Meechim Farm:
A Case Study of Applying an Environmental Farm Plan

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Abstract

Current farming practices of the agriculture system in North America have been linked to health and environmental issues such as water mismanagement, loss of biodiversity, chemical residues in food and water, soil compaction and desertification, and a dependency on fossil fuels contributing to greenhouse gas emissions. A promising and effective way to mitigate these environmental and health issues is through environmental farm planning. We assessed if we could apply the Manitoba Environmental Farm Plan Workbook to a community farm, like Meechim farm in Garden Hill First Nation, Manitoba, which operates at a small scale, community level. The information gained from applying an adapted version of the Manitoba Environmental Farm Plan to Meechim Farm helped to identify and prioritize environmental issues related to agricultural practices on Meechim farm and make suggestions for improvement. To the best of our knowledge, this is the first comprehensive review of farming practices and management as it relates to the natural environment on Meechim Farm.

Table of Contents

Introduction

Current farming practices of the agriculture system in North America are linked to growing public health and environmental concerns (Agriculture and Agri-Food Canada, 2016). Health and environmental issues driven by conventional agriculture include mismanagement of water, loss of biodiversity and natural habitats, chemical residues in food and water, soil compaction and desertification and a dependency on fossil fuels (Plummer, Spiers, Summer & FitzGibbon, 2008; Agriculture and Agri-Food Canada, 2016).

A promising and effective way to mitigate these environmental and health issues is through a process called environmental farm planning. In Canada, environmental farm planning is "a voluntary, confidential self-assessment tool or process which is designed to help farmers enhance their environmental management by increasing their knowledge and awareness of agri-environmental risks and benefits" (Agriculture and Agri-Food Canada, 2016, p. 40). Producers go through numerous risk assessment modules that cover all aspects of farming practicses that pose a risk to air, soil, water, wildlife species and habitat and identify the agri-environmental risks and benefits of their farm and farming methods (Agriculture and Agri-Food Canada, 2016; Smithers & Furman, 2003; Atari, Yiridoe, Smale, & Duinker, 2009).Throughout the process, farmers are able to focus on areas of environmental management that are directly relevant to their land and farm management practices and pose the greatest environmental or health risk. By the end of the process, farmers will have identified agri-environmental risks and have an action plan to lessen or eliminate the risks.

Environmental Farm Plan programs have existed in all Canadian provinces and the Yukon Territory since 2005 (Agriculture and Agri-Food Canada, 2016). Participation in the Environmental Farm Plan process and the implementation of risk management strategies is voluntary, but farmers do stand to benefit from participation in and implementation of the action plan they create. For example, farmers gain knowledge about environmentally-related issues and alternative remedial measures on their farms, receive technical assistance and resources to plan and implement new strategies, and funding for implementing their action plan.

Purpose

For this case study, a modified version of the Manitoba Environmental Farm Plan was applied to Meechim Farm in Garden Hill First Nation, Manitoba in order to identify and prioritize environmental issues related to agricultural practices and make suggestions for improvement. Although the assessment is using a modified version of the Environmental Farm Plan, this

information can be applied to complete the full assessment in the future.

Background on Meechim Farm

Meechim Farm is located at Garden Hill First Nation on Treaty 5 territory, about 610 km northeast of Winnipeg, Manitoba. Garden Hill is home to about 3,500 people and is accessible by road only in the winter (Thompson, Rony, & Temmer, 2014). In Ojibway-Cree, the local dialect in the area, 'Meechim' means food. The concept of Meechim Farm began when Garden Hill First Nation community members, AKI Energy, Four Arrows Regional Health Authority and the University of Manitoba forged a partnership in 2014 to promote a community-level food security initiative in Garden Hill for growing food locally by involving local youth and adults (Loney, 2016). As a result, in 2014, a 15-acre farm, called Meechim Farm, was established in Garden Hill First Nation. This farm functions to provide training and employment for youth, as well as affordable and quality fresh produce and chicken in the community. Although student researchers have worked with Meechim Farm in the past for soil testing and improvements, a comprehensive review of farming practises and management as it relates to the natural environment has not been done.

Methods

Using the Manitoba Environmental Farm Plan Workbook as a guide, an assessment was done on Meechim farm to determine and prioritise environmental issues related to agricultural practises (Figure 1). Assessment data was gathered through key informant interviews (total of 3 including past student researchers and University of Manitoba professor), online video of the farm, government maps, and published literature on Meechim Farm. Interview questions were semi-structured with questions based on the Manitoba Environmental Farm Plan Workbook (see Appendix I). Data gathered was used to fill out the applicable sections of the Manitoba Environmental Farm Plan Workbook to help prioritise and provide suggestions for the mitigation of environmental issues.

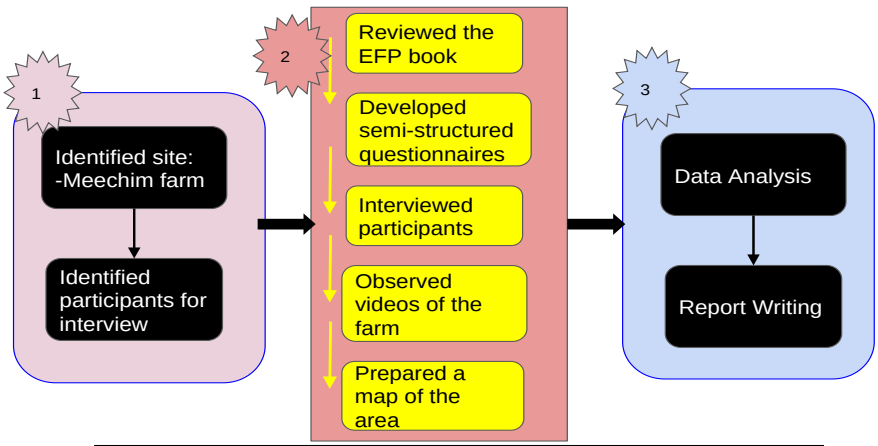


Figure 1. An overview of methods used in this study

Results

Interview Summary

(S.Thompson, personal communication, November 30, 2016; T.Okorosobo, personal communication, November 22, 2016; M.Das, personal communication, November 15, 2016)

Hope in the Community

The farm has sensitized local people that farming is still possible in Garden Hill. Chickens raised on Meechim farm provided the opportunity for local people to see live chickens in their area for the first time. One of the key informant said, "If we grow hopes in peoples' mind they are interested." Local people are motivated to start their own home gardens and poultry production but additional skills and supplies are needed in Garden Hill. It was noted in all interviews that the people involved in Meechim farm were very motivated and enthusiastic. Every year the farm has improved.

Farm Soil

A key limiting factor for crop production in Garden Hill was soil quality. The soil on the farm is mostly clay and most of the top soil was removed when the land was cleared to start the farm. One of the key informants said that the land and soil was acidic, rocky and dry. Soil erosion was not noted as a problem, but one key informant pointed out that the land does slope downward toward the lake. The farm is surrounded by trees to shelter from wind, which further reduces erosion. It was mentioned that the soil in the area where the crops are currently grown is compacted.

The key informants saw opportunity for improving the soil for agriculture at Meechim farm. According to them, an effective way of improving soil is through preparation and application of locally prepared compost, using local peat moss, chicken manure, cover crops and fish fertilizer. Compost sources can come from the farm and the community. For example, the community can provide dried or green grass after mowing the lawn. For composting to be successful, the right location must be selected and a structure that protects the compost from rain is needed. The practice of cover cropping is not done widely and represents an opportunity to improve the soil. The top soil still exists on site, as part of large poplar piles from when the land was cleared. Hugelkultur using the onsite wood piles is ongoing to reclaim the top soil, but is slow as it takes many years to break down wood. Still, this represents an opportunity to reclaim the fertile soil.

Potential for Poultry

Poultry production is seen as an immediate success in Garden Hill. The farm brought 900 broiler chicks in 2014 and 700 broiler chicks in 2015 from Winnipeg. There are also about 20 laying hens. Some homes in the community also received chicks for raising. Some chicks on the farm died in the first year due to low temperatures and lack of space for such a large number of chicks. Currently most chickens are kept in the broodhouse and some are under the greenhouse.

Chicken feed is purchased from Winnipeg and stored at the farm, although sprouts grown on

the farm for chicken feed were also used to great success. The chickens were grazed in the pasture, which also added manure to the field. Chicken manure collected in the farm house was also used for crop fertilizer. The piling up of chicken manure has been an issue in the past due to poor design of the brood house.

Most chickens were given away in the community for Thanksgiving. Other chickens were made into a soup or cooked rotisserie style and sold at the arena. Sales of whole rotisserie chickens were limited due to poor packaging according to one key informant. Freezer storage for butchered chickens is also limited. All key informants agreed that poultry raising is possible in Garden Hill with a good planning and infrastructure support.

Crops

Meechim Farm has grown crops such as carrot, tomatoes, beans, carrots, corn and potato. However, the harvest was not encouraging due to late planting of these crops and poor soil in the first year. Crops grown improved in the second and third year due to the use of fish fertilizer. Meechim staff and student researchers realized that the crops must be planted as early as possible in the summer to get a good harvest as the cool weather comes quickly. The use of fish fertilizer, discovered in the farm's second year, has hugely contributed to better crop production and is an ongoing practice.

Fifteen to twenty apple trees and raspberry plants were also planted in a small area with clover as a cover crop. These plants have established well. Vegetables, like tomato, pea and bean, were produced in the greenhouse. June is the right time to plant crops in the greenhouse. Seeds for crops are purchased every year from Winnipeg although income for farm expenditures, such as purchasing seeds, is limited.

Most of the 15 acres is currently not being utilized and a plan to use the remaining land for crop production is welcome.

Other Management Practices

- Fertilizers: No chemical fertilizers are used on the farm except lime for soil reclamation in the first year. Chicken manure is used as well as fish fertilizer, but the frequency and quantity of application is unknown.
- Chemical pesticides: No chemical pesticides are used on the farm. The farm has not faced any pest challenges but it was noted in one interview, it could benefit from a pest management strategy.
- Weeds management: Weeds have been managed manually and by using a weed trimmer. Weeds are not a huge issue as the soil is very infertile.
- Irrigation: The surrounding lake is the source of water to the farm. There is a diesel pump and water storage on the farm to irrigate the crops by hose. Some plants, such as the raspberries, have drip irrigation set up. Other areas of the farm could benefit from drip irrigation, especially if farm operations increased. The water storage is located on the highest point on the land and feeds the hose by gravity. It might be beneficial to move the water tank to a more central location if crop production increases.

- Human resources: Schedules, such as watering, feeding chickens, and ordering chicken feed have been made and seem to be functioning better every year. It was suggested in one interview that no single person seems to be in charge and more organization in the form of farm policy is needed on the farm to move things forward. There is also a lack of a record keeping system for what is planted and sold. Vandalism and theft has been a problem in the past.
- Equipment: The farm has a small tractor. The type of maintenance done on the tractor and frequency of maintenance is unknown. Lack of lighting is further an issue on the farm.
- Storage: The farm stores diesel for the tractor in a small tank. The farm does not have special facilities for storing seeds, feed and crops. So far, the farm is adequately managing with the storage system in place, but additional infrastructure for storing seeds, animal feed and crops may be needed in the future.
- Diversification opportunities: Surrounding the farm area is Labrador tea, which is considered a medicinal plant. There may be opportunities for harvesting and selling this tea.

Observations from YouTube Video : *Mechim Farm: Kistiganawacheeng*
(Thompson, n.d.)


Aerial Farm Shot

Tilling the Land


Manual Labor is Mostly Used


Small Farm Tractor


Hose Irrigation

Clay Soil

Chicken Feed

Greenhouse/Kitchen/Storage Area (some chickens kept underneath)

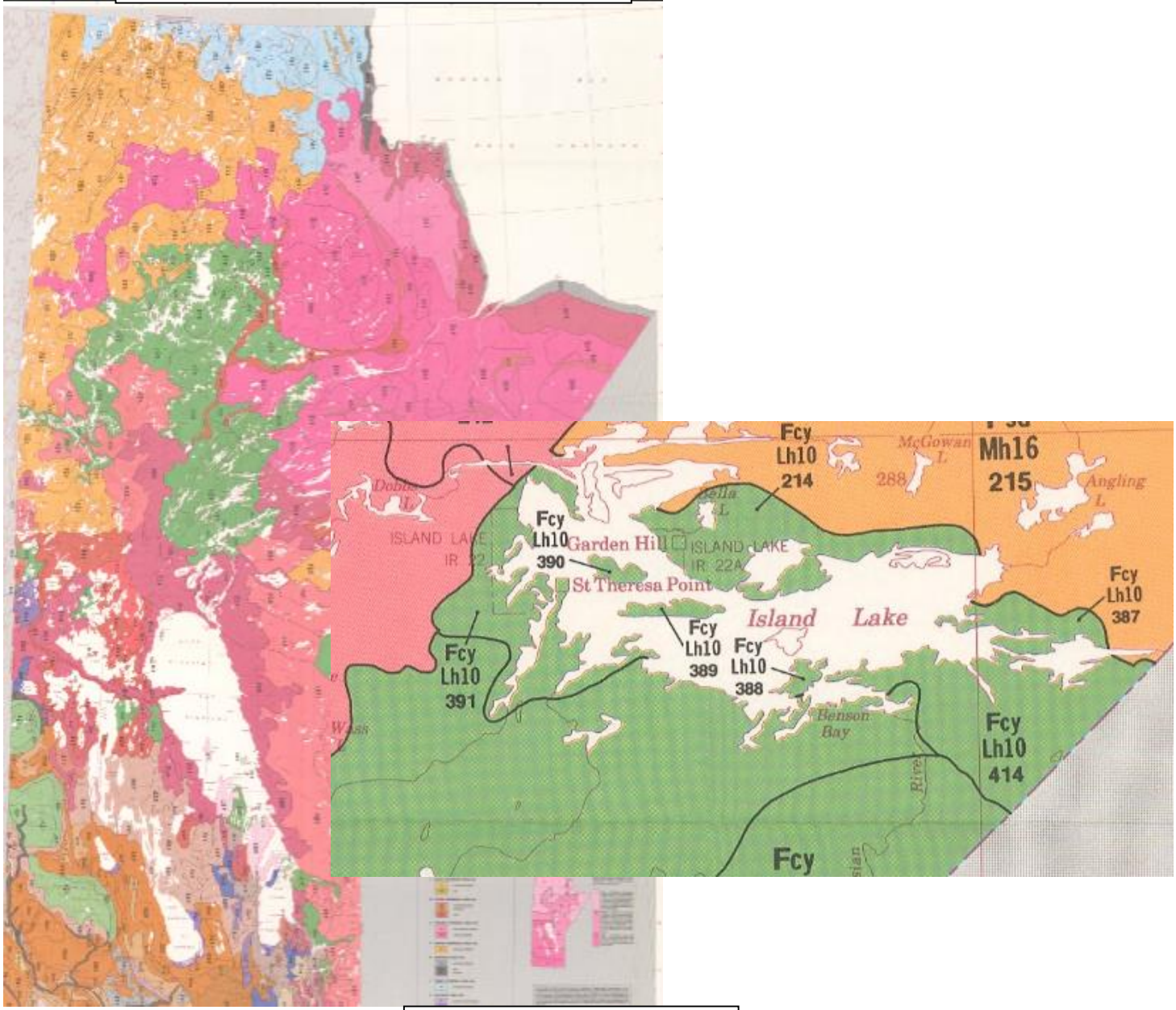
Greenhouse/Kitchen/Storage (infront) and Trailer (behind)

Maps

Soil Landscapes of Canada

Government soil maps describe the soil and land at Garden Hill to fall under the Fcy, Lh10, 390 category. According to the legend, this means the predominant soil is clay with a hummocky surface form (extremely irregular surface with knolls or mounds above ground). Soil drainage is well to moderately well. The slope in this area is 10-15% (Agriculture Canada, 1986).

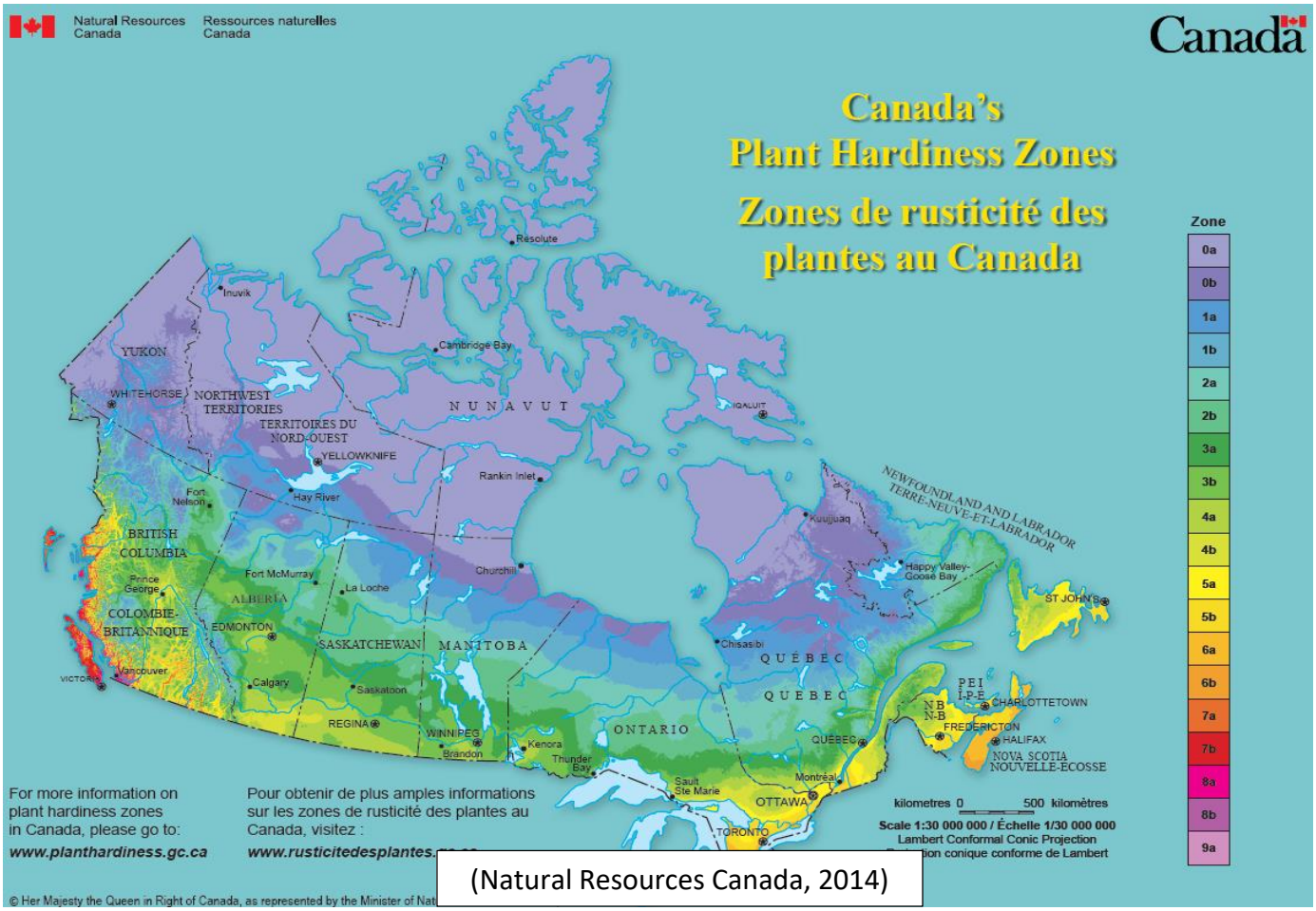
Soil Landscapes of Canada [map]



(Agriculture Canada, 1986)

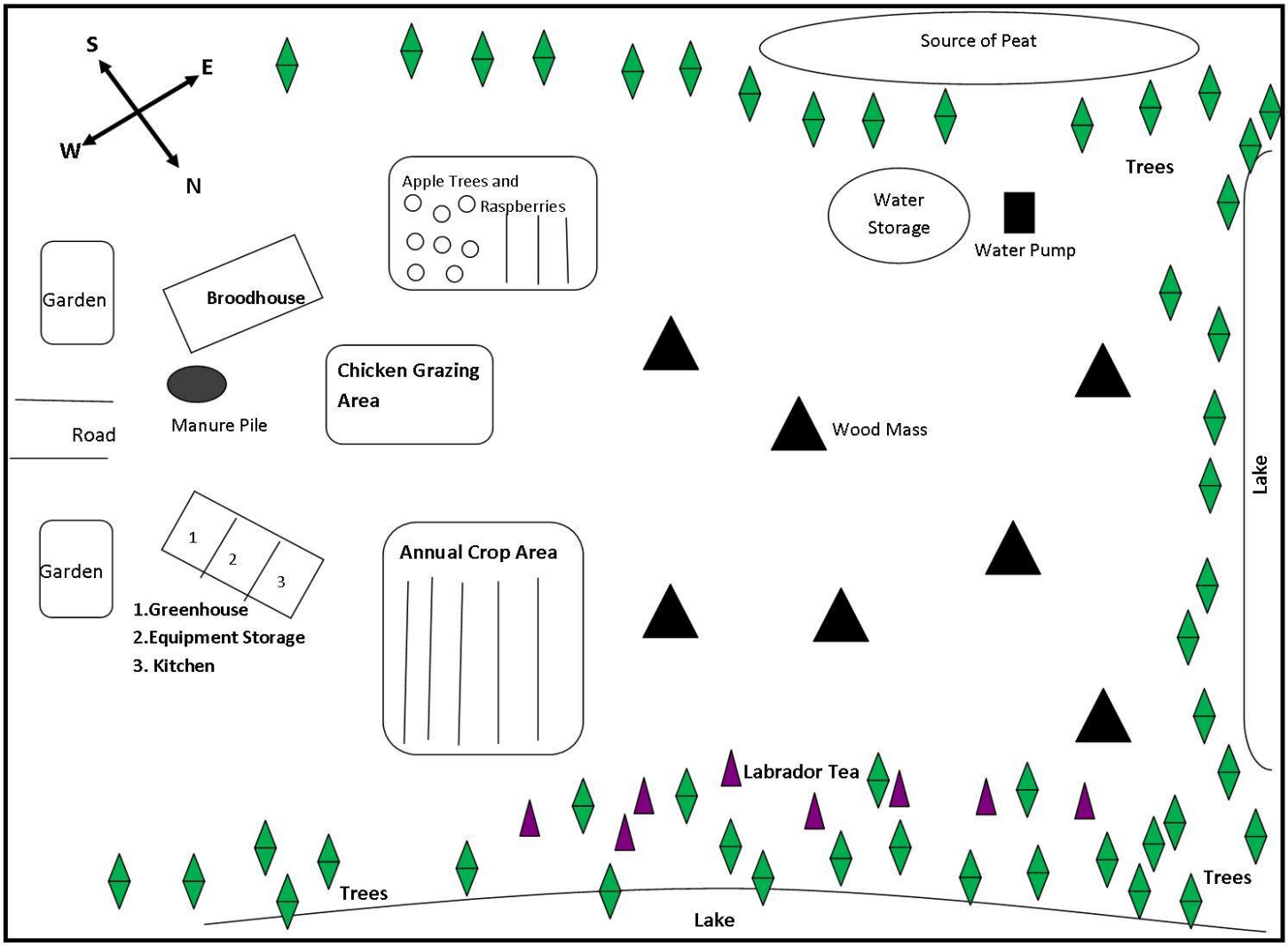
Plant Hardiness Zone

Garden Hill falls under a plant hardiness zone of 2b. This is important when choosing plants for this area that will be adapted to the harsh climate.



(Natural Resources Canada, 2014)

Farm Sketch- Based Interviews and Video



Manitoba Environmental Farm Plan Workbook

Relevant sections of the Manitoba Environment Farm Plan workbook were filled out to reflect farming practices on Meechim farm. Many sections were not applicable due to the small size and scale of Meechim farm. Some areas of the workbook may become relevant if Meechim farm were to expand operations in the future. It is recommended that farm practices be re-assessed for environmental impact at that time.

The following is a summary of the environmental farm practices on Meechim farm that pose the greatest risk to the environment:

Table 1: Summary of Environmental Farm Practices

Area	Justification
Feed Storage	It is not known whether chicken feed is stored in a covered, airtight container. This would prevent any leaching of nutrients from the feed into the surrounding land and water.
Soil Management	There is risk of soil compaction due to the initial land clearing, use of tractor on the farm, and mainly clay soil in the farm. Lack of cover crops on the farm poses a risk for increased soil erosion. Crop rotation is not practiced which can lead to soil nutrient depletion. There is a need for an assessment of the quantity and frequency of organic amendments added to the soil.
Crop Management	There is no practice of crop rotation and no records kept of crop varieties planted, harvest dates, yield amounts, and weather conditions.
Manure Application	There is potential for manure to leach into the lake due to clay soil on site as well as slope downward to the lake. Rate of manure application is not based on manure analysis, soil tests, and crop type.
Biodiversity, Ecosystems and Natural Resources	No assessment has been done to ensure irrigation from lake does not disrupt wildlife. There has been no riparian health assessment or management plan. There has been no fire risk assessment and action taken to prevent fire risk.

Discussion

Conceptual Framework

Overall, Meechim farm has negligible negative effects on the local environment, but would benefit from some preventative suggestions and could improve in certain areas to enhance the

farms efficiency and productivity with no harm to the environment. We propose three key areas that require additional investment in Meechim farm to sustain its operation and care for the local environment. Figure 2 presents the proposed three areas of priority interventions in the Meechim farm. In the succeeding sections, we elaborate our perspective that revolves around this conceptual framework.

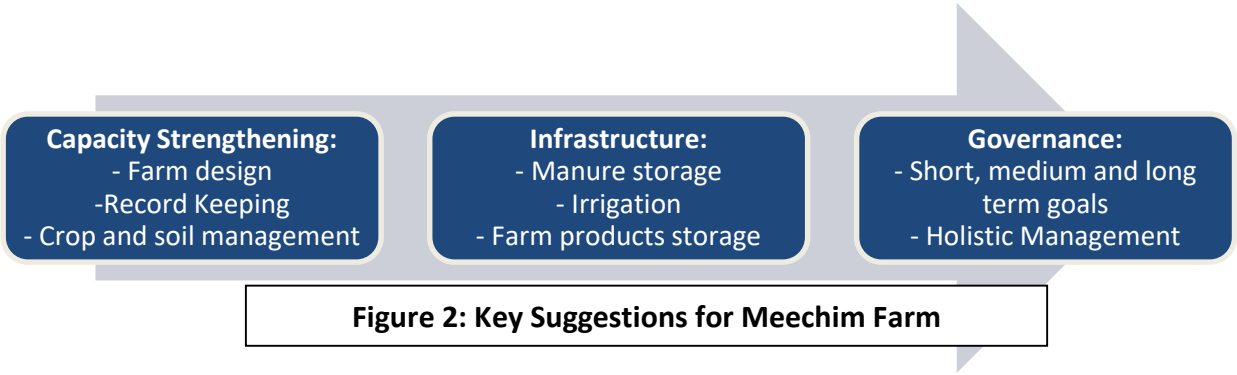


Figure 2: Key Suggestions for Meechim Farm

Farm Design

Meechim farm can be designed to improve its productivity through community-based agro-ecological farming methods such as permaculture. Permaculture strives to work with nature to care for the earth, care for people and to share the surplus (Ferguson & Lovell, 2014). Permaculture uses local and indigenous knowledge to create a resilient food system. Meechim farm was originally planned to be an irrigated permaculture farm including chickens (Thompson, 2015). A permaculture framework will be applied again to conceptualize the future growth of Meechim farm (see Figure 3). As one of the core tenets of permaculture is care for the earth, permaculture naturally aligns with environmental farm planning.

Some of the main design principles of permaculture include observation, mimicking nature, zone analysis, produce no waste, apply feedback and catch and store energy (Ferguson & Lovell, 2014). Zone analysis involves placing farm elements so they reduce work, resource use, maintenance, boost yields and diversity, recycle resources and maximize useful relationships. In the zone analysis, farm zones are broken down from 0-5, with zone 0 being the home or main area of activity. The more time you need to visit an element, the closer to zone 0 the element should be placed.

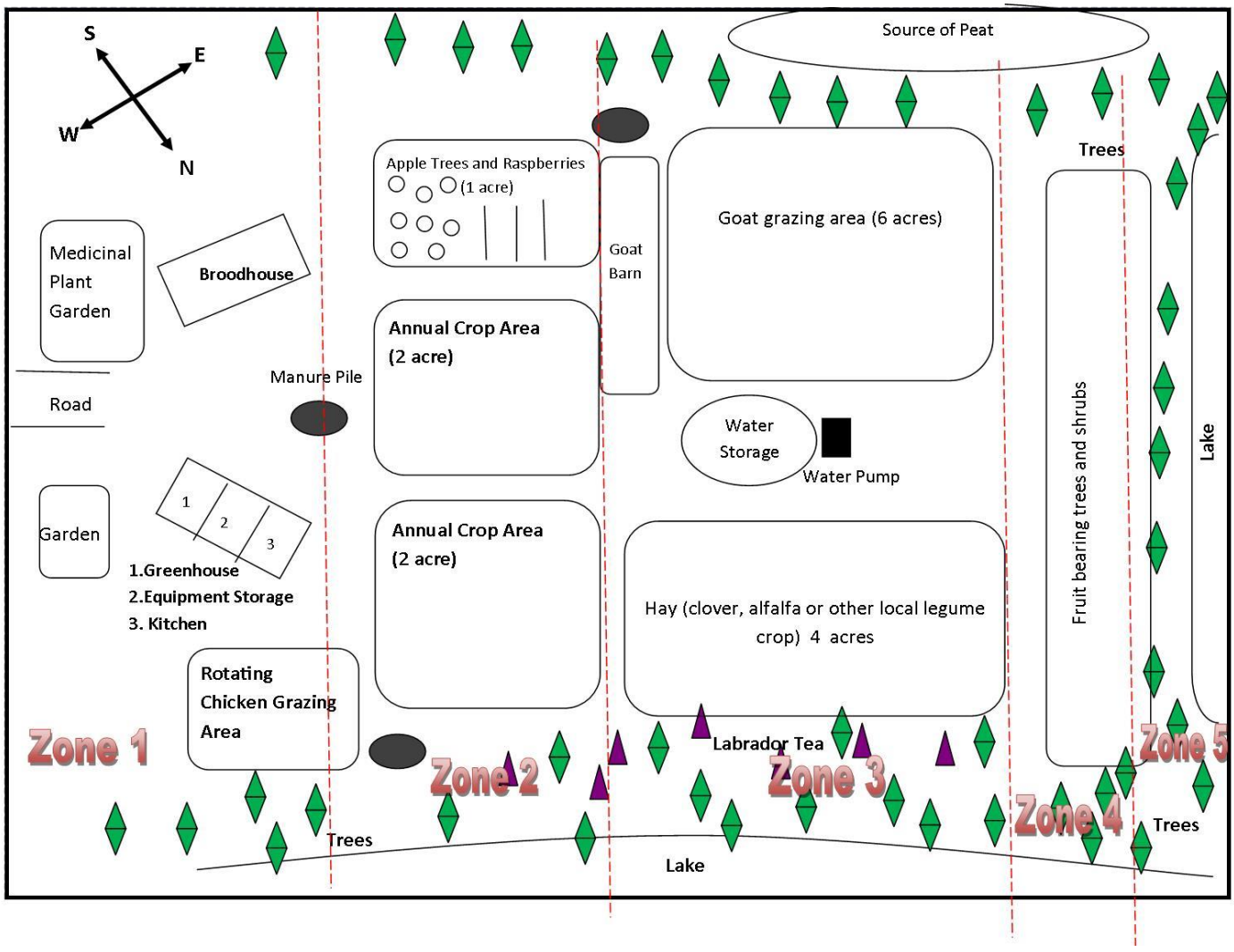
Meechim farm has already done a good job of this, placing the small gardens, trailer, greenhouse, chicken coop and kitchen in zone 1 as they need to be accessed daily. Zone 2 is for annual crops and small orchard of apple trees. Zone 3 and 4 are currently not in use. Zone 5 is left as the unmanaged boreal forest and lake for inspiration and foraging. Although using the highest point on the land to facilitate gravity fed irrigation, the water tank is on the edge of zone 2 or 3, which increases the energy needed (human and nature), to get the water to the annual crop area. A more central location for the water tank would greater ease in irrigation, although it would need to be set higher up off the ground to continue to catch and store energy.

Proposed Design (see Image1)

Compost and manure storage are recommended for Meechim farm. Manure and compost sites are visited almost daily and should be close to main areas of human activity. The optimal location for these elements would be between zone 1 and 2. A small medicinal garden could also be included in this zone, adding additional social, cultural and health benefits. Potentially medicinal plants could be sold.

Zone 2 has been expanded for additional annual crop space. Closest to the trailer should be crops that may need to be harvested more frequently, such as beans, peas, lettuce and

Image 1: Proposed Meechim Farm Sketch (not in scale)



herbs, while further away are plants that are harvested usually once or twice in a growing season like potatoes, carrots and beets. Plant rows should run north and south to receive the maximum amount of sunlight. Chickens will also be grazed in zone 1 and 2 as moving the

chicken tractor is difficult to move and the chickens need to be moved daily. Areas in zone 2 that are not being used should also host green manure. Chickens can also be grazed on these areas. Nitrogen fixing annual crops like clover and peas are recommended for planting.

Until zones 3 and 4 are used, green manure should be planted to begin to loosen and add fertility to the soil. Further, green manure acts as a cover crop to reduce soil erosion. Zone 3 could also be used to raise 5 or 6 goats. In this case, some of the land should be used to grow food such as clover or alfalfa and to also function as bedding. The farm would benefit from goat milk and goat milk products (soaps, creams) that could be processed and sold. Goats could also be butchered for meat. A barn to keep the goats is also needed and is located in zone 3.

Zone 4 could be used for perennial crops like fruit bearing shrubs like strawberry, Saskatoon berry, blueberry, crabapple, dwarf sour cherry, lingonberry, cloudberry, and high bush cranberry. Many of these plants grow wild in Northern Manitoba and are recommended for planting in cold climates (Government of Manitoba, 2011). The farm could benefit from the commercial sale of berries and fruits, especially if they were processed into jams or syrups. Fruit bearing shrubs and trees will also attract pollinators to the farm, which can aid in crop growth. This area would be of higher maintenance until the trees and shrubs are established, but eventually could be self-maintained. As Labrador tea already grows in this area, a larger medicinal garden could also be placed in zone 4. Medicinal plants could be used for economic, social and spiritual purposes.

Permaculture is about observation and integrating feedback from the system. Farmers and workers must pay close attention to how changes are being integrated into the system and if adjustments need to be made. Daily observation and record keeping is advised to provide feedback and inform farm practices each year. In a successful permaculture system, eventually the worker becomes the watcher and the farm system, for the most part, is able to maintain itself.

Soil

Soil Testing

As soil testing is done very infrequently at Meechim Farm, it is recommended that soil sampling be done at least every year once the ground is thaw in spring. Soil testing allows for producers to match crop nutrient requirements with nutrient levels present or missing in the soil, allowing for improved crop quality and productivity (Agriculture and Agri-Food Canada, 2016). Soil sampling could be done using a whole field composite sampling method. A whole field composite sampling practice means that soil samples are taken from about twenty sites in the field and mixed together to be tested for soil nutrients (Government of Alberta, 2016). After specific areas have been planted, moving to a landscape-directed soil sampling technique is recommended (i.e. soil samples would be taken from each differentiated growing area to plan for the right nutrients in the right amounts for different plants). It is recommended that records be kept of the areas tested and the results each year.

Soil Fertility and Structure

The addition of organic material to the soil will provide fertility, help prevent erosion, reduce

soil compaction, and improve the ability of the soil to hold water (Agriculture and Agri-Food Canada, 2016). Organic material is currently being added as peat moss, chicken manure and fish fertilizer to the soil in current growing areas. The addition of compost is also an option and may support waste reduction in the community. The compost prepared by using organic waste of the farm and individual households can enrich the soil with organic matter. It is recommended that organic materials should be added to areas not currently being used to begin to prepare the soil for future use.

Optimally, manure should be spread and incorporated into the soil the same day. This prevents nutrient losses to the environment through volatilization or precipitation, and minimizes odor (Agriculture and Agri-Food Canada, 2016). Green manuring is another recommended practice to add organic matter and nutrients to the soil while reducing soil erosion by providing soil cover. Green manure is a short term crop that is cut down eight to ten weeks after planting and is worked into the soil (Government of Alberta, 2016). Some crop residue must be left on the surface to provide soil cover. Nitrogen fixing crops like peas and clover are recommended as green manure crops as they will add nitrogen back into the soil. The farm, in the future, should take precaution in using chemical fertilizers and pesticides, which are detrimental to soil and agro-biodiversity, to manage nutrients and pests respectively.

Crops

Promote Diversity

As we propose permaculture-based farming in the Meechim farm, the selection of crops and farming practice should promote agro-biodiversity and multiple functions in the farm. Production of a variety of crops through agro-biodiversity approach is important for promoting community food and nutritional security (Altieri, 2009). However, local weather limits the crops that can be selected and planted. The farm operation for selecting crops should proceed based on the experience of its previous 2 years of operation and consider those crops that performed well such as potato, pea, tomato, carrot, onion, and legumes. In addition, the farm can in a small scale test the crops and varieties recommended for producing in the cold climate. An example of cold tolerant, faster maturing crops that could be used at Meechim farm is presented in Image

Preliminary List of Vegetables for Northern Gardens	
Vegetable	**Variety Name (days to maturity)**
Leaf Lettuce	Buttercrunch (60 days), Simpson Elite (48 days), Esmeralda (53 days), Baby Star (65 days), Grand Rapids (45 days) - make two or three successive plantings
Radish	Cherry Belle (24 days), Champion (23 days), French Breakfast (20 days), Scarlet Globe (25 days), Lobuk Sweet Radish (55 days) - make two or three successive plantings and thin
Beets	Scarlet Supreme (48 days), Ruby Queen (55 days), Yellow Detroit (55 days)
Swiss Chard	Bright Lights (40 days), Fordhook Giant (55 days), Perpetual (50 days)
Turnip	Royal Crown (55 days), Early Snowball (45 days)
Carrot	Baby Spike (55 days), Little Finger (60 days), Scarlet Nantes (68 days) - thinning required
Cucumber	Straight 8 (58 days), 702 Burpless (50 days)
Potato	Shepody, Viking, Norland—hilling required
Pea	Spring (57 days), Alaska (55 days) - use net for climbing
Onions	Dacong Tall Green Onion (65 days), Yellow Onion—Candy hybrid (85 days); use onion sets (bulbs), pick as green onions

Image 2: Varieties of vegetables for northern gardens in Canada (Government of Manitoba, 2007)

2.

Integrate Traditional Knowledge about Crops and Farming

The local and traditional knowledge of gardening in the area could also provide information related to the traditional crops that can be restored in Meechim farm. According to a video on Garden Hill, one elderly person from Garden Hill said that Garden Hill First Nation has a history of gardening (Mauro & Beardy, n.d.). It would be important to identify the specific knowledge and experience of elderly people of Garden Hill First Nation regarding the crops that they used to cultivate, specific practices in managing crops from cold condition, and seed production and storage of these crops.

Crop Production Practices

Mixed-cropping can be an important crop production practice in the Meechim farm. Mixed-cropping involves cultivating multiple crops together in a given piece of land. It can be random (i.e., more traditional approach) and intercropping (i.e., growing one crop in the space between two rows of the other crop). In mixed-cropping, crops are selected to complement each other such as adding nutrients to use by the main crops (e.g. legumes), repelling insects of the main crops (e.g. aroma producing crops such as garlic, coriander, and radish), weed control (e.g. legumes), and not competing with the main crop but using the space and nutrient that the main crop does not use. In Meechim farm, mixed cropping of legumes with potato, tomato, and leafy vegetables can be a good start to promote diversity.

Storage

Manure Storage

Proper storage of chicken manure would protect nutrients from the manure and minimize environmental risks. The environmental risks associated with solid manure storage depends on how the stored manure is managed (Agriculture and Agri-Food Canada, 2016). The key to reducing nutrient loss is to use storage systems with covers, impermeable bases and/or runoff containment. Currently there are no storage practices for manure at Meechim Farm.

Crops Storage

Storage structures to safely store crops are necessary at Meechim farm. The farm operation has been gradually increasing with increased production of amount and diversity of crops. A proper storage structure would minimize the risk of spoilage or damage due to pests. A root cellar may be a viable and inexpensive option for the storage of crops. In addition to the crops, saving and storing local seeds such as legumes and potato tubers would allow for a local seed supply and reduce the cost of purchasing seed.

Farm Governance

Farm governance requires the management of human, social, financial and natural resources. How these resources are managed is closely related to the environmental farm planning process. Governance of Meechim farm is through the Employment and Training Center at Garden Hill and the community board. Other stakeholders who affect farm operations and management include AKI Energy and the University of Manitoba (Loney, 2016).

From interviews, better day to day management and long term planning is needed on Meechim Farm. There are no formal policies or strategies in place for the achievement of short, medium and long term goals, although the mission has been decided to train youth and reduce food insecurity in the community (Lonely, 2016). The farm could benefit from setting short and long term goals and coming up with strategies to achieve them. The goal setting process should include all governance members and farm employees. Record keeping of things, such as day to day farm activities, harvest, and finances, could provide feedback on goal achievement. Record keeping is a best management practices for environmental farm planning (Agriculture and Agri-Foods Canada, 2016).

A holistic management model could also be used on Meechim farm. Holistic management is an approach to managing a farm that builds biodiversity, improves production and generates financial strength (Holistic Management International, 2010). It is a decision making process that helps farmers to make decisions that are socially, economically, and environmentally sound. Holistic management is related to environmental farm planning as it allows a farmer to increase profit while improving quality of life and improving the health of the land. This is important as one of the main reasons for not making changes on the farm to improve the environment is financial pressure (Agriculture and Agri-Food Canada, 2016).

The holistic management model begins with fully understanding and listing what must be managed including decision makers, money, and natural resources (Holistic Management International, 2010). A holistic management goal is made to guide farm operation and practices which is based on desired quality of life, forms of production, and future resource base as well as the community the farmer would like to see. The holistic management goal is to be reviewed and reflected upon for effective decision making. The management process uses testing questions, such as “Which action provides the greatest return, in terms of my/our holistic goal, for the time and money spent? If I/we take this action, will it lead toward or away from the future resource base described in my/our holistic goal? And does this action address the root cause of the problem?” (Holistic Management International, 2010, p.10). These questions are designed to consider the short-term and long-term consequences of decisions in light of financial, biological and social outcomes. Progress must be monitored toward meeting the holistic goal and purpose statement and corrective action is taken as needed.

Limitations

The completion of the full workbook was not possible due to: 1) missing and incomplete information; 2) difficulty in adapting the workbook for a small farm; and 3) not visiting the farm and gathering firsthand knowledge. Farmers or land managers who know the land well and work with government staff specializing in agriculture are more able to fully fill out the Environmental Farm Plan Workbook. Filling out the entire Workbook may have produced further knowledge and suggestions. The suggested future design of Meechim Farm was also limited due to lack of first hand observation. Observation is an essential part of a comprehensive permaculture design process, for example, to see where the light falls, the low laying or moist areas are, the patterns of the people and animals on site. The farm design was

based on discussions and video only limiting the depth of the design process. However, it opens up a window of opportunities for adapting the EFP workbook and working on improving the Meechim farm.

Conclusion

The adaptation of the Manitoba Environmental Farm Plan Workbook in the form of semi-structured questionnaires, videos and maps for farm data, while limited, can provide an overview of the environmental implications of community farms. The workbook is designed for farms that operate at large scale who have the technical agriculture education or can hire people with technical agriculture or environmental background. For small farms and community farms that have minimal environmental implications, the Manitoba Environmental Farm Plan Workbook needs modification that a small holder farmer or a small community farm can easily complete and apply to their context.

Good environmental practices are essential to the long term viability of the Meechim farm and the health of the local community. The practices and management of a farm not only impact the economic viability of a farm but also impact on the ecosystem in which the farm is a part of. Meechim farm is small enough that it has minimal impact on the environment, but the potential for Meechim farm to expand operations exists. In this case, the environmental implications of the farm operations may have a greater impact on the environment and should be re-assessed at this time.

References

Agriculture Canada. (1986). Soil Landscapes of Canada [map]. Retrieved from: http://sis.agr.gc.ca/cansis/publications/maps/cli/1m/agr/cli_1m_agr_manitoba.jpg

Agriculture and Agri-Foods Canada. (2016). *Environmental Sustainability of Canadian Agriculture Report #4.* Retrieved from: http://www.agr.gc.ca/eng/science-and-innovation/agricultural-practices/environmental-sustainability-of-canadian-agriculture-agri-environmental-indicator-report-series-report-4/?id=1467307820931#a3

Altieri, M. A. (2009). Agroecology, small farms and food sovereignty. *Mon Rev*, *61*, 102–111.

Holistic Management International. (2010). Creating Healthy Lands and Health Profits 2. Retrieved from: http://biglibrary.co/download/healthy-people-2010-vol-i.pdf

Atari, D. O. A., Yiridoe, E. K., Smale, S., & Duinker, P. N. (2009). What motivates farmers to participate in the Nova Scotia environmental farm plan program? Evidence and environmental policy implications. *Journal of Environmental Management*, *90*(2), 1269–1279. https://doi.org/10.1016/j.jenvman.2008.07.006

Ferguson, R. S., & Lovell, S. T. (2014). Permaculture for agroecology: Design, movement, practice, and worldview. A review. *Agronomy for Sustainable Development*, *34*(2), 251–274. https://doi.org/10.1007/s13593-013-0181-6

Government of Alberta. (2016). *Beneficial Management Practices: Environmental Manual for Crop Producers in Alberta - General Considerations.* Retrieved from: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9331

Government of Manitoba. (2007). *Basic Gardening Manual*. Retrieved from http://www.gov.mb.ca/ana/pdf/mafri-gmnm.pdf

Government of Manitoba. (2020). Environmental Farm Planning Workbook. Growing Forward, A federal-provincial-territorial initiative, Government of Canada, Government of Manitoba.

Loney, S. (2016). An Army of Problem Solvers: Reconciliation and the Solutions Economy. ISBN 978-0-9952685-0-0

Mauro, I. & Bryon, B. (n.d). *Meechin Farm*. [video file]. Retrieved from: https://www.youtube.com/watch?v=fFtVVuRa2jg

Natural Resources Canada. (2014). Canada`s Plant Hardiness Zones [map]. Retrieved from: http://www.planthardiness.gc.ca/

Selection, V. (2011). *Fruit Crops for Northern Manitoba A Guide to Planting , Growing and Variety Selection.* Retrieved from: https://www.gov.mb.ca/ana/pdf/pubs/mafri-frcrops.pdf

Smithers, J., & Furman, M. (2003). Environmental farm planning in Ontario: Exploring participation and the endurance of change. *Land Use Policy*, *20*(4), 343–356. https://doi.org/10.1016/S0264-8377(03)00055-3

Thompson, S. (2015). Growing a farm in a fly-in First Nation community using shipping containers for building infrastructure and capacity, *4*(3), 37–43.

Thompson, S. (n.d.) *Mechim Farm: Kistiganawacheeng.* [Video file]. Retrieved from: https://www.youtube.com/watch?v=9CeWRoRQaZk

Thompson, S., Rony, M., Temmer, J., & Wood, D. (2014). Pulling in the indigenous fishery cooperative net: Fishing for sustainable livelihoods and food security in Garden Hill First Nation, Manitoba, Canada. Journal of Agriculture, Food Systems, and Community Development, 4(3), 177–192. http://dx.doi.org/10.5304/jafscd.2014.043.016

Appendix I

Interview Questions
(The chapter of Manitoba Environmental Farm Plan Workbook in which the question(s) relate are provided in heading)

B1 Water Protection
What are the sources of water on the farm site? Is the water tested? How far is the farm from the lake?

B2 Feed Storage
How many chickens are on site? How much chicken feed is on site and where is it stored?

B4 Fertilizer Storage
Is there any chemical fertilizers used? If so, where is it stored?

B5 Pesticide Storage and Handling
Are pesticides used? And if so, where and how are they stored? How are the containers disposed of?

B6 Storage of Petroleum
Is fuel stored on site, and if so, where and how is it stored?

B7 Management of Farm Wastes
What types of waste does the farm generate and how is it disposed of? (ex. dead chickens, chemicals, old equipment)

B10 Soil Management
What type of soil is on site? Are tilling practises used? Cover crops? Crop rotation? Any erosion evident? Are there any steep areas on the farm? Is the soil tested? Are any fertility enhancers added to the soil?

B11 Crop Management
Where do seeds come from? Is seed saving practised? What types of crops are planted? Is crop rotation used? Is there any record keeping of crops (ex. where they are planted, how well they are doing, crop sales)?

B13 Pest Management
Has the farm suffered damage from pests? If so, which ones? What are the pest management strategies?

B14 Greenhouse and Horticultural Production
Is there a greenhouse? What crops are grown here? Is it heated? How often does it get watered? How is the space utilized?

B16 Drainage and Irrigation
How are the crops watered? How often? Any issues with irrigation?

B17 Manure Application
Is chicken and/or fish manure/fertilizer used on the farm? Where and how is it stored? How often is it used and how is it applied?

B18 Biodiversity
Are weeds a problem on site? How are the dealt with? Any wetlands near the farm? Any wild life corridors on site? Is there any farm activities in the riparian area? Any chemical fertilizers used?

B19 Energy Efficiency
Is there lighting on site? How often is the equipment used? Is the chicken coop or trailer insulated? Is there lighting and ventilation in the greenhouse? What structures are on site and how far apart are they?

Can you highlight any practises on the farm that are working really well?

Can you highlight any practises that you would consider to be environmentally friendly?

What are some areas of improvement?