Wisconsin Case Study – R & G Miller and Sons Farm

Regional Information

Southern Wisconsin and Northern Illinois Drift Plain

Major Land Resource Region (MLRA) 95B makes up the southern part of the Northern Lake States Forest and Forage Region. MLRA 95B is nearly 11,000 square miles of which 81 percent lies in Wisconsin and 19 percent in Illinois. The MLRA includes the valley of the Wisconsin River, the eastern Baraboo Hills, and some large lakes and wetlands.

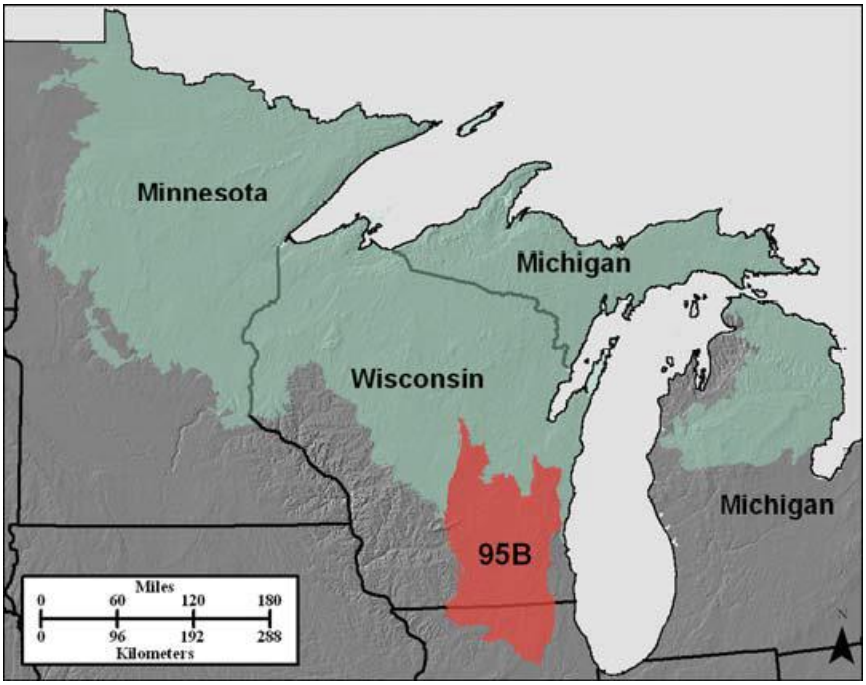

FIGURE 1. LOCATION OF MLRA 95B

This area is characterized by gently sloping ground moraines, lake plains, outwash plains, drumlin fields, end moraines, flood plains, swamps, and marshes. Most of the area has belts of morainic hills and ridges and nearly level outwash terraces. Drumlins (steep-sided, elongated or oval hills) are prominent features in the north-central part of the area. The area is dissected by numerous streams and rivers. Elevation ranges from 660 to 980 feet (200 to 300 meters). Local relief is mainly 25 feet (8 meters), but the moraines, drumlins, and bedrock escarpments rise 80 to 330 feet (25 to 100 meters).

Most of this MLRA is in farms. More than one-half of the area is cropland. Agricultural uses include the production of dairy cattle, other livestock, forage, hay, feed grains, sweet corn, snap beans, canning peas, soybeans, winter wheat, barley, and fruit. Much of the hay, feed grain, and forage is fed to dairy cattle and other livestock on the farms where the feed is grown, but cash-grain farming also is important. Canning crops, potatoes, fruits, and other specialty crops are important, especially around urban centers. A significant part of the area is in small, private woodlots or is used for urban development. Some of the better farmland is increasingly used for urban development. Outdoor recreational uses are becoming more important.

Climate Information

The average annual precipitation in this area is 30 to 38 inches. Most of the rainfall occurs as high-intensity, convective thunderstorms during the summer. Snowfall is common in winter. The average annual temperature is 43 to 48 degrees F. The freeze-free period averages about 170 days and ranges from 150 to 190 days, decreasing in length from south to north and from the shore of Lake Michigan inland.

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, Histosols, and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. They are very deep, generally well drained to poorly drained, and loamy. They formed dominantly in a mantle of silty or loamy sediments over loamy till, in sandy till or mudflow sediments, in a sandy or loamy mantle over glaciofluvial deposits, in silty or clayey glaciolacustrine sediments, in mixed alluvium, or in organic material.

Three of the many soil series found on the farm and common throughout the MLRA are St. Charles silt loam with slopes of 2 to 6 percent. This series is found on till plains on plains. The parent material consists of loess over glacial loamy till with a depth to a root restrictive layer greater than 60 inches. The natural drainage class is well drained. Dodge silt loam has slope that are 2 to 6 percent. This series can be found on drumlins on drumlin fields. The parent material consists of loess over calcareous loamy till. The depth to a root restrictive layer is greater than 60 inches and natural drainage class is well drained. Virgil silt loam is found with slopes of 1 to 4 percent. This component is on drumlins on drumlin fields. The parent material consists of loess over calcareous loamy till with a depth to a root restrictive layer greater than 60 inches. The natural drainage class is somewhat poorly drained thus many fields contain subsurface tile drainage networks.

Water

Following are the estimated withdrawals of freshwater by use in this MLRA:

Public supply—surface water, 10.8%; ground water, 9.0%

Livestock—surface water, 0.3%; ground water, 1.1%

Irrigation—surface water, 0.0%; ground water, 1.2%

Power generation, paper production, cranberry production, mining, aquaculture, industrial—surface water, 74.2%; industrial, aquaculture, mining -- ground water, 3.4%

The total withdrawals average 2,280 million gallons per day. About 15 percent is from ground water sources, and 85 percent is from surface water sources. The moderate precipitation generally is adequate for crops and pasture, but in years of little or no precipitation, some crops on coarse textured soils are damaged by a lack of moisture. Many of the fine textured soils require water management practices that facilitate tillage and harvesting. Drainage of poorly drained soils is needed for good production of cultivated crops.

The many inland lakes and streams typically have good-quality water. The surface water can be impacted by agricultural and municipal pollution, but it is generally suitable for most uses. Ground water is abundant in unconsolidated sand and gravel deposits throughout the areas covered by glacial drift. All of the ground water in this MLRA is a calcium-magnesium bicarbonate type.

R & G Miller and Sons Farm

R & G Miller & Sons Inc. is in northeastern Dane County about 15 miles northeast of Madison, WI. The 1550 acres of certified organic land is used for 418 acres of rotational grazed pasture and 1132 acres to grow crops to feed a dairy herd and young stock, totaling about 800 head. The following is an excerpt from R&G Miller and Sons website describing their commitment to “Keeping it Organic”:

> *Crop rotation is an important cornerstone of farming organically. The rules of our certifier require that we rotate crops in such a manner as to maintain soil fertility and plant health. The rotation we are presently following is: alfalfa for 3 years, followed by corn for 1 year, soybeans for 1 year, corn again for a year, small grains (oats, rye or barley) for 1 year, and then back to alfalfa.*
>
> *Maintaining this regime enables us to disrupt insect life cycles, avoiding the need for pesticides. It also helps with the perennial battles with weeds. Correct crop rotation improves soil health and texture, lessens soil erosion, and prevents one crop from exhausting the soil.*
>
> *Weed control is a relentless battle for all farmers. We control them organically with fieldwork techniques, timing of field preparations, propane burners, and maintaining superior soil fertility. Our most important soil input and our primary nitrogen source is the organic manure from our dairy.*
>
> *Plowing under cover crops, using chicken manure compost, and adding mined potassium sulfate and mined gypsum, are additional ways of enhancing soil fertility. Micronutrients are also added in accordance with National Organic Standards, along with soil tests and our own Nutrient Management Plan.*

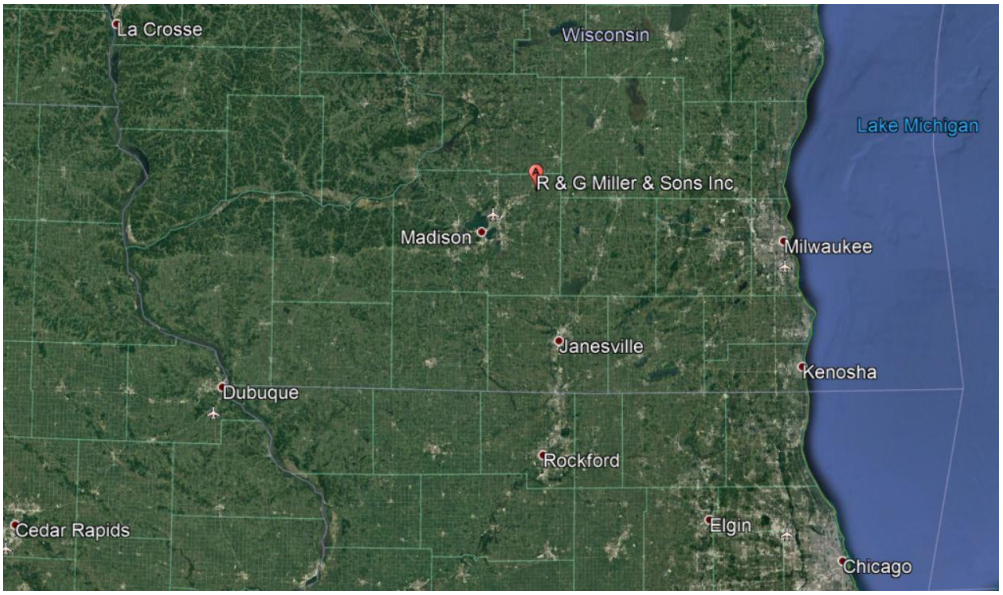

FIGURE 2. LOCATION MAP OF R&G MILLER AND SONS INC FARM.

FIGURE 3. R & G MILLER AND SONS INC GRAZING PASTURES WITH OUTLINED SOIL TYPES.

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 the steps were conducted over the phone and internet via an interactive Skype session with Ron of R&G Miller and Sons Inc and I in a conference room together with Maria and Joan Howard tuning in remotely.

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.

Step 1: Define management goals and objectives.

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

Farm or Project Area:	**R & G Miller & Sons Inc.** R & G Miller & Sons Inc. is located in northeastern Dane County about 15 miles northeast of Madison, WI. The 1550 acres of certified organic land is used for 418 acres of pasture and 1132 acres to grow crops to feed a dairy herd and young stock, totaling about 800 head. The rotation presently used is: alfalfa for 3 years, followed by corn for 1 year, soybeans for 1 year, corn again for a year, small grains (oats, rye or barley) for 1 year, and then back to alfalfa.
Location:	Dane County, WI

Management Unit	Management Goals	Management Objectives	Time Frames
Entire Property	Continue to produce the highest quality organic milk without sacrificing the health or comfort of the herd Maintain or increase surplus yields of grain and hay for revenue and/or reserve stocks Maintain diverse land use including pasture, cropland		
Cropland (1132 ac)	Maintain or increase yields	Utilize a targeted fertilization management system that maximizes variable rate technology to increase yields [Transition to acceptable yielding management system took 5 years (improved soil fertility and grain yields). Future yield improvements will be gradual.]	Long-term
Pasture (418 ac)	Maintain productivity of cows Maintain and increase plant vigor of pasture grasses Maintain and increase plant/pasture productivity	Maintain productive cow herd while maintaining good vegetation Continue to increase acres of pasture inter-seeded	Annually
Farmstead	Improve/increase energy efficiency of milking and housing facilities	Increase use of LED lighting, replace condensers in milking parlor (milk cooling)	Within next year

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

What climate change impacts and vulnerabilties are are most imporant 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)	No frost pockets here or local microclimate	Moderate/ average overall with ponding of greatest concern
	Increase in number of days above 95°F	Interannual variability-- e.g., 2017 was cold but 2012 drought year had a week of 95-100 degrees	
	Future heat waves to be more intense	Increased livestock stress.	
	Increase in nighttime temperatures	Increased livestock stress.	
	Average number of days without precip to increase	Dry winter in 2017-2018 drier periods between events	
	Frost-free season will be longer.	Potential for increased pest pressures.	
	Increased precipitation during winter and spring (less snowfall due to increased temps) -- more rain during winter (not snow), especially during shoulder season	Potential for increased erosion.	
	Higher frequency and intensity of extreme precip events	Already seeing this increase in events, particularly in spring (delays planting, getting cows out) Extended wet periods (e.g. 5 inches per week), sometimes big deluge rains Ponding in some areas -- more areas that are more susceptible to ponding than other farms; areas that have drain tile, but problems in a few fields. *More tiling might be needed, or fixed in some areas. Not much erosion (unless soil exposed) -- rolling topography	

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 Property					
Cropland	Utilize a targeted fertilization management system that maximizes variable rate technology to increase yields	Heavy rain and wet spring conditions-- more difficult to get into fields in spring, ponding-- make it harder to plant, haul manure in spring/fall (hauling on wet soils can increase compaction) Ponding reduces yields (Weather doesn't affect fertilizer applications) Drought decreases yields	Crops will benefit from longer growing season, as long as there's enough moisture Seed companies are keeping up with some environmental changes (e.g., drought-tolerant corn) and more options are available Do plant some crops (Winter tricale, winter wheat. etc.) during fall and could do more of that-- for forage or grain (would reduce corn acres	High-- Several consectutive dry years would affect decisions (seeds, etc.)	Market prices and availability
Pasture	Maintain productive cow herd while maintaining good vegetation Continue to increase acres of pasture inter-seeded Maintain and increase plant/pasture productivity	Wet spring conditions-- more difficult to get into cows out (access in lanes-- muddy/greasy with all the traffic) Potential for more diseases with prolonged wet conditions?? (not sure if weather) Diseases do reduce productivity of plants (orchard grass) Drought decreases yields; grasses shut down and increases need to feed	Pasture will benefit from longer growing seasons, as long as there's enough moisture	High	Market prices and availability
Farmstead	Improve/increase energy efficiency of milking and housing facilities	More intense heat would require greater cooling within buildings. Current design is mostly natural ventilation-- no misters, etc. Manure storage-- increased spring precipitation or larger events causes lagoon to fill faster (also another barn); too much at once means hauling at inopportune times, risking compaction, etc.	N/A	High	Market prices and availability

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					
Cropland	Reduce severity or extent of water-saturated soil and flood damage Adjust the timing or location of on-farm activities	plant some crops in fall (Winter triticale, winter wheat. etc.) -- for forage or grain	already doing winter tricale	don't have to worry about getting into fields in spring (ponding issue) retains continuous cover without cover crops	would reduce acres in corn	High	Yes
	Reduce severity or extent of water-saturated soil and flood damage Adjust the timing or location of on-farm activities	Switch from summer annuals (e.g., corn) to winter annuals or overwintering crops (e.g., winter rye)		don't have to worry about getting into fields in spring (ponding issue)	Might reduce corn acres Lower seed/feed value? Need to determine nutrition value to overcome perception of low forage value	High	Yes
	Manage crops to cope with warmer and drier conditions	Changing seed varieties to drought-tolerant corn				High	Yes
	Switch to commodities expected to be better suited to future conditions Manage crops to cope with warmer and drier conditions	Change from corn to sorghum or sudangrass		Increased tolerance to heat and drought	Limited availability of seeds, varieties, equipment (current focus on corn) Might reduce corn acres Lower seed/feed value?	High	Yes
	Manage crops to cope with warmer and drier conditions	Reduced tillage		Helps retain moisture works well with fall-planted crops		High - as much as can	Yes
	Maintain and improve soil health Reduce peak flow, runoff velocity, and soil erosion	Cover crops		feed the soil can be a feed source keeps cover, reduces erosion	can be hard to plant if summer/fall harvest is delayed (timing)	High	Yes
Pasture	Diversify crop or livestock species, varieties or breeds, or products Maintain livestock health and performance Maintain and improve soil health	Interseeding	already doing and want to do more of	Helps improve pasture without tilling everything up; retains moisture; diversifies species in mix; improves nutrition Can adjust mix to site and soil conditions		High	Yes
	Manage crops to cope with warmer and drier conditions	Shift varieties as needed	already doing			High	Yes
	Manage crops to cope with warmer and drier conditions	Warm season perennial grasses		Some that already come in	Lower forage production and quality; needs to fit into rotation and change other things Uncertain on winter hardiness	Low	No - conditions would really need to change
	Maintain livestock health and performance Maintain and improve soil health	Graze cover crops			limited due to fencing issue; fields are not currently fenced-- might work for in limited locations. Often poor proximity	Low/ moderate	No - (better for other farms)
	Reduce severity or extent of water-saturated soil and flood damage	Increase rehabilitation and upgrates of lanes (e.g., lime screening)	working on	improves access to let animals out to pasture (required number of days to be outside)		High	Yes
	Maintain livestock health and performance	Stockpile feed/hay		Increase food source in late summer/ droughty conditions (Already cut early flush of growth on pasture) Weed management	Can be limitations on time (maybe just mow and leave)	High	Yes

Management Unit (from Step #1)	Adaptation Actions		Time Frames	Benefits	Drawbacks & Barriers	Practicability of Tactic	Recommend Tactic?
	Approach	Tactic					
Farmstead (Cows and barns)	Adjust the timing or location of on-farm activities	Portable parlor - automatic		Don't have to bring cows home Pastures can be more distant from farm Grass-fed = more money Less need for manure management Some cows might milk more often/as needed Lower labor	Cost/existing facilities Would need to overhaul systems Production would drop with all grass fed-- need to compare costs	Low	No let somebody else do this!
	Improve or develop structures to reduce animal heat stress Maintain livestock health and performance	Fans	already have some; could do more if needed	Do have some fans--would add before misters	Barns canbe designed to stay cool without fans Increased energy usage Retrofitting challenges	High	Yes - as needed
	Improve or develop structures to reduce animal heat stress Maintain livestock health and performance	Misters			Increased moisture and risk of mastitis/health issues Increase water demand Increase need for manure storage by increasing volume Retrofitting challenges	Moderate	Not - unless needed
	Improve or develop structures to reduce animal heat stress Maintain livestock health and performance	replace conventional lighting with LED	already doing some & more			High	Yes
		solar panels	already doing some & more	Reduce energy costs		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
Cropland	Crop productivity (bushels per acre per year)	Similar or better yields annually and over a 10-year period	Continue current recordkeeping (computerized, by field)
Pasture	Productivity	Visual, health	Inspections
Dairy	Cow production		Continue current recordkeeping
Dairy	Cow health		Continue current recordkeeping

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.