The Political Ecology of SW Michigan Agriculture, 1837-2004

Alan Rudy
Alan.Rudy@ssc.msu.edu
Craig Harris
Craig.Harris@ssc.msu.edu
Brian Thomas
thomasb7@msu.edu
Michelle Worosz
woroszmi@msu.edu

Department of Sociology
Michigan State University
316 Berkey Hall
East Lansing, MI 48824
Rudy Ph: 517-353-0745

INTRODUCTION

Flying over southwestern Michigan, one looks down on what appears to be a glorious example of the agricultural landscape of classical American populism. The farm units are discernible by their woodlots, windbreaks and rural roads and are fairly small, or at least approximate what some have called a human scale. There is a mixture of pasturage, grain production, fruit trees (if you are on the right flight path), animal enterprises, and other forms of agriculture from tree farms to glass-house nurseries. Each farm seems to have a residential homestead and many have small gardens, red barns, and white or blue silos, interspersed with more recent structures for heavy machinery.

FIGURE 1. STUDY AREA

Two things are noteworthy about this landscape. First, appearances are deceiving. While today's fields remain more or less continuous with historical agricultural unit sizes, much of agricultural production is now generated by farm operators who rent lands across extensive distances in order to maintain economically viable levels of gross production and net profitability. At the same time, the majority of farm owner-operators are pluriactive – they and members of their households pursue multiple modes of income generation – given the difficulty of making a viable living from agriculture. Additionally, new forms of exurban rural development are encroaching on what have historically been agricultural spaces -- e.g., small aggregations of megahomes, dispersed modest rural residences on 5-10 acre parcels, and clusters of inexpensive, prefabricated housing on recently converted, and still treeless, agricultural fields. Within these fairly new and increasingly prevalent patterns of exurban development, woodlots hide newly constructed country homes the residents of which rarely appreciate the sounds, sights, smells and slow-moving machinery of agriculture.

Second, it obviously hasn't always looked this way. Michigan's rural landscape is the contemporary product of historical agricultural activity, including its diversity of enterprises, its golden ages and financial crises, and its ecological harmonies and social contradictions. In fact, the state's agricultural landscape is the accreted and residual product of a series of agricultural periods. It is the dynamics of, and transitions between, these periods that have produced the social and ecological characteristics of Michigan's diverse rural areas and the urban areas they environ.

Most importantly for our narrative, each of the historical periods reconstructed the landscape differently. Each of the periods of Michigan agriculture is an outcome of the interaction among the previous period of agriculture, the historical and current social institutions, and the ecological context.[1] The influences among these three realms are reciprocal and relational (see figure XX) in

Figure XX: Agriculture Periods Mediate Exogenous and Endogenous Conditions

fluencing and stimulating, enabling and constraining each other. These transformative processes can be seen at local, regional, state, national and international scales in forms that shifted as the national agricultural economy developed, as technoscientific advances emerged, and as the international export of commodity surpluses became the global trade of inputs and services, bulk and specialty commodities, and fresh and processed foods. Following on this, each of the historical periods is marked by a restructuring of the agricultural landscape associated with emerging political economic processes. The region many people now call southwest Michigan is a result of these transitions in the agricultural landscape.

PRE-SETTLEMENT HISTORY AND THE GEOPHYSICAL

(A) The first four billion years of the history of the land that comes to be called Michigan is a series of glacial flows and tropical ebbs. After four major periods of glaciation, 15-20 thousand years ago the last glaciers retreat across eastern and central North America.

(B) Geomorphologically, the glaciers left behind a terrain which slopes upward gradually from the southwest to the northeast, but across which there is very little change in elevation – at the maximum approximately 450 feet from the lake shore to the Muskegon highlands.

FIGURE 2. ELEVATION

The interaction of all the geology that had gone before with the retreating glaciers means that rich soils, wetlands and prairies are predominant in the southwest part of the state, and sandy soils are predominant in the west central and northwest part of the state. More specifically,

[1] See Cronon {, 1983 #4;, 1991 #5} for accounts of New England and the Midwest along these lines. Worster {, 1979 #30;, 1985 #31} provides accounts of the Dust Bowl and the Arid West, while FitzSimmons {, 1983 #6} and Pisani {, 1984 #21} provide accounts of the development of California's agroecological landscape.

geophysically, the southwest region is composed of predominately Southern Michigan and Northern Indiana drift plain, peppered with small pockets of Indiana and Ohio till plain and the Southwestern Michigan Fruit and Truck Belt soils (see figure 3).

The region averages 35 inches of rain annually (see figure 4), with the greatest rain and snow fall in the west as a result of lake effect precipitation. The southwestern corner of Michigan – Berrien County – has an average growing season that is 20 days longer than the rest of the region, which averages 130-160 growing days, with a fairly smooth and moderate gradient across the 17 counties. As a result of the combination of soil and climate, southwest Michigan was, prior to European settlement, predominately hardwood forest and swamp, while the white pine forests to the north grew on fairly porous sandy loams.

FIGURE 3. SOILS

STUFF FROM ANTHRO??

(C) INDIGENOUS (RE)PRODUCTION STRATEGIES

The Native Americans who occupied the region that became southwest Michigan arrived approximately 12,000 years ago, as the retreating glaciers left behind grassland and woodland that supported large herds of game. {Cleland, 1992 #113}These inhabitants went through several transitions as the grassland and coniferous forest became deciduous forest[2], and as trade relations developed with other Native American groups to the south and west. By the middle of the last millennium, these Woodlands Indians of the southern Lower Peninsula had established a relatively stable cultural ecology. {Kinietz, 1965 #114} Villages of 10 to 20 households, including 75 to 150 persons, were almost entirely self-provisioning based on an annual pattern of transhumance. During summer, swidden (slash and burn) techniques were used to produce corn, beans and pumpkin/squash in woodland clearings; the maturing crops had to be protected from birds (especially passenger pigeons) and mammals (especially deer). Nuts and fruits were gathered from the woodlands. Weirs were used to catch fish as they ascended the rivers to spawn. Although hunting occurred throughout the year, during the winter months each household went to a separate hunting camp to procure meat, hides and furs.

➔ New material of questionable value (note that I use many references and page numbers. Please feel free to delete as you see fit – I like to have them in drafts so I know where to go back for info. In addition, I did little editing since it appears to still be somewhat unclear how it will be used):

The two primary groups of interest in SWMI are the Potawatomi and the Ottawa. Between 1600 and 1650 the Ottawa were located around the St. Georgian Bay in what is now Ontario, Canada {Cleland, 1992 #1776}. They were relatively sedentary relying on White Fish and long standing,

[2] Efforts to reconstruct land cover from historical documents have concluded that at the start of the 19th century 99.9 percent of Southwest Michigan (SWMI) was covered in dense mixed hardwoods such as maple, beech, and walnut {Sparhawk, 1929 #33}; if we accept that the Little Ice Age dominated climatic conditions from 1500-1850 a.d., we can assume that this land cover characterized the period of several hundred years before the arrival of the first Europeans.

well developed, farms that produced enough yield to be stored for their winter consumption and to supply French trappers and traders throughout the region {McClurken, 1988 #1779}. The Ottawa were an integral part of the French fur industry, regularly sending hunting parties into the interior of Michigan, primarily for beaver.

The Potawatomi were part of a larger group of Woodland Indians, or *Anishnabeg*, in the Southern half of lower Michigan. They were "Algonquian-speaking swidden agriculturalists" {Cleland, 1992 #1776:87}. The Woodland Indians tended to be more mobile than the Ottawa. They lived in villages, "gardening" in the summer, and separating into smaller hunting groups in the winter. Their "hilled" intercropped gardens of corn, pumpkins, squash, and beans were developed in cleared fields via tree girdling and burning {Cleland, 1992 #1776:47}. Like the Ottawa, villages were located near or adjacent to waterways, but instead fished for Sturgeon {Cleland, 1992 #1776:47}.

(D) TRAPPER, TRADER AND MISSIONARY ACTIVITIES, AND EARLY SETTLEMENT PATTERNS. Four major rivers traverse southwest Michigan flowing from east to west – the St. Joseph, the Grand, the Kalamazoo, and the Muskegon (see map). Two bear the names by which the native American inhabitants of the region knew them, and two carry the names the European invaders gave them. When the first European missionaries and explorers arrived in the 1600's, they came via Lake Michigan. Because the region was largely covered by dense forest, they used the large rivers to penetrate inland. They established a few small settlements, which provided bases from which traders and trappers could operate. The earliest non-native populations, French missionaries, fur trappers and traders, found indigenous fruits including crabapples, strawberries, and raspberries {Kessler, 1971 #34} :114).

➔ New stuff:
The Potawatomi became part of the fur industry in the late 1600 {Cleland, 1992 #1776:97} and were later positioned at important waterways giving them a geographic advantage in seeking new sources of beaver farther west {Cleland, 1992 #1776:107}. While the French fur industry abruptly ended in 1696 {Cleland, 1992 #1776:111}, the British continued to trade in fur until the industry crashed in the early decades of the 1800s {Cleland, 1992 #1776:180}.

With the material aid of the British, the Iroquois displaced all Native groups in Western Ontario and Michigan's lower peninsula. Cleland {, 1992 #1776:92} defines this period as the "Great Diaspora." In fact, it is believed that there were no virtually aboriginal groups in Michigan's lower peninsula in 1670. The Ottawa went to the most northern regions of Lake Michigan and the southern coast of Lake Superior. The Woodland Indianans went to the Western coast of Lake Michigan, predominately in the Green Bay region of what is now Wisconsin. After reconstituting with other displaced peoples, the group became known as the Potawatomi {Cleland, 1992 #1776:96}.

Figures??

By the early 1700s both groups began repopulating Michigan, in part because they both sought regions with biophysical features that permitted access to fish and the ability to raise corn

{McClurken, 1988 #1779:65}. Within 60 years both groups became reestablished in the southern Lower Peninsula. The Ottawa settled in the north and the Potawatomi in the south, with the Kalamazoo River valley as the major dividing line between them {Tanner, 1987 #1778;Cleland, 1992 #1776}. However, it was not uncommon for these groups to have villages near each other {Cleland, 1992 #1776:148}.

With respect to SWMI, the most prominent Ottawa settlement was a cluster of eight villages along the western portion of the Grand River. They were established by 1755, but their era of prominence was 1763 to 1812 {McClurken, 1988 #1779:54}. The Ottawa ventured south of the Grand River only for hunting {McClurken, 1988 #1779:80}. The Ottawa, a population of approximately 1,214 people {McClurken, 1988 #1779:90}, remained in this region until the end of the removal period in the mid 1800s {McClurken, 1988 #1779:81}. The most prominent Potawatomi settlement consisted of approximately four main villages across SWMI {Tanner, 1987 #1778}. They primarily "settled in the prairie openings and bottomlands of the Kalamazoo and St. Joseph rivers" {Cleland, 1992 #1776:148}.

Maps??

According to Cleland {, 1992 #1776:194}, a systematic census of Michigan Indians took place in the late 1830s, but it was conservative, purposely excluding some groups. He believes there many have been as many as 30,000 Native Americans across the southern third of the Lower Peninsula that were broken into smaller groups averaging around 150 people each. During this time women became prominent because they produced marketable goods—wild rice, maple syrup, and corn—for an increasing White population, now numbering approximately 31,640 people {Cleland, 1992 #1776:209}, of which 69% were in the southeast {McClurken, 1988 #1779:76}. By statehood, 1837, the White population rose to 174,543 and only 45% were in the southeast. Those migrating into SWMI were now interested in the Grand River valley due to its rich agricultural lands {McClurken, 1988 #1779:77}. By 1840 the White population "outnumbered the Ottawa by nearly 200 to 1" {McClurken, 1988 #1779:77} [he cites Dunbar]. Although there was a small amount of back migrant into SWMI by the end of the 1800s {Cleland, 1992 #1776:224}.

As the Whites settled Michigan (as part of the overall push West), the Great Lakes Indians faired somewhat, if only marginally, better than most Native Americans. The Ottawa were able to switch from provisioning French traders to Euro-Americans pioneers coming from New England and New York. They were a significant part of early settlement process supplying pioneers with a wide range of food and fiber including leather, moccasins, canoes, and baskets; and fish, deer, pigeon, and turkey {McClurken, 1988 #1779:87}. Despite uncertainty about the population, it is believed that a significant portion of the deer and edible bird stock was decimated during this time {McClurken, 1988 #1779:85}. In addition, it is believed that the Ottawa gathered honey and cranberries, and cultivated 3,000 apple trees and 2,500 acres of corn, as well as a variety of other veggies {Tanner, 1987 #1778:133}. Maple syrup was one of their most important commodities {see \McClurken, 1988 #1779:83}. In fact, production of the latter was of such significance that it is said to have been shipped to New York, Boston {McClurken, 1988 #1779:87}, and England {Cleland, 1992 #1776:175}.

During the late 1830s, some Ottawa began to take on "civilized" characteristics (e.g., dress, agricultural practices, language, religion) {Cleland, 1992 #1776:229}. Of particular importance was the purchase lands using their annuities from the 1836 Treaty of Washington {Cleland, 1992 #1776:228}. Land ownership was the means by which some Ottawa were declared citizens of Michigan (not the U.S.) by the Governor. Their farms were interspersed with White landholdings {Cleland, 1992 #1776:236}. In spite of their importance to the settlement of the Grand River valley, 900 Ottawa were removed in 1857 and sent North {Tanner, 1987 #1778:179}. Many others lost their land to a series of financial maneuvers, some legal and others not. For instance, the agent in the General Land Office swindled the Ottawa out of their legally designated homesteads (i.e., Indian Homestead Act of 1872) across an entire township in Ingham county [Mason] via loan sharking and closing on $20 loans {Cleland, 1992 #1776:254}.

In 1830 the Potawatomi population was estimated at 2,500 [by comparison, Detroit had @ 2,200 Whites] across nine small villages in present Kalamazoo County, while the White population was still quite sparse {Tanner, 1987 #1778:135}. Most of the Potawatomi were moved out of the Great Lakes during the removal period, but approximately 300 people who claimed to be Catholic, were also allow to stay and to be legally recognized as citizens of Michigan {Cleland, 1992 #1776:78;Tanner, 1987 #1778:178}. Following statehood, many left the area and moved to Northwest Michigan. Those who remained were primarily located in Berrien County, with a very small number in Calhoun County, and the rest scattered across the Southern region to avoid the Indian Agency in Detroit {Tanner, 1987 #1778:178}. The Potawatomi engaged in hundreds of Treaties with the U.S. government. The Treaty of Chicago (1833, ratified in 1835) was particularly important in the opening of SWMI to White settlement. It essentially consolidated the remaining Potawatomi in regions away from where the new road connecting Detroit and Chicago was to be built {Cleland, 1992 #1776:222}. At the time, none of the three major roads (i.e., Detroit to Chicago; Detroit to St. Joseph; and Pontiac to Grand Haven) were fully passable {McClurken, 1988 #1779:77}. As a result the, the Potawatomi were, again, located throughout Calhoun, St. Joseph and Berrien counties {Cleland, 1992 #1776:220}. As these groups were pushed out of the area, pioneers complained because they, like those who moved into the Grand River valley, relied on the Native population for provisioning {Cleland, 1992 #1776:221}.[3]

(E) EURO-AMERICAN SETTLEMENT. Several factors drew the first settlers to southwest Michigan in the decades before 1850. One was grain production. From the colonial period up to the early part of the 19th century, wheat production in the mid-Atlantic region dominated national production. {Brigham, 1910 #37} In the first decades of the 1800's, however, market saturation and rising land prices prompted many settlers to take advantage of low land prices in the newly opened Northwest Territory {Freedman, 1992 #38;Gray, 1996 #39}. A second factor was transportation. The completion of the Erie Canal in 1825 facilitated the westward movement of new settlers and supplies and led to the establishment of a land office in Kalamazoo in 1834. Settlement in the region immediate accelerated. The third factor was fruit production. It is the introduction of an exotic, the peach (*Prunus persica*) early in the 19th century, that is credited

[3] The 1990 census found 55,638 Native Americans in Michigan, but the Michigan Indian Commission claims the number is closer to 62,000 {Cleland, 1992 #1776:287}. There is currently no legally recognized band of Potawatomi in SWMI. The closest Ottawa band is in the Grand Traverse Region of the Northwest portion of the Lower Peninsula {Cleland, 1992 #1776:289}.

with the start of commercial fruit cultivation in SW MI {Armstrong, 1993 #36}.[4] Railroads and land speculators hyped land in southwest Michigan as the next Garden of Eden. The combination of the three factors meant that extensive farming development preceded even Michigan's statehood in 1837 {Gray, 1996 #39}. On these farms, animal enterprises were important both for self-provisioning and for petty commodity exchange, as well as for draft power.

➔ New stuff:
According to Lewis {, 2002 #1777:68}, the earliest settlers (i.e., after 1815) were keenly aware that the landscape had been "produced" by the Native Americans. They saw fields that were either in use or abandoned. He states that "burning remained so prevalent in the late 1820s that the territorial government passed legislation to protect settlers' property" {Lewis, 2002 #1777:68}. Nevertheless, the pioneers used the modifications that were deemed useful—village sites were presumed to be fertile, trails were made into roads. The city of Jackson, for instance, was seen as central because of the concentration of trails.

Maps?

White settlers began moving into the prairies that the Potawatomi farmed during the 1820s {Cleland, 1992 #1776:220}. They specifically sought these areas—"openings," "prairies"—because they were perceived to be easier to cultivate, yet protected by the surrounding woods. The thinking was that these abandoned areas must be fertile and viable using "modern" farming practices. As a result, nearly all above ground traces of Native American villages, farms, and/or gardens were removed from the landscape {Lewis, 2002 #1777:70}. Thus, the exact location and/or extent of Potawatomi gardening is unknown [see Tanner 1) map 13 of 1768; map 20 of 1810; and map 33 of 1870 @ http://magic.msu.edu/search/tatlas+of+great+lakes+indian+history/tatlas+of+great+lakes+indian+history/1%2C1%2C1%2CB/l856&FF=tatlas+of+great+lakes+indian+history&1%2C1%2C%2C1%2C0].

Lewis {, 2002 #1777:51} claims at least one of the "oak openings" was in southern St. Joseph County. "Oak openings" were said to have a park like appearance with trees of uniform size—four to five feet high—with an orchard appearance, whereas the prairies were described as vast and "picturesque" {Lewis, 2002 #1777:56}. Early settlers believed the "wet" prairies were the result of lake evaporation and "dry" prairies the result of periodic ground fires from aboriginal peoples {Lewis, 2002 #1777:58}. The most desirable lands were 1) oak openings, 2) prairies, and 3) timbered lands {Lewis, 2002 #1777:59}. Pine land was avoided and swamps entirely undesirable. Lewis {, 2002 #1777:59} states that the presence of swamplands had a significant influence on settlement patterns in Michigan. The lands identified as Class 1 and 2 were the most desirable for mixed farming and, presumably, farmed first, as were areas believed to be free of

[4] It is believed that a trapper or fur trader planted the first peaches in Berrien county around 1775 (Kessler 1971). When the first Euro-American settlers came to southwest Michigan early in the 19th century, they only brought apples and pears because they thought the weather would be too harsh for other fruits. Finding these trees and seeing that they were still bearing fruit was a surprise, and led them to bring in more peach trees. Armstrong (1993) asserts that had these trees not been found, folks would not have tried mass plantings of peaches for commercial production; he credits this mass planting of peaches for the start of commercial fruit cultivation in southwest Michigan.

malaria {Lewis, 2002 #1777:65}. Later settlers had to drain swamps and clear dense forests. In 1833 it was reported that wheat, Indian corn, oats, barley, buckwheat, potatoes, turnips, peas, apples, pears, plums, cherries, and peaches were easily grown in abundance in the southern Lower Peninsula {Lewis, 2002 #1777:64}.

It is important to note that early accounts of the biophysical environment are difficult to follow/use because writers had various agenda and incentives to portray Michigan in a positive light {e.g., for opposing points of view, see \Lewis, 2002 #1777:53}. Furthermore, many lived through the tail end of the "Little Ice Age" in which there were extreme weather changes. The winters of the 1820s were reported to be mild, while the winters of 1830-2 were harsh, 1835-6 even worse, 1836-7 were said to be warm and 1842-3 were again harsh {Lewis, 2002 #1777:65}. Actual temperature data in was not recorded in until the 1840s. It shows that the winters were extremely cold in 1843, 1847, 1849 and 1855-7 whereas warm winters were recorded in 1842, 1844-5, 1851 and 1853 {Lewis, 2002 #1777:61}.

FIGURE 4. LAND COVER MAP FROM 1800

(F) FAST FORWARD. Almost 200 years later, agriculture is still a dominant aspect of southwest Michigan. The early emphasis on wheat production has shifted to crops that support industrial agriculture – especially corn and soybeans. Animal enterprises now are concentrated on a smaller percentage of the farms in fewer locations across the region. Vegetables and fruit are very important in parts of the region. Currently, almost half of the fruit acreage in the state is located in the southwest Michigan region; within the region, five of the 17 counties account for 92 percent of the fruit land. These specialty crops engage growers in a unique set of agroecological, socioeconomic, and geopolitical relationships that influence spatial-temporal changes across the landscape. Indeed, it is the diversity of agriculture in southwest Michigan that is its outstanding characteristic. After describing how we delineated the region we call "southwest Michigan", we turn to an analysis of the social and ecological interrelationships that produced the several transitions of southwest Michigan agriculture from its beginnings in the early 1800's to its situation at the present time.

REGIONALIZATION METHODS

Since the glaciers receded, the shoreline of Lake Michigan – the western boundary of southwest Michigan – has been fairly constant. With the establishment of the Michigan Territory, in 1805, and the move to statehood, in 1837, the southern boundary of the region was politically and institutionally established. With the depletion of central lower Michigan's white pine forests –for the construction of Chicago and the fencing of the Great Plains {Cronon, 1991 #5} – the northern boundary of the region emerged in the late 1870s. Lastly, it was not until the completion of post-World War II highways and the development of suburban Detroit that the eastern boundary of our region emerged. Figure 5 traces our region onto a map of Lower Peninsula farming areas in the 1930s, at a point early in the geographic expansion of Detroit and other urban centers in the state. Our point is that southwest Michigan as we define it represents a relatively recent product of regionalization.

FIGURE 5. 1930s LOWER MICHIGAN FARMING AREAS

We initially constructed the region on three bases. The first was the lake, state and county boundaries noted above. The second was historical geographic market orientation; before the most recent period of globalization, the market orientation was either locally within the region or westward toward Chicago. The third basis was contemporary cropping data; northeast of our region dry beans and sugar beets predominate, while north of our region are the sandy soil crops of potatoes and asparagus. However, this initial construct was adjusted when we looked at historical cropping data and ecological processes. The final boundaries reduced the initial region's scope by one county (Lenawee) in the southeast largely because of its orientation to Detroit and Toledo and the much larger scale of agricultural production there.

Methodologically, our approach derives from recent work in cultural and economic geography {Gilbert, 1988 #32;Pudup, 1988 #22}, as well as the sociology of space {Friedland, 1992 #7;Friedland, 1994 #8}. Both of these traditions see regions as processes of territorialization including the consolidation and alteration of regional boundaries over time {Amin, 2002 #1;Gilbert, 1988 #32;MacLeod, 2001 #17;Pudup, 1988 #22;Swyngedouw, 1997 #28}. In short, they view the production of sociocultural space and political ecological landscapes as ongoing processes rather than as fixed realms. We could have made alternative methodological choices. If we focused on the social and ecological processes and legacies of agricultural commodity chains {Buck, 1997, and Guthman 1997;Friedland, 1984 #9;Friedland, 1994 #10;Friedland, 2001 #11;Friedland, 1981, and Thomas 1981}– which include processing, distribution, exchange and consumption practices – then the spatial extent and political economic networks involved would have been quite different – and likely global in character from the beginning of Euro-American settlement. {Buttel, 2001 #3;Hartwick, 1998 #15;Leslie, 1999 #16;Mather, 1999 #18} Alternatively, we decided to stress agricultural landscapes understood as farm production so as to stress regionally endogenous processes situated within exogenous social and ecological trajectories and tendencies.

In the following narrative, we will show how the meaning, endogenous social and ecological characteristics, and exogenous political economic and environmental relationships most important to southwestern Michigan's agricultural transformations have shifted, collapsed, jumped scale, and been reinterpreted since statehood in 1837.[5] For example, with respect to the General Farming and Corn and Livestock regions – as delineated in the map in Figure 5 above – our eastern boundary broadly differentiates the counties currently oriented predominantly to Detroit from those serving Chicago to the West. Nevertheless, the location and meaning of this

[5] Peter Walker {, 2003 #29: 12-13} suggests, along these lines "that the region remains an important meso-scale that mediates between local and global processes. In defense of the region as a theoretical and analytical construct, Alexander Murphy (1991, 166) argues that '...understanding the geographical complexity of regions is critical to any effort to explain local outcomes, for those outcomes are often the result of the intersection of broader structural forces with regionally distinctive social histories, cultures, environments, and institutions'. There are other reasons that political ecology may benefit from a more regional approach. Since the early works in what might be called the 'structural' period in political ecology, the field has swung so far toward local-scale studies that some have asked whether political ecology left the broader structural approaches behind too quickly." {Walker, 2003 #29}

line shifted dramatically as Detroit, along with a number of smaller cities throughout the southern Lower Peninsula, boomed in the early 20th century.

REGIONAL AGRICULTURE

Our study of southwest Michigan focuses on the means by which agriculture draws upon, reproduces and transforms particular ecological and social landscapes which then, in turn, affect subsequent iterations of the agroecological landscape's development. Central to our analysis is the idea that the history of agriculture lies at the heart of southwest Michigan's contemporary ecological and social conditions. In contradistinction to conventional agroecological studies {e.g., \Hecht, 1985 #132;Pfeffer, 1983 #20}, which generally start with biogeophysical characteristics and explore regional conditions of comparative advantage and agricultural opportunity, we start with agriculture and attend to its modification of, and strategies for dealing with, biogeophysical conditions**.** Similarly, but from the opposite direction of agroecology, conventional sociological studies {e.g., \Murdock, 1998 #122;Albrecht, 1990 #121;Mann, 1978 #98} with social and technical divisions of labor in agriculture and assess the regional ecological consequences and natural obstacles to agricultural development

Simply put, one approach starts with natural forms and looks for social content while the other starts with a social forms and looks for ecological content. In contrast, we view agriculture as a realm where the two reciprocally interact – in fact, agriculture is an absolutely pivotal arena where the state of agroecological nature and rural society is produced. We argue that agriculture in southwestern Michigan is the prime historical cause and consequence of social ecological development. It is the foundation upon which settlement first occurred and the economic base for the regional urban economy prior to the advent of intensive industrial development in the early 1900s in the Grand Rapids area and following World War II in the rest of the region.

Pivotal to our account, however, is that the social and ecological characteristics of the region's agricultural landscape are diversified. In contrast to both agroecologists and sociologists who sought to explain contrasting homogeneities, we seek to understand a continuous diversity. We have an agricultural region, but not one that has specialized in any one commodity to any marked extent. In this way, perhaps the most important characteristic of southwest Michigan is the agricultural diversity found within the region's differentiated but not particularly diverse ecological and social landscape. Weighing the relative import of ranges of climatic, topographic and pedological diversity as opposed to historical, technological and political economic variability in the history of agricultural landscape diversity is rarely straightforward. In our case the limited ecological ranges would seem to constrain the influence of nature and enable analyses that focus on society. However, this would be to misunderstand the importance, on the one hand, of the importance of small differences in microclimatic conditions and, on the other, the historical accommodations producers and crops have been forced to make in the landscape.

Nevertheless, the traditional North American agricultural narrative {e.g., \Pfeffer, 1983 #3330;Swanson, 1988 #1688} is one that suggests region-specific processes of agricultural specialization and homogenization, offset in some areas by the ecological capacity to foster

enterprise diversity.[6] In this traditional narrative, agriculture is generally presented as initially founded by family farms that grow crops – or at least a garden – for their own consumption, produce bulk commodities for the market, and/or rotate pasturage in support of draft, consumption and market animals. Over time, each farm generates sufficient surplus that children can be established on new farms of their own in a process of social reproduction defined as simple commodity production in Marxist terms {Chevalier, 1983 #96;Friedmann, 1978 #97} and agrarian populism along Jeffersonian lines {Sanders, 1999 #94;Williams, 1969 #95}. A variant of this model, that of the agricultural ladder, suggests that even hired hands can accumulate enough wealth to purchase farmland when conditions are propitious. {Winters, 1978 #99;Heller Jr., 1996 #100} These populist conditions are then seen to be whittled away during the 20th century as the technical demands of mechanical, chemical, and biological intensification and the market demands of commodity specialization force fencerow-to-fencerow monocropping. This process at the level of the farm is usually combined with ecological and economic conceptions of regional comparative advantage to generate processes that some describe as regional simplification and others describe as agricultural progress or economic rationalization or ecological modernization.[7]

REGIONAL PERIODIZATION

We have divided the region's history into **six periods.** Beyond our discussion above of Native American inhabitants and early Euro-American settlers, we will provide little data on agricultural practices in the first period, prior to Michigan's statehood in 1837; while the Native American transhumant agriculture of that period is of cultural value and anthropological interest, it is essentially erased by the agriculture implemented by the Euro-Americans in the 19th century. Thus, from 1837 to 1898 two primary processes occurred. On the one hand, the forests were gradually and partially cleared and removed and land was drained in the pursuit of extensive, self-provisioning and limited market oriented agriculture. On the other hand, with increasingly efficient transportation infrastructures related to the advent of Chicago as a metropolis and a rail hub with trunk lines to the east {Cronon, 1991 #5}, more intensive production developed.

Most southwestern Michigan agricultural products not intended for very local markets (the emerging urban centers of Grand Rapids, Kalamazoo, Jackson, Lansing, Benton Harbor-St. Joseph, and Battle Creek have historically been oriented westward towards Chicago. Grains, fruit, and livestock have historically dominated agricultural production, social practices and

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6 As above, with respect to ecological and socioeconomic variability, it is difficult to assess whether or not the key for the purposes of regional analysis is the general social processes of the pursuit of agricultural accumulation, rationalization, appropriation and substitution {Goodman, 1987 #14;Goodman, 1985 #109} or the local ecological and cultural conditions that mediate their local expression {Mooney, 1982 #116;Mooney, 1988 #117;Mooney, 1987 #118}. Our project stresses the centrality of both moments in agroecological transitions.

7 Here, of course, one's definition of the term "region" and the spatial scale at which that definition works is pivotal. Arguments have been made for regions as a) comprised of major cities and their rural hinterlands, b) as single digit subdivisions of nation-states – in the US the number is usually five, and c) as agglomerations of nation-states. Our conception is closer to that of a bioregion, though we reject the foundational bioregional assumption that topography or climate establishes coherent boundaries for social space. See Rudy {, 2004 #23} for a similar argument with respect to watersheds.

emerging technoscientific institutions, though the relations between these commodities – as well as their downstream processing, distribution and consumption – has shifted in the process of Midwestern agroindustrialization. {Page, 1991 #19} Agroindustrialization represents a process by which Midwestern agriculture and industry coevolve to produce regionally specific networks of farmsteads, rural communities, small cities and megalopolises. While Cronon {, 1991 #5} sees Chicago as dominating its hinterland, our focus on regional agroindustrial-ization stresses the way southwest Michigan is mutually comprised by its rural areas and its urban centers, and de-emphasizes the role of Chicago. Our focus thus is on the historical social ecology of southwest Michigan.

By stressing the temporality of regional development, rather than the dominance of one spatial actor, we are able to explore the differing historical dynamics that have contributed to the social and ecological processes and legacies of agriculture in southwest Michigan. Our periods start shortly after statehood and build to the present in five segments. The first encompasses the, largely, extensive forms of agricultural development during the 19th century. The second is associated with the technological, productive and institutional intensification tied to the Golden Age of American Agriculture from the turn of the century to 1919. The third period is that of the agricultural depression of the 1920s, deepened by the financial and industrial depression of the 1930s.

The fourth period is that of post-War agricultural Fordism – when mechanical and chemical intensification, the Cold War, and the increasing integration of rural social life into urban consumer society radically alter agricultural social and ecological relationships. The last period, which can be broken into two parts, is that of agricultural and rural restructuring starting in the early 1970s. Initially this process was driven by the new forms of government regulation, social movements, and cultural priorities associated with the environmental movement (and its coincident development along side rising production costs related to oil shocks and increasing debt associated with intensification).[8] Agricultural and rural restructuring subsequently accelerated in southwest Michigan following the rise of neoconservative fiscal policies and neoliberal global economics in the early 1980s.

POLITICAL ECONOMY

19th Century Extensive Development, 1837-1898

Settlement, clearing of trees, draining of land, crop experimentation, infrastructural development, the determination of microclimatic niches, and commodity development all characterize the patterns of extensive development in SW Michigan during the boom-bust market cycles of the nineteenth century.[9] While southwestern Michigan was climatically and pedologically well-suited for wheat production, settlers were confronted with a densely forested landscape and many areas of swampland that required extensive draining before they could be successfully farmed.

[8] While the agricultural labor movement was also important during the period in other parts of the country, it was not a major influence in the southwest Michigan region.

[9] Booms and busts were sometimes characterized by bad harvests or the negative consequences of extreme climatic events, but were as often related to the saturation of national and international markets tied to wars, recessions and simple overexpansion of production.

At the same time, the lakeshore, wetlands, and mixed deciduous forest of the region provided a complex mix of microenvironments and a wide diversity of flora and fauna for hunting, crafts and harvesting.

Small prairies sprinkled across the landscape provided the initial land for wheat production {Dunbar, 1995 #43} and it was in these areas of southwest Michigan that small settlements first developed {Gray, 1996 #39}. While the majority of the logging industry extracted white pine – the state tree – from the area just to the north, the hardwood forests and swamps of the southwest were predominantly cleared and drained in the process of the establishment of agriculture. Following the Chicago fire, hardwood extraction from SW MI intensified, though this boom had ended by the 1880s and forestry in western Michigan as a whole was all but over by the 1920s. {Sparhawk, 1929 #33: 6}

Prior to the development of railroads during the latter half of the century, lakes, rivers and canals were the primary means of transporting agricultural crops. In many cases in southwest Michigan, crops were shipped first along rivers to Lake Michigan where they were taken by steamer to Chicago, or in some cases, to eastern markets {Hartshorne, 1926 #35}.. The extensive development of agricultural production was further stimulated in the latter half of the century by the development of railroads, which reduced transportation costs to regional markets, though monopoly pricing power caused notable protest {Dunbar, 1969 #44}.

Early developments in the mechanization of agriculture eliminated increasing amounts of human contact with the object of production and farming became inextricably joined to a system of social institutions—economics, government, education {cf., \Stoll, 1998 #35: xiv}. These social institutions ranged from public institutions like the USDA and land grant universities, to private ones like the Chicago Board of Trade and the Grange.

During this period the diversified agriculture characteristic of southwest Michigan began to develop. While wheat predominated in terms of acreage (see Table XY), hay for animals was the second largest acreage, and fruit was not insignificant.

Figure XX: Top 6 Commodities by Acres in 1880[10]

The Golden Age, 1899-1919

With the opening of global markets following the US victory over the Spanish in 1899, augmented by the institutionalization of federal funding for Progressive agricultural science and cooperative extension programs at the turn of the century, agricultural transformations in southwest Michigan reflect broadly robust markets and the national tendency towards intensification both in mechanization and in plant and animal breeding. In particular, the establishment of state-wide, county-level Cooperative Extension offices as part of the Agricultural Experiment Station at Michigan State University began a century of close, two-way communication between progressive farmers, extension agents, and university scientists.

[10] In 1874 there were 654 acres of grapes vines in SWMI. In addition, 2,156 acres of berries were recorded which is 72% of the state total. Acres of berries (non grape acres) increased to 21,610 acres by 1899, representing is 74% of the state total small fruit production.

Production problems, technical needs and development desires moved from the field to the lab and science in the form of solutions and recommendations moved from the university to the farm.

This is the Golden Age of American Agriculture and it runs up through the end of World War I. Again, however, southwest Michigan agriculture was fostered by the myriad feedback loops associated with the complexity of the Chicago market, the ethnic diversity of Michigan's population, and the experimentation with crop mixes possible given the generally moderating climatic effects of Lake Michigan. Michigan may have produced significant volumes of grain for export, but the majority of its agricultural commodities were intended for domestic consumption.

The Agricultural and Great Depressions, 1920-1940

As with the rest of the nation, in the 1920s southwestern Michigan entered into an agricultural depression despite the industrial and market boom of the Roaring Twenties. The return of European agriculture to viability after World War I depressed important markets that US agriculture had grown used to and caused national overproduction crises in grain and animal sectors. In southwestern Michigan the crops most seriously affected would have been primarily grains and secondarily livestock. Michigan grain producers would have been affected directly as the export segment of the total market decreased; when they turned to feeding livestock as a way to realize value from their grain crops, they found that livestock markets were also depressed by the loss of European outlets. While markedly reduced, fruit growers were actively planting during this time, which symbolizes a sense of financial security (i.e., it takes many years for most fruits to reach full production) (For example, see Appendix III, Non-Bearing Apples Trees. Note that the numbers of non-bearing trees were at their lowest in the 1950s).

Most importantly, however, and partially as a response to the crisis, during this period "Progressive Farmers" moved aggressively into mechanized production (tractors for plowing and cultivation, combines for harvesting, sprayers for pest control). The greater productive capacity of tractors was a boon to those farmers who could afford tractors; less time was required per acre for tillage, cultivation, harvesting and pest management, which meant that fewer persons had to provide the labor needed for a given farm. On the opposite side of the coin, however, tractor-driven increases in productivity across the nation exacerbated overproduction (and social ecological transformations grounded in agriculture) in two ways -- mechanization meant that farmers no longer needed to keep draft animals, and it also meant soil compaction and erosion. Not keeping draft animals meant not needing to plant pasturage, nor receiving the soil nutritional benefits of recycled animal waste as fertilizer. Fields historically rotated with pasturage then became available for commercial crop production, increasing gross marketable production and net productivity in the hopes of maintaining (or increasing) net profits, despite exacerbating already saturated market conditions.

The agricultural depression from 1919 to 1941 effectively ends – as does the Great Depression – with US entry into World War II. With the national demands for food and fiber for the military, and later global reconstruction in the context of the Cold War, robust agricultural markets returned. Further, however, institutional, mechanical and chemical developments associated with Depression era political restructuring, scientific and technological research within the land grant

university complex, and the war effort laid the groundwork for the Fordist revolution in southwestern Michigan's agriculture.

Agricultural Fordism, 1941-1973

Agricultural Fordism represents two basic processes, one in production the other in consumption. In terms of production, Fordism represents what Goodman, Sorj and Wilkinson {Goodman, 1987 #14} term appropriationism -- the increased penetration of agriculture by capital goods like tractors, hybrid seeds and pesticides. Processes that had been endogenous to agriculture (e.g., supplying the energy for draught power with crops raised on the farm, selecting and saving seed to maximize desirable attributes) are moved off the farm and into the realms of manufacturing, commercial and financial capital (e.g., machines that rely on petrochemical fuels, synthetic pesticides distributed by national and transnational firms). In terms of consumption, Fordism intensified the capacity, desire and need of farm families to increase their consumption of market goods – particularly mass-produced consumer goods and "labor-saving devices." Thus for the structure of farming practice, Fordist consumption is associated with 1) a deepening of the orientation of agriculture to the market and away from even partial self-provisioning of household food and fuel, and, as a consequence of this, 2) a deepening of farmer commitments to either monocropping or very simple rotations for the purpose of productivity.

Simultaneously with the promotion of mass market commodities, however, and in a pattern more like its distant cousin, California, than its near relatives Ohio, Indiana, and Illinois, Michigan agriculture maintained and increased its agricultural diversity after World War II. Whereas states more central to the Corn Belt broadly reduced their crop diversity to a limited range of grains (corn, wheat and soy predominant among them), increased the presence of feedlot livestock, and in both respects increased the size of agricultural units, southwestern Michigan's units of production remained fairly small and its agricultural diversity fairly complex, including both crops and animals. Land concentration was limited during this period, although average unit size did grow slightly and middle range farmers declined over time in the face of larger numbers of large and small farms. F

Figure X: Average Farm Size in Michigan, 1920-1997

To understand why farmland concentration in southwest Michigan was limited during this period, it helps to view the social process related to agricultural land concentration as consisting generally of two subprocesses. One subprocess makes farmland available; this may happen as current farmers and/or their heirs sell their land, as large operations downsize, or as new land is brought into farming (draining, clearing); this first process is fostered by the aging of the farm population, falling commodity prices, rising tax burdens, and the current and speculative demand for land for exurban residences, as noted above. The second subprocess takes this available farmland into farming operations via purchase or rental or partnership; this second subprocess is fostered by government commodity programs based on acreage, and by the increasing scale of farm machinery. Among the constraints on land concentration in southwest Michigan are 1) the different ethnic/cultural commitments to farming that keep some farmers from exiting farming and keep other farmers from increasing the scale of their operations {Salamon, 1979 #25;Salamon, 1980 #24;Salamon, 1986 #26}; 2) opportunities for full-time industrial work off

the farm that generate income to sustain the household and to subsidize the farm operations, thus diminishing movement out of agriculture; 3) opportunities for part-time industrial, retail and tourism work off the farm that siphon off the supply of labor that would be needed for farm expansion ({Cantrell, 2002 #74}; and 4) increased productivity and/or profitability associated with new inputs, new cultural practices, new high-value crops, and on-farm value-added crop processing.

How these two subprocesses operate determines the outcome for concentration. To return to the four constraints above, the increased productivity made possible by new inputs and practices diminishes the need to get larger; relatively small farms can be highly productive, and economies of scale in production may level off at a relatively small size and opportunities for work off the farm decrease the incentive to get larger. As important, however, was the pre-existing agricultural diversity. Southwestern Michigan has rarely experienced saturated markets in grains, livestock, fruits, vegetables, and hay simultaneously and the region has a fairly long history of moving land in and out of production, and/or from one form of cropping to another – most often, particularly in the western counties, moving between grain and fruit production.

Agroecological and Profitability Crisis, 1974-1989

The combination of the OPEC oil embargo and the associated period of economic stagflation during the 1970s provides the beginning conditions for the end of agricultural Fordism in southwestern Michigan. In addition to rising costs of direct (e.g., fuel) and indirect (e.g., agrichemicals) petrochemical inputs to agriculture, and rising costs associated with state and federal environmental regulatory regimes, the 1970s also seriously damaged the Michigan automobile industry and Michigan's industrial sector generally, diminishing opportunities for off-farm employment and supplemental income. This state-level economic downturn was then exacerbated by the Reagan recession and the decision of USDA officials in the Reagan administration to call in the many agricultural loans extended during the "fencerow-to-fencerow" planting strategies promoted by the Carter administration in the face of the Soviet grain deals.

These changes to the industrial and agricultural foundations of southwestern Michigan were happening at the same time that new, more ecologically oriented (in theory) and input cost reducing (in effect) production practices were introduced – integrated pest management, corn-soy(-wheat) rotations, minimum tillage, and intensive rotational grazing. While the costs of some inputs decreased, at least in real terms, the costs of other input factors rose, more than offsetting the potential cost savings. At the same time, real prices for agricultural commodities continued their long-term downward trend, and farm operators were squeezed between the rising costs and the falling prices. This cost-price squeeze was relieved to some extent by federal government payments; by the 1990's, federal payments constituted more than half of net farm income.

At the same time that more and more farm households were developing pluriactive strategies for staying on the land (and choosing production, cropping systems and niche crop varieties that fit with the demands of multiple income strategies), science, technology and markets generated opportunities for alternative forms of value-added production (and/or regional crop diversification). During the 1980s and 1990s, the American diet became more diverse and

demand grew for a wider variety of fruits, vegetables, and meats at the same time that consumers sought "healthy" options associated with poly-unsaturated oils, organic production, and vegetarian diets.

Southwest Michigan's historical agricultural diversity has allowed it to foster some of these new consumer demands and respond to some of the market signals generated by these new consumer desires. In particular, alternative marketing systems, from farmer's markets to Community Supported Agricultural production, have emerged within the region's still dominant production of corn, soy, and wheat. This has been possible because apples, grapes, and blueberries provide both industrial commodities for mass marketing and processing, and specialty crops for niche marketing and value added processing. The intricate and uneven dynamics of the relationship between changing land management styles, changing dietary demand, changing agricultural land-use patterns, and changing rural development trajectories are intimately bound up with one another and engender complex consequences for social relations, ecological conditions and rural conservation practices – social and ecological – all around.

Globalization, 1990-present

We noted at the outset of this chapter that the distinguishing characteristic of the agriculture in the southwest Michigan region is its diversity. Our job in the wider study for which this chapter is a start is to explore the historical (amount, composition) and spatial (location, patchiness) patterns of this agricultural diversity as well as its sociocultural and ecological influences and consequences. These days in the southwest Michigan region, as is true across much of the densely settled portions of the US, farms are increasingly growing houses where they used to grow grains, fruits and vegetables; increasingly the use of the land is changing from farming to low density residences, strip malls, government facilities and highways. While in the Fordist epoch suburbanization was broadly associated with expansion at the boundary between the urban core and the suburban ring, these days urban expansion is associated with spotty and non-contiguous exurban development whether as medium-density prefabricated housing developments or low-density mega-home construction. How this set of social transitions of the agricultural landscape is playing itself out in relation to new cropping systems and forms of animal agriculture – and how each is impacting the environment -- will be central to our developing understanding of southwest Michigan's contemporary agricultural transformations.

Most archaeologists agree that the agricultural revolution occurred in one or more locations over a period of a few thousand years roughly 11,000 years ago. To self-provisioning patterns that relied on gathering, hunting and fishing, agriculture added the cultivation of crops and the domestication of animals.[11] These agricultural adaptations remained relatively local in scope until technological and social developments supported trading and raiding at increasing geographical scale during a period about 5,000 years ago {Hall, 2000 #136}. These patterns of exchange remained relatively regional in scope until technological and social developments supported a shift to global scale during a period beginning about 600 years ago {Wallerstein,

[11] Of relevance to southwest Michigan, wheat was developed in the Middle East about 7,000 yearsago, maize was developed in Central America about 3,000 years ago, grapes were developed in Europe about 3,000 years ago, and swine were domesticated about 1,000 years ago.

1974 #137}. What begins as a contest between monarchies for global power, by the middle of the 1800s has become a system of nation-states, and private corporations operating internationally but usually based in dominant nation states {Friedmann, 1989 #2480}. Over the next 100-plus years, the organization of power gradually shifts in favor of the transnational corporation as opposed to the nation state, with only rudimentary development of a transnational state that might exert countervailing power against the transnational corporation {Friedland, 1994 #10;Friedland, 2001 #2473}. By the last two decades of the 20th century, transnational corporations are able to access and move raw materials, finished goods, and financial and human capital anywhere on the surface of the globe with almost no regard for the wellbeing of the communities or nation-states involved {Gereffi, 1994 #156}.

Thus, by the late 1900s, agrifood systems are increasingly global in scope and local in consequences – hence Swyngedouw's {, 1997 #28} felicitous term "glocalization." Working at the interface of Smith's {, 1984 #90;, 1989 #93;Smith, 1987 #92} arguments about the inherent and simultaneous homogenization and differentiation of social ecological landscapes under capitalist development, and the geographic literature on the de-/re-territorialization processes of globalization (whether global warming or free trade), Swyngedouw {, 1997 #28} argues that the scalar dynamics of social and ecological processes are shifting. In terms of agrifood systems this means that the relatively stable national dynamics of agricultural markets, policy and research have been destabilized – with direct consequences for local or regional agroecological conditions. It also means that relations between agricultural production, distribution, markets and consumption are being restructured as relations with the patterns and governance of (ex-)urban development and environmental standards and agrifood regulation shift as they face and engage globalization.

For southwest Michigan this means that historical rural/agricultural and urban/industrial dynamics are shifting rapidly and agroecological land-use and conservation measures need to adapt at a similar pace. Issues ranging from the promotion of and struggles over the social and ecological consequences of 1) alternative agriculture, 2) genetically modified crops, 3) niche or specialty crop production, 4) value-added agritainment, craft production and rural vacationing, 5) exurban sprawl, 6) the environmental and human health implications of agrichemical use generally and pest management particularly, and 7) industrial animal farming are all developing along international and regional lines with widely diverse consequences for different localities in the southwest Michigan region.

GRAIN COMMODITIES

19th Century Extensive Development, 1837-1898

Grain production in the region expanded rapidly as more and more land was cleared and drained. Between 1854 and 1904 the acreage planted to wheat and corn increased over 150% from 452,595 to 1,153,512 acres**.** Wheat, planted on 22% of improved acreage in 1884, and corn, planted on 12% of improved acreage, were major parts of the agroecosystem during this period**.** Minor grains such as oats, barley, buckwheat, and rye planted on approximately 7% of improved acreage in 1884 leaving these six grains covering 40 percent of the improved landscape. To the contemporary mind, 40 percent might seem less than it is since effectively all farms had to

maintain extensive acreages rotating as pasturage. *We are continuing to collect data on pasture acreage so the reader can reconcile the figures in this paragraph with the figures in the table above.*

Despite the development of rail transport and the concentration of Midwestern grain marketing and processing in Chicago, practically all of the wheat that was produced in Michigan during the 19th century was milled within the state. Milling centers of southwest Michigan were Grand Rapids, Alma, Coldwater, Lansing, and Jackson {Wood, 1914 #45}. Presumably this flour was consumed by a growing urban population. The Civil War also had a significant impact on grain production as serendipitously timed bumper crops were sent to feed Union armies {Dunbar, 1995 #43}.

The Golden Age, 1899-1919

By the end of the 19th century wheat production had already spread into the Great Plains {Brigham, 1910 #37} and Michigan farmers now had to compete with other regions in an environment of declining prices **(See graph below).** For this reason, the expansion of grain production in the region slowed

Figure XX: SW MI Row Crop Acres, 1854-1997

decidedly compared to the previous fifty years. In fact, although acreage in grain grew slightly from 1,702,481 acres to 1,758,372 acres between 1884 and 1904, acreage in grain as a percentage of improved land actually declined slightly from 41% to 39%.

While the change in acreage was relatively small, there was a significant change in the composition of grains that were produced. By the period from 1898 to 1919, agricultural expansion was starting to level off; however the composition of the grain that was being produced continued to change. Most notably, there was a movement away from wheat production and towards corn and other grains**.** Hart {, 1986 #50} notes that corn was often preferred by farms since they could sell it when corn prices were high or use it as feed for hogs or cattle grown on farm.

Many farmers, in fact, preferred to feed their corn to livestock since livestock production allowed for productive use of labor during winter months {Hart, 1986 #50}. Approximate two-thirds of corn was used as livestock feed {Dunbar, 1995 #43}. Importantly, alcohol consumption, and corn whiskey in particular, was also starting to increase during this period, providing new outlets for excess production of corn {Pollan, 2003 #51}.

The Agricultural and Great Depressions, 1920-1940

The mechanical intensification of agriculture during the Depression era impacted the environment so as to increase soil erosion in many areas. The drop in grain prices made cash grain farming extremely unprofitable and many areas of grain farming were simply taken out of production as farmers across southwest Michigan were unable to pay taxes {Barnes, 1929 #54}. Despite the arrival of the industrial and financial depression in 1929, farmers were also faced with declining relative income compared to manufacturing jobs {Alstou, 1991 #55}.

Furthermore, the intensification of modern, monocultured grain crops, corn in particular, created new opportunities for agricultural insect pests.

The European Corn Borer, introduced into North America around 1910, spread quickly across Canada and entered Michigan in the early 1920s {Larrimer, 1928 #56}. In response to the threat of the corn borer, in the spring of 1927, Congress passed a $10,000,000 corn borer clean-up campaign. Within Michigan, this campaign was largely an educational movement stemming from the cooperative agricultural extension service {Dibble, 1936 #125;Musselman, 1928 #124} that sought to reduce the amount of crop residue left on farm fields. The campaign largely failed to control the corn borer. However the corn borer did represent, at least to some entomologists at the time, a larger structural problem. Dr. Charles Brues, a Harvard professor, suggested that increasing farm size and concentration of farmland was the source of increasing insect pest problems since large, reliable sources of food were allowing pest populations to grow {Anonymous, 1929 #57}. He also argued that a reduction in farm size would be the only way to control pest populations.

The combination of local environmental degradation, increased pest infestation, and national and global depression had a significant impact on both the amount and composition of grain production. As noted earlier, declining prices and decreased grain productivity drove many farmers out of business as their main cash crop became increasingly unprofitable. In order to maintain their farms, many farmers shifted out of grain production and from 1904 to 1940 the

Figure XX: 1940 Grain Acreages

amount of farmland used for grain production declined from 1,314,259 acres to 948,614 acres, and grain's share of cropland declined from around 40% to less than 25%. This drastic decline was due both to land taken out of production and to a diversification of production into crops other than grains.

By the end of the 1930s new opportunities for grain production began to emerge with the development of soybeans as a potential crop that could be rotated with corn and wheat as a means to reduce soil exhaustion, control pest infestations, and take advantage of new market demand for soy oil and soy meal. While even as late as 1940 the fraction of farm acreage used for soybean production in the region was less than 1%, there were indications that soybeans would become critical for SW Michigan agriculture. Significant changes took place first technologically in 1934 when the hydrogenation of soybean oil became possible on an industrial scale and then politically in 1935 when margarine manufacturers decided to use only domestically produced oils and fats {Berlan, 1991 #58}. These key decisions, buoyed by the discovery that soil meal could be used as a high protein animal feed, opened the door for the expansion of soybean production in the coming decades.

Agricultural Fordism, 1941-1973

In the 1940s, the face of grain production in southwest Michigan changed drastically. First, grain production, which had declined significantly in the previous era, found new opportunities in markets in post World War II Europe. Fueled by new demand both internationally and

nationally, grain farmers in southwest Michigan responded by increasing the amount of farmland used for grain production. In this era, however, corn and not wheat was the dominant grain produced. In part due to the agricultural depression, farm ownership became markedly more concentrated and farm size increased while the diversity of grains produced declined. In 1974 the amount of soybeans planted was only five percent of total farm acreage; however, it increased rapidly through the next time period. While there continued to be some farming of grain crops other than corn, wheat, and soybeans during the early part of this era, by the 1970s it was clear that other grains were of relatively little importance. By 1974, less than three percent of farmland in the southwest Michigan region was planted in grains other than corn, soy, or wheat.

Importantly, grain production in this period was defined by new mechanical and chemical developments that increased productivity and provided new economies of scale for large-scale production. Tractors for instance, although available prior to World War II, were not produced in sufficient quantities to meet demand and many farmers in the region continued to rely on animal traction throughout the war years. As industrial production reoriented to include civilian uses, however, fossil fuel driven farm machinery quickly became the norm for grain production. Within the entire state the number of corn pickers alone more than doubled from 10,681 to 23,514 in four years from 1950 to 1954. By 1969 there were 13,053 self-propelled grain and bean combines and over 70,000 tractors. The replacement of horses and the few other draft animals by self-propelled farm machines did not represent simply a labor saving development. It altered the landscape by facilitating the further specialization of farms and by increasing the separation of animal systems from grain production. Farmers no longer had to feed and house animals, but at the same time the agricultural fields of farmers who had no other animal enterprises no longer benefited from the animal manure.

Of course, once livestock was removed from the grain production system, it was essential that new sources of fertilizer be found. Around WWI two German scientists developed a way of synthesizing ammonia through the Haber-Bosch Process. This meant that nitrogen fertilizer could be produced industrially, rather then relying on Chilean guano sources. The industrial production of ammonia was further expanded within the United States during WWII since it was an essential part of munitions production. In 1930, 140,082 tons of commercial fertilizer was applied in Michigan. By 1964, this quantity had reached 679,519 tons. Of course, the use of industrially produced agricultural chemicals was not without a cost nor did it lead to a wholesale domination of the landscape. This was particularly evident in regards to pesticides. In the case of the corn borer, the use of pesticide as a management technique proved to be extremely limited as pesticide application had to take place when corn was nearly full grown, which made scouting and spraying for pests time-consuming and physically inconvenient. On the other hand, management of pests such as the Western corn rootworm, which entered Michigan during this period already resistant to organochlorines, was initially successful through second-generation, organophosphate-based, soil insecticides. Inevitably, however, the rampant use of pesticides developed during this era began to impact non-target species and degrade agricultural and non-agricultural environments alike. Insecticides such as DDT had serious and lasting impacts on avian, aquatic, and terrestrial wildlife populations {Heinz, 1994 #101;Frank, 1981 #99;Heinz, 1985 #100}.

The new tractor driven, monocropped, chemically intensive, and densely planted system could not have succeeded without structurally homogenous crops that were able to utilize high nutrient levels. Hybrid corn fit the bill. While research into hybrid corn had begun in the 1930's, it was not until this period that its commercial use expanded. Griliches {, 1960 #66} found that by 1940 more than ten percent of corn acreage in southwest Michigan had been planted in hybrid corn. By 1959, 90 to 100 percent of all corn planted were hybrids. Importantly, the spread of hybrid corn did not have an equitable effect on all agricultural land. Rather, the yield benefits disproportionately benefited those who had large, relatively successful farms {Griliches, 1960 #66}. Larger farms not only had greater capital to buy the new hybrid seeds, but also they could purchase the host of chemicals and machines that worked with the hybrid crops to make production so high.

Agroecological and Profitability Crisis, 1974-1989

Through the post-Fordist era, from 1973-1989, the composition of grain production continued along similar trajectories as the previous era. Grain as a percentage of farmland continued to increase. Wheat acreage declined, while land planted to corn and soybeans increased. The factors driving these trends, however, were beginning to change. As a result of the homogenization of grain landscapes in previous eras, new environmental problems were being encountered. The homogenization of landscapes and the development of pesticide resistance led to increased pest infestations. Over-application of highly concentrated synthetic fertilizer began to pollute water sources; mechanization made possible increased tillage which facilitated soil erosion. Confronted with heightened public awareness of environmental issues and new federal regulations, farmers had to seek new ways to manage their fields.

While serious grain pests, such as the western corn rootworm, were initially managed with soil insecticides, the rapid spread of resistance was making chemical management increasingly ineffective. At the same time, the homogenized landscape was providing pest populations with a large area of highly concentrated, high quality food to support their populations. The solution to managing the corn rootworm in SW Michigan was to rotate grain crops in order to disrupt the lifecycle of the pest. This strategy was not only an effective means of pest management, but also allowed farmers to take advantage of the growing market for soybeans, which had a further benefit in that it fixed nitrogen in the soil. The continued expansion of soybeans throughout this era is testament to their use by farmers as a strategy for pest management, economic diversification, and soil management.

The problem of soil erosion was addressed through the expansion of no and low-till farming. As with the expansion of soybeans, the benefits to grain farmers were multifaceted. Not only did the reduced disruption of the soil reduce the amount of wind and water erosion, but it also reduced the amount of labor time and fuel that were necessary to work the soil. Unfortunately, the concomitant effect of no-till was that it required more herbicide use in order to control weeds and maintain the clean, untainted fields that had become the norm for SW Michigan. Especially on the sandier soils, the herbicides leached into the groundwater.

Farmland concentration accelerated throughout this era so fewer farmers were working larger tracts of land. Farm machinery itself becomes larger so that corn pickers that once picked a

single row could now pick five or more rows simultaneously. Economic pressure due to low grain prices **(see Figure xx)** force many farmers to "get big or get out". Farmland that had been in families for generations becomes available as a result of death or retirement, and is sold to settle the estate or rented out to provide a pension. In most cases, land that is rented is used for grain crops due to the quick return and low labor requirement compared to fruit or vegetable production.

Figure XX: Grain Price per Bushel Graph

Globalization, 1990-present

If grain production from 1940 to 1973 was defined by technology, and production from 1973 to 1989 was defined by environmental degradation, the final era of grain production, from 1989 to present, is defined by globalization and increasing conflicts with nonagricultural populations. During this era, the forces driving grain production shifted from local or regional conditions and towards global level influences. Certainly, extra-regional factors have always had an impact on southwest Michigan grain production from competition with wheat producing states to the west to the decline in prices of the Depression to new markets opened by World War II. However, in many ways, grain production in this era is driven by the global supply of, demand for, cash grains in ways that had not previously been the case. Not only is the market affected directly by global supply and demand; in addition, grain production is indirectly affected by markets for non-traditional uses (e.g., sweeteners, fuel alcohols, starch utensils) and thus by the global supply of, and demand for, non-traditional competitors (e.g., cane and beet sugar, fossil fuels, wood pulp).

By 1997, the grain landscape in southwest Michigan was dominated by corn and soybeans. Soybeans represented almost 20 percent of all farm acres planted and corn was planted on 28 percent of all farmland. Wheat had fallen to only five percent. Despite the continued homogenization in the types of grains produced, there has been, at least to a limited extent, a diversification in the varieties of grains that are produced (e.g., high lysine corn, high oil soybeans), and in the ways in which these grains are produced (e.g., genetically modified [GM] crops, organic crops).

Biotechnology has had a significant impact on grain production during this period. By 2003 an estimated 73% of soybean acreage and 35% of corn acreage was planted in genetically modified crops. For corn the dominant GM variety was Bt, which incorporated a plant-expressed protectant that controlled for the European corn borer. Since the entry of corn borer to the region nearly 100 years ago, Bt corn represented the first highly effective control. GM soybeans consisted of a variety resistant to the Roundup® herbicide. This allowed for easy weed control of soybean fields. Interestingly, however, despite claims of the biotechnology industry, neither of these varieties contributed to a reduction in chemical application in the region. (Citations pending) While GMO crops were beneficial to farmers in that they reduced crop loss and made weed management easier, they were not without problems. With the expansion of international trade, international markets have become increasingly important to grain production in the region; resistance to GMO crops in countries in Europe and elsewhere has barred some southwest Michigan grain from some markets. In addition, some authors e.g., {Rissler, 1996

#157} have expressed concern that the constant and universal expression of the *Bt* toxin in corn will rapidly lead to resistance in the pest species. Other authors have suggested that the increased use of glyphosate (Round-Up) will lead to resistance in the weed species, and that the herbicide tolerance genetic construct may be transmitted to weed species and become incorporated in one or more weed genomes, creating so-called "superweeds" because they are resistant to one of the major herbicides. While there is no indication that any of these outcomes has occurred yet in southwest Michigan, the potential exists for these major environmental impacts.

Organic production still represents a relatively small part of southwest Michigan agriculture; statewide just over 40,000 acres, less than one percent of the total farmland in the state, were in organic production in 2001. However, organic production has grown rapidly over the past 10 years and the amount of acreage has increased over 280 percent between 1997 and 2001. Furthermore, the 2002 adoption of national organic standards and the growth of organic production nationally speak to its future potential. The exact amount of organic production in southwest Michigan is unknown; however, one extension agent stated that the majority of organic production in the region is in soybeans. Organic production techniques emphasize the use of naturally occuring fertilizers that release nutrients more slowly than synthetic fertilizers; thus less nutrient is available for leaching and erosion. Organic farming emphasizes the use of "naturally occuring" substances for pest management, such as sulphur and the *Bt* bacterium; thus there is expected to be less impact on non-target species.[12] It seems likely that as organic production continues to expand, organic production of soybeans, as well as other crops, will likely increase in southwest Michigan in the future.

Currently, grain production in southwest Michigan is not impacted only by technological developments in agriculture and international grain trade. Increasingly, the expansion of residential developments into rural areas in the region is having an impact on how grain is produced. In the past two decades, movement into rural southwest Michigan has increased as urbanites from areas such as Chicago, Lansing, Kalamazoo, and Grand Rapids have sought to take advantage of low land prices to build either vacation homes or homes in the country. Small "hobby farms" as well as bed and breakfasts and other tourist ventures now dot the landscape seeking to take advantage of the pastoral ideal of country living. The implications of these residential developments on grain farming have been significant. First of all, grain farmers must now take into account adjacent nonfarm residences when timing the application of manure or pesticides in order to reduce complaints. Furthermore, surveillance of the environmental impacts of agricultural practices has also increased as the new exurban residents bring with them both environmentalist perspectives and affiliation with environmental organizations. One of the reasons the production of wheat has decreased in the southwest region is the increased difficulty of aerial applications of pesticides and fertilizers.

Despite the partial separation of animal and grain production which took place after World War II, there has not been a complete separation of livestock and grain. While there has been significant concentration of animal production in the region (see below), grain land remains an important sink for the manure that livestock operations produce, at the same time that the manure

[12] Organic growers and supporters see the potential development of tolerance and resistance to the *Bt* toxin in lepidopteran pests as a significant threat to organic agriculture.

remains an important mechanism for recycling many of the nutrients back to the land in a form that releases them relatively slowly. Of course, due to the high water content of manure, transportation costs for distant disposal are very high and manure must be disposed of locally. As farmland has been taken over by residential areas, as animal production has become more concentrated spatially and organizationally, and as legislation has been put in place regulating manure application, there has developed a shortage of land on which to apply manure. This has actually led to the bringing of new land into grain production in order to serve as a sink for manure. At the same time, grain production in the region continues to be an important source for animal feed in the region. It appears evident therefore that, while livestock and grain production have become more fragmented and specialized, they remain closely integrated at the regional level.

FRUIT COMMODITIES[13]

19th Century Extensive Development, 1837-1898

Figure XX: Top 6 Commodities by Acres in 1880[14]

Eastern North American and European varieties of apple and pear seedlings were brought to southwest Michigan by early settlers and planted in the fencerow corners. Some growers grafted them onto wild plums to speed fruiting. They also gathered indigenous small fruits from wild species {Armstrong, 1993 #36}. Although there were a number of fruits native to the region, blueberries were one of few that became a commercial fruit {Kessler, 1971 #678:145}. Early economic successes encouraged growers widely to begin construction of formal peach orchards typically intercropped with staple crops like potatoes.[15] A series of severe frosts killed large numbers of young trees in the 1840s and set into motion both on-farm research and demands by local horticultural societies[16] that the state help to determine how best to cultivate fruit in the region. In this context, fruit growers were involved in the initial negotiations with the state

[13] This fruit section includes 3 types of corrections/modifications that I was making last May: 1) in response to comments received by reviewers (e.g., irrigation), 2) tweaking numbers based on the new data that Evan was collecting (I've finished the first 4 time periods), and 3) responding to other editing changes that had been made.

[14] In 1874 there were 654 acres of grapes vines in SWMI. In addition, 2,156 acres of berries were recorded which is 72% of the state total. Acres of berries (non grape acres) increased to 21,610 acres by 1899, representing is 74% of the state total small fruit production.

[15] "By 1870 everything in and around Berrien County seemed to be related to fruit, especially peaches. The newspapers were filled with information (weather, diseases, new farming techniques, new peach varieties) concerning fruit cultivation…. Advertisements issued from fruit buyers, packers, men who ran trimming and spraying services, and growers who needed laborers to work in their orchards filled the newspapers. Packing operations sprang up across the countryside. New sawmills and veneer mills produced the rough stock for making apple barrels and peach baskets. The peach also was responsible, in large part, for the founding and early growth of Benton Harbor…. The fruit from one acre of trees often brought in $5,000. Sometimes the profits from one peach crop alone paid for the entire land they were grown on." {Armstrong, 1993 #36:PAGE}

[16] Many grower societies were organized between 1854 and 1871. By 1887, 20 different groups published reports in the Michigan State Horticultural Society Annual Report. Land grant university researchers commonly presented "scientific" papers at their meetings. Collectively these societies met with other state and national groups to promote Michigan produce, to exchange growing information, and to establish standards (e.g., variety names).

legislature to open an agricultural college, culminating in the establishment of Michigan Agricultural College in 1855, and in the negotiations to establish a department of horticulture at the College, finally realized in 1883.

When increasing numbers of formal peach, apple and pear orchards came into production, widespread pest damage became apparent as these plantings made the landscape more homogeneous which increased the transmission of diseases and the rapid spread of damaging insect pests.[17] For instance, the Peach Yellows virus, first found in Michigan in 1866 in Berrien County, in combination with the severe winters of 1873 and 1879 severely damaged the peach industry. Yellows causes premature ripening and red spots from the skin through the flesh. While the cause of Peach Yellows was not understood during this period, it was believed that it was contagious and that the only preventative measure was to immediately remove and burn affected trees {Wilcox, 1911 #1669: 276}. Kessler {, 1971 #678: 127} states that control of yellows was so critical that it prompted the passing of the Insect and Plant Disease Act of 1875, the first state legislation in the nation with the objective of controlling a plant disease.[18]

By the mid 1800s several of the biogeophysical conditions (e.g., sandy-loam soils, seasonal variation in temperatures) that make the region suitable for fruit were formally identified and widely promoted {e.g., \Winchell, 1865 #40}. One key feature is Lake Michigan. It was found to extend the growing season along the coast by cooling the air in the spring and summer, which delays budding and moderates the hottest days, and by warming the air in the fall and winter, which delays autumn frosts and creates heavy insulating snows {Hill, 1939 #41}. Those counties that benefit most from the Lake's moderating effects — Berrien, Van Buren, Allegan, Ottawa, Kent — were identified as comprising the "fruit belt"[19] {Winchell, 1866 #42}. In addition, Lake Michigan provided the moisture necessary for production. Unlike some of the major fruit growing regions of California {cf., \Stoll, 1998 #886}, Michigan growers did not require the development of extensive irrigation systems. In fact, research on fruit irrigation did not begin for another 100 years.

Figure X. Topographical map identifying the counties of SWMI Fruit Belt counties and showing its relationship to other fruit growing regions in the nation.

Fruit was initially grown for friends and family. Early commercial growers typically had small orchards on mixed farms {Kessler, 1971 #678}. In 1853 the Detroit & Milwaukee Railroad linked Grand Rapids and Detroit, which was significant to the development of the northern portion of the southwest Michigan fruit growing region. Equally important events for the fruit

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[17] Today, for example, apples are susceptible to six types of pests: plant-sucking insects (7), moths (10), beetles (3), fruit flies (1), spider mites (3), and diseases (7) {Epstein, 2000 #77}. They have long been the most pesticide treated non-citrus crop {Pimentel, 1993, and Shroff 1993}.

[18] The website for the "city" of Walker (now a suburb of Grand Rapids, think Peach Ridge) states "Problems in the early days of the Township differed in their importance compared to today. For example, an office held was that of "Commissioner of Peach Yellows."

[19] The Fruit Belt covers the entire west coast of Michigan and extends inland approximately 15 to 35 miles, but the moderating effects of the lake extend much farther inland. Kessler {, 1971 #678: 130} states that the "Peach Ridge" is the most inland portion of the Fruit Belt. It is located north of Grand Rapids. This strip of land is 10 miles wide east to west and 25 miles long from north to south. He said "although initially a peach area, because of many elevated sites" it was widely planted in apples by 1883.

industry were the opening of the Benton Harbor Fruit Market in 1860 and the subsequent completion of the Chicago-Lake Michigan Shore rail line in 1871 {Kessler, 1971 #34}. By the end of the 19th Century, southwest Michigan was an established fruit-growing region, serving several significant markets, primarily Chicago, and secondarily Detroit, Milwaukee and Grand Rapids, famous for its peaches, but anchored by its other crops, especially apples. In 1884, there were 173,251 acres of apples, peaches and grapes being grown, which represents 4.12 percent of the improved farmland in southwest Michigan.

As the production of fruit expanded, it caused significant changes in the biophysical environment of the region. The varieties of apples and peaches and grapes which were planted were European and eastern North American varieties, exotic to the region. Although none escaped from cultivation to become an invasive nuisance, they did replace a significant percentage of the native vegetation. [but, abandoned orchards did become a nuisance; they were a pest reservoir and the reason for the orchard removal laws – insect plant and disease act noted above] The sizable and concentrated planting of these varieties made it possible for native and introduced insect and microbial pest species to increase to the point of being significant problems.

The Golden Age, 1899-1919

The total acreage of fruit crops in southwest Michigan reached its all-time peak during this period, extending to 213,993 acres in 1904. These plantings, especially along Lake Michigan, were used as an economic development tool to promote regional tourism during the early years of the 20th century {e.g., \State of Michigan, 1914 #46}.

Enormous economic successes in commercial production encouraged a "peach-planting frenzy between 1884 and 1906" {Armstrong, 1993 #36}. A particularly devastating storm on the 10th of October, 1906, killed 73 percent of the peach trees across the region. On the one hand this freeze devastated the industry, which never fully recovered.[20] While peaches were still planted across southwest Michigan, they became spatially concentrated in the southernmost county (i.e., Berrien) where the lake effect is strongest (i.e., the growing season is 20 days longer than the rest of the region) {Schaetzl, n.d. #47}. On the other hand, the losses prompted fruit crop diversification {Kessler, 1971 #678}, and relocation to more beneficent sites. Between the era of "extensive" development (1874) and the "golden age" (1904), there was an increase of almost 94,000 acres of fruit across SWMI. Most of this change (75%) occurred in the SWFB counties, while the non-fruit belt counties lost over 7% of their fruit acreage. [NOTE: 1874 and 1904 are the only early years that have both tree and small fruit data, that is why I changed this text] By 1904, more than nine percent (9.31%) of the improved land in the SWFB was planted in a fairly wide variety of fruits—primarily apples, peaches, and grapes, and secondarily strawberries, pears, plums and cherries. Thus changes in fruit production in southwest Michigan illustrate the efforts during this same period of the Progressive conservation movement {Hays, 1959 #88} to encourage both farmland intensification and site specific planting.[21]

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[20] In 1904 SWMI had 55,384 acres in peaches and by 1974 it was down to 8,068 acres, 96% of which were located in the SWFB and concentrated in Berrien County (54% of Total SWMI peaches).

[21] Apples are hardy relative to other fruits making it possible to commercially grow at least some varieties in less than ideal conditions {Kessler, 1971 #678}. In contrast, grapes are more particular. They require deep, moderately fertile, well drained, soils. {Morton, 1985 #126: 149} Compact, nutrient rich, soils do not encourage

During this period Michigan fruit producers had to respond to increasing tough competition from producers in the Pacific Coast States. Extending the Progressive concern with productive efficiency, the development of the Farm Bureau and Cooperative Extension offices intensified the already-tight relationship between fruit producers and land grant university scientists at Michigan State College. Thus, attention is turned toward alternative strategies including new markets (e.g., processed foods and beverages)[22] {Kessler, 1971 #678}, increasing yield and efficiency, decreasing production costs, and increasing cosmetic appearance.

In response to quality concerns, the recently restructured land grant university system (LGU) focused its efforts on developing scientific, rational, and profitable agricultural techniques and using Cooperative Extension to reach progressive farmers {Rosenberg, 1997 #48}. Entomologists, for instance, brought chemistry to the orchard {cf., \Houck, 1954 #49}; agrichemicals (e.g., lead, arsenic, sulfur) were in full use by 1900. In fact, the plum industry nearly succumbed to the plum curculio. At the time, the only treatment was to shake them from the trees. However, the industry was rescued by the introduction of lead arsenate paste {Kessler, 1971 #678}. In addition, variety testing and long-range breeding programs began to be developed and supported by several new, regional, experiment stations {Kessler, 1971 #678}.

During this time period the fruit industry began to learn how to control nature—the nature of the biophysical environment and well as the nature of socio-political and economic conditions—each of which influenced the distribution of fruits across the landscape. Subsequently, fruit production becomes increasingly concentrated within several counties.

The Agricultural and Great Depressions, 1920-1940

Between the height of the "golden age" (1904) and the end of the "agricultural depression" era (1940), SWMI lost nearly 63,000 acres of fruit. Again, most of this loss was in the non-fruit belt counties. During this period, total acres in southwest Michigan for all fruit crops declined by 29.2 percent. This overall decline was composed of two different trends; while fruit acreage in the southwest Michigan Fruit Belt counties declined only 6.2 percent during this period, fruit acreage in the non-Fruit Belt counties in the region declined by 67.1 percent, effectively continuing the pattern of spatial concentration of fruit production seen in the previous period. *Comment: these figures are 1904-1940; need to correct to 1920-1940* [acreage data is available for berries only between 1904 and 1940 – i.e., there is no way for me to correct these numbers. In 1919 there is only state level acreage – i.e., no county data. What I can tell you is that there was an increase in berry acreage between 1929 and 1940 across SWMI of almost 5,000 acres and 72% of this change was in the SWFB)]. During the Depression Era, overproduction, increased competition, and decreased market prices continued to challenge the southwest Michigan fruit industry. Members of the industry—growers, government agencies, LGU, processors—used

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deep root growth, leaving the vines more susceptible to acute environmental conditions such as flooding or drought.

[22] Commercial processing began in Hillsdale County in 1867 with evaporating and the first regional canning was in 1872 in Van Buren County. Concurrent development of the canning industry was a significant factor in the development of the Michigan fruit industry.

several on-farm strategies to mitigate these challenges, and to keep both the growers farming and the land in production.[23]

According to Rosenberg {, 1997 #48: 141} the LGU saw "all social and economic problems as solvable through the *deus ex machina* of increasing productivity." Rosenberg's argument can be broken down into four main component efforts: to increase quality; to grow for the market, to increase technoscientific use; and to increase orchard efficiency.

1. Increase quality. Continuing from the previous era, the fruit industry concentrated on increasing quality as a way to preserve market share, which often meant increasing applications of heavy metal pesticides. State and federal grades and standards were enacted to force growers to "protect" crops in particular ways (e.g., Michigan Department of Agriculture [MDA] 1929). Cherry growers, for instance, were required to spray their orchards, on particular dates, with lead arsenate to control Cherry Fruit Fly.[24] In 1921 efforts were also put into enforcing the Insect and Plant Disease Act of 1875 by expanding the role of the state Plant Industry Division, which was charged with inspecting nurseries, and later with removal of "nuisance" fruit plants {Kessler, 1971 #34: 123}. Nevertheless, some crops such as pears rapidly declined during this era because of the difficulty controlling fire blight and psylla {Kessler, 1971 #678}.

2. Grow for the market. Due to high market prices, grape planting between 1918 and 1920 markedly increased. Kessler {, 1971 #678:145} states "the sale of grapes for home wine making, because of prohibition, caused additional planting." During the same time, a major juice processor moved into the area. At the market level, at least two approaches were used to increasing quality. First, there were organized efforts, beginning in 1923, to keep immature fruit out of the market {Kessler, 1971 #678}. Second, a shift in varieties grown was encouraged. For instance, the primary plum grown in the 1920s (Damson) was so tart that they were suitable only for processing into jams and jellies. In 1926, the Stanly prune plum was introduced and soon became the dominant variety. At the same time, consumer interest in maraschino cherries during

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[23] Off-farm strategies used to increase sales include 1) deliberate attempts by commodity groups {cf., \Stoll, 1998 #35}, food processors, and nutritionists to encourage increased public fruit consumption {Levenstein, 1988 #79}; and 2) seeking alternative markets (e.g., canned fruit, fruit juice, baby food). For instance, between 1937 and 1940, "most of the apple juice in the United States was produced in Michigan" {Kessler, 1971 #678:119}. As yields and expenses continued to increase, the industry also worked to secure a readily available supply of cheap labor. During WWII, when labor was at critical levels, growers and processors tapped into the federal *bracero* program. As the *bracero* program came to a close in 1964 it was obvious that production changes were necessary to keep yield at the same level {Valdés, 1991 #119;Willson, 1977 #120}.

[24] The Cherry Fruit Fly (CFF) Control Program is a classic example. This program was initially designed to "protect" growers by helping them to benefit from the Food & Drug Administration's (FDA) grading procedures. The outcome was a CFF emergence calendar considered so accurate that the Agricultural Commissioner required authorities—state Agricultural Experiment Station and Department of Agriculture entomologists—to disseminate data through each authorized agency—press, telephone, radio, County Agents, canneries—indicating when growers were to apply pesticides. Furthermore, the Agricultural Marketing Service standards required complete control (e.g., "zero-maggot" law) and regulated control options by requiring Lead Arsenate as the specific mechanism {Beyer, 1970 #80}. Later revisions required growers to treat cherries according to the LGU Spray Calendar {Michigan Department of Agriculture, 1962 #81}. The complete control of a naturally occurring pest, by law, is unique. Brambles, for instance, are permitted up to four maggots per 500 grams of product {Pimentel, 1993, and Shroff 1993}.

the 1930s made it profitable to try growing sweet cherries, a particularly fickle crop; sweets are not only susceptible to frost damage, but also cracking from excessive moisture.

3. Increase use of technoscience. While some commodities (e.g., grains) became highly mechanized during earlier eras, many fruits were found to be too fragile; hand harvesting was required in order to maintain quality. Furthermore, growers had access to a readily available supply of cheap labor. Thus, technological developments consisted primarily of tractors, sprayers, and new pesticides;[25] in addition, existing breeding programs were expanded and many new ones developed. The bluehaven blueberry, for instance, was a mid-size bush developed specifically for southwest Michigan that was easier to pick. The first commercial planting of blueberries was established in 1928, "demonstrating that blueberries are well adapted to thousands of acres of sandy, acid soil, which had until then been considered wasteland"{Kessler, 1971 #678: 146}.[26] Today, land use competition increasingly compromises access to this previously undesirable land.

4. Efficiency in the orchard. At the beginning of the 20th century it was common practice for orchards to have multiple fruit varieties, but efficient orchards require monocultured plantings (e.g., so they ripen at the same time). For example, by the early 1930s, the Montmorency variety of tart cherries was grown almost exclusively (i.e., one variety of one cultivar); this cultivar is still the recommended choice for commercial US production today {Iezzoni, 1988 #53}. In the Peach Ridge Area, peaches were typically interplanted with apples, but as they aged and became unproductive, particularly through the 1930s, the peaches were pushed out and replaced with apples. In addition, the number of apple varieties grown was reduced from nearly two-dozen to only a handful. Thus, harvest became easier to time and to manage

This time period, more than any previously, focused its efforts on marketing. This had several affects on the landscape including the planting of new fruit cultivars, changing cultivar varieties, and the homogenization and standardization of fruit land. At the same time, the pressures of competition from other regions pushed fruit out of less productive areas and into the Fruit Belt counties. Also pressures of insect and disease pests forced greater concentration on those fruits for which the region had a comparative advantage – apples, blueberries, grapes and cherries.

Agricultural Fordism, 1941-1973

Up to the 1940s, increasing fruit production was primarily based on extensive cultivation. Following WWII, the application of capital and technology allowed the industry to use the natural environment maximally {cf., \Stoll, 1998 #35: xiv} with little concern about the impacts of agroindustrialization on the rural countryside.[27] These new practices had several effects on the

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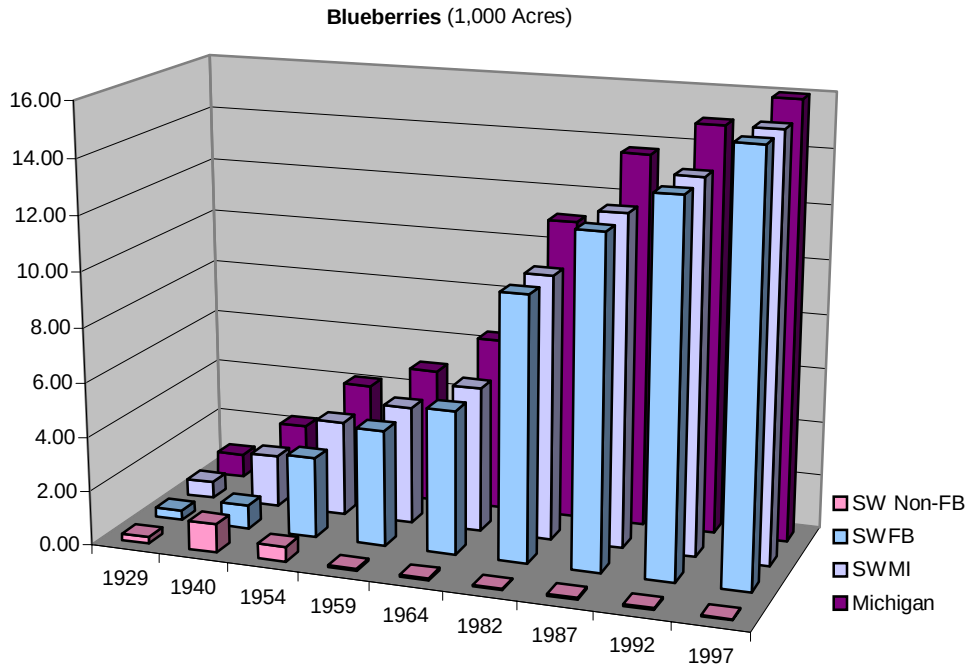
[25] With respect to the tomato harvester, in California, Friedland and Barton {, 1975 #89} argue that – particularly with respect to the Bracero period – labor was sufficiently inexpensive and machinery so costly that it made little economic sense for farmers to push the academy to develop sensitive mechanical means to harvest delicate crops. Further, the tomatoes (and we'd expect, later, with fruit) themselves were modified to – or ripening came to be better understood so that early harvested commodities could – tolerate mechanical harvesting.

[26] Within 25 years there were 3,500 acres of "tame" blueberries being harvested, rising to nearly 15,500 acres by 1997.

[27] While there had been little concern about the environment up to this point, fruit growers have always been

land. On the one hand, it created a visually stunning, uniform landscape, especially around bloom and at harvest. On the other hand, industrialization of the landscape also meant the loss of biodiversity, increased pest problems, and a continuous need for new pesticides and pesticide technologies. These conditions developed as a result of design strategies, pest management practices and new forms of mechanization.

1. Design. Growers changed the landscape with changes in cultivars and cultivation techniques. For instance, commercial blueberry cultivation became important during this time period. They were initially gathered from the wild, now most Michigan blueberry acres are cultivated in the southwest Fruit Belt counties (Figure XYZ). During the Fordist period orchard plantings also came to be "designed," their space calculated, and trees planted for efficiency, technological compatibility, and maximum yield. Research on size controlling rootstocks began in 1937 and they became widely used in the mid to late 1960s (approximate 60 percent of new trees) {Kessler, 1971 #678}. By 1974 dwarfing and semi-dwarfing apple trees allowed growers to increase density from 33 trees per acre during the "golden age" to 109 trees per acre during the Fordist era, which is a change of 232%.



2. Pest management. Following WWII, dichlorodiphenyltrichloroethane (DDT), as well as other broad-spectrum pesticides (e.g., organophosphates) became widely available to fruit growers. They and were immediately accepted and their value and effectiveness unquestioned {cf., \Russell, 1996 #59}. By following the Spray Calendar {e.g., \Mitchell, 1953 #60} and directions

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aware of and discouraged from spraying during bloom when pollinating bees were present {cf., \Eustace, 1911 #82}.

from other "experts" (e.g., chemical company representatives), pest control became a routinized process; pesticides were applied on a regular schedule whether pests were present or not {Perkins, 1982 #61: 260}. At the same time both State and Federal agencies codified grades and standards for quality. For example, formal rules about tart cherries established what processors (i.e., pitters) could receive, purchase, sell {MDA \, 1953 #1169}, can and/or preserve {MDA \, 1960 #1168}, as well as the specifications for what has been pitted {U.S. Department of Agriculture [USDA] \, 1946 [1941] #1172}, canned {USDA \, 1949 #1173}, and frozen {USDA \, 1949 #1177}. Over time wholesalers and retailers reinforced these standards through their preferences for cosmetic appearance and by promoting of the idea that consumers will tolerate nothing less than perfection {Pimentel, 1993 #8:85}. The point, of course, is that these grades and standards left growers with little choice but to attempt to grow perfect fruit with the only means available—agrichemicals—and to continuously intensify their use of such.

3. Mechanization. For several fruit crops, one of the most significant changes was the development and introduction of harvesting equipment. The mechanical cherry harvester (shaker), for instance, was promoted as the "solution" to the labor "problem." However, its use required extensive orchard modification—wider tree rows, special pruning, leveling the ground {Childers, 1975 #65}. It also became necessary to alter the character of the fruit with growth regulators so that they would be ready for simultaneous harvesting.[28] Additional agrichemical applications were necessary to care for the cherries that were inevitably left on the trees,[29] as well as to care for the tree itself. For example, the shaker arm caused bark injury opening an entry point for new pest infestations—lesser peach tree borer (*Synanthedon pictipes* [Grote & Robinson]) and American plum borer (*Euzophera semifuneralis* [Walker]).

While fruit land use in previous time periods focused on industry development (1852-1898), extensive cultivation (1899-1919), and marketing concerns (1920-1940), what stands out in the Fordist period (1941-1973) is the increasing intensity with which the land was used. Industrial, commercial fruit production is synonymous with increasing calculation and control. In fact, contemporary southwest Michigan Fruit Belt growers recount a time in which pests were controlled to the extent that nothing was alive in their orchards—no bugs, no birds, and no grass—just rows and rows of trees on barren soil. By the 1950s the wide scale use of synthetic broad-spectrum agrichemicals began to raise concerns on numerous fronts including pest resistance and secondary outbreaks {Pickett, 1949 #63}.[30]

Agroecological and Profitability Crisis, 1974-1989

Although the fruit growers in the southwest region had their crisis of profitability at the end of the Fordist Era, from the 1970s to the present, the cost/price squeeze and increasing land values

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[28] Ethrel, 2-chloroethanephosphonic acid, was used to develop an abscission layer, separating the cherry from its stem so it could be shaken from the tree {Larson, 1969 #83}.

[29] Since pesticides degrade or are washed off over time, unharvested cherries become a reservoir for new insect generations to lay their eggs, leaving the "larvae to complete their development, pupate in the soil and infest the orchard the following year"{Howitt, 1993 #84: 173}.

[30] A secondary outbreak occurs when a pesticide suppresses the population of a predator or competitor that has been holding in check the population of a potential pest, thus allowing the potential pest to irrupt and become a significant problem.

throughout the Fruit Belt counties in southwest Michigan continued to contribute =to the overall loss of farmland. High capital investment, and delayed return on investment, meant that orchard lands could not be rapidly shifted either between different enterprises or in and out of production.[31] Fruitgrowers who continued to farm used several strategies directly related to land use including enterprise selection, pest management, and risk reduction.

1. Changing crops and/or varieties. Some fruit commodities, (e.g., pears), once strong, faded almost entirely from the landscape during this period. In the case of grapes, however, some growers chose to develop new vineyards and/or change grape varieties. While they were well adapted to the biophysical environment; native grapes (e.g., concords) are valued "about one-fifth that of Vinifera and one-third of French-American varieties" {Baxevanis, 1992. #110: 203}. During the 1980s and early 1990s, *vinifera* acreage increased more than 26 percent statewide {Michigan Department of Agriculture, 1995 #67}.

Figure X. Crop diversity (1900 and 2000).

2. Reducing pest management costs and/or impacts. In the early 1970s, many southwest Michigan apple growers were introduced to integrated pest management (IPM) by the State Cooperative Extension Service and by private crop consultants. The goal was to promote biologically based timing of agrichemical applications that would minimize unnecessary use and maximize effectiveness, thus minimizing environmental burden and maximizing efficiency. Other fruit crops were perceived to be too difficult to manage with alternative techniques; for example, cherries by federal regulation had zero tolerance for fruit fly damage (see above). Thus, most growers continued to rely on a "conventional," routinized, program of pest control. Although the official IPM program succumbed to a lack of institutional support in the mid 1980s, most growers continued to attempt to reduce numbers and rates of pesticide applications, and some growers continued to practice scouting for pests.

Pesticides were once applied by hand, a tree/bush/vine at a time. Following WWII, sprayers were automated, but their application was less exact, emitting the same quantity regardless of plant size or presence. During the 1970s and 1980s, multiple developments in sprayer technology (e.g., electronic eye) greatly increased precision. This precision meant that less product was lost to the air and/or soil. In addition, broad-spectrum pesticides were increasingly replaced with pest specific substances. Growers interviewed during the 1990s remarked that there were more living organisms on their farm(s) at that time than they had ever seen in their lifetime.

3. Reducing risks from "natural" hazards. Prior to the Post-Fordist era, the biophysical environment was highly managed and manipulated. Practices such as windrows, tile drainage, smudge pots, and wind machines were already in use by the 1970s. However, cultural practices such as fertilization, tree bark painting (i.e., to reflect winter sun away from tree trunks) and

[31] Production costs are particularly high for fruit growers. For example, current blueberry production requires specific land (e.g., acidic soils), irrigation (e.g., moisture, frost protection), aerial spraying (e.g., pest management for waterlogged lowlands), regular pruning (i.e., increase berry size) and planting (e.g., $2,500/acre), and contracted mechanical harvesting (e.g., labor) {U.S. Department of Agriculture 1999}. Growers must also plan for delayed productivity (e.g., first crop in year 3, full crop in years 8 to 12) and highly variable yields (e.g., frequent loss from spring frosts).

slope alteration (e.g., to increase growing season sun exposure and/or air drainage) continued to increase the intensity with which the land was used. For example, up until this period, all plant material was removed from the orchard/vineyard/field floor to reduce competition for water and/or nutrients. For most crops this practice ended when the use of herbicides and irrigation became feasible. Today, various grasses are typically used to cover the soil between the rows, both to conserve moisture and to provide habitat for pest predators. From 1974 to 1997, the acreage of fruit land in the southwest Michigan region under irrigation increased 44.2 percent from 6,462 acres to 9,318 acres.

Globalization, 1990-present

During the current epoch, land in agricultural production has continued to decline across the region. Another 17 percent of the land in fruit production in southwest Michigan was converted to non-fruit agriculture or to non-agricultural uses between 1974 and 1997. The spatial distribution of this decrease in fruit acreage further concentrated fruit production in the Fruit Belt counties. Since 1940 the non-Fruit Belt counties in southwest Michigan have lost more than 91 percent of their fruit farm land, while the Fruit Belt counties in the southwest region lost only 43 percent of their fruit acreage; these two components together imply that fruit acreage in the region as a whole declined 61 percent from 1974 to 1997. Today, the region has approximately 94,000 fruit acres, which is most highly concentrated in Berrien (19,768 acres) and Van Buren[32] (22,259 acres) counties {Michigan Agricultural Statistics Service, 2001 #68}. To continue production, growers are, again, faced with increasing size and/or efficiency, changing crops, and/or finding niches. The competition for land in fruit production is particularly fierce because the same attributes that make land good for fruit production (slope, proximity to Lake Michigan) also mean that the land offers scenic vistas that are highly desired for exurban residences. Anecdotal evidence suggests that in response to these pressures, some growers have reoriented their production away from commodities for processing and toward the higher value fresh market. Therefore, requirements for cosmetic appearance, and hence for pest management, are intensified.

1. Pest management. Nearly every grower in the region is believed to currently use at least some aspect of IPM, but the extent to which they have adopted these techniques is unclear. Furthermore, the adoption of IPM has in some cases meant the application of additional pesticides; several growers stated that monitoring and scouting found previously unobserved pests that required treatment. Furthermore, alternative methods are incompatible with some practices and their pest issues. For instance, as noted under the Fordist period above, apple density increased from approximately 32 trees per acre in the 1880s to 140 per acre in the 1990s with the highest density orchards having more than 500 trees/acre. As density increases, pests spread more rapidly and are more difficult to treat. In 2000, the fireblight bacterium (*Erwinia amylovora*) killed nearly 400,000 trees in southwest Michigan {Longstroth, 2002 #69}. Control was compromised both by planting dwarfing varieties that are more susceptible and by planting them closer together which decreased spray penetration and facilitated the rapid spread of the disease.

[32] Blueberries and grapes are the only fruit crops in which acreage is increasing and much of this production is in Van Buren County.

Figure X. High Density Apple Orchard.

2. Population and sprawl. Regional newcomers are especially concerned about pesticide residues and environmental contamination; their concerns are heightened by the federally mandated roadside warning signs that indicate the location of recent agrichemical applications. At the same time, it should be noted that these concerns are not unwarranted. Contaminated soils from heavy metal use (e.g., lead, arsenic) have been found in similar regions across the country {cf., \Jones, 2003 #70}. The rapid expansion of the urban, suburban and exurban populations during this period exacerbated conflicts.Because good fruit land is attractive for rural residences for the reasons noted above, the population in southwest Michigan Fruit Belt counties increased 27 percent between 1980 and 2000 in contrast to only an eight percent increase in the non Fruit Belt counties in the region. The proximity of these new rural residents to the agricultural operations, the traffic congestion, and new community mandates have altered the rural social landscape. Long term residents, both farm and non-farm families, perceive increasing tourism and urban sprawl as the most problematic land use changes. They feel that these newcomers, who are unfamiliar with typical farming practices, change the tone of local politics and increase conflict (e.g., over zoning rules). Nevertheless, the visual imagery of the landscape has had and does have an impact on tourism and responses to sprawl (i.e., farmland conservation and preservation). At the state level, Michigan allows farmland owners to place their farmland in a program that indemnifies them against property tax increases for as many as 20 years. Although it has not yet happened in the southwest region, several counties near the region have implemented programs to purchase development rights from farmland owners. Both of these efforts have the effect of freezing in place a particular relationship between land in farms and the off-farm biophysical environment.

Figure X. Population density across SWMI, SW non-fruit belt, SWFB.

The state has also attempted to interpose its authority between farm operators and non-farm rural residents in conflicts over the off-farm impacts of farming practices. For each major agricultural enterprise in Michigan, the state government has established Generally Acceptable Agricultural Management Practices (GAAMPS), which establish minimal standards that farming practices must meet or exceed in order not to be considered an actionable nuisance under law. The establishment of GAAMPS has made it difficult for rural residents to seek redress for pesticide spray drift or odors from animal operations (the two most frequent complaints {Gunter, 1999 #152}). Again, the GAAMPS program has had the effect of cementing in place a particular relationship between agriculture and the surrounding biophysical environment.

3. "Nature" and "ruralness." The viewscape is how the new residents come to know the agroecological environment and it is reflected in their values and attitudes {cf., \Redclift, 1994 #72}. Their notions of agriculture paradoxically tend to center around an image of "nature" that is constructed as rolling hills with blooming fruit trees. Moreover, the fruit itself has been iconized over time and space. It is a symbol of agriculture and its production the definition of "ruralness". Thus, land use is built on a socially constructed definition of "nature" that does not include the messiness of industrialized agriculture. On the one hand, new rural residents construct nature as "agriculture"; on the other hand, they construct agriculture as "nature" – thus the paradox. In essence, both the "natural" environment and farming become little more than illusions, and the legacy of was agriculture is preserved in the names of roads, subdivisions, and

shopping centers {cf., \Thompson, 2000 #73}, while seasonal events become nothing more than an economic development tool for the non-agricultural community {Aronoff, 1993 #154}. For example, blossom festivals were initially used to request divine intervention (e.g., prevent pest damage, ensure yield), but are now agritainment (e.g., parades, carnival rides) complete with the naming of queens, courts, and kings' men.

At the same time these notions are reinforced by the fruit industry itself and codified by government agencies.[33] The biophysical characteristics of the landscape, for instance, are used to promote local products to tourists such wine labeled "Lake Michigan Shore." The Michigan industry wine has come to rely heavily on tourists; they account for up to 95 percent of the overall business (MGWIC), and much of the tourist trade is to repeat customers.

Figure X. Direct marketing of fruit products.

4. Niche markets. In addition to reorienting production, some growers have also sought to capture niche markets — agritainment (e.g., u-pick, corn-mazes, hayrides), value-added (e.g., branded pies and jams) and direct sales (e.g., farmers markets, roadsides stands) {Cantrell, 2002 #74}. The presence of consumers in and around their orchards/vineyards/fields, again, increases concentration on the appearance not only of the fruit, but also of the farm {cf., \Busch, 1996 #75}. For example, the planting of seasonal grasses in orchards that was recommended during the 1980s and 1990s as a technique to manage pests (see above) is discontinued so that consumers can see a pristine orchard. Thus, orchard level pest/predator manipulation is sacrificed for "beauty."[34]

ANIMAL COMMODITIES

19th Century Extensive Development, 1837-1898

During the whole of the 19th century, despite the fact that animal production grew markedly, the vast majority of livestock products were produced on-farm in small numbers. Chicken, hog, sheep, and dairy production remained ubiquitous and unconcentrated.

Draft animals provided the principal source of traction on the farms of southwest Michigan in this period, and a significant portion of transportation of commodities and goods, both in rural areas and in urban areas. *During this period, the number of horses on farms in the region rose from x to y, increasing from a to b per farm (see figure a).* The breeding of horses was important, both to replenish the farm stock and to supply non-farm uses. The increasing production of small grains and hay, noted above, fed both the farm animals and the non-farm animals.

Figure A: Horses

[33] For instance, the territory of an American Viticultural Area (AVA) must be identifiable on a U.S. Geological Survey map (i.e., bounded by features of the landscape such as rivers and cities) and have at least 20 fewer frost-free days {Bureau of Alcohol, 2003 #86}.

[34] As noted above, some pest/predator relationships can be manipulated by the planting and timed mowing of specific ground covers. During some parts of the season the grasses will be quite long and, to some, unsightly.

The number of hogs quintupled during this period (see figure b), as the farms of the region supplied fresh pork, cured ham and bacon, and lard for baking to the growing urban population noted above. Initially hogs were allowed to graze freely in the woodlands, and later were allowed to root freely in fields of root crops (mangels, rutabagas) planted for that purpose. Slaughter and curing were done either on the farm or by commercial butchers.

Figure B: Hogs

The number of milk cows quadrupled during this period (see figure c), as the farms of the region supplied dairy products to a growing urban population. Milk was sold raw, and butter and cheese were produced on the farms. The growth in other cattle tracked the number of milk cows almost perfectly (see figure c) as male calves were raised for beef. Slaughtering was done locally, either on the farm or by commercial butchers, and hides were processed into leather. Cattle were fed largely on pasture and with hay during the winter. The number of dairy and beef cattle on a farm determined the size of barn necessary to hold the hay to sustain the animals through the winter.

Figure C: Milch Cows

During this period the number of sheep on farms in the region almost quadrupled (see figure d), but the number of farms on which sheep were raised increased only slightly. Sheep were raised both for wool, which was spun in the household, and for meat, which was slaughtered on farm. Sheep grazed either on pasture or on unimproved land, and were fed hay during the winter.

Figure D: Sheep

Poultry, including chickens, ducks, geese and turkeys, provided both eggs and meat for farm consumption and for sale in the rural towns and the urban centers. Although most poultry ranged freely in the barnyard and farm pond, the food they could obtain on their own was supplemented with various grain mixtures.

The animal agriculture of this period in southwest Michigan could be characterized as petty commodity production – a balanced mixture of self-provisioning and production for largely local markets, relying primarily on family/household labor with perhaps some small amount of full-time, long-term hired labor. The animals and animal products that were sold supplied the non-farm residents of towns and cities in the region; however even in 1880 the urban population of southwest Michigan was less than xx percent of the total population.

As noted above, horses, milk and beef cows, and sheep all relied on extensive areas of grass pasture for grazing, and extensive areas of hay for additional feeding. Thus, by 1880, the total herd of xx animal units was inducing the creation of yy acres of grassland, meadows, pastures and hay fields. This area supported populations of arthropods, birds and small mammals. At the same time, the grazing animals deposited manure in the fields very slowly and gradually, recycling the nutrients extracted by small grain production. These amber waves of grain supported bird populations much larger than had existed before the clearing and planting of the

land. {Neumann, 1985 #115} The manure from poultry, from swine when they were penned, and from horses and cattle when they were kept near the barn in the winter was spread on the croplands to replenish the fertility of the soil; because all of the animals' feed had come from the cropland, this did not cause problems of excessive phosphorus or nitrogen.

By the end of the 19th century, the landscape of southwest Michigan had been significantly altered. Almost all of the prairies had been converted to cultivated land. Most of the wetlands had been drained in order to produce hay or cash grains. More than half of the deciduous forest had been cut and replaced with pasture or cropland. These changes in the landscape created niches for exotic livestock and poultry. For example, horses both provided the draft power that produced the changes in the landscape, and consumed the hay and grains which the altered landscape produced. This altered landscape provided supportive habitat for various small and large mammals, birds and arthropods, and for insect and microbial pest species.

The Golden Age, 1899-1919

In process

The Agricultural and Great Depressions, 1920-1940

In process

Agricultural Fordism, 1941-1973

In process

During this period animal enterprises became both operationally and spatially concentrated. While the number of chickens raised in the region declined by almost 60 percent, chickens in Allegan and Ottawa Counties increased by 50 percent. Again, on the one hand, this removed animal enterprises and their recycled manure from many farms; on the other hand, this produced a concentration of manure in a few locations which did not have sufficient land to incorporate the manure without negative environmental impacts.

Agroecological and Profitability Crisis, 1974-1989

In process

Globalization, 1990-present

In process

COMMODITY SUMMARY

19th Century Extensive Development, 1837-1898

Not addressed in earlier draft

The Golden Age, 1899-1919

In process

The Agricultural and Great Depressions, 1920-1940

During this period the steep decline in the use of animals for draught power led to declines in the use of farmland for pasture and hay and small grains. These land uses were replaced by annual crops, especially corn and incipiently soybeans. These changes in land use implied more tillage (for annual crops) and more cultivation (for row crops), and thus more compaction of the soil and soil erosion. The shift to cultivated annual crops meant that less carbon was being sequestered by agriculture, and that greenhouse gases were increasing. The greater use of tractors and combines meant that more greenhouse gases were being produced because internal combustion engines have greater flatulence than horses and other beasts of burden. The shift to combines for harvesting meant that less grain was being scattered in the fields for birds and other animals. The increasing spatial concentration of monocultures of grain and fruit led to more problems with insect and disease pests. The increased importance of cosmetic standards and legal regulations led to more spraying of heavy metal pesticides. At the same time, mechanical sprayers caused greater off-target deposition, and thus greater impacts on off-target species.

Agricultural Fordism, 1941-1973

More than any other, the post-World War II period marks the industrialization of southwest Michigan agriculture. By the end of this period animal draught power was almost entirely gone, replaced by internal combustion engines. Tillage and cultivation were intensively practiced, leading to soil compaction and soil erosion. Less than half of the farms in the region included animal enterprises, so fertilization was increasingly in the form of synthetic nitrogen and mineral phosphates and potash, which resulted in increased runoff to surface waters and leaching to ground waters. These in turn increased the eutrophication of the lakes and rivers of the region. Pest management relied on persistent, broad-spectrum insecticides that generated pest resistance and secondary outbreaks, and that negatively impacted non-target species of birds and fish. These various negative impacts set the stage for the environmental backlash against agriculture in the following period.

Agroecological and Profitability Crisis, 1974-1989

In process

Globalization, 1990-present

Not addressed in earlier draft

CONCLUSION

In process

Fruit time periods

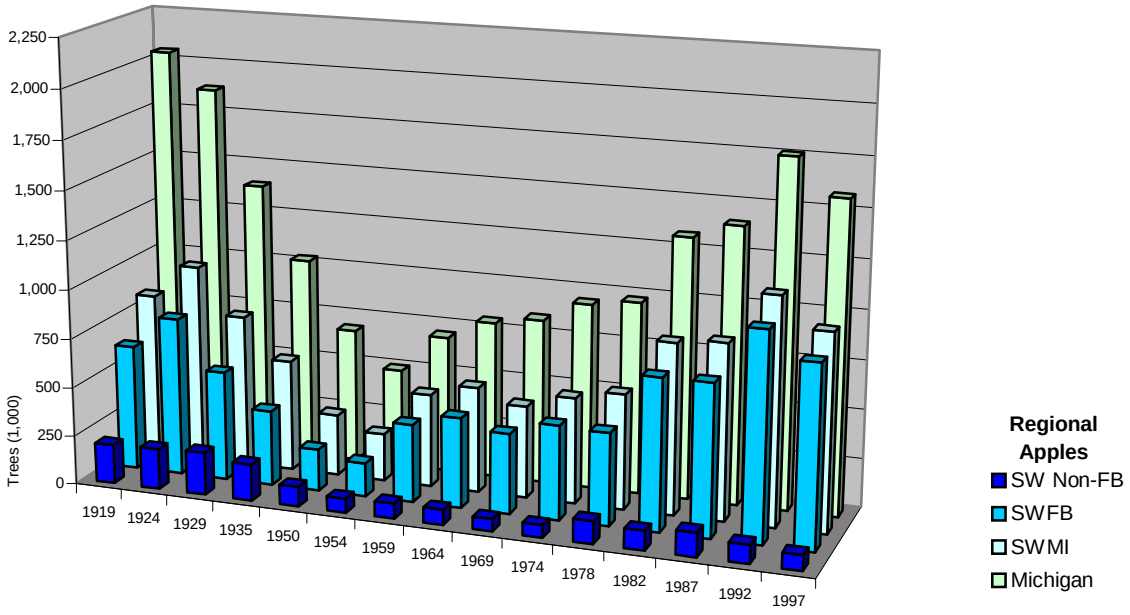
1. **1852-1898: industry development**
2. **1899-1919: extensive cultivation**
3. **1920-1940: marketing**
4. **1941-1973: intensity**
5. **1974-1989: risk reduction**
6. **1990-present: competition & conflict**

Since settlement, grain production has been one of the most significant parts of agriculture in southwest Michigan. During the first era, the ecological suitability of the region due to ease of transportation and the availability of small open prairies helped both to draw settlers and to orient them to grain production. As agriculture expanded, settlers altered the landscape by cutting down trees and draining wetlands. Expanding national (new uses) and international (new users) demand led to increasing intensification of production until finally soil erosion, pest infestations, aquifer reduction, and other environmental limits were felt. Technological and institutional developments overcame some of these environmental limits as grain production became defined by machines, chemicals, and hybrids. Again, however, environmental degradation resulted from these new technologies and farmers were forced to alter production practices to incorporate practices such as crop rotation and reduced tillage. Finally, encroachment at a global scale through technologies such as biotechnology and locally through exurbanization has once again altered grain production. This tension has both created new opportunities for grain production and placed new constraints on decision-making by farmers. Inevitably, these new opportunities and constraints have once again altered and recreated the ecological landscape on which the corn, wheat, soybeans, and other crops are grown.

Appendix I: Precipitation

Appendix II: Sprawl

Appendix III: Non-Bearing Apple Trees



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