Machine (Bulk) Harvest

1991

Co-op farmer Mark Wiggins reported harvesting the following bushels per acre on his portion of the Iowa Power Co. land for 1991: 40 bu/ac average on beans versus 45-48 most years and 100 bu/ac average on corn versus 125-130 normally.

There was no cropland under Service ownership in 1991.

Tom Cady, Refuge volunteer, collected the first seed for establishment of the prairie reconstruction. Pale Purple Coneflower and New Jersey Tea were collected within the area define by Dr. Daryl Smith as providing local genotype sources.

1992

1992 field work concentrated on the collection of local ecotype seed. The designated collection areas for local ecotypes are in 38 counties in central and southern IA. Includes: Jasper, Marion, Marshall, Polk, Poweshiek, Tama, Warren, Benton, Iowa, Johnson, Keokuk, Linn, Mahaska, Washington, Clarke, Decatur, Lucas, Madison, Ringgold, Union, Wayne, Appanoose, Davis, Henry, Jefferson, Monroe, Van Buren, Wapello, Boone, Carroll, Dallas, Greene, Guthrie, Story, Adair, Adams, Audubon, and Taylor.

Scattered remnants of prairie across the state. Initial steps were to find these remnants and make arrangements with the landowners for harvest.

The 5 “seed seekers” in 1992 included Scott Bryant, Tom Cady, Carole Kern, Eugene Kromray, and Dan Varland. Integrated Roadside Vegetation Management office at the U of Northern IA.

Each seed seeker conducted an evaluation of each site. Recorded: landowner info., location, topography, size, management and harvest suggestions, noteworthy species and exotic species of concern. Species list were made to be a quick and useful indicator of the relative value of the site.

Seed seeking efforts took place between mid-July and mid-September. Due to constraints, only 32 of 38 counties were surveyed. Results were used to create priority ratings for hand harvesting and machine harvesting sites.

Approximately 5,933 acres or 481 prairies, including bike trails and railroad right-of-ways, were surveyed. Four hundred seventy were determined to be within our ecotype.

The seed seeking efforts identified several previously undocumented prairie and savanna remnants and generated interest in preservation and management of many of them. In

some cases, landowners were unaware of value and rarity of their "old pastures". Many have since requested further information on prairie restoration.

Most of the seed obtained for WNT involved purchase of seed from commercial prairie seed companies, enterprising individuals and from custom harvesters of prairie remnants pre-approved for harvest by WNT. Use of a Kentucky bluegrass stripper modified by Gene Kromray to harvest several heights of prairie seeds with minimal impact to prairie remnants proved to be a successful method of harvesting. Mr. Kromray was able to harvest seeds from plants 18 inches to five feet tall in a single pass. Although a large amount of extraneous material was also collected using this method, it is anticipated that this chaff will carry egg cases of rare invertebrates as well. Another advantage to this method was that a large amount of standing duff remained for burning in the spring or for nesting habitat.

Approximately 8,000 pounds of harvested material were obtained using the modified stripper. The amounts and species of seed obtained while harvesting depended on the condition of the prairie and on previous management techniques. Burning increased the seed amount on these prairies by about 60%. Some species, such as prairie dropseed (Sporobolis heterolepis), require burning prior to producing seed.

Dan Allen, Allendan Seed, custom harvested using two types of combines. One was a traditional combine and a second was modified with a brush head. This seed was processed, removing much of the chaff. These methods also proved to be successful, but inclement weather conditions prevented maximizing harvesting opportunities for this year.

Aldo Leopold noted "To preserve every cog and wheel is the first precaution of intelligent tinkering." Because we consider all of the prairie remnants we harvest as important pieces of our tallgrass prairie heritage, we are careful to leave seeds for posterity on the site. In all methods of harvesting we have used to date, we have tried to be careful to preserve the resource we are tapping for seed.

Haying, which took place on the Refuge during the last year, was done as a vegetation management tool rather than as a livestock forage producing mechanism. There were approximately 243 acres of ground hayed. This activity reduced weeds and unwanted vegetation growth.

1993

In 1992, several native prairies, savannas and production plots of local ecotype native grass were harvested for planting on WNT in 1993. Fall weights of harvested material varied greatly from spring weights due to drying, even though the harvest season was dry. For example, by spring of this year, weight of coarse-textured material harvested using a modified Kentucky bluegrass stripper decreased in weight by approximately 50% of

harvest weight. The total harvest effort yielded approximately 5,000 pounds of dried material.

Harvested material ranged from a coarse-textured mix of seed, straw and other extraneous material to pure seed. Precise amounts of seed per species were unknown for these harvests. Seed weight estimates were developed based on weights of coarse screen separation of samples of this material and on visual estimates. From these estimates, site visitations prior to harvest, and a previously developed site species list; a general list of species present in the harvested material was developed. Precise species lists per harvest lot, however, have not been developed.

Each machine harvest of a prairie remnant was used as a matrix for first year planting. Species were added to the matrix as appropriate to increase the local ecotype diversity. Seeding rates in 1993, therefore, were based on estimates of seed weight, on estimated species composition of prairie matrices and on known amounts of seed per species available in lots of seed that were hand collected seed or harvested from production plots.

Origin of seed was also considered in development of species mixes. Seeds collected from remnant natural communities nearer the Refuge are presumed to be genetically more similar to historic plant communities at WNT than seed collected from more distant sites. For this reason, nearer sites are considered to be a more valuable seed resource. Six ecotype priority zones were developed based on distance from the Refuge and described by county boundary—Zone 0 being WNT and Zone 5 being the most distant (approximately 90 miles) from WNT.

Seed matrices originating from the sites closest to WNT were planted nearest to existing remnants and in more highly restorable areas on the Refuge. Production plots were designed using selected species of clean, or nearly clean, seed collected on, or in close proximity to WNT. Seed originating from more distant areas were planted on sites more distant from existing remnants.

As in all other field activities this year, harvest of prairie and savanna prairie species was affected by rain. June and July harvests of sedge meadows and fall harvests of wet-mesic prairies were prevented due to standing water or wet soil conditions. Harvesting that would damage remnant natural areas was avoided.

Both machine and hand harvested seeds were extremely wet. We anticipate that we will have approximately the same amount of seed from harvests in 1993 as in 1992. Though we will probably have an equivalent amount of seed from this year's harvest, the quantity of individual species and the conditions of seed harvested is somewhat different that last year, again, due to the rainy season.

Many wet areas were literally under water, ranging from a few days to several weeks; therefore they did not produce seed. Species growing in wet to wet-mesic areas, such as the prairie gayfeather (Liatris pychnostachya), generally did not produce viable seed as successfully as last year. Dry areas, on the other hand, produced abundant, plump seed,

especially from species that bloomed from mid to late season. Scalely blazing star (Liatris squarrosa) and rough blazing star (Liatris aspera) were observed on one dry site in almost solid 20 foot bands (arranged relative to the topography) of healthy seed producing plants. Seed production for such species such as prairie gayfeather, occurring in set sites.

Some species of prairie plants apparently had low seed production throughout much of our local ecotype range and the poor success in seed set seemed more closely related to season of bloom than site moisture conditions. Many of these species bloomed in the first half of the growing season and a suspected cause of low seed production was low availability of pollinators due to the cool, wet season.

Seed predation appeared to be high in big bluestem on some of our harvest sites in 1993. Apparent insect damage occurred in the inflorescence and in the culm. In prairies affected by this condition, many inflorescences did not produce viable seed.

We are also concerned about the potential spread of big bluestem smut, a non-native fungal disease believed to have started in Iowa from plantings of seed that originated in Nebraska. This disease is ultimately fatal to affected plants; symptoms include occurrence of several shortened culms among taller culms. Eventually in successive years, no normal height culms occur and the plant finally dies.

The reconstruction plans called for the elimination of haying in 1993. The weather during the growing season made local hay production very poor, resulting in a shortage. Because of this and the amount of hay ground available on WNT, haying was offered to the Cooperators on selected units. Due to delayed cutting, only 25 acres were actually put up. The quality was inferior, but Cooperators were grateful for the opportunity.

1994

This year seemed to be a good year for Indian grass production (Sorghastrum nutans). However, compass plant (Silphium laciniatum), round headed bush clover (Lespedeza capitata), and false indigo (Baptisia lactea) did not produce seed well. In the case of compass plant and false indigo, seed apparently failed to form on most plants. On some especially low wet areas, false indigo was unusually small and seemed to lack vigor. Round-headed bush clover, on the other hand, produced seed heads, but they tended to be small and riddled with insect damage. Among the many possible reasons for crop failure among certain species is that wet conditions in 1993 caused some root damage in deep rooted species in moist soils, and these species are sacrificing seed production for root repair. Wet weather last year could also have favored disease organisms feeding on species like round-headed bush clover.

Most plantings were mowed once or twice during the growing season to reduce weedy competition and to provide light to developing prairie species. We also baled a cover crop

of oats to remove non-native plant material and expose developing parried species to sunlight.

1995

Vendors offering machine harvested seed in 1995 were required to provide seed analysis from an accredited lab for each lot. Also, harvest sites were required to meet WNT's local ecotype requirements. In 1994, a portion of purchased material was extremely coarse textured and difficult to feed through planting machines. In 1995 seed texture was required to be of a size that would feed through seeding equipment.

A list of species generated last year was used to guide 1995 seed purchase, (refer to 1994 Annual Narrative; Table A). Species included contained on or more of the following characteristics.

- Seeds were known to establish early in planting
- Readily recognizable or showy species important to education goals of the Refuge
- Important members of the developing native landscape

A database was used to track species, origin, collector's name, and weight of seed. Tetrazolium test results were recorded and used to indicate the amount of live seed. Planting prescriptions were developed based on live seed estimates.

Hand collected seed was available through volunteer seed collection efforts and by purchase. Species, origin, collector's name, and weight of hand harvest seed were also tracked. Through bulk harvest provided the majority of grass planted, and served as a matrix to which hand collected species were added, hand collections provided additional diversity unavailable in bulk harvests.

In some three-year-old plantings mowing was used to limit success of particular weed problems on the site. Site 17, for example, supported heavy populations of sweet clover. This biennial exotic species can be a severe problem in prairie plantings. This site was mowed twice at peak blooming and prior to seed set to reduce reproductive success of the sweet clover. Interestingly, a good stand of prairie dominated by little bluestem matured and was harvested despite repeated mowing.

Fall Harvest-
In 1995, volunteers hand collected approximately 100 prairie species, roughly equivalent to the 1994 harvest of 105 species. In 1993, volunteers collected 71 species.
Harvesting success depends on ecological conditions as well as the physical logistics of harvesting. Grass harvest seemed relatively poor in 1995, though WNT staff harvested approximately 2,000 pounds of seed, mostly grass, on 11 refuge sites. Tetrazolium tests indicated these harvest of big bluestem Indian grass, and Canada wild rye ranged from 80-95% viable. Little bluestem tests ranged from 30-32% viable, and drooping coneflower was 53% viable. Viabilities even lower than 30% were expected from big bluestem

because this site was only three years old, had not been burned, and had been mowed twice during the season.

By the end of fall, 8 sites planted in 1993 and totaling approximately 190 acres completed their third growing season. Despite sparse evidence of establishment and growth in 1993 and 1994, prairie species began to thrive this year. All sites with the exception of one produced seed of at least on prairie species to make harvest worthwhile. Additional harvest sites included a 1994 planting site and a small remnant site and a small remnant population of Indian grass.

Harvest resulted in 950 lbs. of big bluestem, 450 lbs. of Canada wild rye, 300 lbs. of little bluestem, 20 lbs. of little bluestem, 300 lbs. of forbs/grass mixture and 45 lbs. of partridge pea. The mix of prairie forbs and grass species was dominated by Virginia wild rye, Canada wild rye, drooping coneflower, mountain mint, black-eyed Susan, and wild bergamot. These weights represent bulk, partially cleaned harvest and are estimated to be approximately 50% pure seed.

In addition to vigorous growth, marked increase in biomass and ultimate seed production, plant species establishment patterns on these sites are interesting in comparison to one another. On most sites, the most visually dominant species are prairie grass species, especially big bluestem. Within a matrix of grass species, a diversity of forbs is present. Asters, goldenrods, black-eyed Susan, evening primrose, tick trefoil, mountain mint, and several other species are common species present in the matrix of dominant grass. Other species such as compass plant, purple prairie clover, white prairie clover, blue flag iris, pale purple coneflower and others are present but in relatively low numbers.

These observations may be deceiving or premature, however, as most of these sites were mowed once or twice in 1995 to accomplish weed control. Though grass species tended to grow vigorously by the end of the season, many forb species tended not to achieve their typical height, and most did not bloom. Long-lived perennials producing only basal leaves at this state, such as pale purple coneflower and compass plant, might not produce additional leaves. Other forb species lost apical dominance with mowing and branched, completing the season at a lower height than their counterparts in unmowed areas. We are taking a "wait-and-see" attitude toward forb establishment in these areas, especially as many species of forbs have a longer establishment time relative to flowering than do grass species.

1995		
Site	**Pounds**	**Dominant Species**
9	18	Partridge pea (*Cassia fasciculata*)
18	450	Canada wild rye (*Elymus canadensis*)
14	70	Big Bluestem (*Andropogon gerardii*)
15	130	Big Bluestem (*Andropogon gerardii*)
8	700	Big Bluestem (*Andropogon gerardii*)
1	50	Big Bluestem (*Andropogon gerardii*)
10	300	Grass/forb mix
17	250	Little Bluestem (*Schizachyrium scoparium*)

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30	30	Indian grass (*Sorghastrum nutans*)
18	100	Indian grass and Little bluestem
Total	2,098	

1996/7

1996		
Site	**Pounds**	**Dominant Species**
9	140	Partridge pea (*Cassia fasciculata*)
2	1,914	Canada wild rye (*Elymus canadensis*)
13	252	Big Bluestem (*Andropogon gerardii*)
14, 15	1,106	Big Bluestem (*Andropogon gerardii*)
8	1,224	Big Bluestem (*Andropogon gerardii*)
23	226	Indian grass (*Sorghastrum nutans*)
17	882	Little Bluestem (*Schizachyrium scoparium*)
Interim	1,736	Mixed forbs
25	2,690	Mixed forbs
22	220	Mixed forbs
10, (22 and 33)	366	Mixed forbs
Total	10,776	

1998

1997 Machine Harvest		
Site	**Pounds**	**Dominant Species**
14	1782	Big Bluestem (Andropogon gerardii)
39 & 13	664	Big Bluestem (Andropogon gerardii)
39, 13, 6, & 8	1212	Big Bluestem (Andropogon gerardii)
8	1778	Big Bluestem (Andropogon gerardii)
6	902	Big Bluestem (Andropogon

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		gerardii)
35	4295	Canada wild rye (Elymus canadensis)
36	2306	Canada wild rye (Elymus canadensis)
Production Plots	18	Rattlesnake master (Eryngium yuccifolium)
3	254	Forb mix
18W	254	Grass/Forb Mix
19	580	Grass/Forb Mix
29	212	Grass/Forb Mix
42	392	Grass/Forb Mix
32 & 33	548	Grass/Forb Mix
27	986	Grass/Forb Mix
31	842	Grass/Forb Mix
9, 10 along trail	25	Grass/Forb Mix
10 including trail	52	Mixed Forbs
Production Plots	44	Drooping coneflower (Ratibida pinnata)
17	1828	Little bluestem (Schizachyrium scoparium)
West of PLC	36	Bullrush (Scirpus sp.)
32	458	Indian grass (Sorghastrum nutans et al
Total	**19468**	

(Fical year 1998 harvest occurred during October, 1997. Hand harvest occurs from spring through late fall, unable to break it up)

In winter of 1997-1998 the Iowa State University Seed Analysis Laboratory was unable to complete necessary seed analysis for seed harvested by machine on the Refuge. However, the staff at the laboratory was enthusiastically willing to teach seed analysis skills to the Refuge staff and volunteers. Refuge biologist Drobney and Erma Selser, WNT volunteer, worked in the seed lab for a day learning purity and viability analysis skills. The seed analyst most skilled in work with native seeds later spent a day in the WNT research labs teaching Ms. Drobney how to prepare seeds in actual WNT seed samples for viability testing.

A cooperative agreement was arranged with Central College Chemistry Department to use fume hoods in the Biology/Chemistry Lab during their spring break so that tetrazolium testing could be performed. Presence of pink color indicates products of respiration. Damaged seeds can also stain pink, sometimes making analysis difficult.

Machine (Bulk) Harvest

Several volunteers collaborated on purity and viability analysis. Ms. Selser contributed numerous hours in these analyses and tabulated results in a computer database. The total volunteer contribution of hours was equal to having a staff person full time for six weeks.

1999

Machine Harvest – Planting projections for the year 2000 were reduced from the average 350 acres per year, planted in the past, to 150 acres. This reduction will allow us to address weed problems, to interseed with hand collections on the rest of the Refuge, as well as focus on development of seed production plots. Despite the reduction in seed need projected for 2000, approximately 31,000 bulk pounds of seed were harvested on-site in a cooperative effort between the Refuge, Iowa Private Lands Office (IPLO), and the Iowa Department of Natural Resources. In this effort, the Refuge provided harvesting sites, equipment for harvesting and drying seed and storage facilities; IPLO provided harvesting effort; and Iowa DNR provided 1 FTE during harvest season. Of this harvest we retained approximately 4,800 bulk pounds, and the IPLO received 26,300 pounds.

Of the seed retained by IPLO most was provided to the Iowa Department of Natural Resources (IDNR) to assist in development of local ecotype seed bases and to develop large scale ecological restoration projects. As such, the Saylorville Wildlife Unit (IDNR) received 22,760 pounds for project near Ledges State Park, and at Bays Branch Wildlife Unit near Panora. An additional 2,540 was transported by the Red Rock Wildlife Unit (IDNR) for use in the large scale Chichaqua Project (approximately 7,500 acres) near Des Moines. An additional 1,000 pounds will be used in various projects in Warren County and in other areas as needed.

2000

Approximately 16,000 bulk lbs. of seed were harvested on-site. Sites were harvested in a timely manner after the Refuge Biologist inspected units and verified seed readiness. The Operations staff harvested and processed the seed with the assistance of available personnel from Iowa DNR. Seed was dried and cleaned at the Refuge and kept in Refuge storage facilities. Of this harvest, the Refuge retained approximately 7,000 bulk lbs. and the Iowa DNR received 9,000 lbs.

Approximately 9,000 lbs of bulk harvested seed was transferred to Iowa DNR as part of the partnership for using local eco-type seed on Iowa restoration sites.

Ecological Outreach and Information Sharing - Development of Local Ecotype Zones for Minnesota and Iowa - A map of local ecotype seed harvest zones for Iowa and Minnesota was begun by Drobney in 1999 upon request from the Regional Office. Such

zones could be used to guide development of local ecotype projects throughout these two states. Within a year, the Northern Tallgrass Prairie Ecoteam developed a priority that stated that within the ecoregion, all FWS programs would become independent of non-local ecotype seed within 5 years. The map and guidelines that Ms. Drobney developed to explain intended use of the map were unanimously adopted by the ecoteam for use in establishing cooperative project areas in the Northern Tallgrass Prairie Ecoregion.

Machine (Bulk) Harvest

In the final map, entitled "Ecotype Zones for Minnesota and Iowa", there are 9 distinctive ecotype zones, with a caveat that land immediately associated with major riverine systems such as the Missouri, Mississippi, and Minnesota Rivers, be considered separate ecotype zones. Each of the major zones are divided into at least two subdivisions, because though there are broad ecological similarities within each of the zones, there are likely genetic differences due to the relatively broad geographic coverage. This is especially true in zones broadly oriented north and south because latitudinal differences are directly related to climatic differences. Climate including daylength, rainfall, and temperature, critically affects genetic characteristics of plants.

A document defining local ecotype and including definitions, rationale, and common-sense guidelines for use were developed to explain intended application of the information on this map. A **local ecotype zone** is defined as a geographic area with generally similar environmental characteristics and plant and animal species associations, and within which genetic characteristics are likely to be similar.

The zones on the map are intended to be used as a general guide, not applied as a rigid rule. For the purposes of prairie seed collection and ultimate planting, local ecotype zones are constructed broadly enough to accommodate large or general projects, but narrowly enough to express ecological uniqueness.

Use of ecotype zones is subject to decisions made on a case-by-case basis by Project Leaders and land managers within the area. In some cases, land managers may design a project local ecotype zone that is much more restrictive than this map indicates, for example, when a parcel of farmland is purchased near a high quality prairie and will be restored to prairie. In other cases, the project local project ecotype zone could include portions of two or more ecotype zones indicated on this map. One reason could be because the project is near or across the boundary of three zones. Portions of all three zones may be appropriate in the project local ecotype zone.

This map is currently being used by the FWS in the Northern Tallgrass Prairie Ecoregion to develop cooperative project areas to share resources and effort to develop specific ecotype zone seed production. Seed nurseries that will produce single species harvests, and multi-species plantings that will produce somewhat diverse harvests are being planted in several areas from seed originating from local prairie remnants.

In addition, the Iowa DNR, noting the FWS leadership in this arena, has decided to adopt the goal of becoming independent of non-local seed within 5 years. Jim Munson, of the Iowa Private Lands Office, spearheaded the cooperative effort between FWS and DNR and at a meeting he facilitated and that was held at the Neal Smith NWR, Iowa DNR staff present unanimously agreed to adopt the same ecotype zone map that the Northern Tallgrass Prairie Ecoteam had adopted. The Iowa DNR is now a strong partner with Iowa FWS team members in our ecoregion. Information is being shared intensively, as is equipment and seed. In some cases, different species are being grown in different localities to facilitate mutual seed needs.

Machine (Bulk) Harvest

Additional inquiries have been made from agencies and organizations outside Minnesota and Iowa, who have been interested in development of similar maps for their areas.

Erma Selser took on the monumental responsibility of compiling the seed inventory for both bulk and hand-collected harvests this year, after completion of service by a term employee, Craig Olawsky, who had previously performed this painstaking task.

2001

Approximately 16,000 pounds of bulk seed is harvested in FY 2001

Summary of prairie seed harvested by machine from plantings on Neal Smith National Wildlife Refuge, Fall, FY 2001.

Planting Site Number	Major Crop	Number of Minor Crops	Bulk wt. (lbs.)	Wt. (lbs.) Viable Seed	% Viable by Weight
22	Indian Grass	13	976	177	18.1
18	Big Bluestem	15	1930	90	4.7
42	Big Bluestem Indian Grass	15	2418	472	19.5
23	Big Bluestem Indian Grass	9	1910	297	15.5
17	Little Bluestem Indian Grass	3	532	190	35.7
22	Indian Grass Partridge Pea	17	1960	382	19.5
70	Canada Wild Rye	7	4794	2366	49.3

Machine (Bulk) Harvest

Machine Harvest - Approximately 16,000 bulk lbs. of seed were harvested on-site. Sites were harvested in a timely manner after the Refuge Biologist inspected units and verified seed readiness. The Operations staff then harvested and processed the seed with the assistance of available personnel from Iowa Department of Natural Resources (Iowa DNR). Seed was dried and cleaned at the Refuge and kept in Refuge storage facilities. Of this harvest, the Refuge retained 7,000 bulk lbs. and the Iowa DNR received 9,000 lbs.

Approximately 9,000 lbs. of bulk seed was transferred to Iowa DNR as part of the partnership for using local eco-type seed on Iowa restoration sites.

2002

Approximately 4,462 bulk lbs. of seed were harvested from five sites this year. The Operations staff harvested and processed the seed. Seed was dried and cleaned at the Refuge and kept in Refuge storage facilities in new storage boxes. The Refuge retained 2,906 bulk lbs. and provided the Iowa DNR with 1,556 lbs.

Analysis of seed viability and purity of material harvested by machine on-refuge this year indicated low purity in grass crops, though viability was only somewhat lower than average on filled seed. Average purity from Indian grass was 10%, big bluestem was 5%, and Canada wild rye was 49%. Average viability of Indian grass was 69%, big bluestem was 77%, and Canada wild rye was 70%. Little bluestem did not occur in our harvests as a major crop this year, due to especially poor seed set in this species.

Refuge seed had always been processed and stored in grain bags. The bags were not entirely bird or rodent proof and were easily infested by rodents who would nest in the bags over winter. This infestation created a health risk in the seed storage facility when the bags were opened to prepare seed mixes in the spring. After rodents chewed holes in the bags, seed would spill onto the floor attracting birds to a winter food source. Birds entered the building when doors were left open and would nest in the beams. The fecal droppings inside the building were a periodic problem and added to the airborne health risk associated with histoplasmosis. One way to solve the problem would have been to build a rodent and bird proof cage in which to store the bags. Instead we purchased grain boxes to store seed that would not require additional pallets or special storage sites. The boxes that replaced the bags are molded fiberglass plastic and are commonly used now by grain companies. They are rodent and bird proof, are stackable, making them easy to store when not in use. They have allowed us to eliminate a food source for rodents and birds which has brought about a dramatic decline in their presence. The seed storage area stays clean and free of odors and other health risk issues.

2003

Machine (Bulk) Harvest

We targeted five species for this year's harvest: big bluestem, monarda, little bluestem, asters, and Canada wild rye. Approximately 5250 bulk pounds of seed were harvested from seven sites. The operations staff harvested and processed the seed. Seed was dried and cleaned and kept in storage boxes.

Each site was monitored and harvested at optimum time for target species. Analysis of seed viability and purity of material harvested by machine on-refuge this year indicated adequate purity in grass crops, though viability was only somewhat lower than average on filled seed. Average purity from Indian grass was 22%, big bluestem 33.5%, little bluestem 76% and Canada wild rye was 82%. Average viability of Indian grass was 50%, big bluestem 76%, little bluestem 56% and Canada wild rye was 82%. Asters and monarda were harvested together with purities between 6-1% and viability ranging from 24–18%.

2004

Boot and Hager prepared for the machine seed harvest which began in late September. In only four days, they were able to harvest 6,300 bulk pounds of grass and forb seeds, WOW! NICE JOB! Boot started to contour terraces and roadsides of old crop fields to give the restoration areas a more even flow from the road into the prairie. Good coordination of hand collection between Public Use and Biology resulted in a very hefty seed collection, even adding a couple of new species to the collection list including nimblewill, obedient plant and foxtail dalea. The seed lab became a very active and busy place and the huge influx of seed was a result of dedicated staff, volunteers and the simple act of working together to accomplish a worthy task.

We targeted several species for this year's harvest - big bluestem, little bluestem, goldenrod, coneflower and Canada wild rye. Approximately 13,705 bulk lbs. of seed were harvested and processed from ten sites. Seed was dried and cleaned at the Refuge and kept in Refuge facilities in seed storage boxes (Photo 10).

Each site was monitored and harvested at optimum time for target species. Analysis of seed viability and purity of material harvested by machine on refuge indicated adequate purity in grass crops. The abundant amount of rainfall provided a bountiful harvest and seed amounts and viability were high compared to last year (5,800/3,000 bulk lbs.). The large harvest gave us plenty of seed for next year: Indian grass – 1,104 pure live seed (pls)/lb, big bluestem – 1,099 pls/lb, little bluestem - 973 pls/lb, goldenrod - 194 pls/lb, coneflower - 146 pls/lb, and 41 pounds of aster (photos 11 – 28).

2005

Machine (Bulk) Harvest

The operation staff was busy with harvest in the first couple of weeks in October. Over 14000 pounds of bulk seed were harvested and dried. Hager, Rich and Allen moved seed into storage containers and delivered samples to biology department.

September 2005

Boot and Krueger machine harvested seed, focusing on forbs. Several areas were harvested, though weights are not yet available. More seed will be harvested when additional species are mature.

October 2005

While combining seed, Boot found a new patch of serecia lespedeza (*Lespedeza cuneata*) in Deer Valley. Krueger verified identity of the species and marked it using GPS technology. Unfortunately, some plants of this highly invasive species were clipped and included in the combined harvest. Krueger treated the patch with Garlon 4. Additional treatment will be needed in future years. Staff are making plans for control of this patch, and will destroy the harvest from that area. On that same note, Researcher Scott Bryant found an individual plant of serecia lespedeza in the parking lot of the Prairie Learning Center. A concerted long-term effort is being planned for control of this species.

Boot, Hager and Krueger harvested, cleaned, boxed and stored nearly 7000 pounds of bulk prairie seed. Samples were collected for analysis of seed content and viability.

November 2005

Bulk seed samples of the refuge's machine harvests were sent to ISU Seed Lab for purity and viability (Tz) analysis.

The refuge harvest objective this year was to harvest more forb seed and less grass seed, as the warm season grass species typically are highly competitive with forbs in initial plantings. Nine sites were harvested in selected forb-dense areas. Unfortunately, the highly invasive species, serecia lespedeza (*Lespedeza cuneata*) was inadvertently harvested in one of the last sites. Serecia lespedeza is a highly invasive species that has been found on other sites and is of utmost management concern because it is fire tolerant and highly competitive with native species and very costly to contain. As such, material from the site was not used in seeding mixes, and the combine will be steam cleaned to reduce the chances that the serecia lespedeza will be spread to additional sites in the planting process.

2006

September 2006

Machine (Bulk) Harvest

Harvest season is upon us. We will need seed for approximately 200 acres that will be taken out of agricultural production this fall. Boot began scouting areas for harvest and harvested the sideoats production area.

October 2006

Boot, Hager and Krueger harvested, dried, cleaned and boxed more than 4600 bulk pounds of prairie seeds.

September 2008

Boot machine harvested side oats.

October 2008

Boot harvested side oats and drop seed this month, in all, harvesting close to a thousand pounds of seed to be used to help establish new prairie.
