

# East Basin Restoration: 2007-2011

The East Basin is an isolated 5 acre parcel at the far east edge of Pleasant Valley Conservancy, down a fairly steep hill from the Ridge Prairie. Because of its location and its difficult access it was passed over when the rest of the Conservancy was restored. Because of its location, work there did not fit in well with that of the rest of the restoration work. Indeed, it was an easy site to overlook. It was only when we began restoration on the adjacent Ridge Prairie that we even noticed the East Basin.

At the time of the 1937 air photo (see Figure 17), the East Basin was completely open, with essentially no trees or other woody vegetation. Because it faces south and southwest, it seemed reasonable that it might have been a prairie remnant, even though the slope is not nearly as steep as the main south-facing hill.

Bringing cows to the East Basin from the barn would have required passing over land owned by others. For this reason, and because it was so far from the barn, there was probably no significant grazing.

The East Basin is underlain with the Jordan Sandstone and its soil is relatively sandy and quite acidic (pH 5-6), which probably influences its plant ecology.

It was only after we had completed planting the Ridge Prairie that we considered any work on the East Basin. At that time there was a wall of tall honeysuckle bushes adjacent to the Ridge Prairie, making it difficult to even walk into the East Basin.

## A pre-restoration walk-through of the East Basin

After we finally decided to restore the East Basin, on October 1, 2007 I did a “walk-through”. This proved to be a difficult undertaking, as the site was very brushy. The honeysuckles were huge, and it was hard to get through them.

I started my walk at top near the Ridge Prairie and pushed my way through the honeysuckles and down into the lower area. It was not as steep as the south slope. The understory was mostly honeysuckles, with a few buckthorn, hazel, and occasional brambles. Probably because of the heavy shade, the understory was very sparse. Herbaceous plants included an occasional *Eupatorium rugosum* (past flowering), sweet cicely (vegetative; lots), *Hackelia*, and *Aster lateriflorus* (calico aster, flowering). Small woody plants included gooseberry and black raspberry.

At the bottom and on the hill on the east side there was a large aspen clone (see Figure 13). This clone was later estimated to be about 100 trees. The aspens were

around 12” diameter and some were dead and broken. There were also some small hackberries, and small and medium-sized oaks. However, there was nothing open grown was seen. However, after clearing several relatively large open-grown oaks were discovered, suggesting that although the East Basin had originally been prairie, it might be better thought of as open savanna. See see page 37 for further on this matter.

The bottom of the hill was the property boundary, and the neighbor had mowed a path around the end of the corn field with a branch uphill to the top. It turned out that the neighbor’s children had used this mowed path as a sledding hill in winter. I followed this path up to the top, where the corner stake for Sections 4, 5, 8, and 9 come together. The upper part was fairly overgrown, and fairly sandy. After the East Basin was cleared, it was possible to observe the soil in more detail. It was all sandy and some areas were fairly iron-rich (red).

There was some tinker’s weed (orange fruits) in the open near the top, in sand. Pieces of fence followed the 5-8 section line from the bottom to the top. There was also fencing along the 4-5 section line. None of the fences were functional. We had had this area surveyed in 2005 and a surveyor’s iron stake was found at this Section corner.

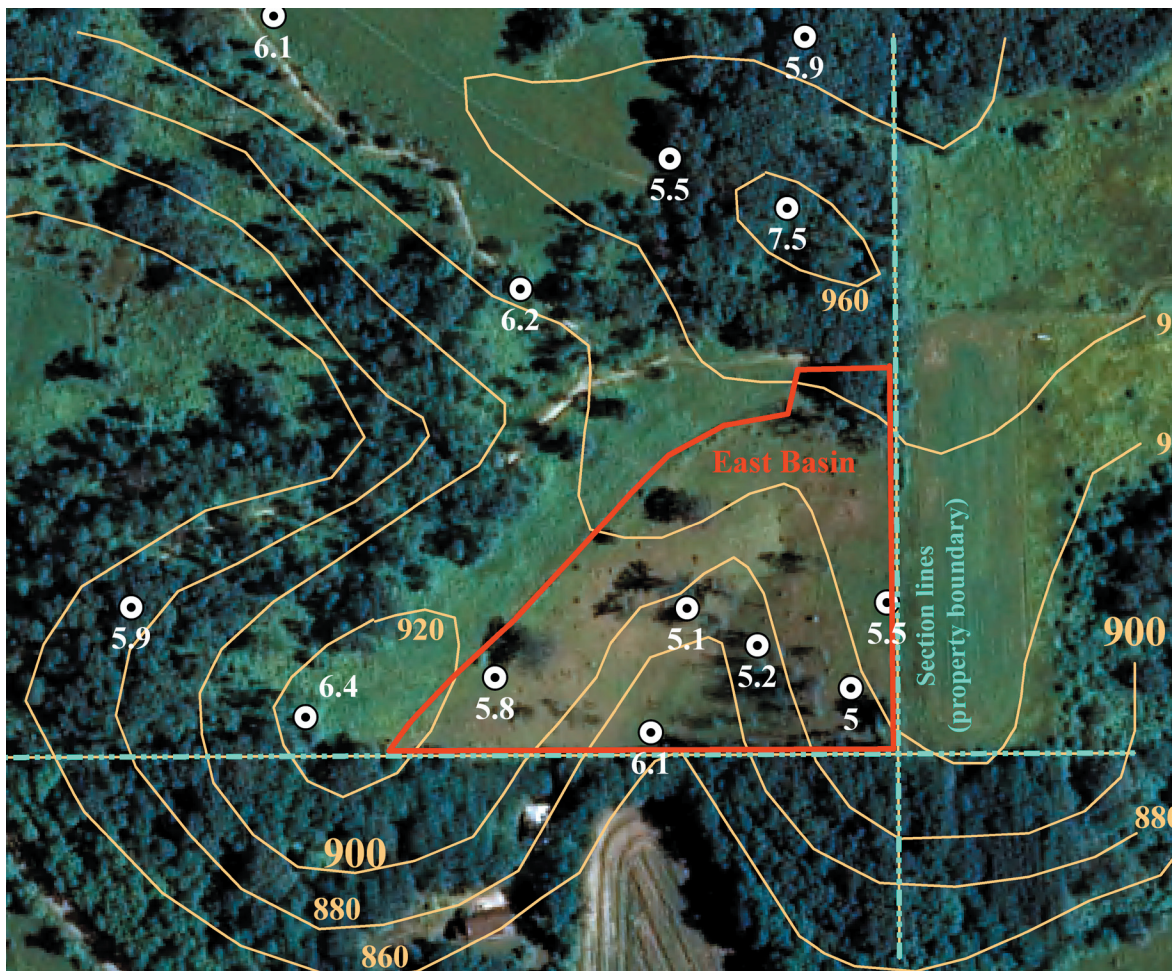
Although the E-W hill along the 5-8 section line was fairly steep, it might be possible to use it for an ATV trail, at least when doing prescribed burns. Beginning at the west end (adjacent to the Ridge Prairie), this boundary descends steeply to the bottom, and then rises up again to the top where the Kremer land begins. Outside the fence on the neighbor’s land there are several nice open-grown bur oaks.

After reaching the east end at the top, I walked back through Kremer’s field to where our lane begins, as it was much too woody to walk inside the East Basin itself. (There is a fairly large prickly ash clone along the Kremer/Pleasant Valley Conservancy boundary.)

Subsequent measurements by GPS and GIS showed that the East Basin is 5 acres in size (NRCS has the size at 4.7 acres.)

## Air photo analysis

An air photo analysis by GIS showed that the East Basin remained mostly open through the early 1960s. By 1968 (which provides an excellent air photo) hedge rows can be seen along the edge of the Ridge Prairie as well as along Kremer’s property boundary. By 1976, the E side was fully wooded but there were still open areas on the W side. By 1990 the whole site was wooded, except for some openness by the aspen clone. By 1999-



*Figure 1. Air photo of the East Basin taken in 2008 just after it had been cleared of woody vegetation. The soil pH values are shown in white. For orientation, Toby's Prairie is the open field (planted prairie) in the upper middle area.*

2000 the site had become fully wooded and remained so until the site was cleared in 2008.

### **Contours, geology, and soils**

Figure 1, derived from ArcMap, illustrates the physical character of the East Basin. Once the East Basin was cleared, but before any restoration work was begun, it was possible to drive either the Kawasaki Mule or a four-wheel drive pickup truck, from the bottom to the top, following the least steep route. Also, once it had been planted to prairie, it was possible, with care, to mow most of the East Basin with a bush hog operated from the rear of the Kubota tractor (see page 28 and Figures 39-41).

Except for the northeast corner, the bedrock under the East Basin is all part of the Jordan Sandstone formation of the Trempealeau Group. The absence of dolomitic bedrock is probably responsible for the low pH values of the East Basin soils (pH 5 to 6.1). Underlying a small area in the northeast corner is bedrock of the Prairie du Chien dolomite. Perhaps because the soil type in this wooded area is different (Basco silt loam; see below),

the vegetation in this area consists of a white oak open woodland/savanna.

According to the soil map, the soil in the upper part of the basin is Elkmound sandy loam, 20-30% slope and eroded. According to the soil description:, the area consists of shallow, excessively drained soils, sloping to very steep soils on uplands, said to have formed in residuum weathered from sandstone bedrock under thin, mixed hardwoods and an understory of prairie grasses. Other features are low fertility, very low available water capacity, and moderately rapid permeability, with water table at a depth of more than 5 feet.”

The soil in the lower part of the East Basin is Basco silt loam, 12-20% slope and eroded. This soil is characterized by narrow drainageways and receives runoff from higher lying soils. The hazard of erosion is very severe. This soil is found only in the east end of Pleasant Valley Conservancy, including the lower East Basin and a small area at the top of the East Basin (white oak savanna). Because of the way the property line runs here, a lot



of this soil is just outside the boundary.

The soil pH values throughout the East Basin are some of the lowest found at Pleasant Valley Conservancy. Also, the soils are sandy, with areas of sandstone rocks high in iron. Again, these soils are different from any of the others in the Conservancy.

### **Removing the big trees**

Although most of the restoration work was funded privately by Savanna Oak Foundation, Inc., there has been some grant support from LIP or WHIP

A small grant from the Landowner's Incentive Program (administered by the Wisconsin DNR) support in part woody plant removal. A grant from the Wildlife Habitat Improvement Program of the U.S.D.A. (NRCS) supported herbaceous weed control, burns, and planting.

The restoration work began in December 2007 and extended into January 2008. This was a fairly large snow year so most of the stumps were cut tall and had to be recut in the summer (see Figure 28).

The members of the logging crew were experienced restoration ecologists and were careful to avoid any damage to the site. To prevent resprouting, all trunks were treated with herbicide (triclopyr). Two or three of the crew operated chainsaws and two or three others dragged the brush and small logs to burn piles.

Most of the cut trees were removed for fire wood, although a significant amount of trees of saw-log quality were transported to sawmills. Also, a neighbor moved in a small saw mill and turned the largest black walnuts into lumber.

The series of photos below illustrates the process by which the land was cleared of woody vegetation.



*Figure 2. Most of the logging was done in the winter of 2007-2008. When the snow was heavy, the trees had to be cut high; they were then recut the following summer close to the ground.*





*Figure 3. Slash and small logs were burned on site as the clearing progressed.*



*Figure 4. View from the top of the East Basin showing an early stage of tree clearing. The cut stump in the foreground, with green color, has been treated with herbicide (Garlon 3A with added dye) to prevent resprouting. The neighbor's buildings can be seen in the distance.*





***Figure 5. Looking south down the East Basin. The double-arrow line shows the approximate property boundary. The wooded area between the property boundary and the open area in front gives an idea of the density of woods before clearing.***



***Figure 6. A chain saw was used to cut up small brush as well as most of the shrubs.***





*Figure 7. Removal of the wood was a major part of the restoration process. A barter arrangement was made with a neighbor, who cut up and removed all the logs of firewood size or larger.*



*Figure 8. Permission was granted to the woodcutter to split and age the firewood at the edge of the restoration site during the summer and fall. The wood was all removed before the next winter.*





*Figure 9. In the northeast corner of the East Basin was a small grove of relatively mature white oaks. These were left intact and the area planted to open woodland/savanna rather than prairie. I*



*Figure 10. An early spring view (2008) of the East Basin the year after initial clearing. The remaining trees were aspens that had been girdled but were not cut until the following year when they were dead.*

## Initiation of Restoration Work After Clearing

The first spring after clearing the East Basin was an interesting experience. We had decided to wait to see what came up spontaneously before we started serious restoration work.

The first thing that appeared was shooting star (*Dodecatheon meadii*), in several large areas (see Figure 11). This fine savanna species is capable of remaining alive without flowering for many years beneath fairly heavy shade, and then when sunlight is brought in it immediately flowers. Data from the East Basin indicate that shooting star can remain alive but suppressed for at least 40 years.

In addition to good plants, there were many “bad” plants, including scattered brambles, honeysuckles, and a few small buckthorns. Past experience had shown that once an area had been opened up and sunlight was available, these invaders (and others!) thrive. Therefore, we decided to eradicate them now, while they were still small. For this purpose, we sprayed all of the undesirable resprouts or small plants with Garlon 3A. Our regular crew did this job, moving systematically across the East Basin and spraying every plant seen.

In addition to the shrubs mentioned, the crew also sprayed any Canada goldenrod or Canada thistle, two invasive and very undesirable plants.

While we were waiting for summer to progress, we were thinking about how this area should be handled. By mid June of the first growing season after clearing we could see that there were going to be lots more bad plants than good. Obviously we could not wait to see what came up before developing a plan.

With this goal in mind, we began to think about seed mixes that could be sown on the site. There were really three areas to consider: 1) the small savanna area at the northeast corner; 2) the large dry mesic area that consisted of the flat area at the top, and the steep hillsides facing south, southeast, and southwest; 3) the flat area at the bottom that is wet mesic.

The other consideration was when to plant? Since the large aspen grove was still standing, and would not be cleared until next winter, we could obviously not plant in November 2008. We would have to wait until the following summer to cut the aspens when they were finally dead. So the target date for planting the East Basin was set as November 2009. This gave us a year to plan the seed mixes and begin to collect seed.

In May 2008 all of the aspens were girdled. However, it takes at least one year for the aspens to die, so they grew essentially normally during that summer. It was only during the 2010 growing season that they finally died, and they were not actually cut and removed until September of that year.

One interesting activity that took place during the summer of 2008 was splitting all the wood that was to become firewood. Our cooperative firewood dealer brought a gasoline-operated wood splitter to the site and spent many a long day using it. (The pile he created in 2008 is shown in Figure 8.)

One of the problems of cutting wood in a natural area is keeping the ecosystem from getting disrupted. Clearing the East Basin resulted in lots of wood, mostly of firewood quality. Fortunately, in the Pleasant Valley Conservancy area there are lots of folks whose main heat source is wood, and they are delighted to get free wood. We, on the other hand, are delighted to get free trucking, since moving heavy wood is expensive (see Figure 16).

Since the firewood dealer was only interested in oak, it was necessary to bring in others for removing other wood species. One neighbor had an outdoor woodburner that would burn anything, and he was happy to haul off any other wood. The main problem was to make sure his truck did not chew up the site. We insisted that he only haul wood when the ground was frozen hard (see Figure 16).

As the summer of 2008 progressed, the whole site began to fill up with annual weeds, such as horseweed (*Conyza canadensis*) and burnweed (*Erechtites hieracifolia*). By the time the Grassland Research Network visited Pleasant Valley Conservancy in late August, these tall annual weeds had taken over the site. When I brought the visitors to the top of the hill, I had to admit that this site was one that only a hopeful parent could find attractive.

Eventually, we decided that we would have to cut this infestation down. I’m not sure why, since these are annual weeds and will be outcompeted once we have prairie plants growing. But in early October three of our crew used Stihl brushcutters to mow the major infestations down (Figure 15).

Mullein (*Verbascum thapsis*; also called “flannel plant”) was another plant that caused a substantial infestation. This biannual is a large weed that colonizes bare ground, of which there was lots in this newly cleared site. Since all of the mullein plants in the East Basin were first-year plants, we sprayed the centers of them with Garlon 4 in oil. This is equivalent to a basal bark treatment. The procedure is to spray just the center of the rosette, above the root collar, and the herbicide finds its way to the root and kills it.

Since there were 100’s of mullein plants, our three-person crew worked systematically across the unit, seeking out the mullein plants. This procedure





**Figure 15. Using the Stihl brushcutter to cut horseweed, an annual.**

worked very well and we had very few second-year plants the following year. The nice thing about spraying mullein at this time of year was that everything else had already died back, making these green plants easy to find.

At the same time the crew was working on the mullein, they also sprayed any remaining honeysuckles or other woody plants. Better to spray now, when there is nothing good, than to wait until later, when the prairie has started to grow.

### **Garlic mustard**

Pleasant Valley Conservancy has been remarkably free of garlic mustard (*Alliaria petiolata*), one of the biggest scourges of Wisconsin natural areas. However, this serious invader is nearby, so it was not surprising when two small patches of garlic mustard were found in the East Basin (Figure 12). Since garlic mustard does best in shady areas, it was not surprising to find it here.

Both patches of garlic mustard were sprayed with glyphosate during the summer of 2008, and twice (spring and fall) in 2009. We will continue to monitor the sites in future years, but do not anticipate any problem in eradicating them from this fearsome species.

### **Use of GIS to follow the restoration process**

A comparison of air photos, derived from an ArcGIS analysis, is shown in Figures 17-19. The red lines indicate the south and east borders of the site.

Figure 17 shows the area that includes the East Basin as seen in a 1937 air photo. As seen, the area is completely open, with only a few rare scattered shrubs or trees. The white (open) areas in the photos indicate agricultural fields. Although no on-the-ground data are available, it seems possible that at this time the East Basin might have been prairie remnant.

Air photos from various years since 1937 have been examined. The 1940 and 1949 air photos indicate that the site was still mostly open. It was only with the 1955 air photo that woody plant encroachment was significant. This encroachment was more extensive in the 1962 air photo, and by the time of the 1968 air photo the site had become completely wooded.

Figure 18 shows the site in 2005, a few years before restoration began. The site was heavily wooded. At the same time, the adjacent field, now called the Ridge Prairie, was completely open and bare, since it was being sprayed with glyphosate in preparation for prairie planting in December 2005.

Figure 19 shows the 2008 photo, taken after major clearing had been completed. Except for the savanna area in the northeast corner, only a few scattered trees remain. Because these trees were fine oaks they were left standing.

The 2010 air photo shows similar results.



*Figure 11. Several areas in the East Basin had substantial natural populations of shooting stars (Dodecatheon meadii). These areas were marked to ensure that these populations were protected. Also, special attention was given to these areas when the whole East Basin was planted to prairie.*



*Figure 12. There were two relatively small patches of garlic mustard (Alliaria petiolata), the only site at Pleasant Valley Conservancy that this noxious weed has been found. Special attention is being taken to ensure that these patches are eradicated.*





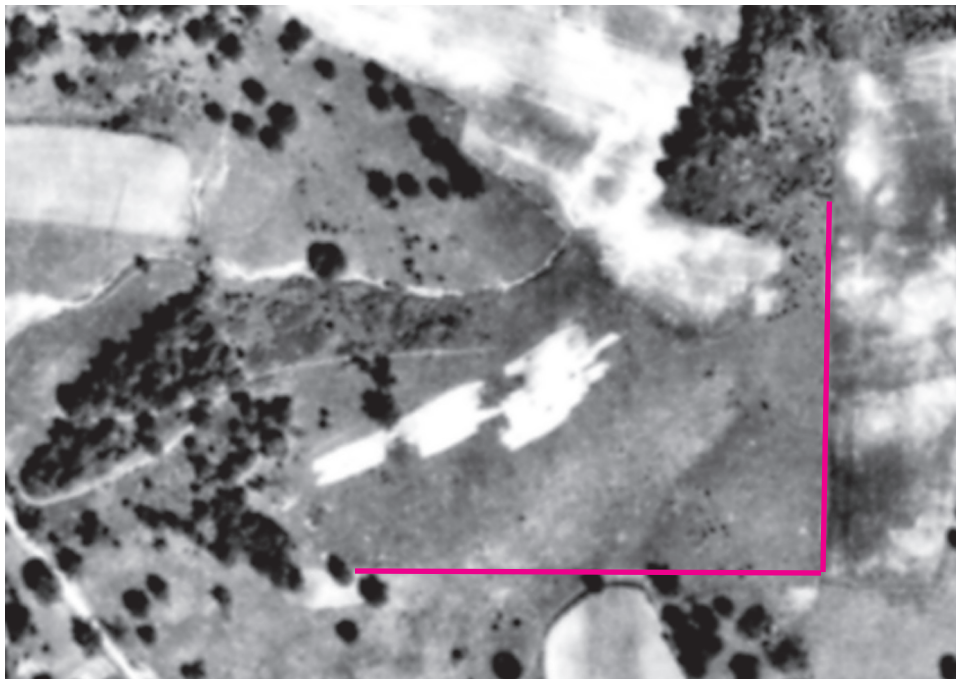
*Figure 13. The aspen grove the first summer after clearing had been done. There were approximately 100 medium-sized trees that had been girdled in May 2008. The following year, after they were dead, they were cut, stacked, and burned.*



*Figure 14. A number of black cherry trees were of saw-log size and were salvaged for lumber. A barter arrangement was made with a landowner who paid for removal of these logs. IMG\_3456.jpg*



*Figure 16. A resident of Mount Horeb, a nearby village, heats his house almost exclusively via an outdoor wood burner. He cuts up the wood and hauls it away. His “rig” is well equipped for hauling wood. In order to avoid disturbance to the soil, he is only permitted access to the East Basin when the ground is frozen, and preferably has a light snow. IMG\_3585.jpg*



*Figure 17. Air photo from 1937 showing that the East Basin was completely clear of trees. Image created by ArcGIS. (air photo 1937 East Basin.tif)*





*Figure 18. Air photo of the East Basin from 2005, showing that the site had become completely invaded by woody vegetation. Image created by ArcGIS (air photo 2005 East Basin.tif)*



*Figure 19. Air photo of the East Basin from 2008, the summer after the site was cleared. Image created by ArcGIS. (air photo 2008 East Basin.tif)*

### **Removing Aspen from the East Basin**

The large grove of aspen in the East Basin (see Figure 13) had been girdled in May 2008 and it took two growing seasons for the trees to die. By September 2009 they were all dead and could be cut.

The crew who had cut all the other trees on the East Basin came back in late September and cut and piled all the aspens (Figure 20).

The aspen piles were burned in late October 2009 (see Figure 31).

### **Removing Trash from the East Basin**

Although it must have happened a long time ago, there is some evidence that the East Basin had been grazed. How do we know it was grazed? Barbed wire fencing!

The crew that was cutting the aspen kept running into pieces of old fence, a menace for any chain saw, so they rolled it all up (See Figure 21).

### **Killing the Summer Growth**

By mid-June 2009 the East Basin had become heavily colonized with undesirable vegetation. Although mostly annuals, there were also a number of perennials. Because of the steep terrain, a conventional boom sprayer could not be used. Therefore, the whole site was sprayed using a 300 foot hose. The spray rig consisted of a 100 gallon tank connected to an electrical pump and pressure-sensitive switch which kept the pressure constant. The herbicide was glyphosate.

It took the operator about three days to spray the whole 5 acre site (Figure 22).

The glyphosate spraying was very effective and within a week the results were starting to be visible. Figures 23 through 27 show the response of the vegetation to spraying.

There were some areas of undesirable new growth that appeared after the spraying. These patches were spot sprayed in mid August 2009.

### **Recutting the tree stumps**

Because of the heavy snow when the tree work was done, most of the stumps had to be cut fairly high. Because of the need to use a tractor for mowing and maintenance, it was necessary to recut all these stumps as low to the ground as possible. In October 2009 the logging crew returned and recut all the stumps. This was a major task (Figure 28).

### **Getting Ready to Plant: Cleaning up**

In order to plant, it was necessary to have bare ground

for seeding. By early October 2009, most of the area was bare and at that time a crew came in and cleaned up remaining logs and debris. This work is illustrated in Figures 29 and 30. All of the wood piles were burned in late October.

### **Fall 2009 burns**

Most of the vegetation that had been sprayed with glyphosate had essentially disappeared by the end of October, but there were areas, especially on the upper flats, that still contained thatch. A lot of this thatch was derived from the second glyphosate spraying that was done in August 2009.

In order to eliminate this dead thatch so that bare ground would be present for planting, these areas were burned in early November 2009 (see Figures 32 and 33).

The small white oak savanna area in the northeast corner was burned separately the same day. The fuel here was primarily oak leaves, and the burn went fairly well (see Figure 34).





*Figure 20 Cutting and stacking aspens from the East Basin in September 2009. Only a small amount of the grove remains standing. These trees had been girdled in May 2008 and took two growing seasons to die. The stacks of logs were burned in October 2009 (see Figure 31).*



*Figure 21 Large roll of fencing taken off the East Basin. Good evidence of former grazing. In addition, a relatively large dump site was found in the northeast savanna. Much broken glass, dishes, rusty hardware, and bottles. A pick-up truck load of trash was removed, and a year later more trash kept surfacing in the same area. (IMG\_5135.jpg)*





*Figure 22. By the middle of June 2009 there was rank growth of undesirable vegetation. Although mostly annuals, there were also perennials that might provide long-term trouble. On June 15-17, 2009 the whole East Basin was sprayed with glyphosate, using a 300 foot hose operated from a 100 gallon tank. This took two days. (DSC\_0637.jpg)*



*Figure 23. June 21, 2009, six days after spraying, the vegetation was already showing a response.*





*Figure 24. Ten days after herbicide treatment (June 25, 2009), the East Basin vegetation was becoming brown. The green area in the foreground was an area of shooting star and had not been sprayed.*



*Figure 25. Contrast between the unsprayed Ridge Prairie and the sprayed East Basin. This photo was taken on July 7, 2009.*





*Figure 26 The East Basin on July 25, 2009, about a month after spraying. Although most of the vegetation was dead, some areas of new growth were appearing. These were sprayed in mid August.*



*Figure 27. The East Basin on October 9, 2009, several months after spraying. Much of the dead vegetation had crumpled and blown away.*





*Figure 28 Recutting the stumps. In order to be able to use a tractor in prairie maintenance it was necessary that the stumps be recut low to the ground. This was a major job in mid October 2009.*



*Figure 29 Cleaning up the East Basin. Although most of the cut wood had been stacked in 2008, there was still a lot of woody debris and log "rounds" that needed to be removed. (See also Figure 30)*





*Figure 30 Clearing the ground of log “rounds” and other large woody debris. Note the large amount of small debris. This was not a problem in prairie planting. ((See also Figure 29)*



*Figure 31. Burning wood piles, October 2009. Most of the wood being burned was dead aspen.*





*Figure 32. Burning off the thatch and remaining wood piles, Nov. 3, 2009. The burn was done on an Indian summer day, and the burn went very well.*



*Figure 33 A fall burn such as this one is fairly flexible to schedule, since no permit is needed. Because of the location and low fuel content, this was an easy burn to control.*





*Figure 34 Controlled burn of the white oak savanna area in the northeast corner of the East Basin.*



*Figure 35. East Basin planting map. Each volunteer was assigned one sector. The units were marked with red traffic cones.*



## **Planting the East Basin Prairie November 2009**

The great amount of work clearing the East Basin was finally finished in early November 2009 and it was time to plant. Because part of our work was being funded by the Wildlife Habitat Improvement Program (WHIP) of the U.S. Department of Agriculture, we had to follow their planting requirements as far as number of species and planting rate. Fortunately, these were minimum requirements and we far exceeded them.

For two years we had been archiving seeds in preparation for this work. Most of the seeds collected in 2008 had been stored and were pooled with the seeds collected in 2009. Five acres is a fairly small prairie, but it still required quite a lot of seed. In fact, the 5-acre East Basin was the largest prairie we had planted at Pleasant Valley Conservancy.

Planting the East Basin was not your ordinary prairie planting. This is hilly terrain with a rather complicated topography. Parts of the basin face east, parts south, and parts southwest. There is also an erosion gully in the middle, and an area at the bottom of the gully which is flat and has a wet mesic character.

Kathie spent a lot of time working out the planting schedule. There were three separate seed mixes, dry-mesic, mesic, and wet-mesic. Each of the mixes had over 100 species of forbs. The dry mesic mix had lots of little bluestem and side oats, with smaller amounts of Indian grass. The mesic mix had more Indian grass plus other grasses that prefer wetter habitats, such as bluejoint grass.

The seed mixes and planting areas are shown in the long table below.

Kathie, Susan, and Tom spent several days laying out the area for planting. Because of the complex topography, we could not simply have rectangular planting areas, such as used when agricultural fields are planted to prairie. Once we had the area laid out, Kathie and I then used a GPS to measure the acreages. The GPS Tracks were then uploaded to my computer and ArcGIS was used to create a map of the whole planting area. (See Figure 35) Each volunteer who was planting was given a copy of this map with their planting unit marked.

On the day of the planting (November 14, 2009) the weather was fortunately relatively warm and partly sunny. The Pleasant Valley Conservancy crew arrived early and distributed the buckets of seeds to the various planting units. Each unit had 2 or 3 buckets. At 10 AM the 18 volunteers arrived and we transported them to the top of the hill with our pickup truck. Kathie explained the procedure and assigned the planting units. Most of the volunteers had planted a prairie before. Planting started at about 10:15 AM and finished at 11:45 AM. After the planting, we had a “debriefing” at which

details of the project were discussed. This was followed by lunch at our cabin.

One final task before winter was to put bales of hay in the erosion-prone areas to keep the bare soil and seeds from washing away during the winter or spring rains. These bales were quite effective and there was no gully erosion. Once spring growth was well established, these hay bales were removed.



### Seed Mixes and Planting Table for the East Basin

Latin name	Common name	DM/M	WM	Cleaned seed wt./ ounces	Notes
<i>Allium cernuum</i>	Nodding onion	x	x	19	
<i>Amorpha canescens</i>	Lead-plant	x		47	
<i>Andropogon gerardii</i>	Big bluestem	x	x	19	
<i>Anemone cylindrica</i>	Thimbleweed	x		13	
<i>Angelica atropurpurea</i>	Angelica		x	4	
<i>Antennaria neglecta</i>	Field pussytoes	x		trace	
<i>Arnoglossum atriplicifolia</i>	Pale Indian plantain	x	x	4	
<i>Arnoglossum plantagineum</i>	Indian plantain (tuberosa)		x	2	
<i>Asclepias incarnata</i>	Swamp milkweed		x	1	
<i>Asclepias syriaca</i>	Common milkweed	x	x	1	
<i>Asclepias tuberosa</i>	Butterfly weed	x		3	
<i>Asclepias verticillata</i>	Whorled milkweed	(x)		1	
<i>Asclepias viridiflora</i>	Short green milkweed	(x)		1	
<i>Aster ericoides</i>	Heath aster	x		29	
<i>Aster laevis</i>	Smooth blue aster	x	(x)	21	
<i>Aster novae-angliae</i>	New England aster	x	x	14	
<i>Aster oolentangiensis</i>	Sky-blue aster	x		8	
<i>Aster puniceus</i>	Red-stemmed aster		x	6	
<i>Aster sagittifolius</i>	Arrow-leaved aster	x		13	
<i>Aster sericeus</i>	Silky aster	x		9	
<i>Astragalus canadensis</i>	Canadian milkvetch	x		21	
<i>Baptisia alba</i>	White wild indigo	(x)	x	18	
<i>Bouteloua curtipendula</i>	Side oats grama	x		132	
<i>Bromus kalmii</i>	Prairie brome	x	(x)	13	
<i>Calamagrostis canadensis</i>	Bluejoint grass		x	8	
<i>Carex molesta</i>	Troublesome sedge	x		1	
<i>Carex vulpinoidea</i>	Brown fox sedge			???	
<i>Ceanothus americanus</i>	New Jersey tea	x		5	boil first!
<i>Chelone glabra</i>	Turtlehead		x	6	
<i>Cirsium discolor</i>	Pasture thistle	x	(x)	3	
<i>Cirsium muticum</i>	Swamp thistle		x	1	
<i>Coreopsis palmata</i>	Prairie tickseed	x		4	
<i>Dalea candida</i>	White prairie clover	x		6	
<i>Dalea purpureum</i>	Purple prairie clover	x		11	
<i>Desmodium canadense</i>	Showy tick-trefoil (Canada)	x	x	5	
<i>Desmodium illinoense</i>	Illinois tick-trefoil	x		18	
<i>Dodecatheon meadia</i>	Shooting star	x		4	
<i>Echinacea pallida</i>	Pale purple coneflower	x		54	



Latin name	Common name	DM/M	WM	Cleaned seed wt./ ounces	Notes
<i>Elymus virginicus</i>	Virginia wild rye	x	x	18	
<i>Erigeron pulchellus</i>	Robin's plantain	x		0	
<i>Eryngium yuccifolium</i>	Rattlesnake master	x	x	30	
<i>Eupatorium altissimum</i>	Tall boneset	x		12	
<i>Eupatorium maculatum</i>	Spotted joe-pye weed (marsh)		x	5	
<i>Eupatorium perfoliatum</i>	Common boneset		x	4	
<i>Euphorbia corollata</i>	Flowering spurge	x		2	
<i>Euthamia graminifolia</i>	Grass-leaved goldenrod	x	x	2	
<i>Gaura biennis</i>	Biennial gaura	x	x	12	
<i>Gentiana alba</i>	Cream gentian	x	x	5	
<i>Gentiana andrewsii</i>	Bottle gentian		x	0	
<i>Gentianella quinquefolia</i>	Stiff gentian	x	x	2	
<i>Geum triflorum</i>	Prairie smoke	x		trace	
<i>Hasteola suaveolens</i>	Sweet Indian plantain	(x)	x	2	
<i>Helenium autumnale</i>	Sneezeweed		x	1	
<i>Helianthus occidentalis</i>	Western sunflower (naked)	x		1	
<i>Helianthus pauciflorus</i>	Prairie sunflower (showy)	x		3	
<i>Heliopsis helianthoides</i>	Ox-eye sunflower	x	x	21	
<i>Heuchera richardsonii</i>	Prairie alum-root	x		1	
<i>Hieracium kalmii</i>	Canada hawkweed	x		0	
<i>Hieracium longipilum</i>	Prairie hawkweed	x		0	
<i>Hypericum pyramidatum</i>	Great St. John's wort		x	1	
<i>Koeleria macrantha</i>	June grass	x		6	
<i>Kuhnia eupatorioides</i>	False boneset	x		10	
<i>Lespedeza capitata</i>	Round-headed bush clover	x		34	
<i>Lespedeza leptostachya</i>	Prairie bush clover	x		0	
<i>Liatris aspera</i>	Rough blazing star	x		5	
<i>Liatris pycnostachya</i>	Prairie blazing star		x	2	
<i>Lilium michiganense</i>	Turk's cap lily		x	0	
<i>Lilium philadelphicum</i>	Prairie lily (wood)	x	x	0	
<i>Lobelia siphilitica</i>	Great blue lobelia		x	1	(pure seed)
<i>Lupinus perennis</i>	Wild lupine	x		32	Pure seed
<i>Monarda fistulosa</i>	Wild bergamot	x		8	
<i>Napaea dioica</i>	Glade mallow		x	25	
<i>Oenothera biennis</i>	Common evening-primrose	x	x	5	
<i>Parthenium integrifolium</i>	Wild quinine	x	x	5	
<i>Penstemon digitalis</i>	Penstemon	x		2	



Latin name	Common name	DM/M	WM	Cleaned seed wt./ ounces	Notes
<i>Polygonatum biflorum</i>	Solomon's seal	x		18	(Wet)
<i>Potentilla arguta</i>	Prairie cinquefoil	x		10	Pure seed
<i>Pycnanthemum virginianum</i>	Mountain mint	x	x	2	
<i>Ratibida pinnata</i>	Yellow coneflower	x	x	25	Pure seed
<i>Rosa sp</i>	Prairie rose	x	x	36	
<i>Rudbeckia hirta</i>	Black-eyed Susan	x	x	12	
<i>Rudbeckia triloba</i>	Brown-eyed Susan	x	x	20	
<i>Schizachyrium scoparium</i>	Little bluestem	x		192	PLS
<i>Scirpus atrovirens</i>	Dark green bulrush		x	2	
<i>Scirpus cyperinus</i>	Wool-grass		x	8	
<i>Silphium integrifolium</i>	Rosinweed	x	x	46	
<i>Silphium laciniatum</i>	Compass plant	x	x	25	
<i>Silphium perfoliatum</i>	Cup plant		x	14	
<i>Silphium terebinthinaceum</i>	Prairie dock	(x)	x	10	
<i>Sisyrinchium campestre</i>	Blue-eyed grass	x		0	Special hand planting
<i>Smilacina racemosa</i>	Solomon's plume (false)			10	Wet
<i>Solidago missouriensis</i>	Missouri goldenrod	x		11	
<i>Solidago nemoralis</i>	Gray goldenrod	x		15	
<i>Solidago rigida</i>	Stiff goldenrod	x	x	32	
<i>Solidago speciosa</i>	Showy goldenrod	x		26	
<i>Sorghastrum nutans</i>	Indian grass	x	x	320	
<i>Sporobolus heterolepis</i>	Prairie dropseed	x	x	3	Special hand planting
<i>Stipa sp</i>	Needle grass	x		2	Special hand planting
<i>Thalictrum dasycarpum</i>	Purple meadow-rue (tall)	(x)	x	4	
<i>Tradescantia ohiensis</i>	Common spiderwort	x	x	9	
<i>Verbena hastata</i>	Blue vervain		x	7	
<i>Verbena stricta</i>	Hoary vervain	x		6	
<i>Vernonia fasciculata</i>	Ironweed		x	5	
<i>Veronicastrum virginicum</i>	Culver's root	x	x	9	
<i>Viola pedata</i>	Bird's foot violet	x		trace	Special hand planting

Seed mixes devised and supervised by Kathie Brock



*Figure 36. Volunteers getting instructions on the planting procedure.*



*Figure 37. Volunteer planting on the upper south-facing hill. The terrain is typical of most of the planting area. Note that the soil surface is virtually bare, so that the seeds were able to find good locations for stratification and subsequent growth.*



## The First Growing Season on the East Basin

Because the East Basin is at the far eastern end of the Conservancy, it is easy to forget about. In the spring, restoration activities are generally focussed on control of woody invasives, which are mainly at the opposite end of the property. By the time I finally remembered to look at the East Basin, lots of things had happened, as Figure 38 shows.

As expected, it was mostly annual weeds, which Kathie mowed (Figures 39-41). With the steep hill, the residual rocks and stumps, and the scattered trees, the East Basin was really tricky to mow. Before starting, Kathie walked the whole site and put flags on objects that she needed to miss.

She used the Land Pride bush hog mower attached to the three-point hitch and power take-off of the Kubota tractor. This arrangement was preferable to using the deck mower of the Kubota, since it was more rugged, could be raised higher, and was fairly maneuverable. There were a few exciting moments. The whole job took several days (probably 6-8 hours total).

However, there were some steep areas that could not be mowed with the Kubota. Amanda mowed these with the Stihl brushcutter (Figure 42).

While Kathie was mowing she made notes of what native species were present. Here is her list:

Plants in the East Basin seen June 19, 2010
Lupine (see Figure 42)
Spiked lobelia
Pasteur thistle
Spiderwort
Venus-looking glass (not planted)
Fleabane (annual, not planted)
Alum root
June grass (flowering)
Black-eyed Susan
Canada-milk vetch



*Figure 38. Spring green-up, May 23, 2010. The first growing season one expects primarily weeds, mainly annuals. However, some perennials in parts of the prairie that had not been treated with herbicide showed up early. This photo provides an interesting pattern. The area that is bare is probably devoid of perennials.*



*Mowing the East Basin in mid summer. The Kubota tractor pulling a small bush hog worked fairly well for this task. Obstacles such as big rocks or large stumps that had not been cut low enough were marked with flags and cut around. Because of the steepness of the hill, mowing had to be done in a vertical direction. Even with great precautions, there were still some dangers involved. Kathie did all the mowing. Top, Figure 40. June 16, 2010. (IMG\_6971.jpg) Middle, Figure 39. June 20, 2010. (IMG\_7005.jpg) Bottom, Figure 41. June 22, 2010 (IMG\_7030.jpg)*





*Figure 42. Amanda mowing the areas on the East Basin that were too steep for Kathie to do with the Kubota. July 1, 2010. These were mostly annuals. The triangular cutting blade was used on the Stihl brushcutter.*



*Figure 43. General view after mowing. July 3, 2010. The tall plants in the foreground could not be mowed because of the large tree stump (visible in front of the plants). Note the areas of bare ground. Later in the summer, many more annuals developed on most of the bare areas.*



*Figure 42. Lupine (Lupinus biennis) in flower, August 26, 2010. Flowers of this species were also seen in early June. The specimen in this photo is an unusually late plant. In the first growing season, timing is often altered.*



## East Basin 2011

### Prescribed burn

Because we had a grant from the Natural Resources Conservation Service for part of the East Basin restoration work, we were required to carry out a prescribed burn in 2011. Although we had doubts about whether there would be enough fuel (since Kathie had mowed it twice), we carried out the burn anyway. As it turned out, parts of the East Basin burned fairly well.

Fortunately, all of our more important burns had been successful, so that by the time we did the East Basin burn, almost all of the Conservancy had been burned. The only concern with this burn was that the east side is next to our a neighbor's land, which includes about 40 acres of highly flammable old-field pasture. We had to make sure that we did not set this field on fire. To keep things under control, a good fire break was mowed on the east side, extending from our property boundary into the neighbor's field. (He had given us permission to burn.)

We also had cleared a fire break along the south boundary of the property, next to another neighbor's

land. This break went down the hill to the bottom and up the other side. Because this line had been mowed well last year, the fuel was fairly low, so that control of the fire was no problem.

This burn was carried out with our own crew: Amanda, Marci, Susan, Kathie, and I. After the fire break had been mowed, we started burning a black line along the east side. Kathie and I operated the pumper unit on the Kawasaki and the crew did the lighting. We took it slow until we had this east line fully black, and then did the rest of the burn. Everything went well and we were finished within about 2.5 hours.



*Figure 45. Burning the East Basin, April 13, 2011.*





*Figure 46. After the burn. Considering how light the fuel was, the fire carried fairly well although the hills burned better than the level areas.*



*Figure 47. After the burn; early spring green-up, May 1, 2011.*



### East Basin: Summer 2011

The second growing season was 2011. Although there were plenty of weeds and rampant annuals the second year, the predominant species were native prairie plants.

The principal invasive plant was sweet clover, and this was primarily localized in the upper part of the southeast corner. The sweet clover was hand-pulled by the PVC crew and by the summer interns. The interns also cruised the whole site and pulled weeds, mainly sweet clover.

By mid-summer, the general aspect was of a lush, 2nd year prairie. This was the first time that one could begin to think that perhaps this whole restoration process might have been worth the time and money.



*Figures 48 (above), 49 (below), and 50 (bottom), all July 7, 2011, showing lush prairie growth. Figure 49 has a nice patch of spiderwort (Tradescantia ohioensis).*





### Species Diversity: 2011

Most planted prairies are low in diversity during their first few years after planting, and improve gradually. Many prairie plants spend the first few years of growth establishing substantial root systems. If a careful survey is made, seedlings of many of the late-establishing species can be found the second growing season, occasionally even during the first growing season. Unfortunately, the press of other activities has kept us from making these early surveys.

By mid summer, the East Basin was beginning to show quite a bit of color, and a number of “good” plants were showing flowers or flower buds. By late summer the situation was even better. Notes were taken whenever the opportunity arose, and these notes have been collated and a 2011 species list has been prepared. This list is given on the next page.

The diversity in this table is sufficient to provide

encouragement on the future of the East Basin.

One point needs comment. Indian grass is much more extensive in this second-year planting than it has been in any of the other prairies we have created here at Pleasant Valley Conservancy. Since the seeding rate for this species was no higher than for the other prairies, it seems likely that growing conditions, probably rainfall, has been more favorable this year than for any of the other prairies.



*Figure 51. A view looking southeast across the top of the East Basin from the edge of the Ridge Prairie, July 7, 2011. The property line begins where the heavy tree growth is seen. (The neighbor's garage can be seen in the distance.)*



## Species survey: 2nd growing season (2011)

<i>Latin name</i>	<i>Common name</i>
<i>Achillea millefolium</i>	Yarrow
<i>Agastache nepetoides</i>	Yellow giant hyssop
<i>Agastache scrophulariaefolia</i>	Purple giant hyssop
<i>Arnoglossum atriplicifolia</i>	Pale Indian plantain
<i>Aster laevis</i>	Smooth blue aster
<i>Aster lateriflorus</i>	Calico aster
<i>Aster novae-angliae</i>	New England aster
<i>Aster oolentangiensis</i>	Sky-blue aster
<i>Aster pilosus</i>	Hairy aster
<i>Aster sagittifolius</i>	Arrow-leaved aster
<i>Aster lanceolatus</i>	Marsh aster
<i>Bromus kalmii</i>	Prairie brome
<i>Cirsium discolor</i>	Pasture thistle
<i>Desmodium paniculatum</i>	Panciled tick-trefoil
<i>Dodecatheon meadia</i>	Shooting star
<i>Elymus canadensis</i>	Canada wild rye
<i>Elymus hystris</i>	Bottlebrush grass
<i>Elymus riparius</i>	Woodland wild rye
<i>Elymus virginicus</i>	Virginia wild rye
<i>Erigeron philadelphicus</i>	Marsh fleabane
<i>Erigeron strigosus</i>	Daisy fleabane
<i>Eupatorium altissimum</i>	Tall boneset
<i>Eupatorium perfoliatum</i>	Boneset
<i>Gaura biennis</i>	Biennial gaura
<i>Gentianella quinquefolia</i>	Stiff gentian
<i>Helenium autumnale</i>	Sneezeweed
<i>Helianthus decapetalus</i>	Pale sunflower
<i>Heliopsis helianthoides</i>	Ox-eye sunflower
<i>Hypericum punctatum</i>	Dotted St. John's wort
<i>Koeleria macrantha</i>	June grass
<i>Lobelia siphilitica</i>	Great blue lobelia
<i>Monarda fistulosa</i>	Wild bergamot

<i>Oenothera biennis</i>	Common evening-primrose
<i>Panicum virgatum</i>	Switch grass
<i>Penstemon digitalis</i>	Penstemon
<i>Phytolacca americana</i>	Pokeweed
<i>Polygonum punctatum</i>	Smartweed
<i>Ratibida pinnata</i>	Yellow coneflower
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Rudbeckia triloba</i>	Brown-eyed Susan
<i>Silphium integrifolium</i>	Rosinweed
<i>Solidago canadensis</i>	Common goldenrod
<i>Solidago missouriensis</i>	Missouri goldenrod
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Solidago rigida</i>	Stiff goldenrod
<i>Solidago speciosa</i>	Showy goldenrod
<i>Sorghastrum nutans</i>	Indian grass
<i>Tradescantia ohiensis</i>	Common spiderwort
<i>Verbena hastata</i>	Blue vervain
<i>Verbena stricta</i>	Hoary vervain

The above list (50 species) was developed from brief notes made by Kathie and/or Tom during various excursions through the East Basin. Most of the observations were made along the upper end of the basin, either near the Ridge Prairie, or along the east border of the Conservancy.

A few observations were made in the wet/mesic area at the south end of the site.

In general, the success has been very gratifying, especially since site preparation was much more difficult than that of most planted prairies.

Finally, the site has been an excellent source for collecting certain species of seeds: prairie brome, pasture thistle, woodland and Virginia wild rye, June grass, and black-eyed and brown-eyed Susan.

## Summary of work hours at East Basin

Reasonably careful records have been kept of the work involved in restoration of the East Basin. The data here are derived from the contractor's monthly invoices and the monthly time sheets submitted by Savanna Oak Foundation, Inc. employees. In addition, estimates were made of the hours put in by Kathie and Tom Brock (all unpaid) as well as the hours of volunteers who participated in the prairie planting activity. These hours are categorized and summarized in the table.

The total is 1677 recorded hours. Some hours likely have been missed, so that it seems reasonable to round this number up to 1800 hours. The time put in by the volunteer wood cutter and his associate are not available, but could easily have amounted to another 96 hours (12 8-hour Sundays). This estimate is not included in the table. As the table shows, most of the work was for cutting trees and removal of wood.

Category	Details	Hours and % of total	Year
Wood	Cut, treat, aspen girdle, main clearing activities	1029.75 (61%)	2007: 142 2008: 742.5 2009: 145.25 (2009= aspen; brush piles)
Blanket spray	Glyphosate treatment of the whole site	118 (7%)	2009: 118
Spot spray	Mainly weed spraying after clearing	106.25 (6%)	2008: 86.25 2009: 2 (GM) 2010: 0 2011: 2
Weeds	Hand weeding (mostly after clearing)	180.5 (11%)	2008: 26 2009: 0 2010: 41.25 2011: 113.25
Mow	Kubota and brush cutter (1st growing season of planted prairie)	24.25 (1.5%)	2010: 24.25
Seeds	Preparation and seeding (does not include seed collecting)	161.5 (10%)	2009: 161.5
Burns	Prescribed burning (not brush piles; which is included under "wood")	56.75 (3%)	2009: 13 2011: 44.25
Total hours		1677	
Hours and \$\$/acre		335.4 hrs/acre At \$20/hr = \$6700/acre	

Area of the East Basin is approximately 5 acres

On their web site Prairie Restorations, Inc. of Princeton, MN has given total costs for prairie restorations. For a 3-10 acre prairie, their cost per acre varied from \$2,100 per acre for a low-diversity planting to \$6,150 per acre for a high diversity planting (5-8 grass, 12-25 wildflower species). Since our planting diversity was even higher than the high-diversity planting, it appears we have done all right. This is especially true when one realizes that the main cost of our restoration, the removal of a huge amount of wood (61% of the total work), would not be a factor in the commercial prairie planting.



## Long-term Management as a Savanna?

Although we originally thought of the East Basin as prairie, it may be better to think of it as an open savanna. Why?

- There are at least five large oaks that were left after clearing the East Basin.

- The crown cover in the East Basin is 13%, based on the number of trees per acre and the basal area per acre. This agrees with Curtis' definition of savanna (greater than 1 tree per acre).

- At its south end, the East Basin borders a neighbors wooded property, and shading from this woods creates a savanna habitat along a wide swath of the site.

- There are scattered hazel shrubs, which are generally associated with savanna.

- There are some herbaceous species that are considered "indicators" such as *Elymus riparius* which grew prolifically as a "volunteer".

- The NE corner of the East Basin already has savanna character.

What does managing for savanna mean? Burns, control of invasive species, and other management activities will be similar. The principal difference is that the remaining large trees in the East Basin will not be cut, and the smaller trees will be allowed to

get larger.

Figure 52 is a typical view of the East Basin in mid summer of its second growing season. The large oak at the top of the ridge has typical open-grown character. It was for this reason that this tree (and the other large trees) were not cut.

The smaller oaks seen in Figure 52 will also be allowed to remain, and to continue to grow as open-grown specimens.

Although the large East Basin trees are included in the large Pleasant Valley Conservancy tree database, the smaller trees have not been measured. It is planned to do a complete survey of all trees in the East Basin, so that they can be monitored as the years go by.

Why were these smaller trees not cut when all the others were? Time and money probably are responsible. There were so many large undesirable trees that had to be removed, that even the smaller oaks were allowed to remain.



**Figure 52. Savanna character of the East Basin. The large open-grown black oak on the upper left is typical of the oaks that were left standing when the East Basin was cleared. The smaller oaks in the foreground will be allowed to retain their open-grown character. August 21, 2011**



## Fall Views of the East Basin: 2011



*Figure 53. The East Basin has been an excellent site for collecting certain species, such as June grass, Virginia wild rye, Gaura biennis, Woodland rye, pasture thistle, and the two Rudbeckias.*



*Figure 54. Fall color in the East Basin. Looking southeast from the west edge of the site, near the Ridge Prairie lane. Virginia wild rye, asters, and goldenrods.*





*Figure 55. West side of the East Basin on the top of the hill. In this area, it blends into the Ridge Prairie. The large oak is probably a Hill's oak (*Quercus ellipsoidalis*).*



*Figure 56. View of the wet-mesic area of the East Basin from the lower south side of the site. The large patches of Indian grass can be seen.*

## Summary

The East Basin restoration has been an interesting experience, and it is fortunate that it is coming out so well. Although we originally planned to restore this site to dry mesic prairie, it now appears that oak savanna might be a better choice.

Here is a brief time line of what has been done:

- Survey of the site in the fall of 2007
- Removal of the large trees during the winter of 2007-2008
- Girdling of aspen in May 2008
- Survey of the site in the summer of 2008 to determine what was present
- Marking of shooting star patches so that they could be protected
- Spot spraying of weeds and woody plant regrowth during the summer of 2008
- Removal of firewood and lumber in the winters of 2009 and 2010
- Control of garlic mustard in 2009-2011
- Blanket spraying of the whole site with glyphosate in June and August of 2009
- Cutting of dead aspen in fall 2009
- Burning cut aspen as well as residual wood in Oct 2009
- Seed collecting in fall of 2008 and 2009
- Planting the new prairie in Nov 2009
- Mowing the new growth in June and August 2010
- Prescribed burn in April 2011
- Surveys of plant diversity in summer 2011
- Seed collection of species that have provided favorable growth in fall 2011