One-hundred years of change in Missoula neighborhoods

Jennifer E. Sutton

The University of Montana
The University of  
Montana

Permission is granted by the author to reproduce this material in its entirety, provided that this material is used for scholarly purposes and is properly cited in published works and reports.

**Please check "Yes" or "No" and provide signature**

Yes, I grant permission  

No, I do not grant permission  

Author's Signature:  

Date: 4/26/04

Any copying for commercial purposes or financial gain may be undertaken only with the author's explicit consent.
One-Hundred Years of Change in Missoula Neighborhoods

A Professional Paper for the Missoula Office of Planning and Grants

by

Jennifer E. Sutton

B.A. Mount Holyoke College, 1997

presented in partial fulfillment of the requirements

for the degree of

Master of Science

The University of Montana

March 2004

Approved by:

Chairperson

Dean, Graduate School

Date 4-27-04
One-Hundred Years of Change in Missoula Neighborhoods.

Adviser: Len Broberg

This professional paper was completed for the Missoula Office of Planning and Grants (OPG). The OPG is interested in the rate of growth and patterns of development of different Missoula neighborhoods. Neighborhoods chosen for study are the Southside, Northside, Lower Rattlesnake, University, Belleview, and Orchard Homes neighborhoods. Historic Sanborn Maps and recent aerial photos were imported into ArcMap, and then the structures that appeared on the paper maps were traced, designated dwelling or non-dwellings, and their surface area, or coverage, was measured. Neighborhood surface area was also measured. Using this surface area data, block and total neighborhood coverage, for both dwelling and non-dwellings, were calculated in percentages. Using the same surface area data, growth rates for dwellings and non-dwellings were calculated by block and for the neighborhood as a whole.

Results were shown in bar and line graphs, adjacent to ArcMap snapshots of the neighborhood development for context. All neighborhoods grew very fast during the first and second time-interval. Growth rates for all neighborhoods declined between 1951-1958. The Southside neighborhood led all other neighborhoods in percent coverage for the duration of the study; in 1997, the Southside neighborhood was 37.18% covered in buildings. The Orchard Homes neighborhood has the least amount of coverage out of all the neighborhoods. Conversely, Orchard Home had the highest growth rate for the interval of 1973-1997 with 321% growth.

Building footprints and density have implications for planning, transportation, and the environment. The results of this project will be primarily used in public meetings, to help disseminate information to residents to help them understand the many different factors that planners must access when evaluating development.

Comparing growth of other neighborhoods over similar time intervals helps to put the phenomenon of development in the Orchard Homes neighborhood in context. The neighborhood is no longer semi-rural; it is a city neighborhood absorbing it’s share of a growing population.
# TABLE OF CONTENTS

List of Tables ................................................................. iv

List of Figures ................................................................. v

I  Introduction ................................................................. 1

II  Methods ................................................................. 11

III  Results ............................................................. 26

IV  Discussion ......................................................... 52

V  Conclusion ....................................................... 73

VI  Bibliography ..................................................... 80
LIST OF TABLES

Table 1  Percentage Neighborhood Coverage, by Year  39
Table 2  Neighborhood Growth Rates, by Year  50
Table 3  Neighborhood growth comparable to Orchard Homes growth, 1973-1997  63
| Figure 1 | Sanborn Index Map for Missoula, 1912. | 12 |
| Figure 2 | Sanborn Map layer aligned with City road and parcel layers after georeferencing. | 14 |
| Figure 3 | Polygons of the University neighborhood after conversion from graphic to shape file. | 16 |
| Figure 4 | Layout of numbered blocks for Belleview neighborhood. | 19 |
| Figure 5 | Layout of numbered blocks for Orchard Homes neighborhood. | 19 |
| Figure 6 | Layout of numbered blocks for Lower Rattlesnake neighborhood. | 19 |
| Figure 7 | Layout of numbered blocks for University neighborhood. | 19 |
| Figure 8 | Layout of numbered blocks for Northside neighborhood. | 20 |
| Figure 9 | Layout of numbered blocks for Southside neighborhood. | 20 |
| Figure 10 | Structural area and graphs of percent coverage by block and neighborhood total, shown for each interval. | 26-37 |
| Figure 11 | Percentage Neighborhood Coverage, by Year. | 38 |
| Figure 12 | Percentage Neighborhood Dwelling and Non-dwelling Coverage, by Year. | 38 |
| Figure 13 | Neighborhood growth rate for each time interval | 40-49 |
| Figure 14 | Neighborhood Growth Rates, by Year. | 50 |
I INTRODUCTION

Utopianism is an important antidote to the siren of incremental environmentalism, or a step-by-step, fix-up approach to our environmental crisis which will ensure that much time is wasted while the most critical issues are postponed indefinitely. The obligation of the Utopian planner is to present an integrated and coherent plan of how society might organize itself to meet a specific goal or goals; in this context an important goal is to devise an urban system which has a fairly benign impact on its supportive environment or ecological niche. Not only must the Utopian planner specify how this benign city would operate; he or she must also try to explain how we might get from here to there, what we might call 'managing the transition' (White 1994).

This professional paper is a project conceived by the Missoula Office of Planning and Grants (OPG) to investigate how different neighborhoods in Missoula have developed over time. Specifically, I will look at how six 40-acre neighborhood sample sites built out or filled in; the purpose is to answer the questions of when, where, and how much build out occurred in those neighborhoods. At first one might wonder why planners would take the time to look backwards at development when there are so many planning issues in need of attention now and in the near future. This project was conceived by the OPG as a visual and quantitative tool to show citizens how neighborhoods have built out over time, growing with the city.

This project complements the efforts being made nationwide to identify desirable and undesirable neighborhood characteristics and then promote or discourage those characteristics through planning policy. There aren’t many people in America who would say they like suburban sprawl in their communities, but at an individual project level basis, many citizens wouldn’t be able to recognize sprawl. Yet, sprawl is what happens de facto when there is an absence of guiding and restricting regulations and policies on development.

It is in the construction of these guiding and restrictive policies that the information disseminated from this project will become useful. This project assesses
how growth happened in the past in order to put current and future development in perspective. Missoula, and northwestern Montana as a region, have both grown exponentially in the last ten years, and tension exists over how the region has absorbed that growth. How has Missoula absorbed growth in the past? Is there a normal growth pattern that can be discerned from past development? If a “normal” neighborhood can be discerned, can future development seek to imitate it?

The U.S. Census is an oft-used tool for examining demographic growth and change. This project differs from projects that can be done using census information by focusing on changes on the land, not the people, through evaluation of the presence and size of buildings as an indicator of growth. Although much attention has been paid to the dramatic increase in population of Western Montana between the 1990 and 2000, there are many myths about how this population increase has translated into real changes on the ground. One can look around the area and notice cranes and construction sites, and grumble about the backups forming on Reserve Street, but there hasn’t been an analysis on number of building permits issued. Yet where and how many are the questions that need to be answered about the number of houses as Missoula confronts population growth and a topography that exacerbates air pollution.

The creation of new housing units, especially affordable housing units, is a difficult topic for planners and residents to tackle. Although housing development can be guided through the planning process, the real estate market and interest rates play a major role in what gets built where. There are many aspects to the field of housing. The major ones are: physical, economic, social, and environmental. These major aspects of housing

---

1 Missoula County: 13.5%; Ravalli County: 43.2%; Lake County: 23%; Flathead County: 22.9%. Source: US Census website, www.census.gov.
are all closely interrelated. When we plan for housing, as a part of the physical environment, we may be making substantial impacts on local social, economic, and environmental conditions (Anderson 2000). Although this project is narrowly focused on the amount of surface area taken up by structures in Missoula, the results can contribute to the ongoing discussion of the economic, social, and environmental implications of growth in the region.

**Planning in Missoula**

The Missoula city and county governments have both recently updated their long-range planning policy documents. The Missoula County Growth Policy was adopted in August of 2002 and the Missoula Urban Comprehensive Plan was adopted in 1998. State law designates zoning ordinances and subdivision regulations as the primary regulatory tools in Montana for advancing the goals of policy documents. A process entitled “Growth Management Phase 1” proposed revisions to both City and County regulations, in order to fully address issues identified in a Themes Document, and appendix to the Missoula Urban Comprehensive Plan, 1998 Update\(^2\). In March 1999, the City zoning and subdivision regulations were amended and adopted by the City Council. In December 2000, the County subdivision regulations were amended and adopted by the Board of County Commissioners as part of Growth Management Phase 1.

Growth Management Phase 2 proposes revisions to the Missoula City Zoning Ordinance, and does not amend any County regulations. The purpose of Growth Management Phase 2 is to develop additional tools to implement the goals and objectives of the Themes Document and the 1998 Urban Comprehensive Plan Update, and to

---

modernize and improve the City zoning ordinance\textsuperscript{3}. Density bonuses, the award of additional lots/density for meeting certain subdivision design criteria, were implemented in the 1998 Urban Comprehensive Plan Update, and have had mixed reviews from the Missoula community. Phase 2 may help to fine-tune the density bonus policy or address design review for development. Although not all infill is a result of density bonuses, design review is a permanent complaint by opponents to infill\textsuperscript{4}. In Planning the Built Environment, Anderson (2000, p 167) outlines the importance of thoughtful density regulations. “For those in urban design, it will be found that residential density is perhaps the most important factor known that sets the basic character of a residential area.”

**Growth and the Environment**

There are four main actors involved in the growth debate in Missoula—developers, elected officials, residents, and planners; all involved acknowledge that the region’s population will continue to grow. The Montana Department of Commerce estimates that Missoula County’s population will increase by 31.6% to 126,040 between 2000 and 2020, which amounts to an average annual growth rate of 1.6% per year\textsuperscript{5}. But there is definitely a tension among these actors about where the growth should occur. No one wants traffic on Reserve Street or Malfunction Junction to get any worse\textsuperscript{6}. At the same time, residents don’t want their own neighborhoods to become denser in order to prevent sprawl development on the edge of town. Compounding these smart growth issues are environmental issues that are localized here in Missoula.

\textsuperscript{3} Source: Growth Management Phase 2 Summary, Office of Planning and Grants website, www.co.missoula.mt.us/OPG/opgweb.

\textsuperscript{4} Infill is building within already developed land that is served by sewer, water, and other facilities.

\textsuperscript{5} Source: Missoula County Growth Policy, adopted August 2002.

\textsuperscript{6} In fact, congestion in Missoula must get better in order for Missoula to get redesignated from "Non-Attainment" for PM10 (particulate matter) and CO (carbon monoxide) to "Maintenance" for those two pollutants. Source: Missoula City-County Health Department, Environmental Health Division website, www.co.missoula.mt.us/EnvHealth/AirQ/redesignationindex.html
The tension between development and the environment is not a new topic in planning literature. McLoughlin made the connection back in 1969. "All this [great human effect on natural systems] may seem somewhat removed from the day-to-day problems of housing developments, parking, open spaces, the location of industry or the renewal of shopping centers. Quite the reverse is true." The negative effects that result from haphazard planning run the gamut of environmental issues. Fragmentary urban development, for example, may reduce the productivity of agricultural lands; degrade, isolate, or shrink habitat patches; degrade the scenic beauty of open spaces; or encourage long, polluting commutes (Platt 2004).

The topography of the valley makes the area susceptible to winter air inversions that trap pollutants in the valley. The Missoula airshed suffers from non-attainment status for particulate matter and carbon monoxide under the National Ambient Air Quality Standards. In addition to air quality, water quality is another environmental issue that is considered when planning for growth.

Missoula is lucky to be the home of the confluence of the Bitterroot and Clark Fork rivers, both of which are valued for a number of recreational uses: fishing, boating and floating, and bird watching just to name a few. The complexity of quantifying the effect of development on water quality is reflected in the quote below, taken from a U.S. Geological Survey Fact Sheet.

The relation of stormwater runoff and reduced ground-water recharge is complex because the surface-water system is coupled to the underlying ground-water system. In many cases there is movement of water from one system to the other that varies seasonally or daily depending on changing conditions. Therefore, it is difficult to reliably determine the effects of urbanization on stream baseflow and spring flows without rigorous investigation. Moreover, mitigating adverse effects after development has occurred can be expensive and administratively difficult. Overlying these
concerns are issues such as stewardship of the resource, the rights of the public, and land owners' rights – both of those developing their land those whose land is affected by this development (USGS 2001).

Related to environmental implications for planning are public health concerns. Planning has gotten attention from mainstream media as of late as a factor of increased obesity among Americans. The design of a community’s built environment influences the physical and mental health of its residents. The Center for Disease Control recognized the link between planning and public health in a May of 2002 workshop to develop a research agenda to study the nexus of physical activity and transportation choices, schools and children, injury, impact of persons with disability, air and water quality, mental health, social capital and environmental justice (Dannenberg, et al. 2003). Although the negative effects of a sedentary lifestyle in an auto-based economy have been well documented, greater awareness has not resulted in society-wide behavior changes. Planning could possibly succeed in changing behavior, such as transportation choices, where awareness has not.

Planning for a Better Missoula?
A healthy community protects and improves the quality of life for its citizens, promotes healthy behaviors and minimizes hazards for its residents, and preserves the natural environment (Dannenberg, et al. 2003). The planning policy documents currently in use acknowledge each of those issues, and are helping to guide development. The public health aspect of planning is supported by density promotion policies.

The planning debate in Missoula has, at times, reached a fevered pitch, complete with extreme rhetoric and name-calling. The emotion that has defined this ongoing discussion is understandable to a certain extent; homes and property are close to people’s hearts. Much of the hype comes from misunderstanding the power and limits of planning
tools and the myriad of ordinance and regulation layers that govern property. Since the OPG staff fulfills the definition of ‘public servant’, maintaining and nourishing communication with the public is an important aspiration of the OPG.

Technology has transformed the field of planning, and made it easier to disseminate information to the public. This project embodies this advancement by taking paper maps and digitizing them, making them compatible with other Missoula geographic information. New approaches to the planning and management of urban regions, such as sustainable development and smart growth, will depend upon improvements in our knowledge of the causes, chronology, and impacts of the process of urbanization and its driving forces. Given the long research tradition in the fields of urban geography and urban modeling, new sources of spatial data and innovative techniques offer the potential to significantly improve the analysis, understanding, representation and modeling of urban dynamics (Herold, et al. 2002).

The concept of the neighborhood has become more popular as a geographic unit to be studied with the advent of smart growth and new urbanism⁷ schools of planning. Defining a neighborhood can use geographic, social, or stylistic criteria. The idea that a neighborhood is walkable also is common among planners and academics, “a common sense limit as the area one can easily walk over.” (Galster 2001). Walkability was a factor in determining the size of my sample sites; my neighborhoods are 40-acre squares, each side measuring 0.25 miles. Galster’s definition of a neighborhood seems to complement the purposes of this project, “Neighborhood is the bundle of spatially based

---

⁷ The New Urbanism school of thought within the field of planning emphasizes urban features -- compactness, walkability, mixed use -- and promotes a nostalgic architectural style reminiscent of the traditional urban neighborhood. The movement has links to the anti-sprawl, smart growth movement. Source: The American Planning Association website, www.planning.org.
attributes associated with clusters of residences, sometimes in conjunction with other land uses.”

Urban development is a complex dynamic process involving various actors with different patterns of behavior. Modelling urban development patterns is a prerequisite to understanding the process (Cheng & Masser 2002). The OPG wants the public to understand the process and patterns; that is why this project was undertaken. Historical maps and aerial photos are crucial to ascertaining any long-term development patterns. Sanborn maps are one such tool for examining the evolution of growth.

**What are Sanborn Maps?**

Sanborn Maps contain an amazing amount of information useful for examining historic patterns of development. Founded in 1867 by D.A. Sanborn, the Sanborn Map Company was the primary American publisher of fire maps throughout the major period of westward expansion. Streets are named. Structures are labeled dwellings, woodshed, hen house, garage, lumber mill, etc. Porches are distinguished. There are symbols to indicate building materials, chimneys, wells, and other features that would be helpful for evaluating a building’s vulnerability to fire. Since the fire maps were made to insure buildings, the company only mapped parts of towns or counties where structures existed. Although the Sanborn Maps may have missed a structure here or there, this project assumes that the Sanborn Maps, which vary between seven and thirty year intervals, provide an accurate picture of where, what, and how big for the Missoula built environment.

The Sanborn Map Company mapped Missoula in 1884, 1891, 1902, 1912, 1921, 1951, and 1958. These historic maps have been available for free in Acrobat PDF format for all counties/regions in the state of Montana, and the website can be accessed from the
OPG homepage. The maps are also available at the Mansfield Library at the University of Montana. For each year, there is a map on a single page that shows the whole area covered by that year. For Missoula, this index map shows the city as it exists in that year. There are map numbers placed over sections of the map where there are structures; the map numbers indicate which maps show the detail of those areas.

Using historical fire insurance maps created by the Sanborn Map Company, aerial photos, and geographic information software, I created a visual aide and quantitative tool that investigates the pace of growth in six sample neighborhoods in Missoula. Although “growth” has many meanings, for the purposes of this project it refers to structural growth of neighborhoods, houses and their accessory structures that popped up gradually and in spurts. The neighborhoods were chosen with variety of age and geographic location in mind. The neighborhoods chosen were:

- **Southside**, located just west of Orange Street, almost to Ash Street, between 3rd Street and a little south of 6th Street.
- **Northside**, located between Worden Street and Dickens Street, Cooley Street, and the Railroad tracks.
- **Lower Rattlesnake**, sandwiched in between Van Buren Street, Mount Jumbo, Elm and Vine Streets.
- **University**, located between Helen and Gerald Avenues, Connell Avenue and south almost to Keith Avenue.
- **Orchard Homes**, located just east of Reserve Street near the river. Specifically, the sample site is located between Curtis and Davis Streets, River Road and south almost to Wyoming Street. It is within a larger neighborhood known as the River Road/Emma Dickinson neighborhood.
- **Belleview**, located just east of where Brooks Street intersects Reserve Street, and just north or 39th Street. Paxon Street is the sample site’s western border, and Charlott Avenue is the site’s northern border.

The Southside sample makes the first appearance, showing up in the 1891 Sanborn Maps. Both the Northside and Lower Rattlesnake neighborhoods appear for the first time in the 1902 Sanborn Maps, and the University neighborhood shows up for the
first time in the 1912 Sanborn Maps. Both the Bellevue and Orchard Homes
neighborhoods are not mapped by the Sanborn Map Company, therefore, the information
on neighborhood development we have for those neighborhoods comes from the 1973
and 1997 aerial photos. Dwellings and non-dwelling structures were delineated in
ArcMap, and neighborhood coverage percentages and growth rates were calculated and
compared between the neighborhoods.
II METHODS

Roots in the Neighborhood Sampler
This project evolved from the work that David Gray started with the Neighborhood Sampler, a project of the Office of Planning and Grants (OPG) that can be found at http://www.ci.missoula.mt.us/ogp/neighborhoodsampler/sampler.htm. The Sampler provides ten-acre snapshots of twenty-two different neighborhoods throughout the Missoula area. Neighborhood information such as current density, allowed density, setback distances, age, and housing type helps to describe neighborhoods to the public in a way that calls attention to the types of details considered with planning and zoning activities. One of the first things I thought of when I browsed through the Sampler was that it could be really helpful for the public to understand how planners and residents think about a neighborhood differently when evaluating development proposal.

Choosing the Neighborhoods
The Sampler looks at neighborhoods across the spectrum: old and modern, urban and semi-rural, larger and modest homes. Like the Sampler, this project creates a visual and quantitative tool for public use to help disseminate information about community development issues related to planning, subdivision, and infill. As this project was fleshed out, it was decided that it should supplement and enhance the Sampler. Each forty-acre neighborhood site chosen for this project surrounds a ten-acre Sampler site. Philip Maechling, Missoula’s Historic Preservation Officer, and OPG Director Cindy Klette picked areas of interest and then Philip and I non-randomly selected the final six neighborhoods. The neighborhoods were intentionally chosen to represent variety in age and geographic location.
Bringing Historical Maps and Aerial Photos into ArcMap

GIS software works by using meaningful and measurable layers that visually depict characteristics of a location such as topography, streets, utilities or school districts. The OPG uses many different layers for planning, but I needed only three layers of the greater Missoula area to complete this project: roads, parcels, and the forty-acre square boundary that defines each neighborhood sample site. First, I brought the Sanborn Maps for my neighborhoods, which are available in PDF format from the Internet, into ArcMap. Pictures are best brought into ArcMap as TIF files.

![Sanborn Index Map for Missoula, 1912](image)

To do this, I selected the map image in the PDF file, and copied it into a Microsoft Photo Editor file. I saved the file as a JPG, and then re-saved the JPG file as a TIF file. For reasons that Dave Gray could not fully explain to me, the TIF pictures able
to be imported into ArcMap had to have been created from a JPG file, not a PDF file. The aerial photos of Missoula from 1973 and 1997 were already formatted as TIF files.

I did this for each year beginning in 1891, for each neighborhood. The Southside neighborhood had up to seven different Sanborn maps that made up the neighborhood for some years, whereas the Lower Rattlesnake neighborhood had only three Sanborn maps that made up the neighborhood. The neighborhoods did not appear all at once. By 1891, only the Southside sample site had any structures in it (the only other neighborhood in Missoula that had structures in 1891 was the downtown neighborhood). By 1902, the Northside and Lower Rattlesnake neighborhoods had seen some development, and the University neighborhood appeared for the first time in the 1912 maps. The Orchard Homes and Bellevue sites do not appear in the Sanborn Maps. As mentioned above, for this project, I assumed that if the area did not appear on the Sanborn Maps, then there weren’t structures in that area yet. Therefore, I relied on the 1973 and 1997 aerial photographs for those sites.

Each TIF file map was then imported into ArcMap as a separate layer. I grouped the layers by neighborhood and year. When the picture map layers were turned on, the maps looked to be the same as they did when viewed in Adobe Acrobat. The maps are just pictures though, and did not have any relation to the underlying city geographic layers- roads and parcels. In order to manipulate the pictures so that they lined up with the roads and parcels, I needed to perform a function called georeferencing. The georeferencing tool allows you to select a point in one layer, then another point in a second layer, and then the two points will be aligned by ArcMap shifting the layers. Dave Gray advised me to use the corners of blocks, since all project layers (the picture
map, and the city roads and parcel layers) had known streets and corners of blocks. The corners I georeferenced were usually the corners that were visually farthest apart between the two layers. Most of the maps were sufficiently aligned after georeferencing two corners diagonal from each other. A few required three or four georeferencing points to get aligned. The fewer georeferencing points needed, the better, because with each georeferencing point the map gets shifted again, and it becomes harder to align the map as a whole.

Figure 2 Sanborn Map layer aligned with City road and parcel layers after georeferencing.

Drawing Houses
The picture map layers aligned with and overlaid by the road and parcel layers, make the map look as though houses and woodsheds have been drawn with pencil into
ArcMap. Essentially, my task is to trace around the houses and other structures using the *draw polygon* tool\(^8\).

I traced the structures with the *draw polygon* tool, which created colored geometric shapes in the map view. Tracing the structures on top of the aerial photos for 1973 and 1997 was more difficult than for the Sanborn Maps. Structures in the aerial photos are partially hidden by trees, and their size is sometimes difficult to judge because of shadows. These difficulties were overcome by zooming in on extra-hidden structures, and consulting the 1958 Sanborn maps for confirmation.

At this point, these traced houses are graphics, and have only superficial visual properties. After drawing all the neighborhood structures for a mapped year, I selected all of the structures in the neighborhood. Using the command *convert graphics to shapes*, I saved the shapes as a layer named for the neighborhood and the year. This operation does not visually change the drawn houses, but turns them from individual little pictures into polygons that make up one shape file, a type of GIS file that is measurable in many different ways, and possesses an attribute table\(^9\). I repeated this drawing process for each neighborhood, for each year, turning the appropriate imported map layer on as I went.

---

\(^8\) The *draw* tool has several options such as circle, rectangle, polygon or line. Since the structures are varied in shape, the *draw polygon* tool was selected.

\(^9\) Examples of attributes that would be listed in a shape file attribute table like the one I created are Polygon ID number, Area, or Perimeter.
Designating Dwellings and Non-dwellings

A Missoula growth topic sure to induce passionate discussion is the alley house, also known as an accessory dwelling unit (ADU). With the vacancy rate usually hovering near 0%, Missoula homeowners have recognized that their sheds can be turned into small houses, perfect for university students. This practice angers some neighborhood advocates as violating the long-held notion that one lot should equal one dwelling structure, but others hail ADUs as an important affordable housing option for students and other low-income residents. The rhetoric on this topic often nears a level of hysteria, with accusations of excess garbage, shortage of parking, and gentrification.

Since the Sanborn Maps identify use of the structure, adding a dwelling or non-dwelling designation to the polygons that make up each of the shape files was not difficult. Designating structure use for the 1997 and 1973 aerial photos was not as clear-cut. With copies of the 1997 aerial photos and a print out of the 1997 shape files from ArcMap, I walked each of my sample neighborhoods to groundtruth them. I walked the streets and alleys, leaned over fences, and made notations on the maps about which structures were dwellings and which were not. Some garages and ADUs were difficult to tell apart, but a list of tell-tale dwelling characteristics evolved as I inspected the
neighborhoods- a separate house number, chimney, curtains or blinds, door mat, satellite TV receiver. But in the end, it was my best guess about structures that at first glance only looked like sheds. Once I had the 1997 neighborhoods groundtruthed, I compared the 1997 neighborhood map with the 1958 neighborhood map. The rational was that if a structure was a dwelling in 1958, and in 1997, it was probably a dwelling in 1973.

At this point, I knew which of the polygons in each year were dwellings and non-dwellings, but ArcMap did not. I had the paper copies of the Sanborn Maps and aerial photos in front of me, with dwellings colored green or crossed out. In order to designate the polygons dwellings or non-dwellings in ArcMap, I added another attribute to each of the neighborhood/year shape files. I called the attribute “Labels”, making it a “Text” type of attribute\(^\text{10}\). The designating process went neighborhood-by-neighborhood, year-by-year. Dwelling polygons were selected on the neighborhood shape layers, and designated as dwellings \(D\) within the attribute table. The same designation process was repeated for non-dwelling structures, which were labeled \(S\) in the attribute table.

**Measuring Surface Area, Block-by-Block**

This project measures neighborhood structural coverage, by block, and uses that coverage as an indicator of the amount of neighborhood development. In addition to examining neighborhood growth rates, the OPG was interested in how development over time translated into lot coverage, which is a source of tension with homeowners, environmentalists and planners alike. Coverage is the area of a building lot that is covered by a structure, expressed in square feet; or the proportion of a building lot that is covered by a structure, expressed in percent or in decimal parts (Anderson 2000). Certain

---

\(^{10}\) The type of attribute determines what kind of characters may be used in describing that attribute. Text, obviously, means that letters of the alphabet can be used. A string attribute is used for entering numbers, and a Boolean attribute is for only zero’s and ones, as in designating something yes or no, true or false.
aspects of lot coverage, such as set backs or distance between houses, have become a mainstay in neighborhood planning techniques in the past one-hundred years, usually incorporated into zoning codes. Lot coverage is a concern to environmentalists because an accumulation of impervious surfaces could result in degraded surface water runoff and potentially pollute the Missoula aquifer or tributaries of the Clark Fork or Bitterroot rivers.

However, measuring lot coverage changes would have been difficult using the information that was available to me. Lots change frequently over time, as they are subdivided and sold. In order to measure lot coverage changes over time, the lot size would have had to remain constant throughout a study. Since the surface areas of the lots could not be held constant over time, block coverage was measured instead. Most neighborhood blocks and alleys in the city were platted out long before development occurred, and almost without exception, they have not changed in size since they were platted. The rational is that if a block were found to be 40% covered by structures, then the lots on that block would, on average, be 40% covered with structures.

Therefore, instead of measuring the ratio of house size to lot size, we measured the ratio of the total structural surface area of blocks to the surface area of the blocks. To organize the data, I assigned each block in the neighborhood a number. The Orchard Homes and Belleview neighborhoods are not organized on a grid-pattern like the other neighborhoods are, so dividing up the neighborhood into segments was more difficult. Between 1973 and 1997, the Orchard Homes neighborhood went from a semi-rural area with large tracts of fields to a place of subdivisions served by cul de sacs. The Belleview neighborhood has long blocks without through streets. For both of these neighborhoods,
I used the aerial photos and lot lines to divide up the neighborhood into roughly equal segments, which I then numbered. The neighborhoods are shown below, oriented with North towards the top of the page.

Figures 4 & 5 Layouts of numbered blocks for Belleview and Orchard Homes neighborhoods, left to right.

Figures 6 & 7 Layout of numbered blocks for Lower Rattlesnake and University neighborhoods, left to right.
If the neighborhood boundary line dissected a block, I included the surface areas of parcels and structures that were more than 50% within the boundary line in the study. This seemed like a logical way to accomplish the objective of the project; if more than 50% of the parcel was within the neighborhood boundary, chances were good that most of the structures on that parcel would be at least 50% within the boundary.

In order to figure out the surface area of each block, I first had to change all of the blocks (and parts of blocks) of each neighborhood into a shape layer, which would then make the block measurable. The parcels that were 50% or more within the boundary line were selected, and exported, using the same coordinate system, and added to the map as a shapefile, named for the neighborhood\textsuperscript{11}. The surface areas for the blocks were then calculated using the \textit{statistics} tool, and copied into an Excel spreadsheet. I repeated these steps for each neighborhood, and for each enumerated block in the neighborhoods.

\textsuperscript{11} Only the surface area of the parcels was included in my calculation of block or neighborhood area. The surface area of streets, alleys, and right-of-ways were not included in my study.
Measuring Block Coverage by Dwellings (D) and Non-dwelling Structures (S)

The last set of measurements needed to calculate block coverage and neighborhood growth rates are the surface areas of the structures, by neighborhood block, for each year. I examined each neighborhood one at a time, starting with the earliest year available by turning on the relevant shape layer. ArcMap summarized the total acreage of dwellings; “D” labeled structures, and non-dwellings, “S” labeled structures for each individual block in a small table. The acreage was then entered into the spreadsheet.

A Note About Units of Measurement

In deciding what unit of surface area measurement to use, there were several thoughts that went through my head. Each chosen neighborhood sample site was forty acres in size, a square with each side measuring 0.25 miles. Parcels and lots are most often measured in acres, although in the Missoula City Zoning Ordinance, parcels are measured in feet². Structure size is measured in feet², which includes the total area of each floor of the structure. This project focused exclusively on what some call the building footprint, or the amount of on-the-ground space a structure takes up on the parcel, which would not include the areas of any floors but the ground floor. Since my results are ratios, shown as percentages, the unit of measurement was not important, because if a block is 30% covered by structures, it wouldn’t matter whether the calculation was done in feet² or acres. After some consultation with OPG staff, I decided to do all my measurements in acres. Converting acres to feet² in ArcMap and Excel would not be difficult, if it becomes apparent later that square footage would be more illuminating.

Calculations

Although more sophisticated statistical analyses would now be possible with the dataset, I used Microsoft Excel 2000 for my calculations. My analysis was stratified by
year and neighborhood. For the purposes of describing these calculations, let me assign some abbreviated values.

\[\begin{align*}
T &= \text{Total} \\
B &= \text{Block} \\
N &= \text{Neighborhood} \\
A &= \text{Area} \\
Cov &= \text{Coverage} \\
D &= \text{Dwellings} \\
S &= \text{Non-dwelling (labeled S in ArcMap)} \\
GR &= \text{Growth Rate/ Rate of Change}
\end{align*}\]

The first set of calculations summed up coverage percentages by blocks and the neighborhood as a whole for each year the neighborhood was evaluated.

1. The total neighborhood surface area is the sum of all of the block areas of that neighborhood.
   \[TNA = \sum BA\]

2. The total neighborhood dwelling coverage is the sum of the dwelling surface area for each block.
   \[TNDA = \sum BDA\]

3. The total neighborhood non-dwelling coverage is the sum of the non-dwelling surface area for each block.
   \[TNSA = \sum BSA\]

4. The total block coverage is the sum of dwelling and non-dwelling surface areas for that block.
   \[TBCov = BDA + BSA\]

5. The total neighborhood coverage can be calculated two ways. It is the sum of the total neighborhood dwelling coverage and total neighborhood non-dwelling coverage; it is also the sum of the total block coverage for each block.
   \[TNCov = TNDA + TNSA = \sum TBCov\]

Next I calculated coverage percentages of dwellings and non-dwellings for each block and for the total neighborhood, for each year. The coverage percentage is a more meaningful number than the raw total acreage numbers because it is easier to imagine a block being 30% covered by structures (leaving 70% open space/ non-impervious surface...
than to imagine that 0.6 acres of that same block is taken up by structures. The
calculations were performed in acres, and turned into percentages.

\[ \%BDCov = \frac{BDA}{BA} \]

\[ \%BSCov = \frac{BSA}{BA} \]

\[ \%TBCov = \frac{TBCov}{BA} = \frac{BDA + BSA}{BA} \]

\[ \%TNDCov = \frac{TNDA}{TNA} \]

\[ \%TNSCov = \frac{TNSA}{TNA} \]

\[ \%TNCov = \frac{TNCov}{TNA} = \frac{TNDA + TNSA}{TNA} \]

The overarching purpose of this project is to figure out how and when neighborhoods
in Missoula have grown over the years. With the data that has been collected, the
rapidity of structural development can also be measured. I measured growth rates by
block and for the total neighborhood for dwellings, structures, and total growth. I
acknowledge that growth may be defined in many ways, and that some may take issue with labeling the presence of structures as growth.

There is no calculable growth rate for the first year a neighborhood appears in my study, since a growth rate can't be calculated without data about what it has grown from. Consequently, some blocks may not have a growth rate during the early years, even if the neighborhood has existed for a while, if those specific blocks had not experienced development in the preceding map year. The growth rate calculations used the raw acreage numbers for dwelling, non-dwelling, and total coverage. The ratio was then converted into a percentage. The model growth rate equation I used was:

\[ GR = \frac{A_{\text{year}2} - A_{\text{year}1}}{A_{\text{year}1}} \]

Where \( \text{Year 1} \) is the previous mapped year and \( \text{Year 2} \) is the current mapped year. For instance, to figure out the total growth rate for Block #1 of the Southside neighborhood for 1951, the equation would look like:

\[ GR_{\text{Block 1}} = \frac{TBCov_{1951} - TBCov_{1921}}{TBCov_{1921}} \]

By block, the growth rate for dwelling and non-dwellings, respectively, would be:

\[ DGR_B = \frac{BDA_{\text{year}2} - BDA_{\text{year}1}}{BDA_{\text{year}1}} \quad SGR_B = \frac{BSA_{\text{year}2} - BSA_{\text{year}1}}{BSA_{\text{year}1}} \]

Growth rates for the neighborhood, as a whole, for dwellings and non-dwellings, respectively, would be:

\[ DGR_N = \frac{TND_{\text{year}2} - TND_{\text{year}1}}{TND_{\text{year}1}} \quad SGR_N = \frac{TNSA_{\text{year}2} - TNSA_{\text{year}1}}{TNSA_{\text{year}1}} \]

The growth rate for the neighborhood as a whole would be:

\[ TGR_N = \frac{TNCov_{\text{year}2} - TNCov_{\text{year}1}}{TNCov_{\text{year}1}} \]
These statistics can give a first estimate of growth within neighborhoods based on the footprint of buildings.
III RESULTS

This project creates a visual and quantitative tool to evaluate and understand neighborhood growth in Missoula. To that end, I am choosing to explain the results of my calculations with maps accompanying the graphs.

Percent Coverage Data

Figure 10 Structural area and graphs of percent coverage (building footprint) by block and neighborhood total, shown for each interval. Total refers to the total percent of the neighborhood covered by building footprint.
Figure 11 Percentage Neighborhood Coverage, by Year

Figure 12 Percentage Neighborhood Dwelling and Non-Dwelling Coverage, by Year
Table 1 Percentage Neighborhood Coverage, by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Southside</th>
<th>Northside</th>
<th>Lower Rattlesnake</th>
<th>University</th>
<th>Belleview</th>
<th>Orchard Homes</th>
<th>Annual Average</th>
<th>Annual Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>1891</td>
<td>0.19%</td>
<td>2.99%</td>
<td>3.03%</td>
<td>3.93%</td>
<td></td>
<td></td>
<td>0.19%</td>
<td>3.03%</td>
</tr>
<tr>
<td>1902</td>
<td>5.58%</td>
<td>6.91%</td>
<td>7.27%</td>
<td>9.97%</td>
<td></td>
<td></td>
<td>3.87%</td>
<td>7.09%</td>
</tr>
<tr>
<td>1912</td>
<td>15.70%</td>
<td>12.67%</td>
<td>8.23%</td>
<td>21.49%</td>
<td></td>
<td></td>
<td>8.45%</td>
<td>11.32%</td>
</tr>
<tr>
<td>1921</td>
<td>19.15%</td>
<td>14.73%</td>
<td>13.71%</td>
<td>20.52%</td>
<td></td>
<td></td>
<td>12.50%</td>
<td>18.11%</td>
</tr>
<tr>
<td>1951</td>
<td>23.32%</td>
<td>13.98%</td>
<td>13.84%</td>
<td>28.88%</td>
<td>22.17%</td>
<td></td>
<td>18.31%</td>
<td>17.96%</td>
</tr>
<tr>
<td>1958</td>
<td>23.49%</td>
<td>22.98%</td>
<td>18.13%</td>
<td>29.95%</td>
<td>25.56%</td>
<td></td>
<td>17.96%</td>
<td>24.57%</td>
</tr>
<tr>
<td>1973</td>
<td>34.75%</td>
<td>22.98%</td>
<td>18.98%</td>
<td>28.88%</td>
<td>4.84%</td>
<td></td>
<td>25.76%</td>
<td>26.74%</td>
</tr>
<tr>
<td>1997</td>
<td>37.18%</td>
<td>25.92%</td>
<td></td>
<td>29.95%</td>
<td>15.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Patterns of Neighborhood Development

The most noticeable information from the study is the patterns of development, which differ between neighborhoods. Houses and sheds appear sporadically, all over the Southside neighborhood, uniformly filling in the neighborhood. The Lower Rattlesnake and Northside neighborhoods, however, each have their genesis in one side or corner of the sample site, and the development spreads out slowly from the initial development. The University neighborhood is different still. It starts out developing from the northwest corner of the sample site, initially like the Lower Rattlesnake and Northside neighborhoods, but quickly evolves into sporadic development across the whole site reminiscent of the Southside neighborhood.

Development patterns of the Belleview and Orchard Homes neighborhoods can neither be compared easily to the older neighborhoods nor can they be compared to each other. The Belleview neighborhood appeared all at once in 1973 and every parcel already had a house on it. The only noticeable neighborhood change between 1973 and 1997 was the number of sheds.

The pattern of the Orchard Homes development is different still. Development near the river has historically been home to homesteads with orchards. In 1973, the
Orchard Homes neighborhood was still semi-rural, consisting of 8 very large parcels. By 1997, all but one of those lots had been subdivided at least once, and the resulting development is a series of long courts off of the main roads in the areas, with the houses on each court built all at once.

Neighborhood Growth Rate Data

A note about the growth rate graphs: there were a few instances where a block’s dwelling or non-dwelling growth rate was so high that to show the value in it’s entirety would have made it difficult to distinguish any values on the chart for the rest of the neighborhood. That occurred in the following places:

- 1951 University Growth Rate graph, Block 9 has a non-dwelling growth rate of 3202.08%.
- 1997 University Growth Rate graph, Block 5 has a non-dwelling growth rate of 1241.03%.
- 1997 Belleview Growth Rate graph, the total neighborhood non-dwelling growth rate is 326.79%.

Figure 13 Neighborhood growth rate for each time interval. Results are show by block for dwellings and non-dwellings. Total refers to the growth rate for the total neighborhood for that time interval.
1951-1958 Lower Rattlesnake Growth Rate

1958-1973 Lower Rattlesnake Growth Rate

1973-1997 Lower Rattlesnake Growth Rate
1951-1958 Northside Growth Rate

1958-1973 Northside Growth Rate

1973-1997 Northside Growth Rate
It is important to reiterate that the Orchard Homes and Belleview neighborhoods had only one growth rate calculation, for the time interval of 1973 - 1997. Consequently, on the graph above, a single point, not a line, represents both neighborhoods. The 1902 Southside neighborhood growth rate is also not shown above; it was 2836.95%, and if it had been graphed, all the other data would have been illegible.

All of the neighborhoods had rapid initial growth; it is not surprising- when there isn’t much there to begin with, adding a few houses dramatically affects the growth rate. The Belleview neighborhood is an exception to this trend- it did not change much at all
between 1973 and 1997. Every parcel had a house on it in 1973, and the parcels did not change in the interim. The character of the Belleview neighborhood- attached garages, driveways, houses situated squarely in the middle of the parcel- did not leave much possibility for further subdivision.

The older neighborhoods each had declining growth rates between 1951 and 1958, an increase between 1958 and 1973, and tapered off again between 1973 and 1997 as the neighborhoods built out. The overall declining growth rate between 1951 and 1958 could partially be attributed to the shorter time period of the interval, but also to neighborhood age. Growth rates were high at each neighborhood’s inception; with little development to begin with, a slight increase in coverage could result in high growth rates. As a neighborhood ages and builds-out, the growth rate will naturally drop for two reasons: decline of available building space, and the lower incremental increase relative to pre-existing cover area for each building of the same size as land coverage increases.
IV DISCUSSION

In this section, I’ll analyze the results of block coverage and growth rates in general, and specifically try to explain outlying data, identify trends and potential reasons for localized growth or non-growth and differences between neighborhoods. After discussing the data, this section will contextualize the ongoing growth discussion in Missoula through the lens of planning literature.

Notable Interval Changes

Examination of the coverage calculations and their attendant maps revealed that some intervals featured spikes in coverage increases and block level growth rates. It is important to remember that although the maps are for discrete years, building could have happened anytime between the mapped year, and the last previous mapped year. When scrutinized at the block level, spikes can usually be traced to the development of one sizable building. Overall, non-dwelling structures had a dramatic effect on non-dwelling growth rates at the block level due to the small building footprints of sheds and garages. For instance, a block gaining or losing two or three small non-dwelling structures between the years could result in growth rate spikes of ±25-500%, even though the actual gain or loss of structural area would be small. This section examines these individual changes at the neighborhood level.

Southside

The Southside neighborhood developed uniformly with structures scattered throughout the sample site. Throughout the study, the Southside leads all other neighborhoods in the amount of total neighborhood coverage. The first dramatic spike on the growth rate graphs comes in the 1912 Southside graph. The precipitous increase in building coverage seen in Block 11, for instance, is the result of build out combined with
an increase in dwelling size and non-dwelling number. In 1902, Block 11 had only one
dwelling and one non-dwelling structure, and both were relatively small. By 1912, Block
11 had 11 fairly large houses on it. Each house had at least one non-dwelling structure on
its parcel, and most parcels had two accessory structures on them, probably woodsheds
and garages. The increase in non-dwelling numbers is the reason there was a dramatic
increase in non-dwelling structure coverage between 1902 and 1912.

Scrutiny of other spikes in growth rates reinforced the suspicion that one good-
sized building could make a big difference. For instance, a 1376% increase in dwelling
coverage on Block 16, the corner of 6th Street and Orange Street, between 1912 and 1921
is attributed to the building of the Sacajawea Apartments. Those apartments still exist
today with the same building footprint as in 1921. One of the apartment’s 2 accessory
buildings (probably a garage) was removed between 1973 and 1997, resulting in a -27%
growth rate for Block 16 in 1997. Currently, there is a parking lot that takes up most of
the back half of the lot. Similarly, the First Church of the Nazarene appears on 6th Street
in 1951, causing Block 14 to experience 146% growth of non-dwelling coverage.

A closer look at the specific coverage reveals that Orange Street began evolving
into a commercial thruway during the first half of the 20th century. This is evidenced by
the development of non-dwelling coverage such as a U.S. Forest Service building on
Orange Street, Block 8, and the conversion of a house on the corner of 4th and Orange
Streets in 1951 into a gas station by 1958. In 1973, Block 12 experiences a huge increase
in non-dwelling coverage that is attributed to the Orange Street Food Farm supermarket
and parking lot, which replaced 4 houses and a few accessory buildings and
concomitantly, a loss of dwelling coverage.
I noticed that accessory dwelling units (ADUs, often thought of as alley houses) were common in the Southside neighborhood. By 1958, most of the parcels had subdivided as many times as allowed under zoning. ADU's account for a substantial part of the dwelling growth rates seen in the Southside neighborhood in 1973 and 1997.

*Lower Rattlesnake*

The Lower Rattlesnake neighborhood evolved in the early 20th century sandwiched in between downtown Missoula and the base of Mount Jumbo. It differs from the other older neighborhoods in this study in that it was exclusively a residential neighborhood, void of any retail shops, gas stations, or lumber lots. Unlike the Southside neighborhood, both dwellings and non-dwellings slowly spread out from the initial main corridors of development, along Van Buren and Vine Streets. The Lower Rattlesnake had less buildings change uses compared to the Southside neighborhood, probably due to the lack of retail. Some conversion is notable, however, over the course of the twentieth century, as non-dwellings evolved into dwellings. One of the many examples of this incremental infill can be seen in Block 1. In 1958, the dwelling and non-dwelling coverage for Block 1 measured 8.5% and 3.9%, respectively. In 1973, conversion contributed to dwelling and non-dwelling coverage of 16.3% and 2.0%, respectively, which translated into block growth rates of 93% and –47% for dwellings and non-dwellings, respectively.

Compared to the other older neighborhoods in this study, the Rattlesnake experienced change slowly, resulting in few spikes in total neighborhood growth rate. As Figures 11 and 13 demonstrate, this slow growth accounts for the Rattlesnake lagging
behind the other older neighborhoods for both neighborhood coverage and neighborhood growth rates for the duration of this study.

Another noticeable characteristic of the Lower Rattlesnake neighborhood is the parcel size. Past parcel size can be seen in the Sanborn Maps, and can be visually compared to the current city parcel size\(^{12}\). Unlike the Southside neighborhood, where the parcels have been subdivided many times throughout the twentieth century, the Lower Rattlesnake neighborhood is home to many larger parcels that could have been subdivided two or three more times, but have not been subdivided. These larger lots are spread throughout the sample site, and offer another explanation why building coverage percentages are lower in the Lower Rattlesnake neighborhood. This phenomenon could help explain why the Lower Rattlesnake neighborhood has fewer growth rate spikes than the other neighborhoods. The lack of subdivision is notable in 1951; Block 5 experienced an astounding growth rate of 719\%. In 1921, the block was divided into two parcels, one on either side of the alley; each parcel was home to a relatively modestly sized dwelling building. According to the 1951 Sanborn Maps, those two parcels did not change, but instead of having one small dwelling, each parcel had five dwellings on it by 1951, and those dwellings were much larger than the original homesteads.

Society-wide changes can often be detailed through the lens of neighborhood change. For instance, scrutiny of the 213\% growth in non-dwelling buildings on Block 2 between 1958 and 1973 is not explained by an increase in the number of sheds or garages. Instead, it appears that most of the accessory buildings on that Block doubled in

\(^{12}\) I use the term “visually compared” because of how the Sanborn Maps were imported into ArcMap as pictures. If I had wanted to look at parcel size over time, I would have had to digitize the Sanborn parcel lines into ArcMap as a layer and then measure the Sanborn parcels. Therefore, my observations on parcel size are only estimation, not quantitative.
size between 1958 and 1973. One can speculate that garages and sheds could have been in need of expansion to accommodate the increase in automobile ownership. Changes brought about by the building of Interstate 90 are evidenced in the 1973 Lower Rattlesnake aerial photo. Research of automobile registration records could disclose whether an increase in automobile ownership could have caused the changes. Block 11 experiences negative growth rates of \(-41\%\) and \(-75\%\) for dwellings and non-dwelling buildings, respectively, when the southern half of the block is condemned for building of the I-90 interchange. As of 1997, the Lower Rattlesnake neighborhood ranks fifth out of six neighborhoods in total neighborhood coverage, with 19% total coverage. Only Orchard Homes has less total neighborhood coverage.

**Northside**

The Northside and Lower Rattlesnake neighborhoods developed similarly-originating in one corner of the sample site. The Northside slowly spread out from the corner of Worden and Howell Streets. However, the Northside differs from the Lower Rattlesnake neighborhood in its character-commercial business has always had a presence in the Northside, the neighborhood is close to downtown and the railroad. The Northside neighborhood is also unique in that it is the only neighborhood in the study that contains a school. A public school was built in 1891, and covers 4.6% of Block 16 in 1902 when the Northside sample site first appears in the Sanborn Maps (Mathews). Whittier School replaced the smaller public school, covering 9.8% of the block in 1912 (resulting in a growth rate of 115%), and 12.6% of the block in 1921. A new school was being built on the southern half of the parcel (outside of my sample site boundary line) when the old school burned down, which explains its absence in the 1951 maps.
The 1973 data for Blocks 1, 2, 3, and 4 of the Northside neighborhood was attained a little differently than the rest of the data. Notice that there is no change or loss in structures on these blocks between 1958 and 1973; Blocks 1-4 are identical for the 1958 and 1973 maps, therefore the 1973 growth rates for Blocks 1-4 for 1973 are 0%. The explanation for the static blocks is found in the 1973 Northside aerial photo, which did not include the area north of Stoddard Street, omitting Blocks 1-4. To ensure continuity of evaluation for the Northside neighborhood, the Computer Assisted Mass Appraisal (CAMA) database\textsuperscript{13} was searched for the Blocks in question, and building dates for the buildings on those blocks were ascertained. None of the buildings had a building date between 1958 and 1973. Therefore, using the 1958 data for Blocks 1-4 in 1973 would be largely accurate.

In 1973, Block 7 experienced 283% growth in non-dwelling structures, not with a number of small buildings, but with the addition of a large building. While groundtruthing the 1997 aerial photo results for the Northside, I noted that the large commercial structures on Blocks 7 and 8 made up Otto’s Inc. Towing and Crane Service; the 1973 and 1997 commercial buildings are approximately the same size on Blocks 7 and 8, another example of the diverse land use that has characterized Northside development.

Block 13, the triangular block next to the railroad, boasted houses and their accessory structures until at least 1973; the structures are eliminated by 1997, resulting in -100% growth rate for dwellings and non-dwellings. While groundtruthing I noted that the block is currently fenced off for some industrial use.

\footnote{The State of Montana Department of Revenue produces this database.}
For all the neighborhoods, the growth rates in the early years of the neighborhoods existence are understandably dramatic—some blocks grew from one structure to a dozen in the interval between the early maps. The Northside neighborhood is no exception. There are several growth rate spikes for the 1902-1912 interval. Block 6 grew from one dwelling to five good-sized houses, resulting in an 829% dwelling growth rate. Dwellings on Block 10 also multiplied between 1902 and 1912; one dwelling became 10, resulting in a 965% growth rate. The 880% non-dwelling growth rate for Block 8 in that same interval is somewhat misleading. It is attributed as the change from one small shed to 5 small-medium sheds.

Like the Lower Rattlesnake, several large parcels in the Northside neighborhood subdivided recently, or continue to exist as large parcels. ADU’s are common in the Northside neighborhood, and the evolution of ADU’s, when combined with the slower advance of subdivision of the Northside as compared to the Southside, contribute to positive dwelling growth rates in 1973 and 1997. As of 1997, the Northside ranks fourth in total neighborhood coverage at 25.9%, behind the Southside, University, and Belleview neighborhoods.

University

The University neighborhood made its Sanborn Map debut in 1912. The northern half of the neighborhood developed a little faster than the southern half, but by 1951, the whole neighborhood was filling in uniformly. Several of the first buildings seen in the University neighborhood are sorority and fraternity houses—in fact most of the really big structures in this neighborhood are communal housing. I classified these structures as dwellings, just as I classified apartment buildings as dwellings.
The most dramatic statistics for the University neighborhood is the 1951 growth rate data for Block 9. The addition of the University Congregational Church and a store on Helen Avenue adds up to a growth rate of 3202% for Block 9. The church gets a little bigger with each year. Another big increase in the amount of non-dwelling structure coverage is seen in 1973 and 1997, for Blocks 8 (160%) and 5 (1241%), respectively. No churches or ADU’s were built on these blocks, the increase is simply explained by an increase in sheds and garages.

Like the Lower Rattlesnake neighborhood, the University neighborhood has many parcels that could have been subdivided one or two more times, but have not. Some of the University neighborhood gives the impression the houses are spread farther apart than in the other older neighborhoods. This would lead you to believe that the neighborhood coverage would be less than in the other neighborhoods. However, that is not the case. As of 1997, the University neighborhood has more total neighborhood building coverage, 29.9%, than any other neighborhood except the Southside neighborhood. This is confusing at first, because the University neighborhood has more bigger lots than the Northside neighborhood and the Southside neighborhood, which would seem to add up to less coverage, since there is usually only one dwelling per parcel. When trying to discover how this could be, I went back to my master spreadsheet, and I discovered something. The blocks in the University neighborhood are approximately .25 to .5 acres bigger than the blocks in the other older neighborhoods. So even through there are some larger parcels in the University neighborhood, there can be more of them, because the blocks are bigger than the average Missoula city block, which is 1.788 acres. When
communal housing and apartment buildings are considered, it is not surprising that the neighborhood coverage is so high in the University area.

**Belleview**

The Belleview neighborhood reminds one of Levittown in Montana. The houses did not exist prior to 1973, but were built all at once, and did not change much at all between 1973 and 1997. The 1973 aerial photo of Belleview is the first time in this study where I encountered attached garages. Most garages in the older neighborhoods were structures separate from the house, leading to a sizable presence of non-dwelling buildings. Drawing the structures on top of the 1973 and 1997 aerial photos in ArcMap, I traced the outlines of roofs, and could not tell where the house left off and the garage began. The attached garage effect results by practically eliminating non-dwelling structures—only five non-dwelling structures were mapped in 1973. More parcels had sheds by the time the 1997 aerial photo was taken, accounting for 327% total neighborhood growth for non-dwelling structures.

Belleview was home to a phenomenon not seen while groundtruthing any of the other neighborhoods. I encountered a few motor homes parked in places that I had drawn as polygons in the ArcMap neighborhood layer. I decided not to delete the potential motor home polygons from the layer, and left them designated as non-dwelling structures. My rational behind this was that in the aerial photo, it had appeared to be the roof of a structure in that approximate location, and I could not guarantee that when groundtruthed in 2003, that it in fact was not a woodshed that I saw in the 1997 aerial photo, but a motor home. I also reasoned that if a motor home did exist in the 1997 aerial
photo, and was parked in the same place in 2003, that the concept of a “building footprint” was just as relevant for that block.

Orchard Homes

The most dramatic neighborhood changes throughout the study were seen in the Orchard Homes neighborhood, even though it was only mapped in 1973 and 1997. Between 1973 and 1997 the semi-rural area was transformed by a series of small and medium-sized subdivisions, almost always only accessed by one cul de sac street. Orchard Homes is still changing. The area I designated Block 2 has been subdivided, and that subdivision, Luella Lane is in the process of being built. Since the whole block is under construction, I designated the structures that appeared in the 1997 aerial photo, probably the structures of one or two semi-rural homesteads, as non-dwellings.

Block 4 is also an interesting example of how dramatic individual subdivision projects are changing Missoula. In the 1973 aerial photo, Block 4 was a rural homestead, with a tree-lined driveway, which made it hard to discern which of the buildings I saw was the dwelling and which were the accessory structures. I therefore designated them all non-dwellings. By 1997, Block 4 had become a subdivision consisting of houses on a single long cul de sac, for a total block growth rate of 3060%. Like the Bellevue neighborhood, most of the houses in the subdivided sections of the Orchard Homes neighborhood have attached garage, resulting in low non-dwelling coverage numbers.

One older homestead in my study has continued to hold onto its land, but the rest of the rural estates have already been subdivided. Total neighborhood coverage, 15.0% in the 1997 calculations, is the lowest of all the neighborhoods in this study. This
coverage percentage will rise once the Luella Lane subdivision is completed, but will not likely reach the 37.2% coverage of the Southside neighborhood anytime soon.

The Orchard Homes sample site is the most recent dynamic neighborhood in my study; with only 15% total neighborhood coverage, it would seem that Orchard Homes still has substantial room to grow. Also known as the River Road/ Emma Dickinson neighborhood, the neighborhood has experienced significant new residential development since its annexation into the City in 1996, with the most significant development having occurred since the last half of 2001\(^{14}\). The regular use of density bonuses for subdivision in this area is a source of tension between residents and the OPG. This tension brought about the convening of the neighborhood Infrastructure Planning Coordinating Group, whose participants hailed from most of the city and county agencies, as well as residents and business owners. The group identified characteristics of the neighborhood worth preserving and enhancing, and now that this plan is an amendment to the growth policy, those concerns should be taken into account when local planning decisions are being considered.

The Orchard Homes neighborhood has more actual land for building potential than the other neighborhoods, but the way the neighborhood is laid out is going to make future infill difficult. There aren’t any through streets in my sample site, and so there is less land taken out of the parcels for streets and sidewalks. Because of the orientation of the neighborhood, I had divided the site into 8 roughly equal sections, based on the semi-rural sections. The average area of a designated block in the Orchard Homes neighborhood is 4.2 acres, more than double the area of the standard city block. When

\(^{14}\) Source: River Road/Emma Dickinson Infrastructure Plan, adopted as an amendment to the 2002 Missoula County Growth Policy 8/18/03 by the Missoula City Council.
this extra land is taken into account, the 321% growth rate doesn’t seem quite as alarming.

Rampant Development?
The rhetoric used when describing the Orchard Homes neighborhood is often negative, using phrases such as “rampant development”. Twenty-five years passed between the 1973 and 1997 aerial photos. In 1973, Orchard Homes was 4.8% covered in structures. By 1997, that number had increased to 15.0%, a growth rate of 321%. Did Orchard Homes grow faster than other neighborhoods during similar time intervals? Can the 321% growth rate be explained because neighborhoods grow faster at the beginning of their tenure? The chart below shows percentage neighborhood coverage changes for similar time intervals.

<table>
<thead>
<tr>
<th></th>
<th>Southside</th>
<th>Northside</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>1891 – 1912</td>
<td>0.19% ⇒ 16%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1902 – 1921</td>
<td></td>
<td>3% ⇒ 13%</td>
<td></td>
</tr>
<tr>
<td>1921 – 1951</td>
<td></td>
<td></td>
<td>10% ⇒ 22%</td>
</tr>
<tr>
<td>1958 – 1973</td>
<td>23% ⇒ 35%</td>
<td>14% ⇒ 23%</td>
<td>20% ⇒ 29%</td>
</tr>
</tbody>
</table>

Table 3 Neighborhood growth comparable to Orchard Homes growth, 1973-1997.
Comparing growth of other neighborhoods over similar time intervals helps to put the phenomenon of development in the Orchard Homes neighborhood in context. The neighborhood is no longer semi-rural; it is a city neighborhood absorbing its share of a growing population.

Limitations of Methodology and Results
The 1973 Growth Rate chart also exposes a possible weakness in my data collection. Block 14 experienced a 100% loss in non-dwelling structures between 1958 and 1973. Since the dwellings themselves still existed, this number seemed a little strange to me. I think this may be an example of the difficulty that I experienced while
drawing the polygons in ArcMap on top of the aerial photos. Trees and shadows made some of the buildings difficult to see, and I am speculating that the 100% loss in non-dwelling structures could be partially explained by heavy tree cover in the 1973 aerial photo of the Lower Rattlesnake neighborhood. In comparison, in 1997, Block 6 experienced a 100% loss in non-dwelling buildings, but upon further inspection, it is noted that only one non-dwelling structure existed in 1973, therefore, the elimination of that one small structure is not indicative of the data error that Block 14 had experienced.

The Whittier School on Block 16 of the Northside neighborhood, also serves as an example of a weakness in my methodology. It appears to take up more than 12.6% of the parcel it is on. However, the parcel is actually the entire block between Phillips and Howell Streets (North/South) and Mitchell and Worden Streets (East/West), but only the northern half of the parcel is located within the boundary line. Therefore the ratio of the school to the parcel is smaller, because the parcel is not just the half located within the boundary line.

The Orchard Homes neighborhood is the only location where I question the accurateness of the Sanborn maps. A few of the original homesteads from when the area was comprised of large parcels still exist- where the owner subdivided only a section of their property. To my untrained eye, the building style and wear and tear on these original homesteads give the impression that they were built before 1973, perhaps in the 1950’s. The 1958 Sanborn map shows houses west of Russell Street, but not quite as far as Curtis Street. My assumption with this project was that the Sanborn maps are a comprehensive and reliable source of Missoula development. Since the houses that could have existed before 1973 were on large parcels and relatively far from each other, I think
the possibility exists that they were not mapped by the Sanborn Company because they did not pose as much of risk for fire as buildings that were closer together, and closer to the city center. Inquiry to the Sanborn Company about their methods for selecting areas to map might clarify the situation.

There are many Missoula neighborhoods that did not appear in this study, such as downtown, slant streets, Lewis and Clark, or the South Hills neighborhoods. With 22 neighborhood sample sites, the *Neighborhood Sampler* was more representative of Missoula neighborhoods. Since the neighborhoods were selected with only age and geography in mind, one could argue that the coverage and growth data don't have implications for residential development throughout the region because of the unscientific nature of the sample selection. The counter argument is that this project was for the OPG to develop a descriptive tool for public meetings, and the information is merely descriptive.

This concludes my discussion of individual neighborhood growth information. In order to try and understand why the information presented in this project contributes to ongoing countywide and project-based planning processes, I have reviewed planning literature to contextualize this project. I have sorted the literature into categories: methods, density and infill, the nature of sprawl and community building, and natural resources,

*Methods*

Maps and other visuals have always been an integral part of community planning. Almost 40 years ago, Jeanne M. Davis wrote for the U.S. Department of Agriculture, "Airphotos are an excellent and versatile tool for both rural and urban planning. Used properly, airphotos can help planners save both time and money, improve the accuracy of
their work, and help them explain to the public the problems of change and the benefits of good planning for rural counties, small towns, cities, and metropolitan areas” (Davis 1966 at 1).

Wilson, et al. (2003) used satellite-derived land cover data to classify land by type of growth: infill, expansion, isolated, linear branch, and clustered branch. The classes were determined based on what percentage of the surrounding land use was developed with impervious cover. This effective use of remote sensing to help inventory land use for different time intervals, shows the value of using visuals to track changes in land.

Another study used aerial photos and satellite imagery to assess the impact of urban development in Santa Barbara, California through modeling. The analysis highlighted some problems associated with taking measurements from visual images; the metrics are dependent upon spatial resolution and the extent of the study area, as well as the level of detail. A change in the extent or the spatial resolution could change the data and limit the ease of relating the results of one region to another (Herold, et al. 2002).

Density and Infill

A recurring theme in the literature and in growth conversations in Missoula is density, which currently only involves a metric of number of dwelling units. Density bonuses have been the oft-used tool of the OPG to encourage certain types of development, such as affordable housing. Density bonuses have recently been reviled by a vocal segment of the Missoula public as negatively impacting neighborhood character and quality of life. Anti-infill and density bonus detractors are filling the opinion pages of the Missoulian and seats at city and county public meetings.

Land coverage is currently not incorporated into the discussion on density, but literature reveals that it should be a factor in deciding where and how much development
should occur. Could surface area coverage data become a way of addressing density bonus concerns of the public? For instance, zoning ordinances that regulate the number of units per lot or acre have been criticized as unsustainable; using amount of square footage of the built area instead would produce a more holistic approach to development (Moore 1997).

For some, density has a negative connotation, associated with dirty, overcrowded cities that resulted from the Industrial Revolution of the late 19th century. To counteract the negative effects of industrialization, zoning was adopted, mostly to separate land uses. For others, density is a positive term associated with compactness, walkability, and other new urbanism characteristics.

One of the hardest battles in cities will be over achieving such density... The bad reasons for fearing density are those that suggest it is something inherently evil. There has been a lot of fear that density is synonymous with health problems and social ills. The “nothing gained by overcrowding” abhorrence [of garden cities, Town and Country Planning Association] of density tradition was exported to other [non UK] cities, mostly in the Anglo-Saxon world, by the town planning profession. It is rarely questioned, even though the claims of social and environmental problems associated with density have been shown to be false. Crime, suicide, and health problems are more easily correlated with low density, though in general they are more obviously associated with poverty and poor infrastructure and services (Newman 1997).

Dekel (1995) used a fiscal impact analysis to determine, in budgetary terms, the optimal levels of housing density for various neighborhoods, recognizing that development has a spatial dimension to its cost. He advises, “The planner can even establish general spatial policies at the level of comprehensive planning and zoning. By employing optimal densities, the planner can help to control part of the costs of development, a part that one-time development impact charges leave largely unrecovered. Low-density subdivisions carry a higher tax-service ratio than higher density
subdivisions, therefore, a municipality faces hidden deficits and surpluses in servicing such subdivisions. If services are maintained while density declines, the hidden deficit can turn into an explicit deficit. The explicit deficit must be compensated for by tax increases to the general community” (Dekel 1995). A general public abhorrence for tax increases should support this assessment of density economics and consequently, support density bonuses, ADU’s, and the promotion of more development in all sewer areas of Missoula. We saw in the coverage data that the Lower Rattlesnake and Orchard Homes fall 20% or more behind the Southside neighborhood for percent coverage. Dekel concludes that:

“In short, one must distinguish between costs that are only associated with increasing densities, and costs which are a result of increasing densities. The former category comprises costs of services which are usually allocated according to the number of recipients (i.e. health, education). The costs of such services in a given neighborhood may be higher due to the geographical concentration of their recipients. On the whole, however, the cost of these services would not have been reduced if the same recipients had been scattered throughout a larger area. These costs, therefore, are referred to here as fixed costs. On the other hand, costs which are a result of increasing housing densities (i.e. services, street maintenance, waste collection) are allocated by spatial attributes.

Density is a planning topic with many nuances, and increased density is not a cure-all for growing pains. Without sufficient and maintained sewer systems, high-density development will result in degraded surface water runoff. Low-density development has negative impacts on most other environmental issues, such as energy, habitat, and loss of open space. I suppose there is something to be said for limiting human impact on the earth by concentrating humans. The technology, knowledge and taxation mechanisms do exist to support high densities in geographic areas that are suited to such density (i.e. not wetlands) while maintaining water and air quality through civic
instruments such as surface water runoff treatment, safe and attractive walkways, and public transportation. Where the adverse environmental impacts of density can be ameliorated through existing accepted practices, the environmental impacts of low-density building cannot as readily be amended.

The Nature of Sprawl and Community Building

Literature on "sprawl" spans the social science academic spectrum. Sprawl and terms such as new urbanism and smart growth are vilified and celebrated as market mechanisms and social scourge. A working definition of sprawl that has emerged in the urban planning literature is: "unplanned, uncontrolled, and uncoordinated single use development that does not provide for a functional mix of uses and/or is not functionally related to surrounding land uses and which variously appears as low-density, ribbon or strip, scattered, leapfrog, or isolated development" (Carruthers & Ulfarsson 2002, p 314).

Although there are many characteristics that define sprawl, identifying patterns of development is imperative to creating livable communities, a concept that both new urbanists and traditionalists aspire to. Some urban and regional planners are concerned with the spatial behavior of the economy or of society. In particular, they are interested in the relationships between social and economic activities – such as working, living, shopping, and enjoying recreation – and the spaces available to house them. Planners will need to know the size and location of both, as well as the interrelationships between activities (transportation and communication), which use special spaces called channel spaces (roads or railways, telephone wires) (Hall 1992).

An oft-heard criticism of sprawl is that it produces sterile neighborhoods: low-density neighborhoods and their reliance on the automobile isolates neighbors. In his study of the number of neighborhood ties, Freeman suggests that at least one
characteristic of sprawl, automobile hegemony, is inimical to neighborhood social ties (Freeman 2001).

Sprawl is blamed for driving out local downtown commerce and creating long commutes, giving rise to more traffic congestion and reducing time available for work and family (Wilson, et al. 2003). One of the results of deteriorating downtowns could be what Moudon and Hess (2000) called “suburban clusters”- concentrated suburban development evolved into self-sufficient entities. Their study looked at suburban development throughout the greater Puget Sound region. Although the principal characteristic of identified clusters is concentrated residential, the clusters do have employment, although it is of a lower scale and intensity than that of previously documented urban and suburban centers.

The recent media attention paid to obesity and diabetes rates in Americans have rekindled discussion on the link between public health and the built environment. Data suggest that such community characteristics as proximity of recreation facilities; street design; housing density; and accommodation for safe pedestrian, bicycle, and wheelchair use play a significant role in promoting or discouraging physical activity (Dannenberg, et al. 2003).

Natural Resources
The city is analyzed as part of the cycle of organisms, elements and nutrients that make up the natural environment. Thus we can identify the metabolism of our cities- the ways in which they ingest, process, and extrude elements of these natural cycles. The general conclusion is that we need to manage our cities more ‘intelligently’, meaning that the city lives symbiotically within the environment, rather than at its expense. This has become steadily more apparent as the planet reacts to the stress that humans have placed upon it, unknowingly and uncaringly for the most part (White, R 1994).

Environmentalists view planning as a proactive policy tool for conserving natural resources and for fostering community sustainable community habits (i.e. non-motorized
transportation). These abstract concepts are romantic notions (see above quote) when compared to the daily project-oriented tasks of municipal planners. However, the body of literature about how planning can affect natural resources and the environment is quite extensive. The scope of how this project will be applied in Missoula planning is yet to be seen, but studying patterns of development and lot coverage have obvious implications for water quality, agricultural preservation, habitat integrity, and indirect implications for energy conservation through fostering smart growth neighborhood concepts (discussed above in the Community Building section).

Water Quality

Impervious surface cover, such as buildings, roads, and sidewalks, is a well-accepted indicator of urbanization and its impacts on water resource health (Wilson, et al. 2003). There are a number of determinants of runoff quantity. These include: the amount and intensity of precipitation, soil types, percent of the area covered by impervious surfaces, topography, vegetation, condition of the soil, size and shape of watershed (Anderson 2000).

The USGS (Persky 1986) found a positive relationship between nitrate concentration and housing density. For example, a study conducted of Cape Cod groundwater-quality generated a computerized mapping procedure showing a relationship between nitrate concentration and housing density. Nitrate levels increase with housing density because of the increase in contaminants being added to the aquifer by septic systems (Persky 1986).

Habitat

While the sizes of individual parcels are inherently irrelevant (as parcel boundaries are simply lines on a map), the associated consequences of subdivision have affected habitat. Smaller parcel sizes have resulted in more roads, increased human density, greater wildlife/human conflicts, more septic systems, more fences, noxious weed invasion, and
general loss of vegetation. Thus, the poor health of much of Missoula county habitat can be directly attributed to subdivision. (Missoula Measures, Missoula City & County Government, 1997)

Endangered species and plant communities do not recognize administrative boundaries. They are found on private land, as is much of the productive low-elevation and riparian habitat in the western United States (Broberg 2003). As mentioned before, fragmentary urban development has the potential to degrade, isolate, or shrink habitat patches (Platt 2004). Missoula’s location- surrounded by mountains, federal and tribal land, ribboned with first class fishing streams- puts habitat on the radar screen of local planners. Taxpayers, proud in their love of hunting and fishing, should not want it any other way. “Both land use planners and landscape ecologists promote less fragmentary development patterns and encourage ‘infill’, the utilization of vacant land within partially developed areas (Platt 2004).
V CONCLUSIONS

Most of the attributes of smart development can be found in older, pre-1950 American neighborhoods, many of which have held their value over decades as preferred places to live. These neighborhoods are laboratories of walkable, compact, mixed-use development. In the first half of this century, American cities and towns were substantially different in their design.

American Planning Association and Oregon Transportation and Growth Management Program, The Principles of Smart Development.

In order to conclude this paper, however, it is imperative to recall how this information could potentially be used in Missoula towards building better neighborhoods, and how it fits within the larger planning discussion in the region. The people are coming, where are they going to go?

It is clear from the accompanying maps (Figure 10) that the Missoula neighborhoods featured in this study each developed a little differently, with the most dramatic changes seen towards the beginning of their appearance in this study. Table 1 notes that the Lower Rattlesnake, and the Northside neighborhood to a lesser extent, has much less building coverage (18.98% and 25.92%, respectively) than the Southside neighborhood (37.18%) and less coverage than the University neighborhood (29.95%). Since each of these neighborhoods has been developing over roughly the same time period and has blocks of approximately the same size, it could be argued that neither the Northside nor the Lower Rattlesnake neighborhood has reached their full capacity for residential building. Figures 10 and 11 show how both neighborhoods have larger parcels with one dwelling sprinkled throughout, parcels that could have been subdivided but were not. This is contrasted with the Southside and University neighborhoods, where the parcels have almost all been subdivided as many times as possible. Neither
neighborhood has enough space for a density bonus development, but there is infill potential in the form of ADU's.

**River Road/Emma Dickinson/Orchard Homes**

The immediate effects of this research may be felt in the River Road/ Emma Dickinson (Orchard Homes) neighborhood, the only neighborhood in my study that still has large pieces of “on the ground” room to grow. As seen in Figure 10, the area completely transformed between 1973 and 1997. In response, the residents formed an Infrastructure Planning Group, and worked with city and county agencies to guide the build out of the area. That effort produced the River Road/ Emma Dickinson Infrastructure Plan, passed in August of 2003 as an amendment to the 2002 Missoula County Growth Policy.

The density bonus policy is at the heart of residential frustration. Density bonuses cease being an option once a neighborhood is classified as “built-out”, or 80% of the land has been developed. As of January 2003, the River Road/ Emma Dickinson neighborhood was 72% built out. Although my Orchard Homes site only makes up a portion of the River Road/ Emma Dickinson neighborhood, the 72% “built-out” assessment, does not correspond with the 15% 1997 building coverage data, the lowest coverage data for any of the six neighborhoods, which had led me to the conclusion that there must be sufficient room in the neighborhood for more building. The pattern of development (as seen in Figure 10) helps to support this conclusion. The neighborhood was not plotted on a grid, but small subdivisions served by one cul de sac sprung up as five-acre semi-rural parcels were sold off. Since each subdivision was a separate project, through streets and sidewalks linking them together are rare, as are sidewalks.

---

15 Source: River Road/ Emma Dickinson Infrastructure Plan.
The residents partially blame the city for all neighborhood development issues. The River Road/ Emma Dickinson Infrastructure Plan states, “There has been a strong sense of disillusionment about how the City makes decisions that affect our neighborhood and a growing sense of disenfranchisement...Our neighborhood has become the City proving ground for density bonuses, which help to fuel rapid subdivision.” However, the residents forget that it is not the City which made the decisions to subdivide the land; it was the previous owners’ decision to sell their land to a developer. And although preserving rural land is a noble goal, properties are not static, and location makes this part of Missoula ideal for residential development. The Orchard Homes neighborhood is located close to both downtown Missoula and main travel routes, including Reserve, 3rd and Russell Streets, and the river front trail. It is to the residents credit that they are not playing the blame game anymore, and instead taking an active role in crafting the Infrastructure Plan.

The visual aspect of this project supports the assertion made in the Infrastructure Plan that this neighborhood needs to connect more streets, but does not support the notion that the neighborhood is almost built-out. What can be taken away from this experiment is forethought and efficiency in land development is of utmost importance when new subdivisions are approved. By efficiency I mean that land must be developed so as not waste land that could be used for residential building, with backyards that are a little bigger. Orchard Homes is a perfect example of the inefficiency of approved development. It will be obvious that no effective and responsible regulation and control can occur without the fullest possible understanding of the process of change we have been discussing. Such understanding cannot be confined to knowledge of the behavior of

16 Source: River Road/ Emma Dickinson Infrastructure Plan [A-3].
the individual or group taking the action; it must be extended to encompass the whole fabric of spatial relations between activities and the complexities of their interactions (McLoughlin 1969). By not just looking at density, but also examining the spatial relationship between structures and the land, planners expand their techniques for evaluating development.

While evaluating these neighborhood spatial relationships, it is important to remember that they did not develop in a vacuum. The four older neighborhoods in this study, Southside, Northside, Lower Rattlesnake and University, were each platted out with blocks and streets long before development within those neighborhoods came about. So even though the neighborhoods grew over time, there were hard and fast constraints already in place that guided where development could happen. The haphazard evolvement of the Orchard Homes neighborhood, which is plagued by linkage and walkability issues, gives weight to the idea that Missoula county could be platting out land that is currently in agricultural use, to ensure organized development.

Recommendations
The process of importing the Sanborn Maps and digitizing them in ArcMap was a tedious one. Before time and money is spent on creating these historic snapshots of each Missoula neighborhood, feedback is needed from the public, and maybe even elected officials. The next step would be to use the visual and quantitative aspects of this project in public meetings that involve subdivision approval or neighborhood plan development, followed by evaluation of the information by the public through surveys or questionnaire.
If this visual is in fact used at public meetings, perhaps a short survey could be handed out after the presentation to evaluate the visuals, the process, and the concepts of coverage and growth rates. Sample survey questions are:
How has your knowledge or understanding of neighborhood growth changed as a result of this presentation? __ No Change, __ Very Little, __ Somewhat, __ Significantly

Overall, what were the strengths and/or weaknesses of presenting this information in this manner?

The concept of the livable neighborhood is omnipresent in both growth management policy documents and the ongoing public discussion about what Missoula should look like in the years to come. Throughout this project, I have been extrapolating that the percent coverage for the neighborhood is a good indicator of what the parcel coverage is in that neighborhood. It seems to me that coverage is a better benchmark than setbacks (as defined in the Missoula City Zoning Ordinance) to measure compatibility with the rest of the neighborhood. Further study on total coverage could look at lot sizes and allowable building envelope size compared to building footprint. Current zoning regulations have setback requirements for every zoning classification, and minimum lot size requirements for some. Do those setbacks requirements and lot sizes make sense, or could more homes be built without neighborhood character being adversely affected?

The infill debate in Missoula has sparked demand for stringent design review to become part of evaluating and approving new residential development. Design standards would be an important part of addressing the issues of neighborhood character within a growth management framework. Neighborhood coverage data would complement that effort.

Although Missoula City and Missoula County share a planning office, and have a Consolidated Planning Board, final development decisions are made by two different elected bodies, the City Council and the County Commissioners, using two different
regulatory documents, the Missoula Urban Comprehensive Plan and the Missoula County Growth Policy. As the City of Missoula grows, it will continue to slowly annex county area where logical and necessary. Much of the county land near or adjacent to the city limits is no longer rural; it has been subdivided and developed, although with a different set of infrastructure requirements than City development. Efforts should be made to further synchronize the City and County regulatory requirements.

Another observation of City/County development relations is that long-term planning consideration at the project level is important. Long-term residential development vision, by the Planning Board and both elected bodies, must be at the forefront of development discussions in order to counter the current jurisdictional disconnect. Although the piecemeal cul de sac subdivision of the Orchard Homes neighborhood can be attributed to both City and County decisions, the birds-eye view of dead end streets is a perfect example of why long-term vision is essential, and needs to preempt jurisdictional squabbles.

This study looked at historical patterns of development, with the intent of helping to guide future growth, and could be used in regional long-term planning discussions. The Missoula city and county officials need to continue to work together and with the public to ensure that their growth management policies complement each other, since annexation will continue along with the population growth. If both jurisdictions share common ideas about what characteristics help define thoughtful, managed growth that promotes a livable community, then the greater Missoula area would be well on its way to absorbing the predicted continued population growth. The tension between the public and the regulators about growth could hardly get any higher. The birds-eye visuals of
growth, will hopefully help the public put aside their NIMBY-ism\textsuperscript{17} which currently dominating the public growth discourse.

Although I sympathize with people who love their home, their view, and never want to see it change, I am equally frustrated as sympathetic. People live in the Missoula area, even those who live on the outskirts, not just for the natural beauty, but also for the amenities that living close to Missoula provides- shopping, civic engagement, and university lectures. If people really just cared about the views, and not the other benefits of living in town, they could live in beautiful, isolated places, not even very far away. But Missoula is not the middle of nowhere. It is located within a region that continues to see population growth, and within a valley. The natural growth constraints of the mountains cannot be overlooked when long-term planning discussions are taking place.

The reasons that people who value views don’t move elsewhere are the same reasons that new people are attracted to this city. Residents want to have it both ways, and are not able to. Not now, and not in the future.

\textsuperscript{17} NIMBY is an acronym for “Not In My Back Yard!” sentiment.
VI  BIBLIOGRAPHY


