nozzle's ideal range. Shielded booms and shroud covers are also recommended to protect nontarget broadleaves.

6. Avoid spraying Remedy when air temperatures exceed 85°F.

Best Management Practices: Flint Hills NWR

In the late 1990s, the Refuge established 200 foot buffers on both sides of the Neosho River, and 150-foot buffers on tributaries. Agricultural areas removed from production were planted into native grasses. Many parts of the Refuge were already forested along the River and tributaries and needed no additional buffers.

Beginning in 2002, the Refuge is installing 66-foot field borders on parts of crop fields that aren't part of the riparian buffers. These will be planted to native grasses in an attempt to trap sediments, herbicides, and fertilizers. The 66-foot width was selected to increase filtering capacity within our clayey soils. Furthermore, 66 feet will comply with Total Maximum Daily Load (TMDL) requirements which may be established for the Neosho River drainage in the future.

OUTREACH

The public doesn't need much notification, because our neighbors in this agricultural community battle the same problems with sericea and johnsongrass that we do. The locals understand the threat and the control methods for these weeds. Refuge staff are trained on the proper use, handling, and PPE for the approved pesticides. IPM Plans, PUPs, Specimen Labels, and MSDS are available to all Refuge staff. We post signs "No Entry - Chemical Application" for 48 hours on areas sprayed with Garlon 3A.

Flint Hills NWR Summary of Garlon 3A Field Tests

We tested three application methods for controlling sericea lespedeza (*Lespedeza cuneata*) with Garlon 3A. Results were mixed. With hand-held sprayers and an ATV sprayer, control was good and results were comparable to Remedy if you soaked the entire plant. However, with broadcast spraying, Garlon effectiveness was 50%, compared to 90% with Remedy.

Elaine Snyder-Conn searched for efficacy comparisons between Remedy (Triclopyr ester) and Garlon. (Triclopyr salt). DowAgrosciences did not analyze Garlon 3A effectiveness, because they knew it would be less effective than Remedy. The DowAgroSciences representative for eastern Kansas estimates 50% more Garlon required to create the same effectiveness as Remedy.

Despite the acknowledged leaching potential of triclopyr-ester (Remedy) Flint Hills NWR and Marias des Cygnes NWR would like to continue using Remedy in upland locations for two reasons: 1) unique site features which make leaching unlikely, 2) applicator safety.

Site Conditions

Soils: texture, temperature, pH, organic matter content

Triclopyr ester shows leaching potential in sandy soils, however the soils at both Refuges are silty clays. Even in loamy soils, little vertical or horizontal leaching was documented (USFS 2001). Both the ester and the salt rapidly degrade by soil microorganisms, with the half-life averaging 30 days (The Nature Conservancy 2001). Three factors contribute to this high decomposition rate: warm soils, high organic matter content, low soil pH (The Nature Conservancy 2001). All three factors are present at Flint Hills and Marais des Cygnes Refuges.

Root Depth

Furthermore, microorganism activity is greatest in the root zone. As density and health of the root zone increase, so does the degradation rate of herbicides (Deubert 1990). Few places in the country have as deep or dense a root system as the tallgrass prairies of eastern Kansas. Roots from forbs and warm-season grasses typically reach 6 feet in depth. This should contribute to degradation of the little triclopyr which leaches through the clayey soils.

Interception

Very little triclopyr should reach the soil surface in areas where we spray. The structure and density of vegetation precludes the chemical from falling onto the soil. Grasses stand 3-4 feet tall and at their base form a complete thatch covering the soil surface. Furthermore, triclopyr ester is degraded rapidly into triclopyr acid by live vegetation. The acid binds moderately to soils and quickly degrades in sunlight (The Nature Conservancy 2001).

Applicator Safety

Garlon 3A may cause permanent corneal damage or blindness (MSDS 2001). Complete eye coverage is required and NIOSH respirators are recommended. This PPE (full sealing goggles, rubber boots, and air filter/respirator) is difficult to use, even in early summer. Even with appropriate PPE, I'm hesitant to work with such a hazardous chemical. I also wonder about visitor safety and compliance with the 48-hour closure of areas sprayed.

Refuge IPM Planning for Sericea Lespedeza control: Remedy and Garlon 3A

Flint Hills and Marais des Cygnes Refuges seek approval to continue using Remedy on upland sites. However, we'd like to keep Garlon 3A as an option for the few locations where sericea grows near ponds and creeks. Garlon 3A is important for sericea adjacent to water, but less useful in the uplands, where heavier applications or multiple applications would be necessary to gain the same effectiveness as Remedy.

Our objective is to remain aggressive during the next few years, thus ultimately eliminating the need for broadcast spraying on the Refuge. Spot spraying will always be necessary to keep sericea from re-invading sites.

In summary, we need Garlon 3A near for use near water. However, we'd like to keep Remedy because it's more effective.