Wisconsin Case Study – Brix Cider

Regional Information

Northern Mississippi Valley Loess Hills

Major Land Resource Region (MLRA) 105 lies in the north central part of the Central Grains and Livestock Region. MLRA 105 is nearly 18,000 square miles of which Wisconsin (52 percent), Iowa (23 percent), Minnesota (20 percent), and Illinois (5 percent). There are numerous State parks are throughout the area and much of the Upper Mississippi National Wildlife Refuge is in this MLRA.

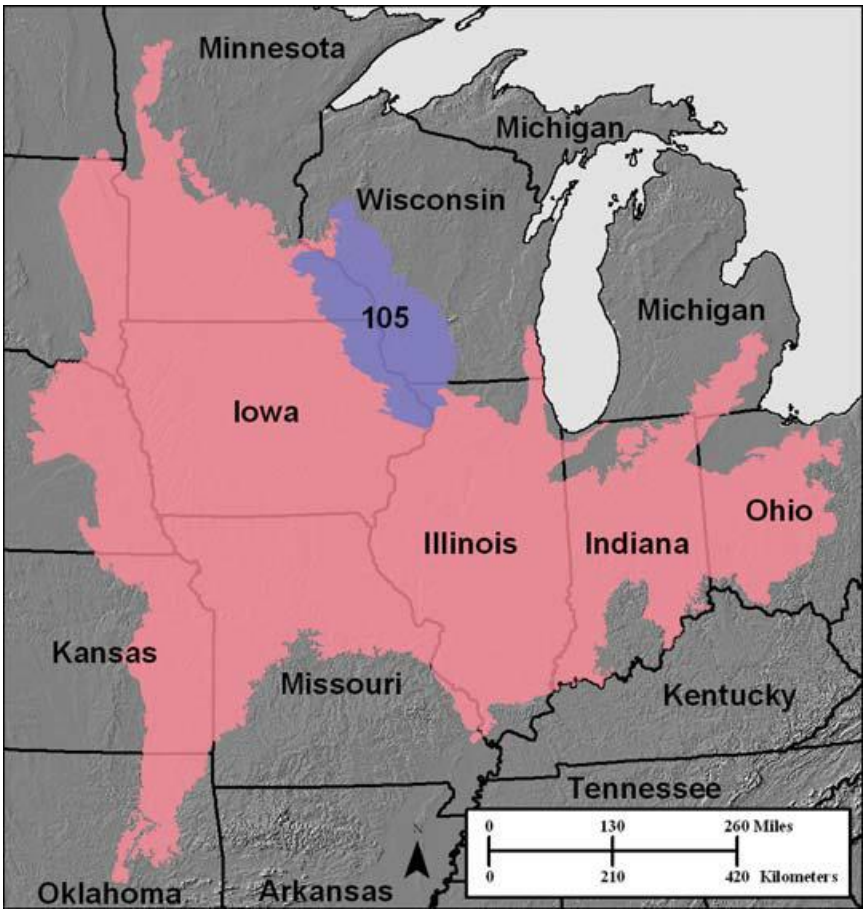

FIGURE 1. LOCATION OF MLRA 105

This area is in the Wisconsin Driftless Section of the Central Lowland Province of the Interior Plains. In Wisconsin, this area is often referred to as the "Driftless Area" because it has undergone only limited landscape formation by glacial ice. The area consists mostly of gently sloping to rolling summits with steeper valley walls that join small to very large flood plains. Scenic landscapes are characteristic of the area. They include deep valleys, abundant rock outcrops, high bluffs, caves, crevices, and sinkholes. Stream valleys are deep, narrow, and Vshaped and have irregular slopes and steep cliffs. The valleys commonly take abrupt, sharp-angled turns, indicating that the local drainage network is controlled by joint patterns in the underlying bedrock. Elevation ranges from 660 feet (200 meters) on the valley floors to 1,310 feet (400 meters) on the highest ridges. Local relief is mainly 10 to 20 feet (3 to 6 meters), but it is as

much as 50 to 100 feet (15 to 30 meters) on valley walls along the major streams and is as much as 250 feet (75 meters) on the Mississippi River bluffs above the river valley floor.

About one-half of the area is cropland, and 15 percent is permanent pasture. Cash crops, such as corn and soybeans, and feed grains and forage crops for dairy cattle and other livestock are the principal crops. A large portion, one fourth of the area, is mainly the more sloping parts, consists of farm woodlots used for commercial timber production or for farm products. The Mississippi River and its major tributaries provide opportunities for recreation. The major resource concerns are water erosion, depletion of organic matter in the soils, and poor water quality. Conservation practices on cropland generally include systems of crop residue management (especially no-till, strip-till, and mulch-till systems), cover crops, nutrient and pest management, contour stripcropping, grassed waterways, terraces, manure management, pasture and hayland planting, tree planting, and grade-stabilization structures.

Climate Information

The average annual precipitation in most of this area is 30 to 38 inches (760 to 965 millimeters). Two-thirds or more of the precipitation falls during the freeze-free period. Most of the rainfall occurs as high-intensity, convective thunderstorms during the summer. Snowfall is common in winter. The average annual temperature is 42 to 50 degrees F (6 to 10 degrees C). The freeze-free period averages about 175 days and ranges from 145 to 205 days.

According to the NOAA National Centers for Environmental Information and their Wisconsin State Climate Summary, projections for Wisconsin's climate include:

- Average temps could increase 3.5-5°F by mid-century (2046-2065).
- Potential increase in number of days above 95°F with future heat waves to be more intense.
- Average number of days without precipitation to increase.
- Increased precipitation during winter and spring (less snowfall due to increased temps).
- Higher frequency and intensity of extreme precipitation events.
- Frost-free season will be longer, thus less time for soils to be frozen.

Soils on the Farm

The dominant soil orders in this MLRA are Alfisols and Entisols and, to a lesser extent, Mollisols. The soils in the area dominantly have a mesic soil temperature regime, a udic soil moisture regime, and mixed mineralogy. They generally are moderately deep to very deep, well drained or moderately well drained, and loamy.

Three of the many soil series found on the farm and common throughout the MLRA are Northfield stony loam with slopes of 20 to 30 percent. This component is on escarpments. The parent material consists of loamy colluvium over sandy residuum with a depth to a root restrictive layer, bedrock, of 12 to 24 inches. The natural drainage class is well drained. Newglarus silt loam with slopes of 12 to 20 percent. This component is on Galena/Platteville ridges on loess uplands. The parent material consists of loess over clayey pedisediment derived from dolomite with a depth to a root restrictive layer, strongly contrasting textural stratification, of 10 to 25 inches. The natural drainage class is well drained. The third most prevalent soil is Northfield sandy loam. This component is on hills. The parent material consists of deposits of loamy slope alluvium over sandy residuum with a depth to a root restrictive layer, bedrock, paralithic, of 12 to 24 inches. The natural drainage class is well drained.

Water

In most years the moderate precipitation is adequate for crops and forage, but in years of little or no precipitation, yields are reduced on soils that are shallow over bedrock. The many springs, streams, and farm ponds are additional sources of surface water in the area. The surface water is abundant and generally is of good quality. Poor water quality in stream reaches is primarily the result of nonpoint sources of sediment, nutrients, and pesticides from agricultural land or wastewater discharges downstream from the larger cities.
Ground water is abundant in glacial outwash deposits in most of the river valleys in this area. This water is moderately hard or hard but is generally of very good quality.

Brix Cider

Brix Cider's apple orchard is located in Iowa County about 35 miles west of Madison, WI. The following is an excerpt from the Brix Cinder website describing their mission, vison and ethos:

Vision:

We believe that cider should be something beautiful. It should be simple. It should be about the land, the people who grow the apples, the people who drink the cider, and the connections between us all.

People:

For now it's just us, Marie and Matt Raboin. Brix Cider is a dream we imagined together over several years and over many glasses of cider. We've had a lot of help and support from friends and family who have volunteered their time and labor in everything from cleaning up the farm and planting trees to making and tasting cider. We've also had some great babysitters who've stepped in when we were in a pinch. We'd be a sinking ship without everyone's support.

Orchard:

We planted our first trees in 2014 and have added more each year since. We're now at about 1,000 trees and counting. The orchard is a living experiment. We are trying out over 70 varieties of cider apples to see which ones we like best, and over the years, we'll plant more of our favorites. A few chickens lay eggs for us, and we have some geese who help mow the orchard understory. We're also growing some cherries, pears, plums, apricots, and black raspberries which will likely find their way into a cider one day.

Cider:

We made our first few gallons of cider in 2010. Not knowing what we were doing at the time, we bottled the cider before it was entirely done fermenting, and we sealed the bottles with wine corks. A few weeks later, two corks blasted out of bottles on our wine rack, and cider flowed onto the floor. The cider that we salvaged actually tasted pretty good, and our first humble vision of a cider business was conceived. We've learned a lot since then, and we've produced countless batches of cider, some good, some bad, some award winning. Making cider is a never-ending learning experience, and as we continue to hone our craft, we'll bring our very best to you.

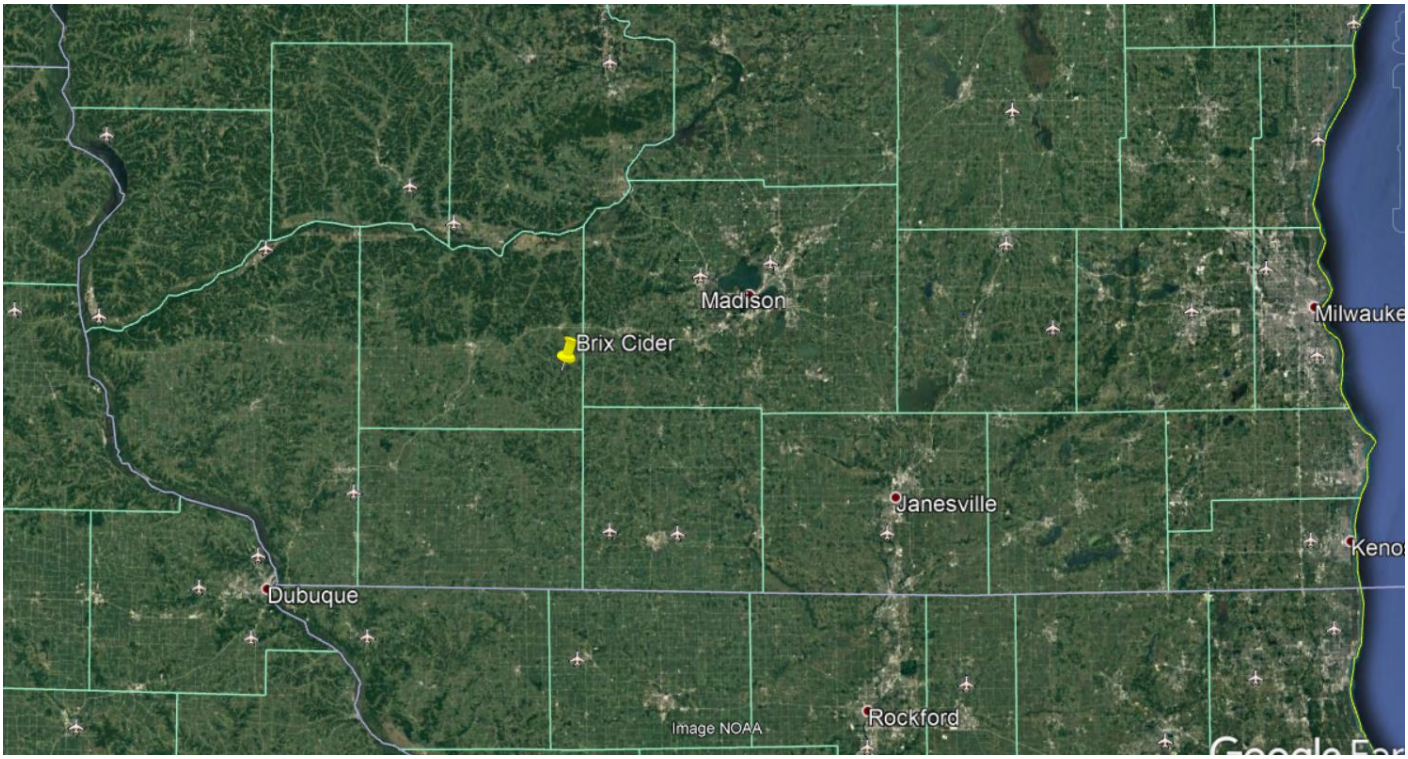

Figure 2. Location map of Brix Cider.

Utilizing the five-step adaptation workbook process the following information was collected utilizing the spreadsheet format developed by Maria Janowiak of the USDA, Forest Service, Northern Research Station. The majority of steps were conducted over the phone and internet via an interactive Skype session with Marie and I in a conference room together with Joan Howard tuning in remotely.

Step 1: Define management goals and objectives.

What are your management goals and objectives for the project area?

Farm or Project Area:	Brix Cider Farm near Barneveld, WI is home to a two acre high density orchard consisting of apples, cherries, pears, and plums. 90 percent is for apple production and other 10% is cherry, pear, and plum production. Heirloom variety, dual purpose verities, or cider varieties, Geneva root stock (Geneva, NY) disease and pest resistant.
Location:	Iowa County, WI

Management Unit	Management Goals	Management Objectives	Time Frames
Entire Orchard	Apples for Cider production	Yield-Growing for highest production and minimum inputs	Started in 2014 and adding 200 to 300 apples a year to build up to 1500
Entire Orchard	Reduce Pest Pressure	Adding Geese for orchard floor	2020

Step 2: ASSESS site-specific climate change impacts and vulnerabilities.

What climate change impacts and vulnerabilities are are most important to this particular site?

Management Unit (from Step #1)	Regional Climate Change Impacts and Vulnerabilities	Climate Change Impacts and Vulnerabilities for the Project Area or Property	Vulnerability Determination
Entire property	Average temps could increase 3.5-5°F by mid-century (2046-2065)	During growing season it is ok, it is the temperature swings in January and February that break dormancy and cause winter kill.	Very High
	Increase in number of days above 95°F	Irrigation and permanent cover help with days above 95 degrees	Low
	Future heat waves to be more intense	Irrigation and permanent cover help with heat waves, vulnerability is in spring with tree establishment.	Low
	Increase in nighttime temperatures	Increase in temperature may increase moisture which leads to more fungal diseases and increase in insect pest life cycles, increasing pests damaging orchard and develop resistance to chemical and biological controls.	Medium
	Average number of days without precip to increase	Drip irrigation helps to mitigate with this issue.	Low
	Frost-free season will be longer.	If it is erratic and major temperature swings at the wrong time can damage the fruit crop resulting in a large loss of production.	High
	Increased precipitation during winter and spring (less snowfall due to increased temps)	Early snow, ground does not freeze and more exposed to winter kill. Rain in the winter if it contributes to thawing soils causing winter kill. Trees become more susceptible to cold and lose hardiness.	Medium
	Higher frequency and intensity of extreme precip events	Chemical or biological control; difficult to spray with increase in frequency of precip events. (more than normal rain for spring)	Low

Step 3: EVALUATE management objectives given projected impacts and vulnerabilities.

What management challenges and opportunities may occur as a result of climate change?

Management Unit (from Step #1)	Management Objectives (from Step #1)	Challenges to Meeting Management Objective with Climate Change	Opportunities for Meeting Management Objective with Climate Change	Feasibility of Objectives under Current Management	Other Considerations
Entire Orchard	Yield-Growing for highest production and minimum inputs	Temperature swings with warmer winters, frost damage, and increased disease and pest pressure	NA	Short term-High Long term-moderate to low	Financial- market prices, crop loss, increase cost to purchase apples and increase cost in harvest and distance to alternative suppliers (greater than 30 miles).
Entire Orchard	Adding Geese for orchard floor	Increase night time temps and moisture increase pests, decrease in forage production during July and August and have to supplement feed and water to geese or harvest geese.	NA	Short term-High Long term-moderate to low	Financial- spray more or use more biological controls and possible increase cost of apples from other growers

Step 4: IDENTIFY adaptation approaches and tactics for implementation.

What actions can enhance the ability of the ecosystem to adapt to anticipated changes and meet management goals?

Management Unit (from Step #1)	Adaptation Actions		Time Frames	Benefits	Drawbacks & Barriers	Practicability of Tactic	Recommend Tactic?
	Approach	Tactic					
Entire Orchard	4.4 Reduce severity or impact of temperature extremes	Plant several varieties with different flowering times	2018	Reduce your chance of total crop loss	Makes management very hard with crops flowering at different times for spraying and	High	Yes
	6.1 Diversify crop or livestock species, varieties or breeds, or products	Planting of several varieties with different flowering times	2018	Reduce your chance of total crop loss	Makes management very hard with crops flowering at different times for spraying and	High	Yes
	4.4 Reduce severity or impact of temperature extremes	Planting on north slope to keep trees from flowering early in spring, reduces risk	2018	Reduce your chance of total crop loss	Limited by landscape	High	Yes
	4.4 Reduce severity or impact of temperature extremes	Frost protection by spraying water at high risk times	long term option	Insulates the flower from freezing	Limited by equipment, need large tanks, and spray equipment.	Medium	Yes
Entire Orchard	2.1 Reduce the impacts of pests and pathogens on crops	Geese, timely mowing, and spraying.	2020	Marketing tool to see biological control in an orchard and provide future meat for Restaurant. Increase in nutrient cycle, plat diversity and OM for soil health	Cost of infrastructure (food, water, fencing, and shelter) and cost of livestock	Medium	Yes
	2.2 Reduce competition from weedy and invasive species	Geese, timely mowing, and spraying.	2020	Marketing tool to see biological control in an orchard and provide future meat for Restaurant. Increase in nutrient cycle, plat diversity and OM for soil health	Cost of infrastructure (food, water, fencing, and shelter) and cost of livestock	Medium	Yes
	5.2 Promote biological diversity across the landscape	Plant a variety of forages for both pollinators, support the geese, and to maintain constant cover	2020	Marketing tool to see biological control in an orchard and provide future meat for Restaurant. Increase in nutrient cycle, plat diversity and OM for soil health. More beneficial insects to control pests and increase pollination.	Cost, time, and management	High	Yes

Step 5: MONITOR and evaluate effectiveness of implemented actions.

What information can be used to evaluate whether the selected actions were effective and inform future management?

Management Unit (from Step #1)	Adaptation Monitoring Variable	Criteria for Evaluation	Monitoring Implementation
Entire Orchard for Apple Cider production	Crop productivity	Similar or better yields annually	Continue record keeping, inventory and sales

Lessons Learned

It is critical that those just learning and attempting to navigate the 5 step Adaptation Workbook process are guided by a trained facilitator who has direct experience with the process. To that end, if USDA views utilization of the workbook process as vital to the USDA mission more trainings in the form of workshops need to be offered to USDA

employees to gain confidence and experience in becoming a workbook facilitator. Thus, those newly trained facilitators can start conducting full day seminars/workshops to those agricultural producers who are interested in climate change adaptation on their operations. NRCS makes an effort towards a 9-step planning process with clients with varying success so attempting an additional stepped process will likely be more successful with producers who are innovators and early adopters in their respective ag sectors/communities.

Sources: United States Department of Agriculture, Natural Resources Conservation Service. 2006. *Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.* U.S. Department of Agriculture Handbook 296.