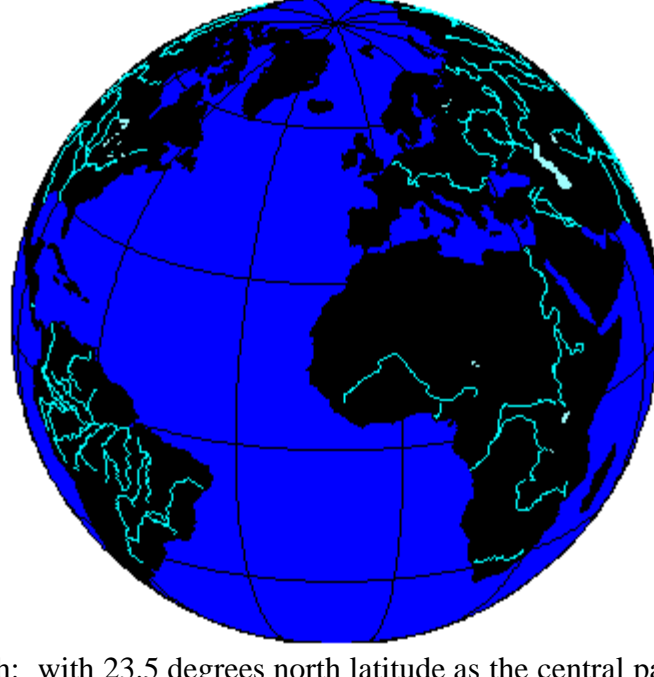


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Earth: with 23.5 degrees north latitude as the central parallel.

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[Related articles on the IMAge website:](#)

[The Spatial Shadow: Light and Dark--Whole and Part Analogue Clocks \(pp. 71-87\)](#)

SET IN STONE: An Analemma in Northern Italy.

[John D. Nystuen](#)

The University of Michigan
and
Community Systems Foundation

On a recent trip through the less traveled parts of northern Italy (less traveled compared to the crowds encountered in Rome, Florence, and Venice) our traveling party found expected, and surprising, evidence of the great contributions to our modern world made by Italians in the first and second millennia. The evidence is set in stone.

In the fifth and sixth centuries A.D. [Ravenna](#), on the Adriatic Sea, was the seat of authority of the emergent church at the time the division was opening between the eastern and western churches. Evidence of both Byzantine and western Christian traditions are preserved in the beautiful mosaics of the churches, mausoleums, and other religious places in Ravenna. The images, made of stone and colorful glass, have remained bright and clear over time. The [interior of Basilica di Santo Vitale](#) (6th century) is an example. Many [mosaics in the basilica](#) cover walls, ceilings, and floors as do others in various religious structures throughout the city. Ravenna has been continuously occupied; it was an intellectual center during the Renaissance. [Dante's tomb](#) next to the old churches is evidence of the importance of the city in the thirteenth and fourteenth centuries (Dante 1265-1321).

[Urbino](#) is a well-preserved Renaissance town in the mountains to the south of Ravenna. It was prominent in Italian history for two short centuries after which fortunes declined and it was annexed to the Papal States in 1631 and left to languish in obscurity. Its rise to fame was due to Duke Federico di Montefeltro (1444-1482) who was most influential in advancing its political, artistic, and intellectual achievements. The value of this history to us is that the magnificent [Ducal Palace](#) (the linked photo shows its courtyard) and other renaissance buildings in the city were not demolished or scavenged in the process of building new structures suited to subsequent eras. In the decline, the Palace fell into a state of abandonment and many of its art treasures were scattered to Rome, Florence and other seats of power. Restoration began in the early part of the 20th century and the Palace is now the National Gallery of the Marche. Also, fortunately, the Palace appears to have escaped the ravages of World War II despite the fact that heavy fighting occurred in the vicinity. Urbino was by-passed by the battles of that conflict.

Restoration of the Ducal Palace, along with the new acquisition of Renaissance art, has created a magnificent museum of the Renaissance. Here, within limestone and marble walls more delicate evidence of high civilization can be seen in the paintings, sculptures, and inlaid wooden cabinets and doors. The Duke's study, paneled with [inlaid wood](#), celebrates the discovery of perspective views used by artists to depict, with mathematical precision, three dimensional images on two dimensional surfaces. The panels in the Duke's study have several versions of the illusion of three dimensions executed on a flat surface.

[Padua](#) is another mid-sized Italian city just to the north of Ravenna with architecture and art dating back before the renaissance. It is also the site of some of Galileo's experiments with telescopes and of the first scientific studies of the human body carried out by careful dissection of cadavers. These medical demonstrations took place on the stage of a steep-sided amphitheater located at the University of Padua, one of the oldest universities in Europe, founded in 1222 ([Leslie Nystuen, M.D.](#) attempts to enter the amphitheater). The careful, dispassionate demonstrations by professors in front of medical students were meant to impart knowledge to medical students as it was being created through use of the new empirical tradition of science. The walls of the [loggia](#) enclosing the old courtyard of the Bo Palace, one of the core buildings of the university, are [lined](#) with [stone seals](#) and [crests](#) of graduates of the medical school.

[Bergamo](#) is a city located at the foot of the Alps northeast of Milan. The city is divided into the old, *Alti Calli* (high city) located high up steep-sloped hills with the new town spread out across more level surfaces at lower elevations. The central piazza might serve as a setting for a Shakespearean play ([photo](#); [sketch by author](#)). A medieval cathedral and a renaissance church stand close together at one end of the main piazza and are separated from it by an [open-sided arcade](#) covered by a high arched and vaulted ceiling.

An unusual feature located under this covered space is an [analemma](#) (and meridian) made of marble inlaid in the stone floor. An analemma is a graduated plot of the declination of the sun observed at solar noon throughout the year. A beam of sunlight passes through a small hole in a shield mounted high on the south facing wall. Through the course of a year the beam traces out the equation of time in an elongated, [asymmetric figure 8](#). The months and days of the year are marked on the analemma and each day is illuminated in turn by the sunbeam as it traces out a calendar year. The centerline of the structure marks the line of the meridian (north/south direction). At solar noon on the day of the Winter Solstice (December 20 or 21) the sun is at its lowest declination and casts its pencil of sunlight onto the crossing of the meridian by the analemma trace at the extreme northern extent of the larger of the loops of the figure 8 shape. On the summer solstice (June 20 or 21) the sun is at its highest

point in the sky and the pencil of sunlight illuminates the crossing of the analemma trace with the meridian on the southern extreme of the smaller of the loops of the figure 8. The light beam crosses the meridian twice more during the year; in the center of the figure 8, once on the Spring Equinox and again on the Fall Equinox but with the pencil of light approaching from opposite directions.

On our visit, we immediately recognized the inlaid figure on the floor to be an analemma but we were puzzled because it was located under a roof and surrounded by large buildings. How could direct sunlight fall on it? Close observation revealed that to the south just enough open sky existed to permit the [sun to shine through the shield](#) and onto the floor at noon on any day of the year (with a view of the shield in mind, now check back to the [broader general picture](#) to see it in context). Analemmas are specific to the latitude at which they are located. Inscribed in the floor along with the analemma is a record of the latitude, longitude and elevation of the figure. The inscription reads, [<Latitude 45° 12' 11" Nord, - Longitude 9° 39' 46" Est>](#) and on another line, [<Altitudine M. 360.85 sul livello Dell Adriatico>](#).

A [compass rose](#) is also present to which is affixed the presumed date of the work, 1857. That date is 137 years after telescope-equipped theodolites came into wide use for accurate measurement of angles (1720) (Wilford, p. 97). In that era, more accurate and stable surveying equipment was introduced and used for land surveys and earth measurements. In 1666, Isaac Newton had predicted that the earth might be better modeled as an ellipsoid or oblate spheroid (a solid figure generated by rotating an ellipse around its short, or minor, axis) than as a sphere (Wilford p.99). Using the improved surveying instruments and techniques, the French investigated this hypothesis by undertaking to measure an arc of the earth near the North Pole along the Meridian of Kitts (Lapland) (1736-37) and similarly along the Meridian of Quito (Ecuador) (1735-43) (Wilford, p. 101). The arc nearer the pole proved flatter than the arc at the equator, that is, a degree at high latitudes is longer than a degree near the equator. The curvature of the earth is greater at the equator and flatter near the poles. The technology increasing the precision in the measurement of angles and distances had been put to great scientific purpose, establishing the shape of the earth by empirical means in support of theory.

That more precise earth model was needed for the Bergamo analemma to be constructed with sufficient precision of shape and position for the sunbeam to stay on the track laid in stone. The Italians had undertaken cadastral and topographic surveys of northern Italy by the time the Bergamo analemma was constructed. Knowledge from such surveys would have been used to fix the location and altitude of the analemma. The two decimal figures for altitude implied high order geodetic control.

I wonder though whether theory alone was sufficient to predict the placement of the analemma relative to the shield mounted on the wall. It could be closely predicted but I speculate that the theory might have been backed up by empirical observations made throughout the seasons. Theory would direct how the construction should proceed; practice, on sunny days throughout the year, would suggest the location of the beam of light that could then be checked and recorded empirically. This presumes that they could determine the moment that high noon occurred. Over the months the precise path of the spot of light could be traced out.

Our overnight (May 15) visit to Bergamo was too short for us to learn of the history of the construction. A large library located on the piazza no doubt has a record of the project and perhaps on another day we will return and look into it. We were able to conduct some empirical observations of our own. [Jeffrey Nystuen](#), one of our party, had a portable GPS (global positioning system) receiver. The instrument was a hand held Magellan GPS receiver that he named Enrico, after Henry the Navigator (1394-1460). Despite being under cover with little open sky visible, [Enrico](#) could fix the location and altitude of the analemma. The receiver recorded the same latitude to the exact second as that written in the stone. There was one-second difference in longitude. Enrico reported elevation as five meters higher than that recorded in stone. Fixing elevation with a GPS is less exact than fixing position.

The length of one second of longitude at 45 degrees north can be approximated by multiplying the cosine of latitude by the length of a second of longitude at the equator of the athermal sphere (a sphere with the same surface area of the ellipsoidal model of the earth) (Robinson, et al.). This works out to be about 22 meters. Using the GPS Precise Positioning Service the positioning error of the Magellan GPS receiver should be less than 2 meters. [The circumference of the athermal sphere is 40,030.2 kilometers; thus, dividing the circumference by 360 yields one degree as equal to 111,195 kilometers and, subdividing further, one second as 30.89 meters. Cosine 45 degrees times 30.89 meters equals approximately 22 meters (Robinson, et al.)]

In May of 2000, the [Selective Availability](#) feature of the GPS was turned off by the U.S. government. Prior to this date, for military purposes, deliberate degrading of the stability of the on-board atomic clocks in the GPS satellites degraded the GPS signals. The Standard Positioning Service that had been previously available (worldwide) provided at best 100 meter accuracy. As it was, this degradation could be overcome by using differential GPS procedures in which a base receiver station with a well-known position could be used in conjunction with a roving receiver. This procedure was being routinely applied by a variety of civilian users.

Today relatively inexpensive GPS receivers are being employed in myriad tasks not at all envisioned by the designers of the system. For example Enrico, the hand-held receiver, provides the basic latitude, longitude, and altitude with error terms attached but it can also indicate direction and speed of movement -- even walking speed. One can fix a position in Enrico's memory, such as the location of the parked car, and then wander off through a maze of medieval Italian streets and Enrico can show the path to take to return to the car. It has in its memory the locations of most towns and cities with population greater than twenty thousand, at least, in North America and Europe where Enrico has been put to use.

Precise agreement in latitude and one second discrepancy in longitude seems very good for the performance of a hand-held GPS receiver and for the older methods that were employed to locate and design the analemma. Yet given the assumed accuracies, a 22 meter discrepancy may be too large. The likely explanation is in the differences in the theories applied. The Italians in 1858 modeled the earth as an ellipsoid using the best available datum (values for earth radii and eccentricity) perhaps the Bessel, 1841 model that is widely used in Europe. This datum differs from WGS84 (World Geodetic System, 1984) which now is used in conjunction with modeling the satellite orbits. Those orbits respond to the earth's center of gravity, not its geometric center. The same basic assumption must be made to achieve identical results. What the good correspondence we observed indicates is that both models are very good.

The Italians have made many contributions to Western Civilization and to our modern global society. Fortunately records of some of these achievements have been set in stone. I wonder, in this new informational age that we live in today and that is so rapidly becoming digital and electronic, are we leaving imprinted forms so durable that after one hundred fifty years, a thousand years, or fifteen hundred years they will be fresh and bright, full of grace and beauty and intellectual achievement? Will they charm passing travelers?

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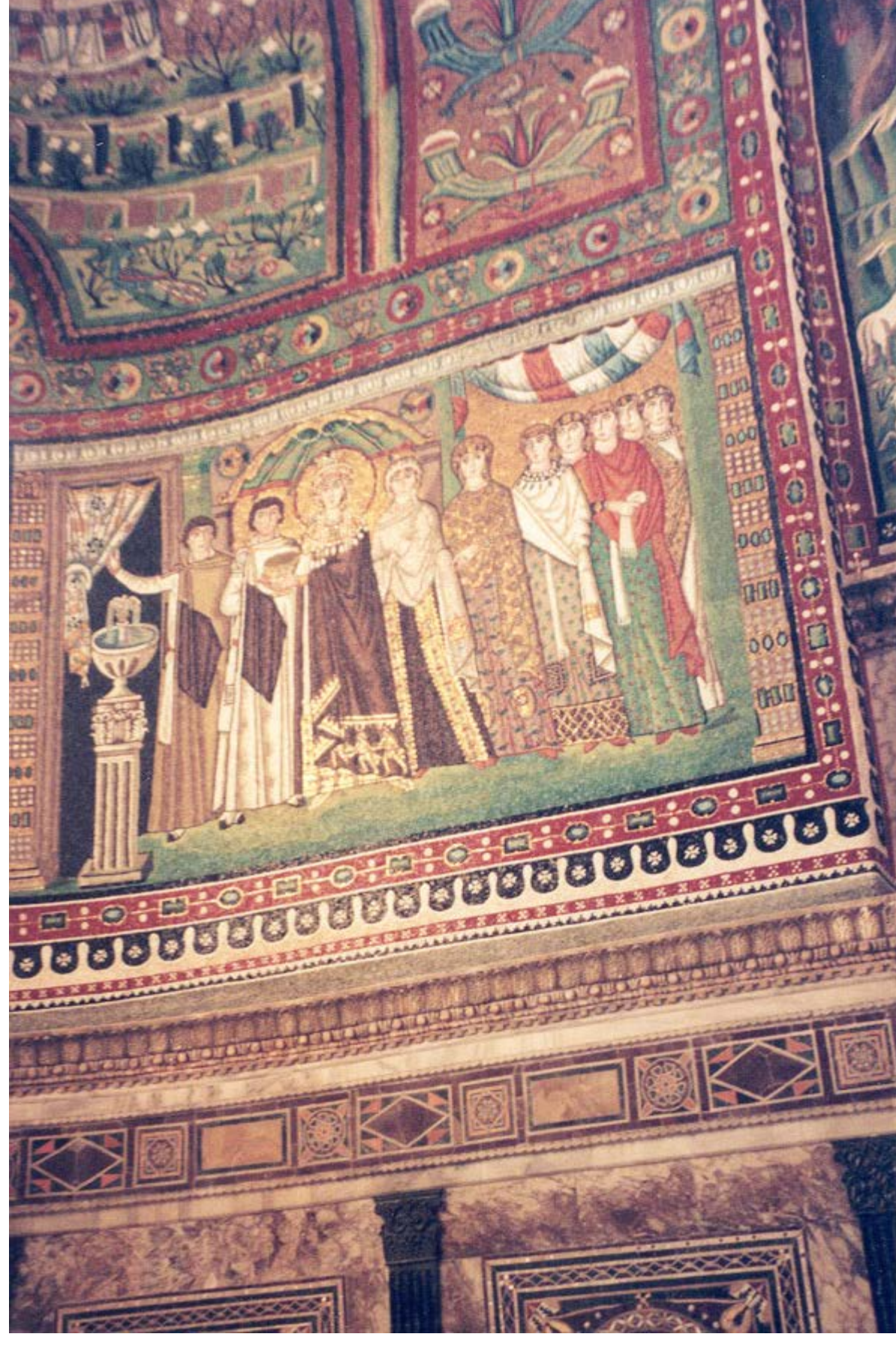
[Equation of Time](#)

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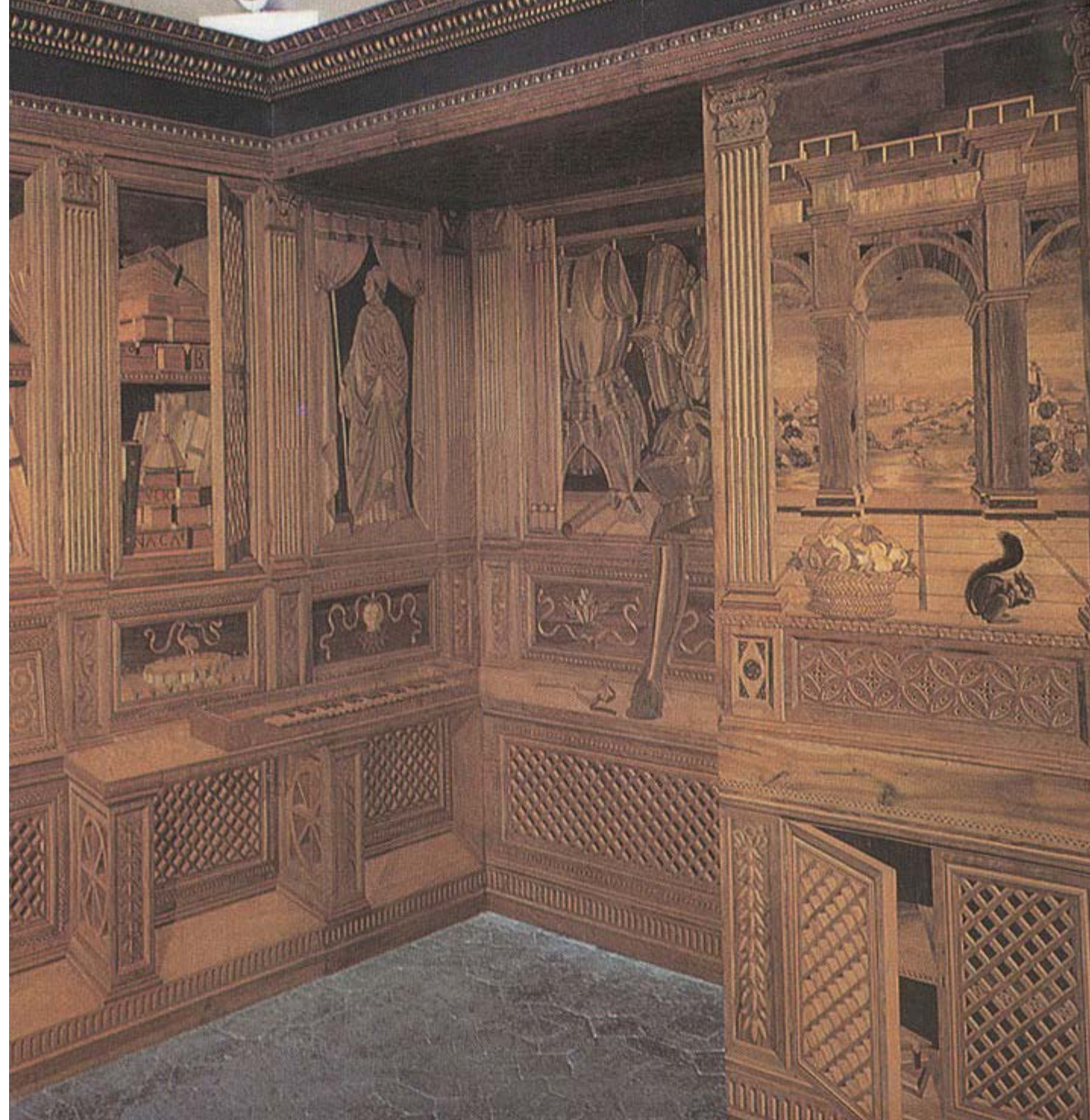








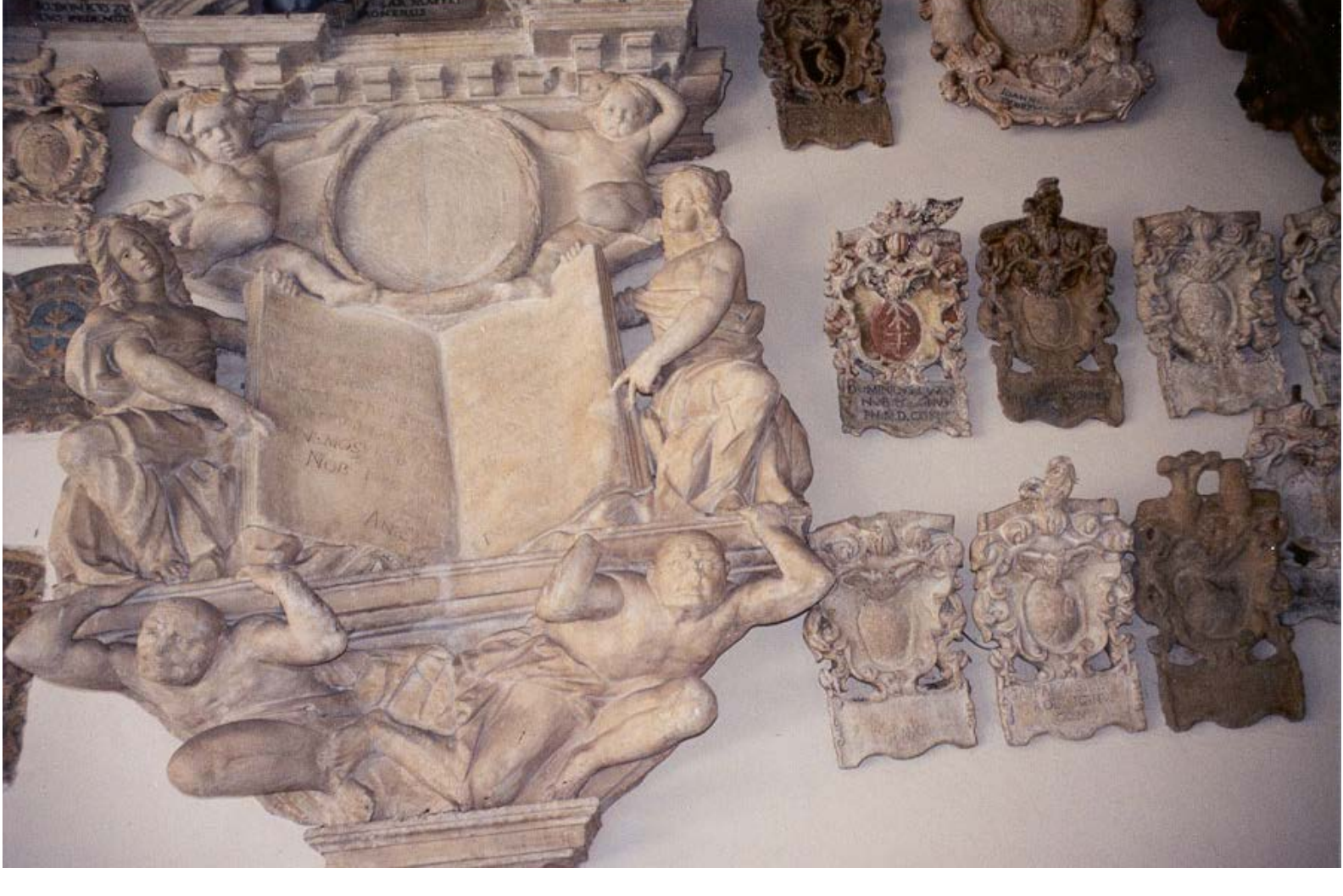














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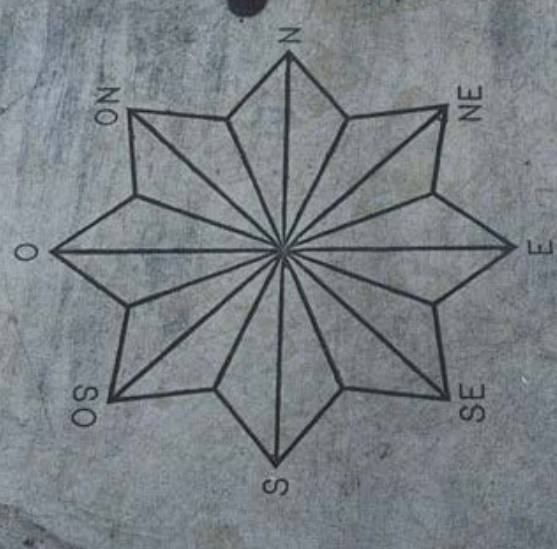




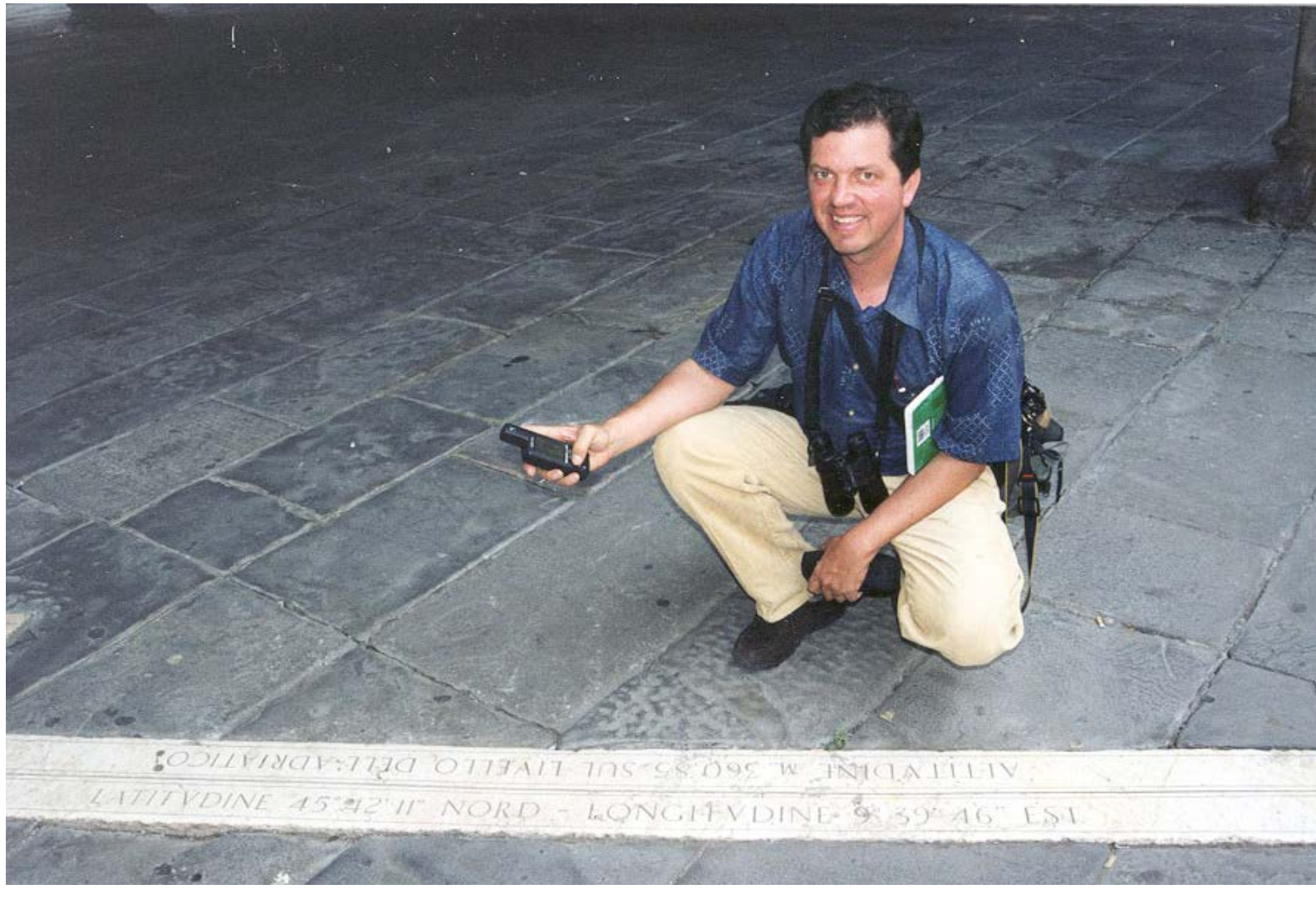




ALTEZZA GNOMONICA METRI 7 CENT 64



Costrutta nel 1715 Rinnovata nel 1857



Quotation from PC Magazine, online.

The Global Positioning System is now ten times more accurate than before.

By Alfred Poor ♦ May 18, 2000

"The Global Positioning System (GPS)... has become an important part of our business and recreational activities. With the flick of a switch in May, the U.S. government instantly made it about ten times more accurate.

Originally designed to provide navigation information for the military services, the GPS depends on a constellation of 24 satellites and five ground stations. In order to prevent the system from being so accurate that enemies could use it against us, the Department of Defense had been using selective availability (SA) to degrade the signal. As a result, civilian applications were limited to about 100-meter accuracy, while the military's own equipment was able to eliminate the SA errors.

Turning off SA has improved GPS accuracy for all users to from 10 to 20 meters. With SA enabled, reported positions could be as much as 300 feet distant from the actual ones--enough to cause a mapping program to place your car on a street parallel to the one you were actually on. With SA turned off, the resulting 30-foot accuracy is enough to determine whether your car is on one side of a divided highway or the other. This level of accuracy will provide many benefits, including faster response times by emergency services.

...Although the United States intends to make the GPS system available for free for worldwide use, the military retains the ability to enable SA distortion 'on a regional basis' if required for national security."

Sundials on the Internet

For a full overview [click here](#)

sundial trail of Milan and Bergamo

These notes are based on a very short visit to Northern Italy in October 1999.

Milan

The Duomo (cathedral) of Milan has a magnificent tiled floor, interrupted by a meridian line which runs nearly the full width of the building, and goes on for 3m. up the left hand wall. You will find it just inside the main entrance doors, in front of the small publications booth. The line is a brass strip, with white marble on either side. The signs of the zodiac are marked at appropriate intervals along the meridian line. There is a small hole in the wall high up on your right hand side as you enter the cathedral; a spot of light shines through the hole and casts a small circle of light on the floor around the time of solar noon. There is a printed table on the left hand wall showing the time of solar noon (together with sunrise and sunset)

According to the guide book, there is another sundial outside the cathedral as well, but I was not able to locate it.

While other sundials in Milan appear to be very few, there is a magnificent collection of sundials and other scientific instruments concerned with the sun at the Museo Poldi-Pezzoli which is quite close to the Duomo. There are some 230 exhibits in all, well displayed in three cases on the first floor. The museum is a delight - not a bit like the formal public art galleries (such as the Pinoteca Brera nearby) but with some really nice paintings displayed in fairly small rooms with furniture, china cabinets, etc, and some displays of other classes of objects such as sundials, clocks, and weapons.



The picture shows an ivory sun-dial in the shape of a ship known as a navicella. Posters of this sundial are sold in the museum.

The sundial display has many attractive portable dials, including two sundials combined with a small cannon fired by the sun's rays focused through a magnifying glass at noon, a curious horizontal sundial with a gnomon adjustable for latitude (though, since the lines on the dial plate are fixed, it would not be very accurate at any location other than the latitude it was designed for), and some shepherd's dials and astrolabes. Altogether unmissable!

Bergamo

Bergamo is a very interesting town located some 40 km. east of Milan, and accessible either by the blue motorway buses which leave from the Piazza Castello, or by train from the Central Station. The bus station and train station in Bergamo are very close together. Catch a no. 1 or 1A bus to the foot of the funicular railway, and take the funicular to ascend into the old town. From the terminus, walk directly across the square and up some steps into another small square. There is a group of 4 large sundials on the wall high up to your right.

Carry on in the same direction until you reach the Duomo (cathedral). In the colonnade opposite the main door of the cathedral is a very handsome meridian line. The central line is marked with the dates and months throughout the year. There are two subsidiary lines fanning out which indicate 15 minutes before noon, and 15 minutes after noon. Between these two outer lines, an analemma is engraved in the stone. High up in one of the arches of the collonnade is a disk with a central hole. Towards solar noon, a spot of light shines through the hole on the pavement, and gradually moves across the meridian line. When it is on the meridian line, it is exactly solar noon. When it crosses the hour-glass shape of the analemma, it is exactly local noon, which is about 11.35 by your watch (or 12.35 when daylight saving is in operation). This difference is because Bergamo is some 9 degrees west of the standard meridian for Central European Time, which is at the longitude of Prague.

For a full overview of Sundials on the Internet [click here](#)

This site designed and maintained by [Internetworks](#) Ltd of [Epsom](#), England

www.sundials.co.uk/~ottawa.htm first posted December 1998 last revision 25 April 1999

Comments/ suggestions/ problems, please get in touch with the [Webmaster](#)

Sundials on the Internet

For a full overview [click here](#)

Sundials on the Internet - the Equation of Time

"Sun time" and "clock time"

Sundials tell "sun time". Clocks and watches tell "clock time". Neither kind of time is intrinsically "better" than the other - they are both useful and interesting for their separate purposes.

"Sun time" is anchored around the idea that when the sun reaches its highest point (when it crosses the meridian), it is **noon** and, next day, when the sun again crosses the meridian, it will be noon again. The time which has elapsed between successive noons is sometimes more and sometimes less than 24 hours of clock time. In the middle months of the year, the length of the day is quite close to 24 hours, but around 15 September the days are only some 23 hours, 59 minutes and 40 seconds long while around Christmas, the days are 24 hours and 20 seconds long.

"Clock time" is anchored around the idea that each day is exactly 24 hours long. This is not actually true, but it is obviously much more convenient to have a "mean sun" which takes exactly 24 hours for each day, since it means that mechanical clocks and watches, and, more recently, electronic ones can be made to measure these exactly equal time intervals.

Obviously, these small differences in the lengths of "sun days" and "mean days" build up to produce larger differences between "sun time" and "clock time". These differences reach a peak of just over 14 minutes in mid-February (when "sun time" is slow relative to "clock time") and just over 16 minutes at the beginning of November (when "sun time" is fast relative to "clock time"). There are also two minor peaks in mid-May (when "sun time" is nearly 4 minutes fast) and in late July (when sun time is just over 6 minutes slow) (These minor peaks have the fortunate effect, in the Northern hemisphere, that the differences are relatively minor during most of the months when there is a reasonable amount of sunshine).

The differences do not cumulate across the years, because "clock time" has been arranged so that, over the course of a four year cycle including a leap year, the two kinds of time very nearly come back to the same time they started. (The "very nearly" is because "clock time" still has to be adjusted by not having a leap year at the turn of each century, except when the year is exactly divisible by 400, so 1900 was not a leap year, but 2000 will be). Even with this correction, we had an extra second added to "clock time" recently.

The reasons for these differences are discussed below, followed by some information on what the differences are at given times of year.

Why the days are of different lengths

These differences arise from two quite separate causes. The first is that the plane of the Equator is not the same as the plane of the Earth's orbit around the sun, but is offset from it by the **angle of obliquity**.

The second is that the orbit of the Earth around the sun is an ellipse and not a circle, and the apparent motion of the sun is thus not exactly equal throughout the year. The sun appears to be moving fastest when the Earth is closest to the sun.

These two effects are explained in more detail in a leaflet of the [Royal Greenwich Observatory](#) and in [Art Carlson's excellent article](#) on the subject at the end of this page.

The sum of the two effects is the Equation of Time, which is the red curve with its characteristic twin peaks shown below. (Many thanks to Patrick Powers for providing this graph from his own [sundial page](#)).



Some people like such information presented in tables rather than in graphs, so two tables are presented for your information below. These are both handy summary tables, which will give you a different view of the Equation of Time, and may help you to remember some key features, for example, that between the end of March and mid-September the sun is never more than 6 minutes away from "clock time", and for the whole of February it is 13 or 14 minutes slow! If you want to know the Equation of Time for every day of the year, there is a table in Appendix A of the [book](#) by Waugh.

Table showing the dates when "Sun Time" is (nearly) exactly a given number of minutes fast or slow on "Clock Time"

Minutes Fast					
16	Nov 11			Oct 27	
15	Nov 17			Oct 20	
14	Nov 22			Oct 15	
13	Nov 25			Oct 11	
12	Nov 28			Oct 7	
11	Dec 1			Oct 4	
10	Dec 4			Oct 1	
9	Dec 6			Sep 28	
8	Dec 9			Sep 25	
7	Dec 11			Sep 22	
6	Dec 13			Sep 19	
5	Dec 15			Sep 16	
4	Dec 17			Sep 13	
3	Dec 19	May 4	May 27	Sep 11	
2	Dec 21	Apr 25	Jun 4	Sep 8	
1	Dec 23	Apr 21	Jun 9	Sep 5	
0	Dec 25	Apr 15	Jun 14	Sep 2	
1	Dec 28	Apr 12	Jun 19	Aug 29	
2	Dec 30	Apr 8	Jun 23	Aug 26	
3	Jan 1	Apr 5	Jun 29	Aug 22	
4	Jan 3	Apr 1	Jul 4	Aug 18	
5	Jan 5	Mar 29	Jul 9	Aug 12	
6	Jan 7	Mar 26	Jul 18	Aug 4	
7	Jan 9	Mar 22			
8	Jan 12	Mar 19			
9	Jan 15	Mar 16			
10	Jan 18	Mar 12			
11	Jan 21	Mar 8			
12	Jan 24	Mar 4			
13	Jan 29	Feb 27			
14	Feb 5	Feb 19			

Table showing the Equation of Time on the 5th, 15th and 25th of each month, together with the average daily change in seconds (given in minutes and second, + = "Sun time" is fast on "clock time"

Eq.of time on the:	5th	15th	25th	Av. change (secs)
January	-5m03	-9m10	-12m12	20
February	-14m01	-14m16	-13m18	5
March	-11m45	-9m13	-6m16	16
April	-2m57	+0m14	+1m56	18
May	+3m18	+3m44	+3m16	4
June	+1m46	-0m10	-2m20	16
July	-4m19	-5m46	-6m24	20
August	-5m59	-4m33	-2m14	11
September	+1m05	+4m32	+8m04	20
October	+11m20	+14m01	+15m47	13
November	+16m22	+15m28	+13m11	10
December	+9m38	+5m09	+0m13	27

The equation of time

Written by [Art Carlson](#). October, 1995 .

The rotation of the Earth makes a good clock because it is, for all practical purposes, constant. Of course, scientists are not practical and care about the fact that the length of the day increases by one second every 40 000yrs. For the rest of us, it's just a matter of finding a convenient way to determine which way the Earth is pointing. Stars would be good, but they are too dim (and too many) at night and go away during the day. A useful aid is the Sun, which is out and about when we are and hard to overlook. Unfortunately, the apparent position of the sun is determined not just by the rotation of the Earth about its axis, but also by the revolution of the Earth around the Sun. I would like to explain exactly how this complication works, and what you can do about it.

The diameter of the Sun as seen from the Earth is 1/2 degree, so it moves by its own radius every minute.

$$\frac{24\text{hrs}}{360\text{deg}} \times \frac{60\text{min}}{1\text{hr}} \times \frac{1}{4} \text{-deg} = 1\text{min}$$

That means it will be hard to read a sundial to better than the nearest minute, but then, we don't bother to set our clocks much more accurately than that either. Unfortunately, if we define the second to be constant (say, the fraction 1/31 556 925.974 7 of the year 1900, the "ephemeris second"), then we find that some days (from high noon to high noon) have more than 86,400 seconds, and some have less. The solar Christmas day, for example, is 86,430 seconds long. The discrepancy between "apparent time" and "mean time" can add up to +/- 15min. How does it come about?

The inclination of the ecliptic

First note that the Earth rotates on its axis not once in 24hrs but once in 23hrs 56min 4sec. It's just that in the course of a 365dy year, the Earth must turn an extra time to make up for its orbit about the sun.

$$\frac{1\text{dy}}{366} \times \frac{24\text{hrs}}{1\text{dy}} \times \frac{60\text{min}}{1\text{hr}} = 3\text{min } 56\text{sec}$$

The trouble comes in because this 3min 56sec is only an average value. Think of an observer sitting at the north pole on a platform which rotates once every 23hrs 56min 4sec. She will see the stars as stationary and the sun as moving in a circle. The plane of this circle is called the "ecliptic" and is tilted by 23.45deg relative to the equatorial plane. The observer will see the sun move from the horizon, up to 23.45deg, then back down to the horizon. The sun will move at a constant speed (I'm lying, but wait till later) along its circle, but the shadow cast by the North Pole (the one with the red and white candy stripes) will *not* move at a constant rate. When the sun is near the horizon, it must climb at a 23.45deg angle, so that it has to move 1.09deg before the shadow moves 1deg.

$$\frac{1\text{deg}}{\cos(23.45\text{deg})} = 1.0900\text{deg}$$

On the other hand, in the middle of summer, the sun is high in the sky taking a short cut, so it must move only 1deg along its circle to cause the shadow to move 1.09deg. This effect generalizes to more temperate climates, so that in spring and fall the 3min 56sec is reduced by the factor 1.09 to 3min 37sec, whereas in summer and winter it is correspondingly increased to 4min 17sec. Thus a sundial can gain or lose up to 20sec/dy due to the inclination of the ecliptic, depending on the time of year. If it is accurate on one day, six weeks later it will have accumulated the maximum error of 10min.

$$\frac{20\text{sec}}{1\text{dy}} \times \frac{2}{\pi} \times \frac{1\text{min}}{60\text{sec}} \times 45\text{dys} = 10\text{min}$$

The seasonal correction is known as the "equation of time" and must obviously be taken into account if we want our sundial to be exact to the minute.

If the gnomon (the shadow casting object) is not an edge but a point (e.g., a hole in a plate), the shadow (or spot of light) will trace out a curve during the course of a day. If the shadow is cast on a plane surface, this curve will (usually) be a hyperbola, since the circle of the sun's motion together with the gnomon point define a cone, and a plane intersects a cone in a conic section (hyperbola, parabola, ellipse, or circle). At the spring and fall equinox, the cone degenerates to a line and the hyperbola and the parabola, ellipse, or circle). With a hyperbola for each day, hour marks can be put on each hyperbola which include any necessary corrections. Unfortunately, each hyperbola corresponds to two different days, one in the first half and one in the second half of the year, and these two days will require different corrections. A convenient compromise is to draw the line for the "mean time" and add a curve showing the exact position of the shadow points at noon during the course of the year. This curve will take the form of a figure eight and is known as an "analemma". By comparing the analemma to the mean noon line, the amount of correction to be applied generally on that day can be determined. At the equinox, we found that the solar day is closer to the sidereal day than average, that is, it is shorter, so the sundial is running fast. That means in fall and spring the correct time will be earlier than the shadow indicates, by an amount given by the curve. In summer and winter the time will be later than indicated.

The eccentricity of the Earth's orbit

If you look at such a figure eight calculated correctly, you will see that the fall and winter loop is actually somewhat larger than the spring and summer loop. This is due to the lie I told above. The Earth does not actually orbit at a constant speed around the sun. On January 2, the Earth is 1.7% closer to the Sun than average and thus the angular velocity is 3.4% larger (conservation of angular momentum). This makes the solar day longer than the sidereal day by about 8sec more than average,

$$\frac{3\text{min } 56\text{sec}}{1\text{dy}} \times 0.034 = 8.0\text{sec/dy}$$

and in the course of 3 months a sundial accumulates an error of 8min due to the eccentricity of the Earth's orbit.

$$\frac{8.0\text{sec}}{1\text{dy}} \times \frac{2}{\pi} \times \frac{1\text{min}}{60\text{sec}} \times 91\text{dys} = 8\text{min}$$

Thus the correct time will be later than the shadow indicates at the spring equinox and earlier at the fall equinox. This shifts the dates at which the sundial is exactly right from the equinoxes into the summer, making the summer loop of the figure eight smaller.

The 20sec/dy error due to the inclination of the ecliptic and the 8sec/dy error due to the eccentricity work in the same direction around Christmas time and add up exactly (and the 30sec/dy error due to the 30sec/dy mentioned earlier. The accumulated errors of 10min and 8min due to these two effects don't add up quite so neatly, so the maximum accumulated error turns out to be somewhat less than 18min. If you calculate everything correctly, you find that during the course of a year a sundial will be up to 16min 23sec fast (on November 3) and up to 14min 20sec slow (on February 12).

Suppose in October you start a 15min coffee break at 10:45 by the wall clock. If you believe the sundial outside and not accounting for the equation of time, you will already be late for the 11:00 session as soon as you step out the door.

Other pages on the Internet which are concerned with the Equation of Time are from the

Royal Greenwich Observatory
<http://www.ast.cam.ac.uk/pubinfo/leaflets/equation/equation.html>,
and from a number of individual pages, including
http://ourworld.compuserve.com/homepages/patrick_powers/sundials.htm, from
<http://cpcug.org/user/jaubert/sundial.html> (this link now changed or superseded)
<http://www.ipp.mpg.de/~awc/sundial.html>

We would appreciate an [E-mail](#) from you if you know of any others. Thank you

For a full overview of Sundials on the Internet [click here](#)

This site designed and maintained by [Internetworks](#) Ltd of [Epsom](#), England
www.sundials.co.uk/equation.htm first posted 1996 last revision 25 April 1999
Comments/ suggestions/ problems, please get in touch with the [Webmaster](#).

Related articles on the IMAge website:

- Motor Vehicle Transport and Global Climate Change: Policy Scenarios
- The Photographic Record - SunSweep: A Visit on the Summer Solstice
- The Spatial Shadow: Light and Dark--Whole and Part

Personal Reflections on Solar Power

Richard Wallace

**The University of Michigan
and
Community Systems Foundation**

By my calculations, on May 16, 2000, with the summer solstice fast approaching, the sun should have been directly overhead at noon roughly somewhere near where I stood in south Goa. The **linked photograph shows the author's wife, Kami Pothukuchi, on the beach in Goa**, approximately 74 degrees east longitude, 15 degrees north latitude. Consider the pattern of shadow in that photograph. Prior to this past May, I had never experienced the sun **directly overhead, nor had I traveled to India, my wife's home country**. Thus, during my stay in India, I could not help but contemplate the sun and its byproducts and how they affected life in India.

Appropriately, the sun and its effects played a central role in our trip. Even before our departure from Ann Arbor, my wife and I regularly checked the weather reports for Mumbai and Chennai in order to gauge just how hot it might be there during our stay. We arrived in Mumbai around midnight on May 7, but the heat and humidity still were intense, especially with the monsoons only about one month off. From then on, every day required consideration of the sun and the deleterious effects it might have on my pale skin: dressing properly, finding shade, applying sunscreen, obtaining safe drinking water, and timing trips to avoid the worst heat of the day, if at all possible. (**Linked photo** shows the author, looking weary of the sun, in Mumbai. The street is not named for the author.)

Indirect products of the sun, too, were much in evidence during this trip. Fossil-fuel powered **vehicles** (note traffic in linked photo) are becoming increasingly common in India, for example, and they have begun to cause severe pollution effects. Even in the hill station resort of Ooty, surrounded by tea plantations, diesel exhaust proved omnipresent. Like Mexico City, Ooty is nestled in a mountain valley. Therefore, the exhaust produced by the countless tour buses, motor scooters, and power boats that ply the narrow mountain roads and mountain lakes settles in and stays the night, just like the tourists. Indeed, by my nasal meter, air quality in Ooty was worse than what we encountered in Mumbai.

Plastics, too, the polymerized end-products of eons of photosynthetic activity, have found their way into the Indian environment. Everywhere we went plastic bags and bottles littered the countryside. Apparently, the Indian system of creative reuse and recycling of all waste products has yet to devise a system for keeping up with the supply of discarded plastic.

Let's not forget about the rain. The monsoons, terrific storms powered by the intense summer sun heating the land far in excess of the sea, were due shortly after our scheduled departure for the U.S. As luck would have it, however, our return to Mumbai from greeting the sun in Goa was met with the worst **pre-monsoon rains in 50 years**—rains so intense that they shut-down the trains and buses and even dislodged a seemingly endless series of stories dedicated to gambling scandals in cricket and the **Miss Universe Pageant (an Indian won yet again)**—could the sun have played a role here, too?) from the front page of *The Times of India*.

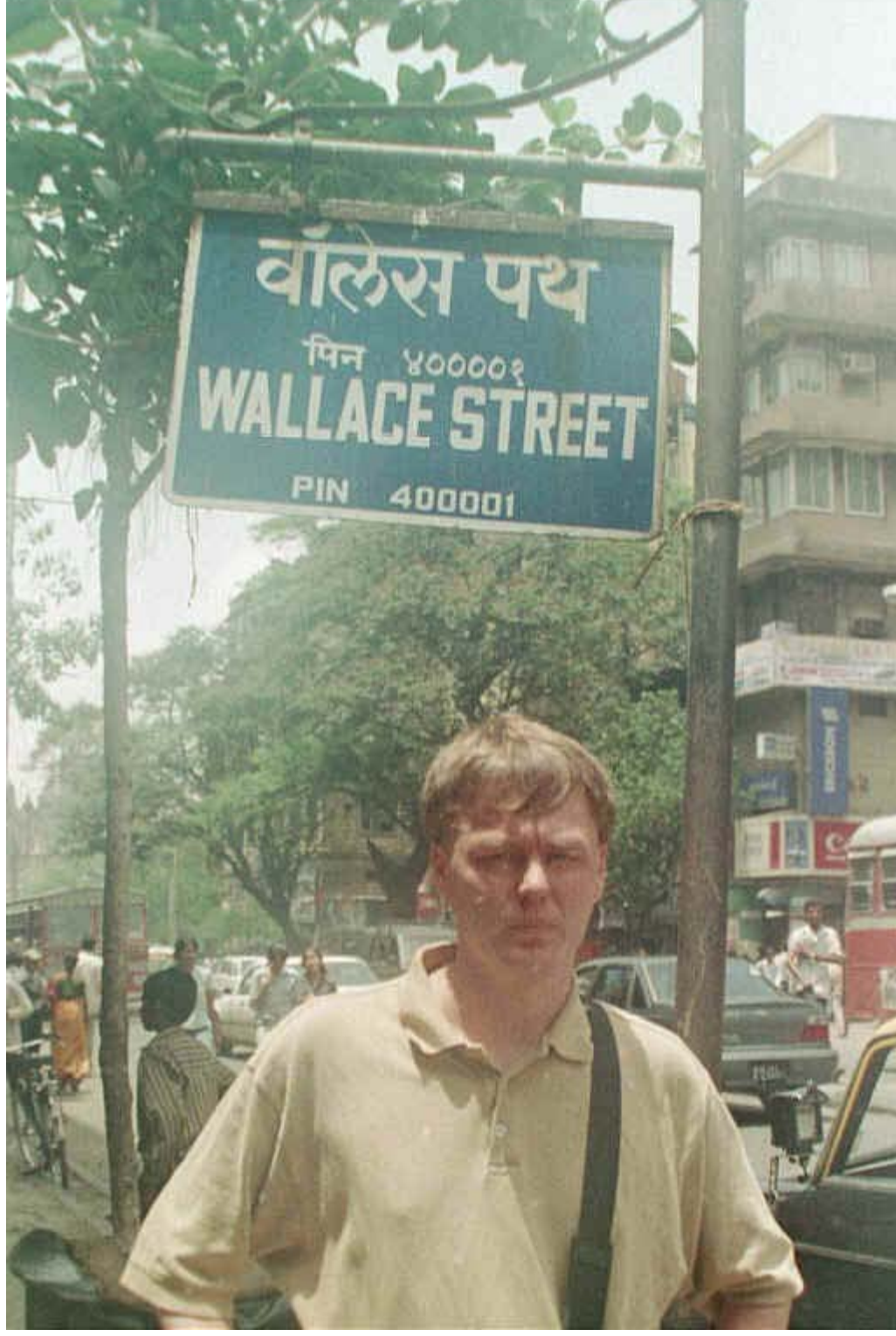
Today (summer solstice, June 21, 2000), the sun begins heading south again, headed toward the Tropic of Capricorn for about the ten billionth time. As it does so, it will pass over much of a nation that is increasingly a leader in high technology, albeit while still having most of its one billion people mired in deep poverty. Now that I am back in the US, avoiding use of my car and recycling all of my plastic, I am hopeful that India will devote some of its newfound high-tech expertise toward improved use of our shared solar resources. Perhaps, for example, an Indian engineer will develop a solar-powered car, or at least one that runs cleanly off all those empty plastic water bottles that I left behind.

Source of solar image: http://umbra.gsfc.nasa.gov/eit/eit_full_res.html

Source of sand image: cropped from the author's photograph of a beach in southern Goa.



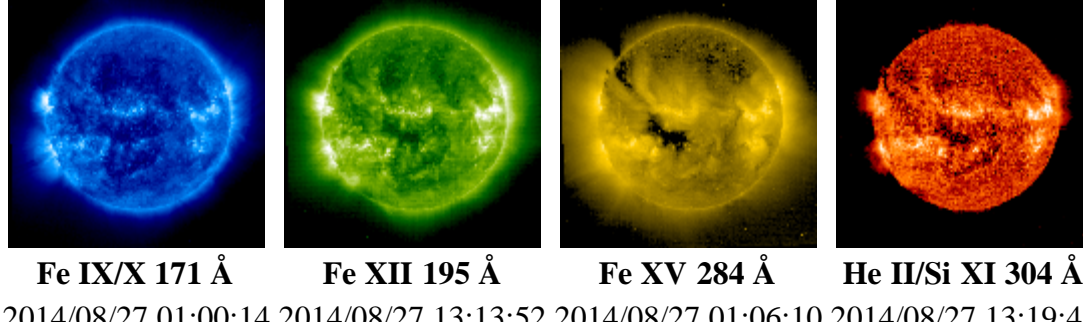




Latest EIT full-field images

Starting 2010 August 1, EIT is obtaining only two sets of images in these four wavelengths per day. The Solar Dynamics Observatory (SDO) Atmospheric Imaging Assembly (AIA) obtains EUV images of the Sun every 12 seconds, and links to those images (updated every half hour) can be found at the SDAC [latest images page](#).

Each thumbnail image is a link to a 512 x 512 GIF image of the corresponding, latest EIT **synoptic** file. The "full res" link is to the full-sized image, whether 512 x 512 or 1024 x 1024. Only files with fewer than 15 missing pixel blocks are included.



Fe IX/X 171 Å **Fe XII 195 Å** **Fe XV 284 Å** **He II/Si XI 304 Å**

2014/08/27 01:00:14 2014/08/27 13:13:52 2014/08/27 01:06:10 2014/08/27 13:19:45

[full-res](#)
[512 x 512](#) [full-res](#)
[512 x 512](#) [full-res](#)
[512 x 512](#) [full-res](#)
[512 x 512](#)

Please note that the GIF files to which the "full-res" thumbnails are linked may be representations of full-resolution images, and so are fairly large (700 - 800 Kbyte) when the originals are 1024 x 1024 pixels in size.

Access to full-resolution images has been freely available since 1998 January.

For 512 x 512 representations of the images (more practical if you have a low-bandwidth connection anyway), click on the "512 x 512" links.

[▲ The EIT home page](#) [▲ The SDAC home page](#) [▲ The SOHO home page](#)

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Related articles on the IMAge website:

- [Animaps](#)
- [Animaps II](#)
- [Animaps III: Color Straws, Color Voxels, and Color Ramps.](#)

Animaps IV: Of Time and Place

[Sandra Lach Arlinghaus](#)

The University of Michigan
and
Community Systems Foundation

[Link](#) to original: Caution--browser may crash on loading Java applets.

"The people along the sand
All turn and look one way;
They turn their backs on the land
They look at the sea all day.

They cannot look out far,
They cannot look in deep;
But when was that ever a bar
To any watch they keep."

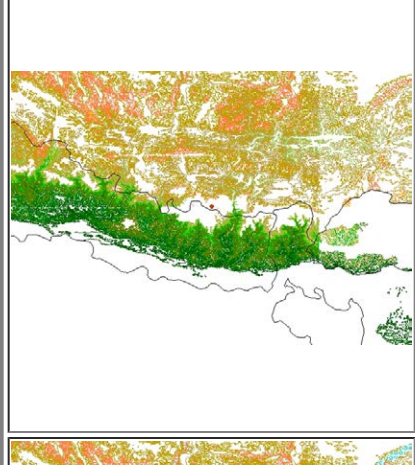
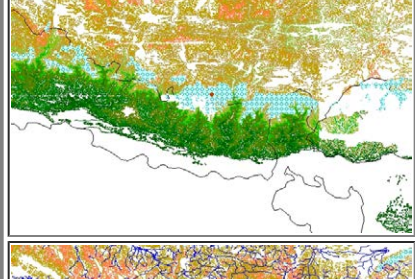


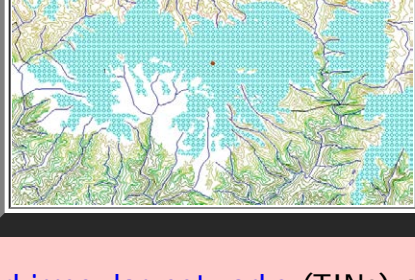
Robert Frost, *Neither out far nor in deep.*

Animated maps offer exciting possibilities for tracking spatial change over time. In earlier work in this journal (see links above), animated maps (or "animaps") were used to track changes, across the globe, in [bee mite population](#) over time. They were also used as analytic tools that could employ surrogate variables to [mimic change over time](#) in variables that were difficult to learn about. The introduction of time, through animation, into the mapping process allows the user to participate "with" the map in more than a purely passive manner; two examples are offered below that allow the reader some degree of interaction with the process. In the first, the reader experiences emotional involvement only and a downloadable interaction, only; in the second the reader can actually drag elements of the map around on the screen, as an instantaneous interaction achieved directly through the browser.

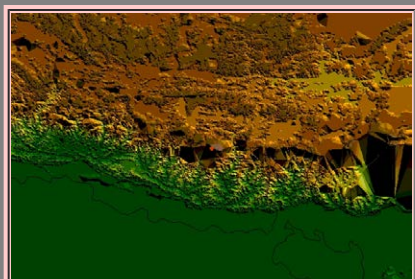
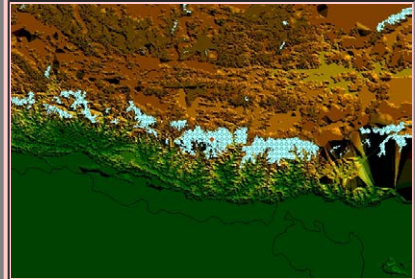
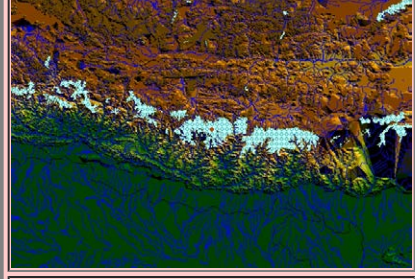
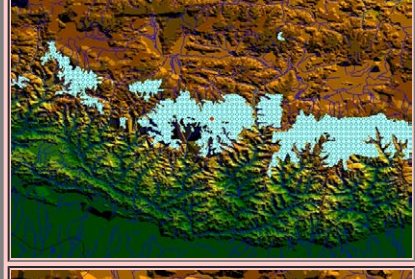
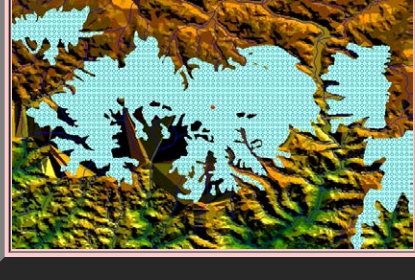
Mount Everest: Landing and Take-off

Maps showing mountain ranges are often some of the most difficult to read. Tightly spaced contours look like a jumble of spaghetti that communicate effectively only at quite a local scale. The broad picture can be difficult to grasp. Consider the following sequence of maps of the India/Nepal/China region surrounding Mount Everest. Here the Himalayas come right up against the Gangetic Plain; tightly spaced contours give way sharply to no contours at all.

All the maps in the table below are made from files from the Digital Chart of the World. The contour interval is 1000 feet. The red dot on the map was placed there at 28 degrees north latitude and 86.95 degrees east longitude, the coordinates of Mount Everest given in Goode's World Atlas. That dot appears in all images in this section.

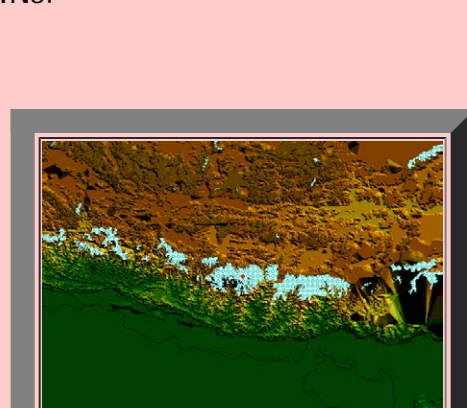
	The only layers used in this map are those for contours from 1000 to 26000 feet along with the country boundary file. Note the vertical separation line between tiles and the gaps in contours at higher elevations. These suggest a lack of information. Scale: 1:5,000,000.
	When the layer for glaciers is added some of the missing information is added. Scale: 1:5,000,000.
	When the layer for perennial streams is added the remaining missing information is not filled in. Extra information and extra clutter are added. Scale: 1:5,000,000.
	Taking a closer look (1:2,500,000) one can separate some of the contours; others still are clumped.
	Taking an even closer look (1:1,000,000) permits visual separation of all contours but at the expense of any broad view of the mountain range.

[Triangulated irregular networks](#) (TINs) are one way to bring some degree of visual order into maps with tightly spaced contours. The table below shows a TIN for each of the maps in the table above. They were made in ArcView 3.2 with both Spatial Analyst and 3D Analyst Extensions loaded. The shading ramp employed was one of the default hypsometric set of hues. (The reader should note that even though these are "standard" in some sense, green does not necessarily mean that there is lush vegetation nor does brown necessarily mean that there is dry, barren land.)

	TIN based on the contours; the gaps in the contours appear as unusually steep slopes in the associated TIN (as at the right of the map). Scale: 1:5,000,000.
	Glacier pattern covers some of the contour gaps and unusually steep slopes. Scale: 1:5,000,000.
	Streams added to the TIN cover it up a bit too much at this scale. Scale: 1:5,000,000.
	A closer view shows streams filling swales, as one might expect. Scale: 1:2,500,000.
	In an even closer view some of the finer triangular facets forming the TIN become evident. Scale: 1:1,000,000.

At a broad scale these have the advantage of offering some order where little was discernible with contours alone or with contours and other layers.

To get both Frost's close-up and far-out view--to look both out far and in deep--animate the TINs.



The animation above is formed from a sequence of 100 TINs of this region. The single images range in scale from 1:5,000,000 to 1:100,000 with images captured at intervals of 100,000 change in the scale. There are 50 images in the landing on Mount Everest sequence and 50 images in blasting off from Mount Everest sequence. The red dot is fixed; it appears to move because, with scale change, the glacier background pattern is changing size and the pattern within it is changing position in relation to the fixed red dot.

Mapplets.

In previous animaps, change was displayed on a base map. Thus, clustering of regions on the map became apparent over a number of time periods. What did not become apparent was clustering of events in time. Such a clustering is important if one is looking for ways to intervene in the diffusion process; choke-points provide an opportunity to introduce innovations that can control or enhance the diffusion process. A relatively new graphical device, a Java applet (Java is a trademark of Sun Microsystems), offers an exciting way to display change over time and reveals clusters of information in a graphically dynamic manner, much as one might imagine in watching the accelerated growth pattern of grape clusters on a vine.

This set, "Mapplet" below offers a different perspective on the [varroa mite data set](#). That data set shows easily that there is one country reporting the mite in 1963; in 1912 there is a siting in one other country. This sort of sporadic siting, one country at a time, occurs until 1963. Post-1963 there are multiple countries that come in on a yearly basis: sometimes 3 new additions, sometimes 7 new additions. The pattern of new reporters may show cycles; indeed, experts on the mites might reflect on whether or not the graphical pattern on number of new countries by year corresponds in any way to various biological cycles associated with the mite or its host. If it does, then choke-points in the pattern offer possible timing opportunities to intervene (Arlinghaus and Nystuen). If it does not, then one might consider the extent to which there is cyclical pattern in reporting error or in shipping (<http://www.agric.wa.gov.au:7000/ento/bee.htm>) and travel patterns. A glance at the [maps](#) suggests that those who live in as yet unaffected regions might find such observations of particular interest.

In the Mapplet below, the pattern of reported sitings from multiple national sources starts just after 1963: hence, the red color of 1963, as the pattern initiator. The next siting of the mites occurred in 1967, in four different countries: hence the entries of 67a, 67b, 67c, and 67d. In 1968 there were also four sitings; thus, another four boxes, 68a, 68b, 68c, 68d. The 1963 box is joined to each of 67a, 67b, 67c, and 67d using a length of line segment four times as long as the lengths from each of 67a, 67b, 67c, and 67d to each of 68a, 68b, 68c, and 68d. Variation in time between sitings is represented by varying the length of line joining them. All sitings in year X are joined to all sitings in year X+1 (or the next year in which sitings occurred). The rationale for joining all from one year to all in the next year is that one does not know how the diffusion is taking place. What is interesting here, perhaps, is that even when there are years with relatively large numbers of countries reporting sitings, still the pattern settles back to a small number eventually even though one might expect it simply to spread even more. Two obvious directions to interpret this involve reporting error or some sort of saturation of the diffusion, perhaps related to forces such as human travel patterns or mite biology, that are outside the simple mechanics of diffusion (Hagerstrand). The Mapplet can suggest directions for research questions.

Mapplet: Structural model of varroa mite diffusion through time. Pull the red year-box for 1963 all the way across to the right (use the scroll bar) and then drag and drop various pieces of the left side of the mapplet

to unravel it and see the pattern of possible time points of opportunity at various stages in the diffusion process. If a box "sticks" on another, pull it in a bit of a different direction. Generally it is possible to move beyond the obstacle. Mapplets seem to offer a wide array of possibilities for description, interpretation, and analysis of complex spatial systems.



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BOOK REVIEW

Arundhati Roy, *The Cost of Living*, Modern Library, 1999, 126 pp., \$11.95 (pap.).

During a recent trip to India, my first, I was struck by the imposition of technology into the culture, despite the widespread poverty. Everywhere one turned, billboards touted the latest dot com or advertised training in C++ or Perl. Inevitably, however, below the billboards one would find sidewalk dwellers or streethawkers, none of whom could ever fancy a computer purchase. The newspapers, too, were awash in high-tech advertisements (and cricket scandals and beauty pageants), while news about the majority of Indians—impoverished and free of computers—was nearly non-existent. Clearly, the papers reflected the lives of the middle class. What of everyone else? In *The Cost of Living*, Arundhati Roy raises her voice on behalf of those who pay the price for the advancement of others.

In this slim volume, Roy brings together two controversial essays that were previously published in general interest magazines (*Outlook* and *Frontline*). In these essays, the Booker-Prize winning author of *The God of Small Things* directs her considerable written skills against two sacred cows of Indian governmental policy: dams and nuclear weapons. Both essays are polemics; yet, they raise important issues and deserve serious attention from activists, policymakers, and scholars.

Although written by the same author, the two essays in the volume may appear at first glance to be otherwise unrelated. Upon exploring the book, however, at least two unifying themes emerge. First, both essays raise serious concerns about human efforts to employ technologies that, whatever their perceived benefits, threaten human and natural systems on a large scale. In Roy's view, both large dams and nuclear bombs put human society at war with the natural environment. Second, these essays discuss the often-unexamined costs of technological development and find that not only do all segments of society not benefit from technology, but also that many pay dearly for what is achieved. Third, both ask fundamental questions about democracy, patriotism, and citizenship.

The first essay in the book (♦For the Greater Common Good♦) makes an impassioned plea against completion of the Sardar Sarovar Dam on the Narmada River. This river, the fifth longest in India, traverses portions of [Madhya Pradesh](#) and [Maharashtra](#) before winding through the drought-prone state of [Gujarat](#) for most of its course. Originally planned in the time of Nehru, and backed by an international coalition of development interests (the World Bank, Western consultants, Japanese contractors, Indian politicians, and so forth), the Sardar Sarovar Dam threatens the homes of some 40,000 families. Opposed by environmentalists in India and abroad—just this month (June 2000) a protest of the dam is scheduled for New York City—as well as local activists among the affected residents, the dam, partially constructed and way over projected costs, appears to the author as an epic battle for the soul of the nation. Will India be a nation that cares about the state of its natural environment and the welfare of its least privileged citizens or not?

Trained as an architect, Roy brings more than the novelist's skill as a wordsmith to her task. Rather, she meticulously analyzes the promises made by dam proponents and finds their claims of benefits (irrigation, drinking water, and others) to lack credibility. For example, she finds past Indian dam projects have quickly led to waterlogged soil and soil salinization. Second, she details a cycle of debt-creation imposed on developing nations by large projects funded by foreign loans. Third, she examines government plans for Project Affected Persons (the government's official term for those living in the area that will be flooded by the dam)—many of them Adivasis, the original inhabitants of India, most of whom live in dire poverty—and finds these plans inadequate. Worst of all, she finds that non-landowners, including many of the Adivasis, are scheduled to receive no compensation at all for being displaced. All told, she questions the scientific economic, environmental, and moral bases of the project. By extension, she raises serious doubts about the efficacy and equity of all large dam projects, be they in the developing world or elsewhere.

No doubt, many readers will question her analysis, or at least wonder about its accuracy. For these readers, she offers detailed footnotes of her sources allowing interested readers to perform their own analyses and draw their own conclusions. Furthermore, readers can balance Roy's polemic by visiting the dam's own web site (www.sardarsarovar.com) for an opposing view. Ultimately, despite her impassioned plea in opposition to the dam and its related projects (including numerous additional dams on the Narmada River system), she accepts that some will disagree with her and insist on building the dam, regardless of the costs. These forces may even win (and are winning as this review goes to print). That understood, Roy makes one request of dam supporters and opponents alike:

Whether you love the dam or hate it, whether you want it or you don't, it is in the fitness of things that you understand the price that's being paid for it. That you have the courage to watch while the dues are cleared and the books are squared.

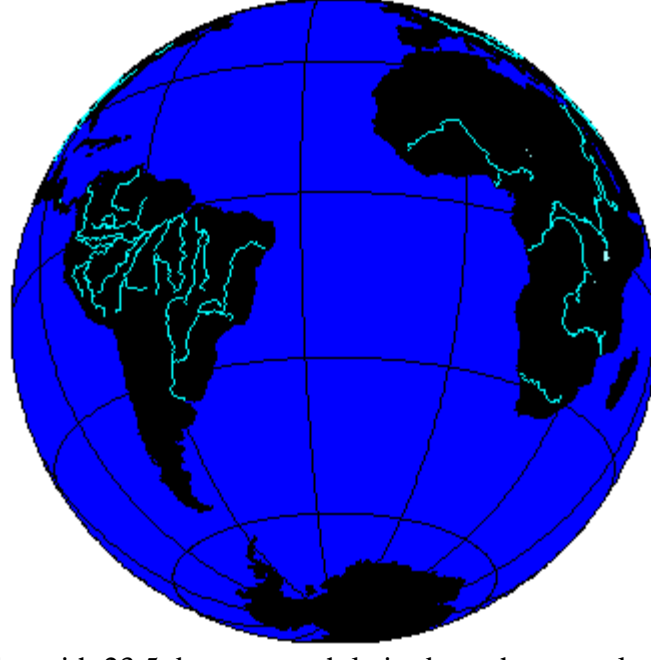
The second, and briefer, essay in the book, ♦The End of Imagination♦, presents a voice of dissent against the general domestic jubilation that accompanied India's first successful nuclear bomb test. In so doing, Roy questions the validity of the theory of deterrence and laments the loss of the moral high ground that building bombs implies. In her words, a better position would have been: ♦we have the technology, we can make bombs if we want to, but we won't. We don't believe in them.♦ For good measure, she also takes a shot at fundamentalism of all flavors and questions popular portrayals of what it means to be an authentic Indian. In sum, this essay makes a case for nuclear non-proliferation for India regardless of what other nations are doing. The bomb itself, and its potential destruction, she argues, is sufficient reason for not building any.

Together, the two essays in *The Cost of Living* present a significant challenge to new and old democracies alike. Is it enough to argue for the greater common good, when the same group of people is asked to pay the costs over and over? Can democracy truly be maintained in a nuclear weapons state? Such questions have yet to be answered anywhere definitively. If nothing else, *The Cost of Living* invites all to enter the debate.

[Richard Wallace](#), Ph.D. Candidate,
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College of Architecture and Urban Planning
Ann Arbor, MI 48109
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Ann Arbor, MI 48104

SOLSTICE:

AN ELECTRONIC JOURNAL OF GEOGRAPHY AND MATHEMATICS



Earth: with 23.5 degrees south latitude as the central parallel.

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WINTER, 2000

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ANN ARBOR, MICHIGAN

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MISSION STATEMENT

The purpose of Solstice is to promote interaction between geography and mathematics. Articles in which elements of one discipline are used to shed light on the other are particularly sought. Also welcome are original contributions that are purely geographical or purely mathematical. These may be prefaced (by editor or author) with commentary suggesting directions that might lead toward the desired interactions. Individuals wishing to submit articles or other material should contact an editor, or send e-mail directly to sarhaus@umich.edu.

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In Memoriam

Donald Frederick Lach

September 24, 1917 - October 26, 2000

**Bernadotte E. Schmitt Professor Emeritus
of History
University of Chicago**

**Author: *Asia in the Making of Europe*,
The University of Chicago Press.**



Scanned floral image by Alma S. Lach.
Real flower from the rose garden of the Quadrangle Club, donated by Nicholas Fulop.

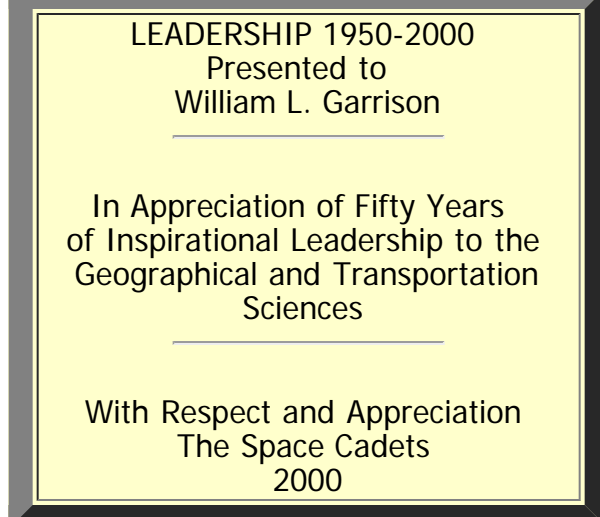
FIFTY YEARS OF SPATIAL ANALYSIS:
A SYMPOSIUM IN HONOR OF WILLIAM L. GARRISON,
1950-2000

PHOTO ESSAY BY JOHN D. NYSTUEN

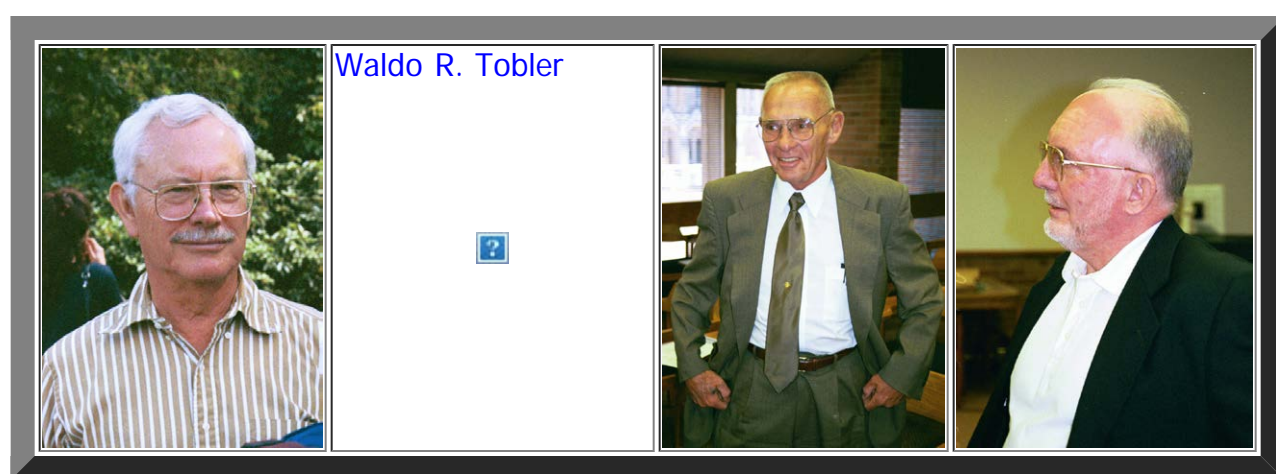
Brian J. L. Berry (right) presents plaque to William L. Garrison (left) commemorating the award of his Ph.D. from Northwestern University in 1950.



Text of plaque



Professor Garrison's Ph.D. students at the University of Washington (1958-1961), as they appeared Friday, September 15, 2000 (not arranged in chronological order, but in a pattern that is visually appealing to the author).



Left to right, date of Ph.D. and most recent institutional affiliation noted.

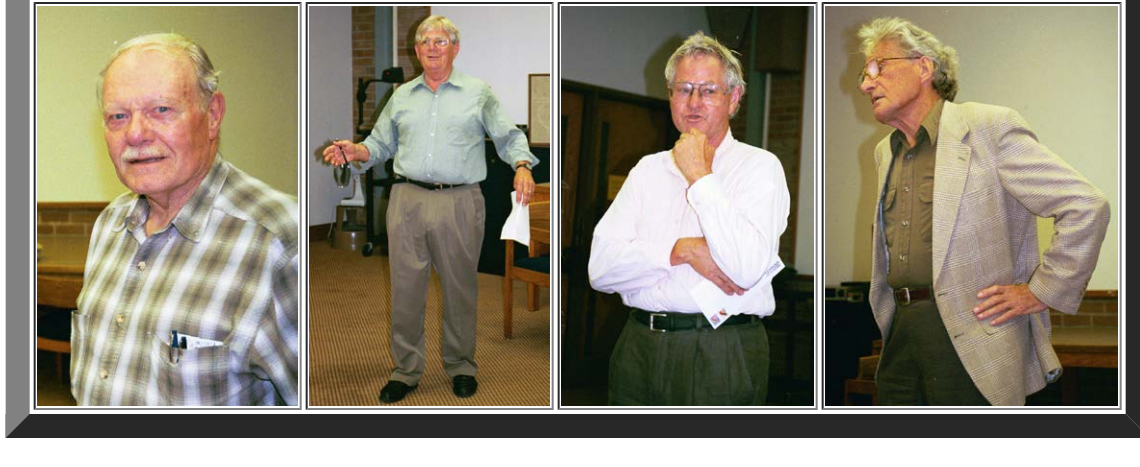
Richard L. Morrill (Ph.D. 1959), University of Washington, Professor Emeritus.
Waldo R. Tobler (Ph.D. 1961), University of California, Santa Barbara, Professor Emeritus
Michael F. Dacey (Ph.D. 1960), Northwestern University, Professor and Associate Dean.
Brian J. L. Berry (Ph.D. 1958), University of Texas, Professor.



Arthur Getis (Ph.D. 1961), San Diego State University, Professor
John D. Nystuen (Ph.D. 1959), The University of Michigan, Professor Emeritus
David L. Huff (Ph.D. 1960), University of Texas, Professor
Duane F. Marble (Ph.D. 1959), Ohio State University, Professor Emeritus

Not shown: William W. Bunge (Ph.D. c.1961), Arthabaska, Quebec.

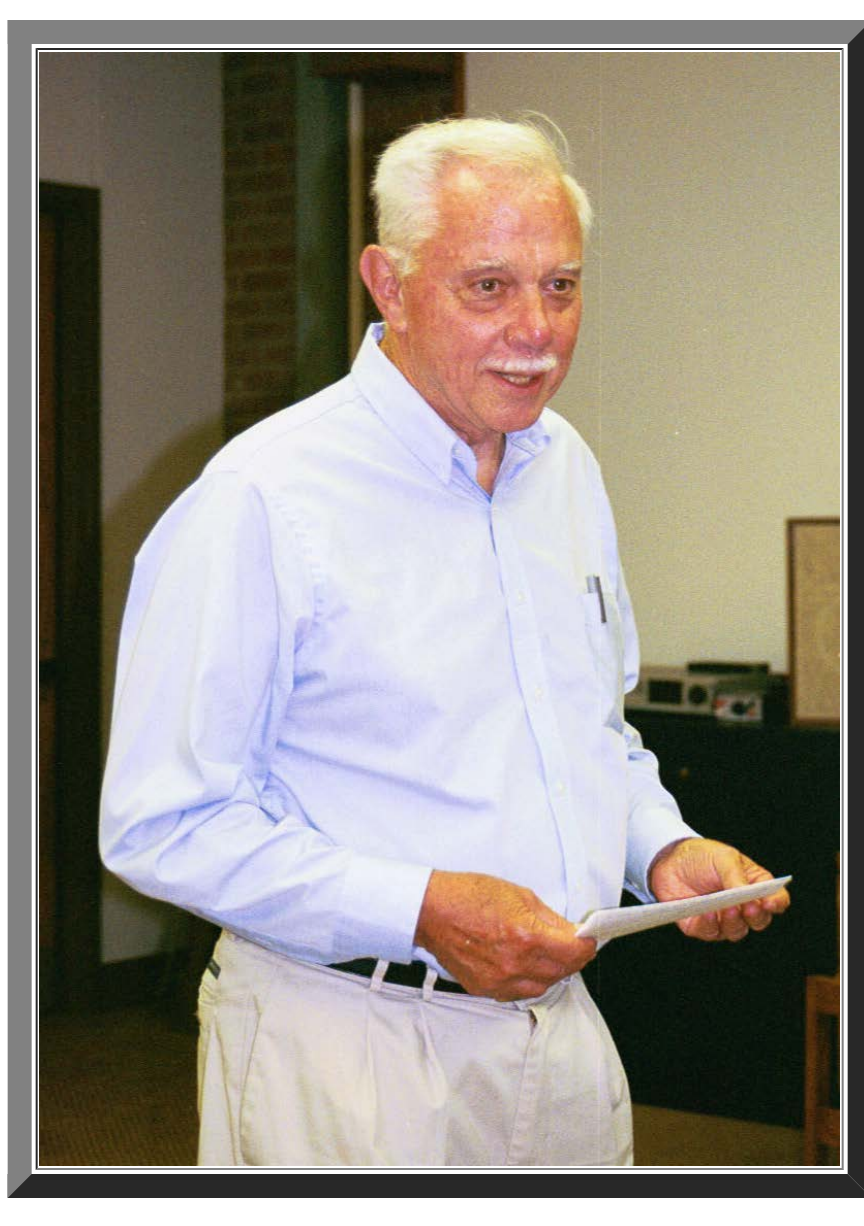
Other speakers photographed:



Forrest R. Pitts (Ph.D. Michigan, 1955), University of Hawaii, Professor Emeritus
Julian V. Minghi (Ph.D. Washington, 1962), University of South Carolina, Professor
William B. Beyers (Ph.D. Washington, 1967), University of Washington, Professor
Leslie Curry (Ph.D. New Zealand, 1959), University of Toronto, Professor Emeritus

Other pictures

- [On the campus](#)
- [At the talks](#)
- [On the boat](#)







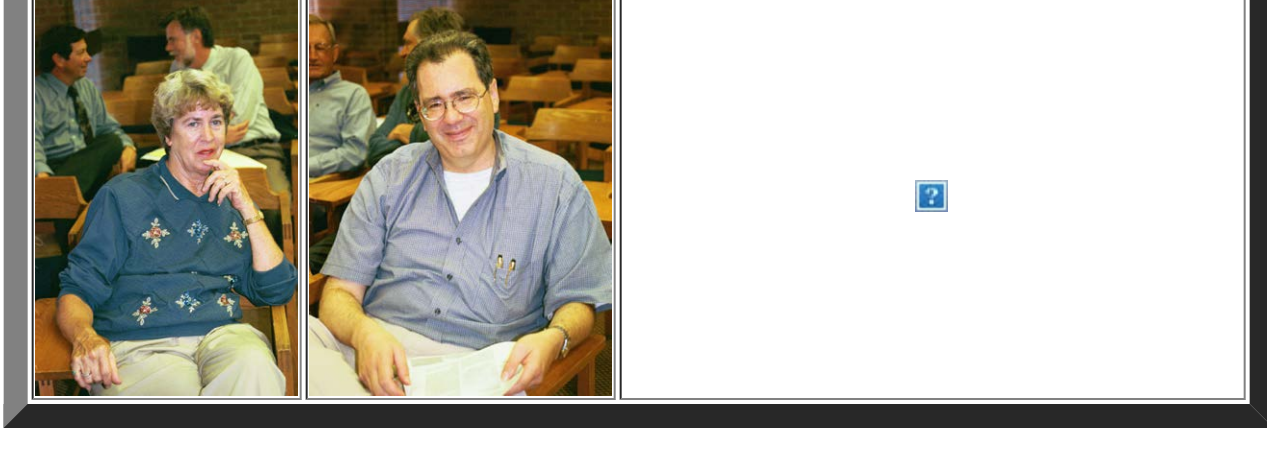
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On the campus:



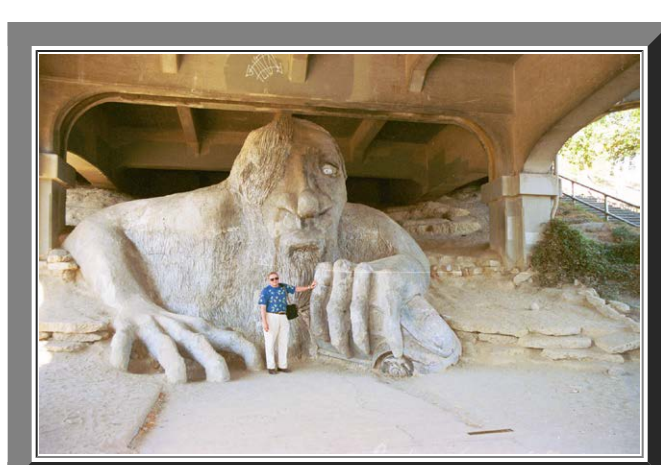
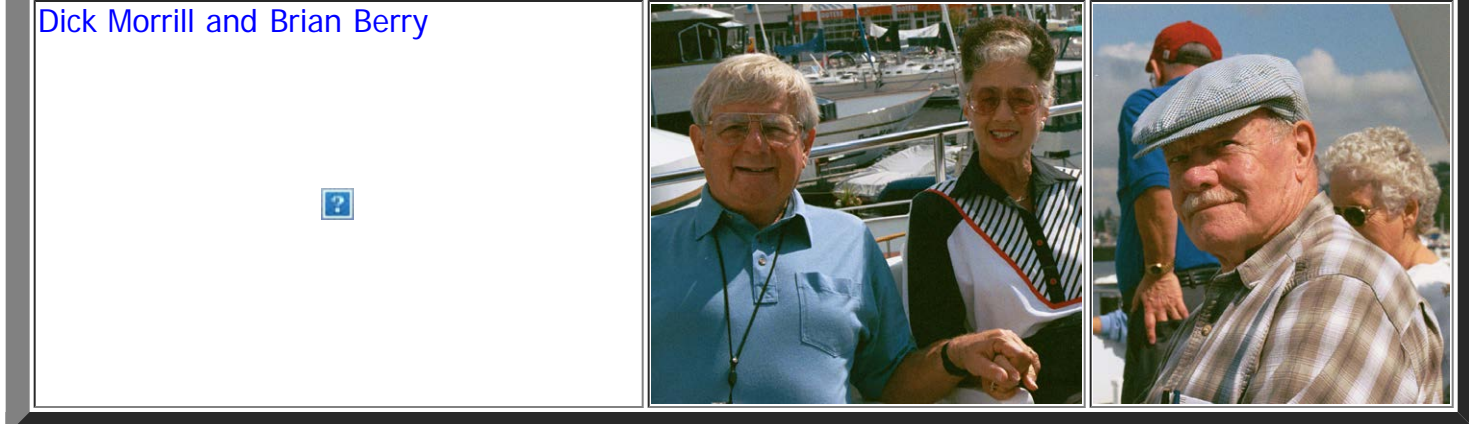
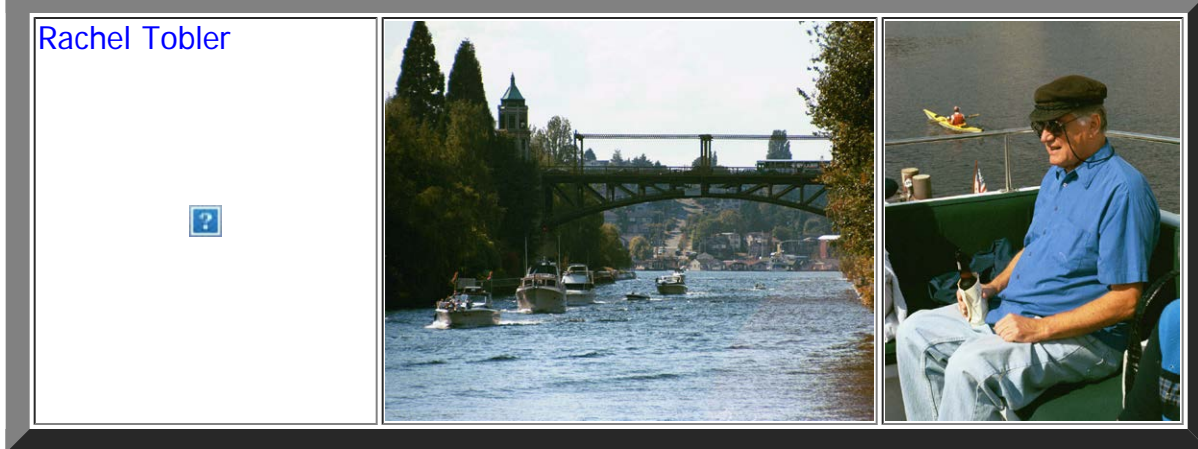
OTHER PICTURES.

At the talks:



OTHER PICTURES

On the boat:



A [Neighborhood Information System](#) within Ann Arbor, Michigan

Sandra L. Arlinghaus
Lloyd R. Phillips

The University of Michigan

Adjunct Professor, School of Natural Resources and Environment and College of Architecture and Urban Planning;

Graduate Student, College of Engineering, Atmospheric and Oceanic Sciences

The power of the internet is with us on a daily basis; however, what we see is (obviously?) only the tip of the iceberg. How can we make better use of it, and the various software package available for mapping and data analysis, in helping people to learn more about their own local settings? The City of Ann Arbor maintains a clickable map site of self-identified neighborhoods (R. Scaff, W. Rampson, C. Hurd, and the first author); <http://www.ci.ann-arbor.mi.us>; see the Planning Department portion of that website).

There have been a number of recent efforts to create Neighborhood Information Systems

- <http://nkla.sppsr.ucla.edu>;
- <http://www.ci.seattle.wa.us>;
- <http://www.cnt.org/news/demo/html>;
- <http://oaklandnet.com/government/government23.html>;
- <http://www.ci.ontario.ca.us/gis/index.asp>;
- <http://www.ci.mil.wi.us/citygov/assessor/assessor.htm>;
- <http://povertycenter.cwru.edu/cando.htm>;
- <http://imlab9.landarch.uiuc.edu/~eslarp/egrets/>;
- <http://www.libertynet.org/nol/natl.html>;
- <http://www.upenn.edu/wplp/wpdd/wpddhome.htm>;
- <http://www.inforain.org/olmap.htm>;
- <http://WWW.rtk.net>;
- <http://little.nhlink.net/nhlink/>;
- <http://www.freenet.msp.mn.us/nhoods/mpls>;
- <http://www.brook.edu>;
- <http://www.nonprofitresearch.org>).

One approach to considering Management Information Systems, at the country or regional level, has involved: "assessment," "analysis," "action," and "feedback" (Community Systems Foundation, <http://www.csfnet.org/>). We employ that strategy here to look at a small section of Ann Arbor, Michigan as a pilot project in developing Neighborhood Information Systems in southeastern Michigan. Please move now to that [site](#).



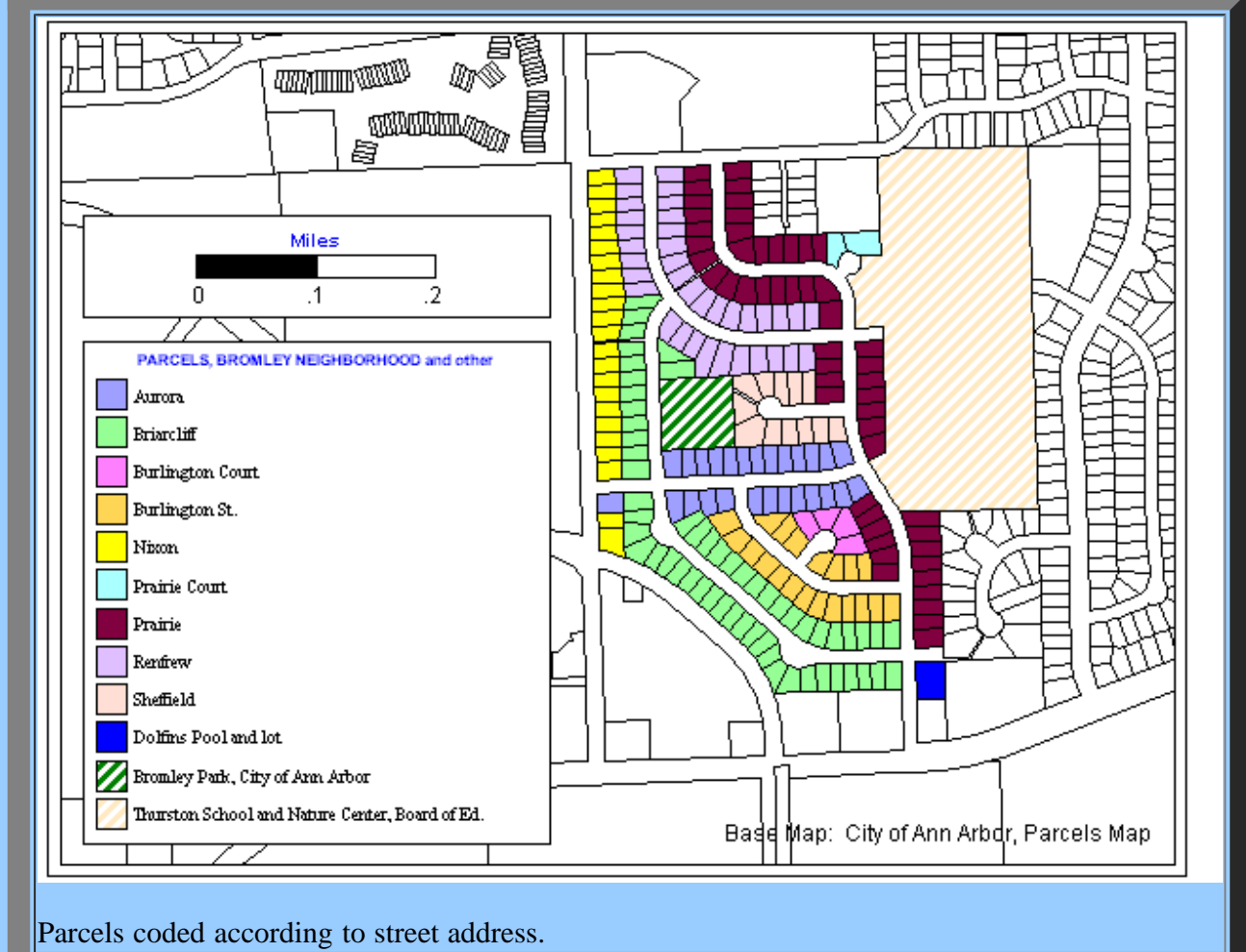
Bromley Subdivision, Ann Arbor, Michigan Neighborhood Information System: 1990-present

[BromleyNIS](#)
[Assessment](#)
[Analysis](#)
[Action](#)
[Feedback](#)

[Atlas](#) of Bromley Maps (entire neighborhood).

Bromley NIS--Reference Map and General Facts

[Link](#) to most recent Bromley Homeowners Association Newsletter.
[Link](#) to Neighborhood Watch Newsletter from the City.



Parcels coded according to street address.

General Description and History.

- Neighborhood of 231 homes in northeast [Ann Arbor](#) (link to City site), bounded by Nixon Road on the west, Bluett on the north, Huron Parkway on the south, and Prairie on the east.
- Homes are single-family residences, generally zoned R1B. See linked parcel map of [City](#) and [neighborhood](#).
- On older maps, or plats, the area may be called North Campus Heights, I, II, III, and IV.
- Housing stock consists of a mix of smaller ranch homes, tri-levels of various sizes, and colonials of various types and sizes. Some homes have no garage; some have a one-car garage; others have a two-car garage.
- Nearby employers include: [The University of Michigan](#), [Pfizer](#), and businesses on Plymouth Road.
- [Ann Arbor Transportation Authority](#) busses serve the neighborhood; U. of M. busses are available nearby. Early builders were Brinson, Brown, and Smokler.

Schools.

- [Thurston Elementary School](#)
- [Clague Middle School](#)
- [Huron High School](#)

Resources.

- Bromley Park, on Briarcliff, is a [City of Ann Arbor Park](#). It contains a playground renovated in the late 1990s and picnic tables (one built and donated by a neighbor, others from the City). It also contains a spectacular rose garden created and maintained privately in agreement with the City.
- Dolphins Pool on Prairie is a neighborhood deep-water swimming pool with diving board. There is a nominal yearly assessment fee that covers taxes, maintenance, and ongoing expenses to the property. Swimming privileges are not covered by that fee and are extra.

Governance.

- Bromley Homeowners Association ([BHA: link to bylaws](#)): all homeowners and renters of homes may join the Bromley Homeowners Association. There is a small annual membership fee. Fees have been used in the past to cover the cost of producing a monthly newsletter, to produce a comprehensive (private) neighborhood directory, to fund projects proposed by neighbors via a "Bromley Grant" program, to sponsor parties for all neighbors in the Park and at the Pool.
- [Dolphins Pool Board](#) (link to bylaws). Separate from, but cooperative with, the Bromley Homeowners' Association.

ASSESSMENT

- Homeowners' [associations](#) offer a forum in which concerned individuals have opportunities of various sorts.
 - [Maps](#) offer various ways of looking at a neighborhood
 - [Neighborhood Watch](#): a passive network. Appropriate action, once aware, is to telephone local police authorities.
-

Welcome to the Bromley Homeowners' Association Home Page!

[Newsletter Archive](#)

Space donated as part of research in community systems; established in 1994. First GIS map of Bromley is from 1989 (made using C-Map); most recent one appears posted on the home page of this NIS and is based on the City of Ann Arbor parcel map. The City has numerous GIS coverages (parks, wetlands, contours, butterfly inventory, and so forth) that enable overlays of maps, aerial photos, and data. These are employed at a variety of levels of decision making.

Remember: The City of Ann Arbor is a Bromley neighbor, too!

Send mail to the Bromley Homeowners' Association from here. Also, to gain access to Bromley On-Line (est. 1993) please send e-mail to address below.



Internet: sarhaus@umich.edu

LINKS:

WARD 2: Ann Arbor City Council Person

Joseph Upton (R)
2019 Seneca 48104
995-8934
e-mail: joe_upton@mail.malloy.com

City of Ann Arbor Website: <http://www.ci.ann-arbor.mi.us/>

Washtenaw County Website: <http://www.co.washtenaw.mi.us/>

University of Michigan Gateway: <http://www.umich.edu/>

ArborLink: <http://www.arborlink.com/cityweb/index.html>

● [BY LAWS, BROMLEY HOMEOWNERS ASSOCIATION](#)

● [SUMMARY OF NEIGHBORHOOD ORGANIZATION SUGGESTIONS BASED ON EXPERIENCE: PERHAPS PARTICULARLY USEFUL FOR START-UP COMMUNITY ORGANIZATIONS.](#)

SUPPORT DOLPHINS, BROMLEY'S OWN SWIMMING POOL

- [Information on ways to support Dolphins Pool.](#)
 - [Bylaws of Dolphins Inc.](#) These Bylaws were scanned from paper copy and then passed through an Optical Character Reader. We have spent a good deal of time correcting errors introduced by scanning old paper copy; however, some may remain and we wish to correct them. So, please, bring to our attention any errors you note (that do not match the original paper copy).
-

FRIENDS OF HURON PARKWAY

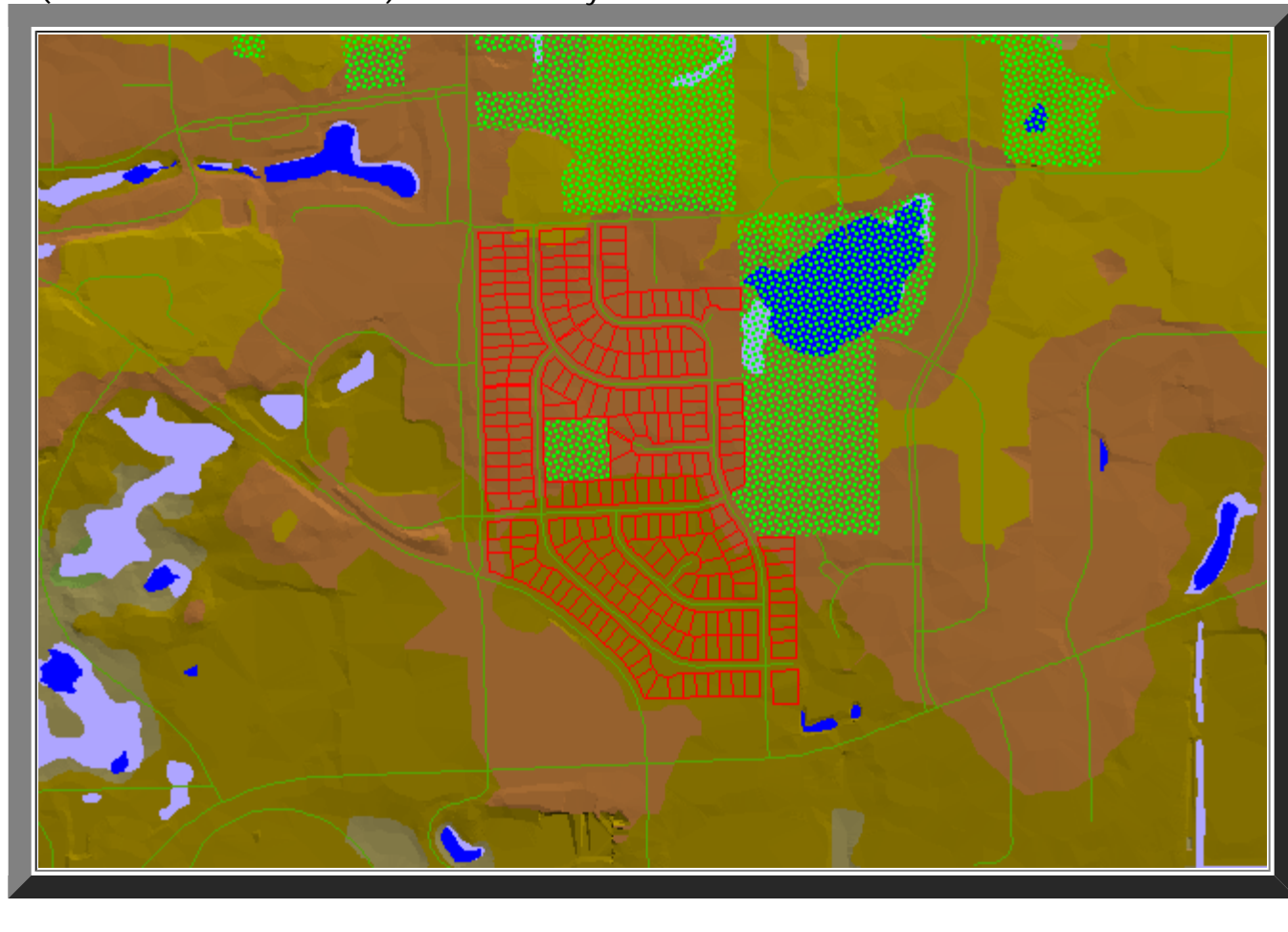
- [Link to this organization.](#) Site includes entire text and set of maps for the North East Area Plan for the City of Ann Arbor; the component of the master plan for the City that applies to Bromley. Use this Plan as a reference guide for zoning and other matters related to the planning and development of parcels of land in the northeast area.
-

RELATED WEBSITES (please send us any you find):

ORCHARD HILLS/MAPLEWOOD HOMEOWNERS ASSOCIATION: <http://www.arboresearch.com/ohmha/>

MAPS

Bromley parcel map, parks, water, and wetlands embedded in a triangulated irregular network based on contours (five foot contour interval). Source: City of Ann Arbor files.

**Regional:**

South East Michigan Council of Governements (SEMCOG)

- Washtenaw County: [Land Use](#) (1995 data, pattern displayed without legend)
- Washtenaw County: [Impervious surface](#)
- Washtenaw County: [Traffic crashes](#) (1994 data, pattern displayed without legend)

City of Ann Arbor

- [Parcel outline map \(Bromley parcels in yellow outline: aerial photo shown\)](#), [Bromley](#)
- [Street centerline map](#)
- [Parks, northeast](#)
- Contour (five foot interval), [whole city](#); [Bromley](#).
- Triangulated Irregular Network for the northern portion of the city (simulates relief). [General](#), [more local](#), [even more local](#).

Neighborhood (source, City of Ann Arbor):

- [Aerial](#) of Bromley
- [Aerial](#) with parcel map superimposed
- [Aerial](#) with parcel map and parks
- Impervious surface study--aerials showing rooftops, driveways, and sidewalks digitized ([work of Lloyd R. Phillips](#)).

Ann Arbor Citizens' Neighborhood Watch WebSite



An all-points information system

GENERAL INFORMATION

Adele el Ayoubi, 994-8775

Neighborhood Watch Coordinator for the entire City of Ann Arbor, in the Ann Arbor Police Department.

[Link](#) to Official Neighborhood Watch website.

[Link](#) to Planning Department list of registered neighborhood homeowners' associations and contact numbers.

Soon to come: Neighborhood Watch Manual in electronic format.

Call 994-8775 for more information on starting and continuing a vital Neighborhood Watch Program in your area of Ann Arbor.

Focus of this page is to provide supplementary links:

- [Bromley Neighborhood Watch](#)
- [Huron Chase Neighborhood Watch](#)

To add your neighborhood group, send information to the e-mail address below.

WebDeveloper and WebMaster: sarhaus@umich.edu

ANALYSIS

- Homeowners' [associations](#) offer a forum in which concerned individuals have opportunities of various sorts.
 - Master Plans offer a broad vision for the City; neighborhoods are a part of that vision and so should be informed as to what it is. Link to [Northeast Area Plan](#) of 1989 and to [Figures](#) for that document; produced originally in 1989. Currently, the City is upgrading the plan (see Planning Department part of City of Ann Arbor [website](#)).
 - Local planning: [trees](#) can cause problems when planted too near to concrete (sidewalks, driveways, foundations). This link offers hypothetical analysis for solving this problem.
-

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[Newsletter Archive](#)

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-

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N O R T H E A S T A R E A P L A N
ANN ARBOR, MICHIGAN

Adopted by, the Ann Arbor City Council
April 6, 1989
Gerald Jernigan, Mayor
Liz Brater
Ann Marie Coleman
Kathy Edgren
Jeff Epton
Larry Hunter

Terry Martin
Mark Ouimet
Tom Richardson
Jerry Schleicher
Ingrid Sheldon

Del Borgsdorf, City Administrator

Adopted by the Ann Arbor City Planning Commission
April 25, 1989
Samuel Offen, Chairman
Janice Caldwell
Isaac Campbell
Raymond Chase
Franz Mogdis

Ingrid Sheldon
Tom Shipley
Claire Turcotte
Ilene Tyler

Martin Overhiser, Planning Director

Prepared for: Ann Arbor City Planning Commission

Prepared by: Ann Arbor City Planning Department with assistance from
the Northeast Area Plan Review Task Force

Northeast Area Plan Review Task Force

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ACKNOWLEDGEMENTS

The City Planning Commission wishes to thank each of the Northeast Area Plan Review Task Force members who participated in the plan review process, the over 130 residents who took the time to provide insight and comments, the City Department representatives and other local planning agencies who informed the Task Force about their planning efforts, and especially to Planning Department staff members Glenn Bowles and Wendy Rampson for coordinating this effort. Special thanks go to the staff of Community Access for their instruction and assistance in preparing the video production highlighting this planning process, to Joy Bisaro, who developed the graphics for the plan, and Jill St. John, who provided patient secretarial assistance throughout the process.

INTRODUCTION

Purpose

The City Planning Commission has resolved to periodically review and update the City Master Plan. The Northeast Area Plan is a sub-element of the Master Plan, serving to pull together and update the recommendations of previous plans and studies as they relate to the northeast area of the City. This plan document is meant to provide a guide for future decisions related to land use, circulation and public facilities in the northeast area. While concerned primarily with the future development of remaining vacant land, the plan also provides guidelines for redevelopment, infill development and the preservation of existing neighborhoods.

Process

This plan is the culmination of a year of review and citizen input. In December 1987, the City Planning Commission appointed a citizen task force to review and recommend changes to the Master Plan elements as they applied to the northeast area of the City. Staff completed an inventory of the land use and population in February, 1988. Following six months of review and discussion, the Northeast Area Task Plan Review Task Force presented its recommendations to the City Planning Commission on June 28, 1988. After two public hearings, the City Planning Commission voted to accept the Task Force report on July 26, 1988, and directed Planning Department staff to develop a plan document based on the current Master Plan and the suggested revisions. The time line shown in Figure 1 outlines the steps taken in this process.

Framework

The Northeast Area Plan is comprised of six main sections: background, guiding policies, land use, circulation, public facilities, and implementation guidelines. The background section provides a brief framework of the history and demographics of the northeast area. The core of the document outlines planning recommendations related to guiding policies, land use, circulation and public facilities. Strategies for implementation of the plan recommendations are outlined in the final section.

BACKGROUND

Study Area

The northeast area is bounded by M-14/US-23 on the north, US-23 on the east, Washtenaw Avenue on the south, and Ferdon Avenue, the Huron River and M-14 on the west. It contains approximately 7,313 acres, of which 2,267 acres, or 31 percent of the land area, is currently located in Ann Arbor Township's jurisdiction. Based on sanitary sewer agreements with Ann Arbor and Pittsfield Townships, this plan assumes that all land within the study area will eventually fall under the City's jurisdiction. Therefore, the sewer agreement boundary corresponds with the study area boundary.

For data analysis purposes, the study area has been divided into 15 planning neighborhoods (Figure 2).

History

The northeast area contains some of the oldest commercial buildings in the City. The "Lower Town" area, located on the north side of the river at the base of the Broadway bridge, thrived as a commercial center in the early 1830's, but its growth, and that of the surrounding countryside, was curtailed when the railroad was constructed on the south side of the river. What residential development did occur radiated north from Lower Town along Pontiac Trail and Traver Street to Barton Drive and along Broadway Avenue to Plymouth Road, which represented the City's northeasterly limits until the 1940's. Early residential development also occurred south of the river, expanding east from the campus area along Washtenaw and Geddes Avenues.

The remainder of the area west of the river was used largely for agriculture until the early 1950's, when the University of Michigan purchased 800 acres of land to establish the North Campus and the Michigan Department of Transportation started acquiring land for construction of a new highway, US-23. These two events, more than any other factors, spurred on the dramatic growth which has characterized the northeast area for the last 30 years. During the late 1950's and early 1960's, research firms located along Plymouth Road, due in part to active encouragement by the University and easy access to US-23. As these research sites developed, they were annexed into the City to allow connection with City services. This resulted in a patchwork pattern of City and township islands which exists even now in the northeast area.

The 1960's were boom years for the northeast area. Single-family subdivisions were established in close proximity to the Plymouth corridor, which continued to attract new research firms. The major commercial developments in the area, including Arborland, Plymouth Mall, North Campus Plaza, Plymouth-Green and the Washtenaw strip, were developed during this time. Several multiple-family projects were also developed during the 1960's, including dormitories and married student housing located on North Campus.

Development continued into the 1970's, particularly residential. The Arrowwood Hills Cooperative, a federally-subsidized residential development, was built in the early 1970's, as was the Traver Lakes development. This time period also saw the introduction of some constraints to the future growth of the City, as the waste water treatment agreements signed by Pittsfield Township in 1975 and Ann Arbor Township in 1976 identified township areas outside the freeway ring that could remain in the township's jurisdiction while receiving City sanitary sewer services.

In the 1980's, development of the northeast area has continued with the construction of a variety of new multiple-family, commercial, office and research developments.

Planning

Background

Although up until this time there has not been a comprehensive land use plan developed specifically for the northeast area, several approved City-wide plans contain recommendations for this area. These include:

3

General Land Use Model - 1974
Transportation Plan for the Ann Arbor-Ypsilanti Urbanized Area 1975
Plan for Solving Circulation Problems - 1977
Plan for Transitional and Vacant Land Areas - 1981
1988-1994 Plan for Parks, Recreation and Open Space - 1988
North Main Street/Huron River Corridor Summary Land Use Policy Plan - 1988

A number of studies have also been done on specific aspects of the northeast area. These studies, in addition to providing an historical perspective, provide guidance in the framing of this plan's recommendations. They are:

Area Plan for Northeast Ann Arbor - 1953
Fuller-Geddes Study - 1964
Northeast Area Study Policy Report (Draft) - 1974
Plan for Northeast Area - Potential Issues - No Date
A Preliminary Opinion Survey For the East/Northeast Area Plan (Final Report) - 1978
Northside Character Study - No Date
Household Survey - 1981, 1984, 1986, 1988
Northeast Area Commercial Needs Study - 1982
North Campus Plan - 1984
Traffic Analysis for the Northeast Ann Arbor Area (Memorandum) - 1986
Green Road Impact Assessment - 1987

Demographics

According to a 1988 Planning Department land use inventory, the Northeast Area contains 13,607 dwelling units and an estimated 31,900 residents. The growth within the area is fairly recent. It has been spurred on largely by The University of Michigan's development of North Campus and active support of research activities, and the completion of US-23/M-14. In 1950, the United States Census shows the population of the northeast area to have been 5,400. By the 1960 Census, population had increased to 8,065. Following the major increase in development during the 1960's, the area's population mushroomed to over 22,000 by the 1970 Census. The population of the Northeast Area is projected to reach 38,800 people by the year 2005. It is possible that if the northeast area is developed according to current plans, the ultimate population may reach 46,500 people, a 46 percent increase over the present population of 31,900.

Residential neighborhoods within the northeast differ considerably from each other. As Figures 3 and 4 illustrate, the neighborhoods South of the Huron River are predominantly owner-occupied, with median household incomes nearly double that of the entire City. Households in this area tend to have a greater percentage of elderly people (over 60 years old), and residential developments have a relatively low density (less than two dwelling units per acre exclusive of right-of-way).

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The older neighborhoods west of the North Campus and the Ann Arbor Railroad, including Arrowwood Cooperative and the Huron Highlands Subdivision, tend to have lower incomes (generally less than 80 percent of the City median household level), a predominance of renter-occupied units, with residential densities ranging from about four units per acre to over

ten dwellings per acre. More multiple-family dwellings exist in Neighborhoods 4, 5, 6 and 7 than in any other northeast neighborhoods.

With the exception of the Northwood V and Greenbrier neighborhoods, housing in the area east of Nixon Road and Huron Parkway is predominantly owner-occupied. North of Plymouth Road, the density averages about five dwellings per acre. South of Plymouth Road, the single-family development density ranges from two to four units per acre and the multiple-family density ranges from seven to 15 units per acre. Income levels, with the exception of the Greenbrier and Northwood V neighborhoods, are well above the \$30,000 City median.

Currently, over 10,600 people are estimated to be employed within the study area. Over 80 percent of this employment is concentrated along the Plymouth Road corridor east of Broadway. Nearly 4,000 people are employed on the University of Michigan North Campus. Another 3,000 people are employed in the ten major research and development businesses located along Plymouth Road. The Arborland and Tuomy Hills commercial concentrations along Washtenaw Avenue employ nearly 1,500 people in retail commercial and office activities. Another 600 people are employed in the Lower Town service commercial center at Broadway and Maiden Lane.

Employment is projected to double to 21,300 with the ultimate development of the area. Over 9,000, or 84 percent, of these new jobs are projected to be in research and development. Nearly all of the growth in employment is expected to be on the north side of the Plymouth Road corridor in the Plymouth Professional Park, the research and commercial development near Plymouth and Nixon Roads, and the proposed research areas north of Dhu Varren and Green Roads.

Inter-Governmental Coordination

In developing a plan for the northeast area, coordination is required between a number of governmental agencies which have plans for the area. These agencies include The University of Michigan, Ann Arbor Township, Pittsfield Township, the Urban Area Transportation Study Group (UATS), the Ann Arbor Transportation Authority (AATA), and the Ann Arbor Board of Education. Several coordinating committees meet on a regular basis. These are:

University of Michigan-City Coordinating Committee
City-School Coordinating Committee
UATS Technical and Steering Committees

Special meetings set up by the Washtenaw County Metropolitan Planning Commission provide additional opportunities for communication and coordination between planning jurisdictions. Wherever possible, elements of the plans and policies developed by these agencies have been incorporated into the Northeast Area Plan.

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GUIDING POLICIES

The 1973 General Development Plan and the policy components of the elements of the City Master Plan provide guidance and direction for the City's planning decisions. These general policies for land use, circulation, public facilities, historical preservation, urban design and environmental quality set the tone for the specific recommendations contained in the Northeast Area Plan. Highlights from these plans are summarized below.

Land Use

Within residential areas, established neighborhoods must be protected from the intrusion of incompatible land uses, increased traffic, deterioration and other negative environmental impacts. Amenities such as public parks, public facilities, convenience stores and a mix of housing types should be made available to all neighborhoods.

Commercial use should be grouped into integrated units of mixed land uses, and new strip development along thoroughfares should be prohibited. Commercial centers must be consistent in scale and appearance with existing neighborhoods and sized to serve the needs of the market area for which they are intended.

Office, industrial and research uses should be planned to be functionally, visually and environmentally compatible with surrounding residential areas.

Public Facilities

All neighborhoods should be provided with developed City-owned parklands to meet local recreational needs. Land or easements for public use should be acquired to form an interconnected greenway system. A policy of acquisition of lands along the Huron River Valley should be followed.

The provision of municipal services should be provided to areas within the City sewer service area. Development of public facilities should proceed in a direction that will permit their eventual linkage to major regional systems if this proves advantageous to the City in terms of environmental quality economic considerations.

Circulation

The planning and funding of pedestrian, bicycle and public transportation systems should be emphasized as an alternative to automobile circulation. Land use patterns should be planned to minimize the need for private vehicular travel. Road patterns and alignments should respect major topographic features, contiguous developed areas and potential future neighborhood units. Local access roads should connect to minor arterials but not serve as short-cuts between them. Major arterials should not divide closely interrelated uses.

Historical Preservation

The preservation of historically and culturally significant sites, structures, streetscapes and neighborhoods should be supported.

Adaptive reuse of historically and culturally significant structures which would be compatible with surroundings uses should be encouraged.

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Urban Design

All development should provide a visual enhancement to the City. An intensified design and implementation program for the visual improvement of all public lands, including street rights-of-way, is necessary. A high density of tree-cover should be maintained.

Environmental Quality

Woodlands, wetlands, and wildlife habitats should be maintained through sensitive land use planning. Major developments should evaluate environmental impacts and comply with established environmental regulations. Surface water runoff should be detained to minimize direct flow into the Huron River. Noise generating activities should be isolated. Alternative waste disposal systems should be investigated to conserve the landfill capacity.

In addition to the policies described in above, guidelines related to annexation and affordable housing have been established by the Planning Commission and City Council since adoption of the 1973 General Development Plan.

Annexation

In the northeast area, all land within the City sewer service area should be annexed by the City in an orderly manner. Any property within this area should be serviced with municipal sewer and water if the land is developed for urban uses.

Affordable Housing

Because the northeast area contains concentrations of lower-income groups, such as college students, single-parent families, retirees, and low and moderate-income workers, housing opportunities should be encouraged to be made available to these groups. Private developers are encouraged to propose methods to reduce costs of housing while still meeting realistic building and land development standards. In selection of affordable housing sites, consideration must be given to accessibility to public services such as public transit, schools and parkland as well as shopping facilities. Planning techniques allowing greater open space and diversity of housing types should be encouraged.

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LAND USE

With, the exception of the Lower Town and near-campus neighborhoods, most of the development in the northeast area has been guided by recent city plans and zoning regulations. As pressures to develop the remaining vacant land grow, it is particularly important to continue a consistent land use pattern for future development. The recommendations outlined in this section and illustrated in Figure 5 focus on the over 1,500 acres of undeveloped land which is within the City sanitary sewer service area. However, redevelopment proposals should also be evaluated with the plan in mind.

Residential Use

The study area has been divided into six planning areas, (Figure 6). Land use recommendations are discussed for sites within each planning area, recognizing that future land use must be viewed in relationship to the entire northeast area.

In total there are approximately 1,000 acres of planned, potential large-tract and infill residential land available in the northeast area. Excluding the existing residences in township island properties, this planned residential development could produce over 4,800 new dwelling units.

In discussing residential density, the ranges used to describe certain land uses can be translated into the residential zoning districts shown below. The zoning district densities are expressed as maximum permitted dwelling units per acre (DU/AC).

<u>Zoning District</u>	<u>Residential Density (DU/AC)</u>	<u>Housing Type</u>
R1A	2.2	Single-Family Dwelling
R1B	4.4	Single-Family Dwelling
R1C	6.0	Single-Family Dwelling
R1D	8.7	Single-Family Dwelling
R2A	10.2	Two-Family Dwelling
R3, R4A, R4A/B	10.1	Townhouse & Multiple-Family Dwelling
R4B	15	Multiple-Family Dwelling
R4C	20	Multiple-Family Dwelling
R4D	25	Multiple-Family Dwelling
R4C/D	75.1	Multiple-Family Dwelling

Area I

The Northside neighborhood contains the oldest residential and commercial structures in the northeast area. Conservation of existing neighborhoods should guide planning decisions for the area. Future development in this area is largely limited to residential infill projects on small parcels. Where development or redevelopment is proposed, residential densities should not exceed the existing range of three to six dwelling units per acre.

The residential areas south and west of Barton Drive and west of the University of Michigan North Campus should be explored as a potential historic district in order to conserve the existing residential scale and character and preserve the many good examples of early Ann Arbor residences (see Historic Preservation recommendations at the end of this chapter).

Area II

This area contains a number of vacant parcels, most of which are still in township jurisdiction. Because of their development potential, this area and the area to the east are anticipated to experience a significant increase in population, an increasing demand for City services and generate additional traffic. Therefore, careful site design and circulation planning is extremely important in this area.

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Single-family detached dwellings and attached dwellings such as townhouses and duplexes are suggested for the 140-acre Subarea "A" west of Pontiac Trail. The residential density of new development in this area should be within a range of four to eight units per acre. A design mixing detached single-family homes in clusters and several higher density attached single-family units should be considered. Buffering must be provided to minimize the highway impacts on residential uses.

In Subarea "B", the vacant land south of the City's Black Pond Park is currently zoned for townhouse and multiple-family development with a maximum density of ten units per acre. Because of the topography and significant natural features on this site, it is recommended that development be clustered on the south portion of the site, with environmentally-sensitive land and/or south of Black Pond being acquired for additional parkland. The township parcel located west of the Black Pond site is recommended for a mixture of single-family attached and single-family detached housing, with residential densities ranging from four to eight units per acre.

The approximately 155-acre Subarea "C" located directly north and west of Leslie Park offers the potential to expand community and neighborhood recreational opportunities in coordination with new residential development and an improved local circulation system. Residential development should include a mix of single-family and multiple-family dwellings with an average density of eight units per acre. New public streets connecting Dhu Varren Road, Pontiac Trail and Traver Road are strongly encouraged to disperse local traffic and provide alternative access points.

North of Dhu Varren Road and west of the Ann Arbor Railroad is the 55-acre Subarea "D", currently owned by the Washtenaw County Road Commission. If made available for private development, the east portion of the site should be developed for single-family attached and detached uses. Residential densities on this site should range from four to eight units per acre. Development of this site must provide buffering from the highway.

Area III

Much of the residential development in this area has occurred in the last 15 years. Of the undeveloped land in the north portion, a large amount is already in the City's jurisdiction and zoned for residential use.

Subarea "A" contains the previously proposed "Foxfire" development, a 245-acre site characterized by farm fields, woodlots and a major tributary of Traver Creek. Clustering of single-family detached and attached housing to preserve the creek channels and woodlots is proposed with residential densities ranging from six to ten units per acre. The 32 acres closest to US-23/M-14 is zoned for multiple family residential use at a density of up to 15 units per acre. As with all other residential sites adjacent to the highway, proper buffering and building orientation is necessary to mitigate the noise and pollution impacts.

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The 40-acre Subarea "B" north of Logan School is recommended for single-family detached and attached homes at a density of four to six units per acre. Clustering is encouraged to preserve the wetlands in the southwest corner of the site and provide additional recreation and open space to be acquired for Logan School.

In Subarea "C", the area between Leslie Golf Course and the proposed north/south collector street is recommended for multiple-family use with a density of up to 25 units per acre. The use of midrise buildings, consistent with development to the west, is recommended to preserve the significant wetlands, woodlots and landmark trees on the site. Duplex or multiple-family use is recommended as a redevelopment option for the two-acre automobile salvage site located at the intersection of Plymouth Road and Upland Drive, unless it is determined that soil contamination would make residential use undesirable.

Area IV

With the completion of Windemere Townhouses at the southeast corner of Nixon and Green Roads, the residential development of this planning area is nearly complete. Individual single-family homes may be added in the future on a few small infill sites and undeveloped platted lots in established neighborhoods. Infill development should not exceed the existing single-family detached density of four to five units per acre.

Area V

The approximately 80 acres of undeveloped land located north of Geddes Road is recommended for single-family detached development. Because of the nature of the existing residential development and the sensitive natural environment, residential densities in this area should be limited to no more than four units per acre. Development of additional housing for senior citizens is recommended on the Glacier Hills site.

Area VI

The west portion of this planning area is largely developed. The Geddes Avenue area contains nearly 120 acres of land in Ann Arbor Township, most of which contain single-family homes. Except for those properties which are connected to City sewer by special agreements, these properties will be annexed individually as their owners petition for City services.

Sub area "A" contains 42 acres on the west side of Huron Parkway, north of Washtenaw Avenue which are zoned for a mix of single-family detached and single-family attached uses. Site design should be sensitive to the wooded areas and protect the watercourse through the site. A significant setback from the Huron Parkway is also recommended.

A mix of dwelling types is recommended for Subarea "B", a 92-acre site north of the proposed Clark Road connection to Huron Parkway and east of Chalmers Drive. Multiple-family use at a density of up to ten units per acre is recommended for the east portion of the site adjacent to US-23 and the south portion adjacent to Arborland. Design of such a development must include buffering to reduce highway impacts. The west portion of the

site is recommended for

a mixture of detached and attached single-family uses, with single family detached being located adjacent to existing single-family development.

Because of the heavily wooded and hilly terrain of Subarea "C", single-family attached development is recommended. Clustered unit design with a residential density of six to ten units per acre should be used to preserve the natural features of the site.

Commercial Use

As both the residential and employment population of the northeast area grow, the need for commercial use increases. Because there is no authoritative formula by which to determine the amount or type of commercial use that will be needed to serve this growing population, recommendations for the location of commercially-zoned land contained in this plan are based on a range of the following rough projections, along with other standards of proximity, convenience and accessibility.

Percentage of land area.

Based on a February 1988 inventory, 2.27 percent of the developed City land in the northeast area is in commercial use. Applying this percentage to the total area of undeveloped or township land (2,267 acres), an additional 51 acres of commercial area would be needed to maintain the status quo.

Per capita floor area.

The amount of existing commercial floor area per resident in the northeast area is 33.4 square feet. This compares to an average of 61.8 square feet of commercial floor area per capita for the entire City. Using the existing 33.4 square feet per capita figure, population growth of 6,000 people by the year 2005 would indicate a need of 200,400 square feet of additional commercial floor area. Assuming an average floor area to lot area ratio of 22 percent, this amount of commercial floor area would require 21 acres of land. If the City-wide average of 61.8 were applied to the additional 6,000 people, this would result in a need for 39 acres.

Shopping center standards.

The Urban Land Institute (ULI) describes shopping centers in general categories of neighborhood, community or regional, although distinctions between these categories are often blurred. In general, neighborhood centers provide convenience goods and services and include a grocery store. Community centers may also provide convenience items, but provide a greater selection of merchandise than a neighborhood center. A community center usually includes a variety or department store or strong specialty store. A regional center is characterized by a major department store and a great variety of general merchandise. Each of these categories of centers is observed to exist within a general range of floor area and acreage, and requires a certain threshold of population to survive.

Based on general ULI standards, 21 acres of community commercial could be supported at this time in the portion of the northeast area north of the Huron River. This area is currently not served by a community commercial center. The standards also indicate that the existing development in the northeast area is adequately served by neighborhood commercial.

Assuming a population growth of 6,000 people by the year 2005, an additional 6 acres of neighborhood commercial and 4.5 acres of community commercial will be necessary to serve the new population. This then results in a total need for 25.5 acres of community commercial and 6 acres of additional neighborhood commercial for the study area. It should be noted that these figures may be reduced by combining community and neighborhood functions into single centers.

Two neighborhood commercial sites are recommended to serve the northern portion of the study area: a five to eight-acre site on one quadrant of the Pontiac Trail/Dhu Varren Road intersection, and a five to eight-acre site on the northwest corner of Dhu Varren and Nixon Roads.

Because of its central location and proximity to three arterials, the ten to 15-acre site at the northwest corner of Plymouth and Nixon Roads is recommended for commercial use. Development of this site for commercial use will create a unified community-type commercial center for the northeast neighborhood. This commercial center should provide pedestrian and bicycle linkages to surrounding residential areas, generous landscaping, and provision for general community services.

Research, Office and Industrial Use

Since the establishment of the University of Michigan's North Campus in the 1950's, the northeast area has become known as a research center. In addition to providing a stable employment base, research development contributes to the open, campus-like feeling which characterizes the area. In order to enhance this reputation, planning decisions should preserve and enhance the existing research and office development in the Plymouth Road corridor.

Additional sites for research and related uses are recommended in several locations: the 50-acre site directly north and west of the Environmental Protection Agency, the 70-acre site west of Nixon and north of Dhu Varren Roads and the 93-acre site east of Nixon and south of M-14. In addition, a 77-acre planned unit development site north of Green Road is currently zoned for office and research development. Heavy industrial use is not recommended for the northeast area.

Research and light industrial developments often allow the opportunity for a more environmentally-compatible design than other types of uses because of the large lot size preference and the

ability to concentrate buildings, parking and other site development impacts. All of the sites listed above contain wetlands and other significant natural features which should be considered in any development proposal.

Institutional Use

University of Michigan

The University of Michigan follows the guideline contained in the North Campus Plan in making land use decisions for this area. The plan, adopted by the Regents in 1984, calls for a central academic/research core area of 100 acres north of Fuller Road between Murfin and Beal Avenues, and eventually extending east to Huron Parkway. This core area is to be surrounded by a campus housing area of 173 acres. The plan calls for 6,500 dwelling units in both married student and dormitory units. Presently, there are nearly 3,900 dwelling units on North Campus. The area of North Campus located east of Huron Parkway, which currently consists of service facilities and vacant land, is proposed to be used for open space, research and campus support facilities. Continued coordination between the City and the University is encouraged to assure compatible development.

Veteran's Administration

Due to a growing demand for space, the Veteran's Administration has developed plans to expand their hospital and parking facilities to the east. These plans involve the realignment of Fuller Road and the development of an improved traffic pattern in the area.

Careful coordination is required between the City, Veteran's Administration and the University to insure that the expansion is consistent with City plans and policies for the area.

Concordia College

Concordia College, a private four-year institution associated with the Lutheran Church, is situated on three parcels totaling 400 acres which surround the intersection of Geddes and Earhart Roads. The school's master plan recommends retaining athletic fields north of Geddes and limiting development on the northeast parcel to residential uses, such as housing for married students. Academic buildings are to be concentrated between Geddes and the river.

Because of the presence of significant natural features on or near the Concordia site, it is recommended that future development preserve these features.

Other Recommendations

Historic Districts

Historic preservation has become the catalyst for the revitalization of entire neighborhoods, spurring private investment in older central neighborhoods. In Ann Arbor, historic preservation regulations have taken the form of overlay districts, supplementing the building code and zoning ordinance. In such districts, historic preservation standards are applied to certain types of exterior alterations of structures.

The northeast area currently contains one historic district, the Northern Brewery District, which contains a landmark structure on Jones Drive. The establishment of historic district ordinances for two neighborhoods located within the study area, Washtenaw-Hill and Northside, should be considered (Figure 7). The Washtenaw-Hill district is proposed to encompass the residential neighborhoods north and south of Geddes Avenue and extending east along Washtenaw Avenue. The Northside district would contain the residential neighborhoods south of Barton Drive between Longshore Drive on the west and Broadway on the east. Regulations for these districts should closely resemble those for existing residential historic districts, such as the Old West Side and the Old Fourth Ward.

The establishment of residential historic districts has generally resulted in a very positive effect. Home ownership percentages and property values have increased in certain districts. However, since older neighborhoods have traditionally housed lower income, elderly, and minority families, care must be taken that the regulations do not result in displacement of these residents.

Natural Features

The northeast area contains a number of natural features on both developed and undeveloped land which should be preserved. These woodlots, wetlands, watercourses, and steep slopes provide a colorful, relaxing environment in which to live and work and can absorb many impacts of urban development if they are accounted for properly. New public and private development or redevelopment of sites containing these features should be designed to preserve as much as possible in undisturbed form. If properly designed, new urban development can coexist in close proximity to natural features without major negative impacts.

The City of Ann Arbor has inventoried sites in the northeast area and identified a number of significant natural features which are of particular importance (Figure 8). These include the 30-acre wetlands north of Green Road and east of Nixon Road; landmark trees, woodlots, and wetland in the area between Traver Lakes and Dhu Varren Road; the woodlot west of Black Pond Park; the significant vegetation and wetlands east of Ruthven Park; and the wetlands and woodlot on the Traverwood site.

CIRCULATION

Framework

Historically, northeast Ann Arbor has been served by four entry corridors: Washtenaw Avenue, Fuller/Geddes Roads, Plymouth Road, and Pontiac Trail. These corridors led into the downtown from outlying areas. These corridors, with the addition of the north/south Nixon Road/Huron Parkway corridor, continue to provide the basic circulation framework for the northeast area.

The road network for the northeast area has been classified by dividing it into several categories:

Regional Route - a route providing continuity and access to and from other parts of the state and region.

Major Route - a route providing major access to regional routes and between parts of the Ann Arbor urbanized area and region.

Intermediate Route - a route which "feeds" major routes and serves a general sector of the City of Ann Arbor.

Minor Route - a route which collects local traffic and "feeds" intermediate routes

Residential Collector Street - a street which conducts traffic from local streets to the above routes.

Local Street - a street whose principal purpose is to provide vehicular and pedestrian access to property abutting the public right-of-way.

Figure 9 illustrates the recommended road functional classification system for the year 2005. In large part, the vehicular circulation pattern for the northeast area has already been established. This plan provides recommendations for the refinement of these patterns. Major aspects of this plan are detailed below.

Clark Road Extension to Huron Parkway

US-23 restricts east/west access into Ann Arbor to five major routes. They are Plymouth Road, Geddes Road, Washtenaw Avenue, Packard Road, and Ellsworth Road. Traffic projections for the year 2005 estimate average daily trips (ADT) for Washtenaw Avenue to be 74,000 ADT, or 34,000 ADT over capacity. The extension of Clark Road west across US-23 to Huron Parkway is proposed in the Urban Area Transportation Study Committee Plan to add another route to the east-west street system. This additional route would carry some of the future traffic that will be using the Washtenaw corridor.

The Clark Road extension over US-23 would function as an intermediate route, "feeding" major routes in the area if built. In addition to extending Clark Road, other traffic improvements should be pursued to address the problem of east-west traffic congestion. These include completion of the extension of Golfside Drive from Washtenaw to Huron River Drive, widening of Hogback/Dixboro from Washtenaw

Avenue to Plymouth Road, improvements to Huron River Drive west of Hogback Road, and improved traffic control at the Washtenaw/Carpenter intersection.

Fuller/Geddes Corridor

Fuller/Geddes Road is classified as a major route, serving as a significant entry corridor into The University of Michigan and the downtown area. Existing trips are from 12,000 ADT west of Huron Parkway to 11,600 ADT on the segment just west of US-23. This represents a use approximately 20 percent above the estimated capacity for the existing two-lane roadway. Because of this capacity problem, Fuller/Geddes Road is considered to be a deficient corridor. Improvements should be made to this corridor to relieve some of the pressure on the Washtenaw Avenue and Plymouth Road corridors.

In order to improve the capacity and safety of the corridor, Fuller Road should be realigned to provide a two-way street north of the Veterans Administration Hospital and east of Oakway Drive. The entire street should be widened from a point west of the bridge over the Huron River to the Geddes/US-23 interchange. Special care must be taken in improving the capacity of this corridor to protect residential and historic structures fronting on the road and to reduce potential environmental impacts. Coordination is also required with Concordia College to insure that pedestrian access between the north and south portions of the campus is preserved.

Huron Parkway/Inner Belt System

During the 1950's, state and federal agencies developed the concept of a circumferential highway skirting the east side of Ann Arbor and proceeded to acquire right-of-way for its construction. City officials subsequently convinced these agencies to relocate the highway path further east and north in the present US-23/M-14 configuration. The concept of Huron Parkway was originally proposed in the 1959 Thoroughfare Plan as an "inner belt" for the northeast area, utilizing the right-of-way acquired for the original US-23 route. This parkway was to act as an intermediate route, providing access to major routes in the area.

Traffic counts conducted by the City Transportation Department in 1985 showed traffic on Huron Parkway to be 10,810 ADT between Baxter and Plymouth Road and 4,090 ADT between Plymouth Road and Nixon Road.

This plan recommends revision of the Huron Parkway "inner belt" concept, making use of existing roads to serve future development in the northwest portion of the study area and minimize disruption to Leslie Golf Course and adjacent residential developments. Under this concept, the Huron Parkway/Nixon Road corridor serves as a major north-south route bisecting the northern portion of the study area. The revised inner belt would consist of Nixon Road, Dhu Varren Road and Pontiac Trail, defining a large super-block north of Plymouth Road. East-west traffic movements through this area are considered to be less critical to efficient traffic movement than the north-south movement.

The segment of Huron Parkway proposed to extend from Nixon Road to Thebigenen Parkway is to be reduced to a collector street and the segment proposed to extend across Leslie Golf Course eliminated from the plan. A portion of the existing right-of-way east of Pontiac Trail should be retained in case there is a need for a residential collector to gain access to the property to the southeast. This access street would only be built to serve a public or private development after a review of possible neighborhood impacts.

In order to function, this revised circulation system requires several

additional north-south connections: Traver Road should be connected to Dhu Varren Road west of the railroad right-of-way, and Tuebingen Parkway should be connected to Dhu Varren Road east of the railroad right-of-way. Another proposed north-south connection would connect the Huron Parkway extension to Plymouth Road west of the Environmental Protection Agency property. Nixon Road between Plymouth Road and Huron Parkway should remain in its current configuration until a City traffic analysis indicates vacation of the street would improve traffic circulation.

Highway Interchanges

Currently there are four interchanges which provide access to the northeast area from regional routes: M-14/Barton Drive, and US-23/Plymouth Road, US-23/Geddes, and US-23/Washtenaw. Further development of this area calls for an additional access point somewhere between the Plymouth and Main Street interchanges, in addition to improvements to the operation and/or location of the existing interchanges. Because final approval of these projects rests with the Michigan Department of Transportation (MDOT), the City and the Urban Area Transportation Study Committee need to coordinate local plans with MDOT officials and attempt to obtain a funding commitment.

The Barton Drive/M-14 interchange is inadequately designed for the amount of traffic it services, and funnels a large amount of traffic through the adjacent residential neighborhood. The North Main Street/M-14 interchange is also inadequate for the volume of traffic it currently handles. Any improvements to the North Main Street/M-14 interchange might consider the construction of a connection from Pontiac Trail to M-14 utilizing the right-of-way that the City owns. A detailed study of the highway access problems in this area should be included as a part of the City's Transportation Plan Update.

The Plymouth Road/US-23 interchange is inadequate for the volume of traffic it currently handles. To prevent further congestion of the Plymouth Road corridor, this interchange needs to be improved.

An interchange should be considered in the Nixon Road and M-14/US23 area to provide an additional access point to the northeast area and reduce pressure on the two existing interchanges. However, the traffic impact of Ann Arbor Township development along the M14/Dixboro corridor must be evaluated for its impact on the need for a Nixon Road interchange. If constructed, the interchange should be located between the two US-23/M-14 junctions, west of existing Nixon Road.

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Mass Transit

The five entry corridors within the northeast area are experiencing capacity overloading. The optimistic mass transit capture rates used in the 1977 Plan for Solving Circulation Problems have not been realized. With the continuing urban development within and surrounding the northeast area, alternatives to continued road construction must be explored and encouraged. Mass transit routes should be expanded into the surrounding townships. A fixed rail system utilizing existing railroad right-of-way should be examined. Official park-and-ride facilities should be established at easily accessible locations such as shopping centers and public buildings by the Ann Arbor Transportation Authority and The University of Michigan. Most importantly, the 1977 circulation plan needs to be updated to provide a comprehensive transportation strategy and implementation guidelines.

Corridor Design

Since modern urban systems are predominately automobile oriented, many urban design issues pertain to transportation systems. Private development and public road construction along major entry corridors such as Plymouth Road and the Fuller/Geddes Road corridor should follow specific design policies.

The Fuller/Geddes Road corridor may be designed with a boulevard center section provided where possible. Tree plantings and sidewalk/ bicycleways should also be part of the design. Access should be limited to existing curb cuts where possible. Road design of this corridor must respect the historical and residential structures and environmental features which front on portions of Fuller and Geddes Roads.

The Plymouth Road corridor is one of the fastest growing areas in the City. Large amounts of open space provided by research facilities and the University of Michigan provides the distinctive appearance of the corridor. This park-like setting is further emphasized by the corridor's smooth, rolling horizontal and vertical alignments. The image of the park-like setting on the entire corridor should be preserved by 1) maintaining expanded front setbacks to both buildings and parking along the road frontage, 2) expanded earth berming and tree plantings in the front setbacks, 3) eliminating unneeded curb cuts, and consolidating cuts where possible, 4) where structures and parking lots intrude with 250 feet of the street right-of-way, the density of tree materials should be increased.

The established Huron Parkway standards of large setbacks and limited curb cuts should be continued as much as possible along Nixon Road, which is proposed to serve as the northern extension of Huron Parkway.

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PUBLIC FACILITIES

Utility Systems

Storm Sewer (Figure 10). Within the study area north of the Huron River, Traver Creek and the North Campus system are the most significant drainage areas. The developed area is serviced with an extensive, underground piped system. The undeveloped portions of the basins are served with open drains.

The Traver Creek Valley system is the largest system. It drains most of the area between Pontiac Trail and Nixon Road south of M14/US-23. West of the Traver basin are three small urban systems, Huron Highlands, Huron River and Argo, which empty directly into the Huron River. The Fleming Creek drains the eastern fringe of the study area.

South of the Huron River, the Pittsfield-Ann Arbor Drain is the most significant organized system. Swift Run drains the far eastern fringe. Because of the low-density residential use on generally hilly terrain, the area between the Huron River and the Pittsfield-Ann Arbor basin is not served by an underground storm sewer system.

Coordinated with improvements to Plymouth Road in 1989, the Traver Creek culvert under the roadway will be improved to correct drainage deficiencies. As development occurs in each drainage basin, each proposal will be required to provide on-site storm water detention designed to limit storm runoff to pre-development levels.

Water Distribution (Figure 11). The older residential Northside neighborhood and the areas south of the Huron River are served with six and eight-inch mains, while the remainder of the area is serviced by 12, 16 and 20-inch water transmission lines.

The northeast area is served by one storage facility, a five million gallon underground facility on Beal. A 500,000-gallon elevated tank facility on Plymouth Road west of Green Road maintains pressure in the system. A major transmission main is planned to loop around the north part of the study area by 1990. This facility is needed to provide improved capacity and pressure.

Sanitary Sewer (Figure 12). Two main sewer trunklines, North Campus and Traver Creek, and two submains, Earhart/Greenhills and Northside, serve the area north of the Huron River. These systems generally correspond to the surface drainage basins and storm sewer districts. All of the existing urban development north of the Huron River in the City either is or can be served by the City sanitary sewer system.

South of the Huron River, the Pittsfield-Ann Arbor trunkline services the drainage basin. The area north of the service area is generally not served with a sanitary sewer system except for the area accessed by the small submains shown on the map. The residential densities range up to two dwellings per acre. Some of

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the township properties were allowed to tap into City utility lines without annexing into the City through special agreements.

Two major sewer mains are programmed for 1989, the Northside Submain Relief and the Traver Creek Sewer Extension. The existing Northside Submain downstream of Barton Drive does not provide enough capacity and a relief sewer is recommended to provide sufficient capacity for the present and future flows. An increase in the service area is predicted to provide service to Barton Hills. Extension of existing sanitary sewer along Traver Road will be necessary to serve future development along Dhu Varren Road. Other major sewer main extensions will be necessary for the area north of Arborland and the areas north of Dhu Varren Road.

Schools

The northeast contains four elementary schools (Northside Thurston, Logan and King), two middle schools (Clague and Tappan) and a high school (Huron). In addition to public schools, there are three private schools: St. Paul's Lutheran School (elementary), Greenhills School (secondary), and the Michigan Islamic Academy (elementary and secondary).

Statistics for 1986 show an elementary school enrollment of 1,490 students within the study area. The combined capacity of the four elementary schools serving the northeast area is 1,925 students. Ultimate residential growth projections would generate sufficient enrollment to create a deficit elementary school capacity. Part of this deficiency may be offset by reactivating Freeman School, located in Ann Arbor Township and presently leased to a day care operation. Middle school and senior high school capacities are considered sufficient for the planning period.

The idea of reserving another elementary school site in the north part of the study area should be studied. The City and the Board of Education should work in concert to identify the need for such a site to accommodate the number of elementary school students generated by ultimate northeast area residential growth.

Fire Stations

Presently there are six fire stations within the City. The northeast area (Fire District #5) is served by the Beal Station, located on The University of Michigan North Campus. The station serves both the North Campus and the northeast area.

Present fire service and response time in the northeast area is generally adequate, but future growth in the north portion of the study area may generate a need for an additional facility. Any plan for fire service in the northeast area must address needs generated by the maximum development of the area. Future expansion of City fire service facilities should explore sharing services with Ann Arbor Township.

Parks

The northeast area contains 600 acres of City-owned parkland. School property provides another 173 acres of recreational land available to residents. The University of Michigan provides 132 acres of programmed open space and recreational sites. The combined

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park and total of 905 acres represents 12.4 percent of the land within the study area.

Neighborhoods with either high demand or that are deficient in parkland have been identified. The Arrowwood and North Campus neighborhoods exhibit a high demand and the Bader/Ann Arbor Hills neighborhood is deficient in active neighborhood parkland. Neighborhoods with high demand tend to have larger household size, a higher percentage of households with children and lower median income.

All neighborhoods should be provided with active recreational space. Neighborhoods with identified recreational deficiencies should be targeted for priority park acquisition and development. In addition to active recreational area, parkland containing significant natural features should be acquired to provide for passive recreation opportunities within the northeast area.

The Leslie recreational complex should serve as the hub of parkland development north of Plymouth Road. This hub should be connected to other park and school facilities through a system of linear parks and pedestrian/bicycle trails. The Huron River and Gallup Park should serve as the hub for the area between Plymouth Road and Washtenaw Avenue. Huron Parkway and Traver Creek are important elements in providing linkages between these two park systems.

Specific parkland acquisition and development recommendations for the northeast area are contained in the 1988-1994- Parks, recreation and Open Space Plan and the North Main Street Plan (Figure 13). Because a joint responsibility to provide and maintain recreational space exists between the City of Ann Arbor and other local units of government such as the Ann Arbor Public Schools and Washtenaw County, increased coordination and communication between these different agencies is essential for a responsible park program.

Recycling

Currently, the only recycling facility located in the study area is a composting drop-off site at Leslie Science Center. Recycle Ann Arbor, in coordination with the City, provides curbside pickup of recyclable materials for residential households and collection programs for the commercial sector. City plans to expand the recycling program include development of small local collection sites to increase participation by residents of multiple-family developments. Additional programs and facilities should be developed to provide alternatives to landfill disposal of refuse.

Other Facilities

The northeast area contains several other facilities which are utilized by the public. A neighborhood branch of the Ann Arbor Public Library is located at Plymouth Mall. Northside Community Center, administered by the City Parks and Recreation Department, provides community services to low-income families and seniors. A privately-run community center, Green-Glacier, is operated by the Methodist Church and provides a number of neighborhood services.

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PLAN IMPLEMENTATION

Several methods may be used by the City to implement the recommendations contained in the Master Plan. These methods fall into two general categories: development of ordinances or regulations and the spending of public money on capital improvements.

Ordinances

State enabling legislation allows communities to zone land and adopt other land development regulations to protect the health, safety and welfare of its residents. The Zoning Ordinance (Chapter 55 of the Ann Arbor City Code) establishes regulations for the use of the land, its maximum density and the height, size and placement of structures on the land. In order to be enforceable, objectives outlined in Master Plan must be translated into specific regulations and adopted as part of a zoning ordinance or land development regulations.

In addition to the Zoning Ordinance, there are a number of other City ordinances which regulate the use of land:

Chapter 26 - Refuse	Chapter 61 - Signs
Chapter 47 - Streets	Chapter 62 - Landscape
Chapter 55 - Zoning	Chapter 63 - Soil
Chapter 57 - Subdivision and Land Use	Erosion
Chapter 59 - Off-Street Parking	Chapter 103 - Historic Preservation
	Chapter 104 - Fences

The City Council has also adopted development policies requiring the installation of street trees and sidewalks or bike paths, and guidelines for the provision of parkland or off-site improvements by new developments.

Because a development petition must be submitted to the City for review before land development regulations can be applied, their role in implementation of the Master Plan is limited. However, these guidelines also help shape other public decisions that relate to the development or improvement of City facilities or services.

Capital Improvements Plan

Regulations dictate what may or may not occur on a particular site, not if or when the development or redevelopment should occur. The timing of development can be influenced through the a City's capital improvement plan and the operating budget.

Each year, the City Planning Commission develops a plan which specifies the priority of City-financed capital projects over the ensuing six years. These projects include utility line extensions and improvements, parkland acquisition and development, street construction and other major projects on City-controlled land or right-of-way. Once adopted, this plan is used by the City Council in making budget decisions throughout the year.

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The 1988 Capital Improvement Plan identifies over 20 million dollars to be spent on projects located within the northeast area over the next six years. The table below indicates how these funds are proposed to be spent.

	1988	1989	1990	1991	1992	1993
Park and Rec	\$2,570	652	1,018	400	75	225
Sanitary Sewer	\$1,513	150	600	321	442	-
Storm Sewer	\$563	563	-	-	-	-
Water Mains	\$626	26	600	-	-	-
Street Improve	\$15,628	4,050	6,562	2,816	-	200
TOTAL	\$20,900	\$5,441	\$8,780	\$3,537	\$517	\$400
						\$2,225

Other Approaches

A variety of supplementary approaches are used to implement the recommendations contained in this plan. One is the encouragement of annexation within the sewer service boundaries in coordination with improvements scheduled in the Capital Improvement Plan.

Another important aspect of implementation is communication and coordination between planning agencies. Because development and circulation within the northeast area are impacted by the actions of the surrounding townships, the University, the Board of Education, the Urban Area Transportation Study Committee, Ann Arbor Transportation Authority, and a variety of regional and state agencies; coordination with these decision-makers is necessary to insure that objectives contained in the City plan are met. This in turn requires a commitment on the part of the City to participate in joint coordinating efforts.

Northeast Area Plan, figures. Document produced in 1989. Linked images are intermediate in size; right-click on them and choose to "view image" to see the figure in greater detail.

- [Document Cover.](#)
 - [Figure 1. Plan Review Time Line](#)
 - [Figure 2. Outline map of northeast area neighborhoods.](#)
 - [Figure 3. Northeast Area by Neighborhood: a table showing various demographic variables](#)
 - [Figure 4. Demographic Character. Sequence of small maps showing visual display of demographic variables.](#)
 - [Figure 5. Map showing Northeast Area Landuse Summary.](#)
 - [Figure 6. Outline map of Residential Planning Areas.](#)
 - [Figure 7. Outline map of Historic Districts.](#)
 - [Figure 8. Map of Major Natural Features.](#)
 - [Figure 9. Map of Circulation Pattern. Major, intermediate, and minor collector routes.](#)
 - [Figure 10. Map of Storm Sewers \(with drainage basins\).](#)
 - [Figure 11. Map of Water Distribution System.](#)
 - [Figure 12. Map of Sanitary Sewer System.](#)
 - [Figure 13. Outline map for Parks, Recreation, and Open Space.](#)
-



Fuller Park Pool

What do you need?

- Elections
- Farmers Market
- Golf
- Jobs
- Online Payments
- Parks & Recreation
- Pay a Parking Ticket
- Report a Problem
- Road & Lane Closures
- Trash & Recycling

City of Ann Arbor News

[Labor Day Holiday to Delay Solid Waste Collection and Close Municipal Offices](#)

August 26, 2014 - There will be no trash, recycling or compost collection services in the city of Ann Arbor on Labor Day, Monday, Sept. 1. The Monday pickups will occur on Tuesday, and the rest of the collections will occur one day later throughout the week. The normal Friday routes will be serviced on Saturday, Sept. 6. City of Ann... [read more »](#)

[Renovations Scheduled for Ann Arbor Fire Station No. 3, Followed by Stations No. 4 and then No. 5](#)

August 22, 2014 - Some Ann Arbor Fire Department stations will soon undergo renovations to their bathrooms and locker rooms. The project is included in the fiscal year 2015 adopted budget. Work at station No. 3 (2130 Jackson Ave.) is scheduled to begin... [read more »](#)

[Main Street Closures & Stadium-area Parking Restrictions Resume for U-M 2014 Home Football Game Days](#)

August 21, 2014 - Main Street closures will again be in place during the 2014 University of Michigan football season (click the map to open a PDF version). These closures will occur for all U-M home football games, beginning with... [read more »](#)

[Programs Temporarily Relocated During Ann Arbor Senior Center Construction](#)

August 15, 2014 - (*UPDATED Aug. 27, 2014) Ann Arbor Parks and Recreation has temporarily closed the Ann Arbor Senior Center, 1320 Baldwin Ave., due to an unscheduled construction project (*please see additional details at the end of this press release). The majority... [read more »](#)

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Property Information

Validate if an address is within the city limits of Ann Arbor, MI and verify mailing, voting, and solid waste pickup information.



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PLANNING FOR TREES:

GEOGRAPHIC NEIGHBORHOOD SIGNATURES BASED ON CRITICAL ROOT ZONES.

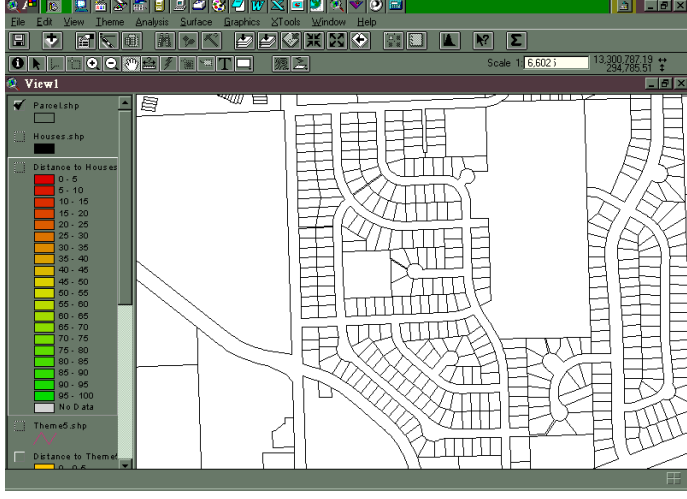
When tree roots and impervious surfaces meet each other, disaster is usually the result. First, the concrete house foundation, driveway, sidewalk, or sewer line gives way to the tree roots--disaster for the surface and its owner, and then in retaliation, the tree may well be cut. The problem of course is that the long-range pattern of tree root growth was not anticipated by the original developer of the parcel of land. Most people think only of how the trees and shrubs look, and how they will enhance property sales, at the time of construction. The cumulative effect of initial lack of consideration of this problem leads to disaster years later: disaster to homes, to sidewalks and sewer lines, and, to tax base that gets gobbled up in lawsuits. All of this could have been avoided by planning for trees that considered the problem of conflict between roots and surfaces and adopted a strategy for minimizing or resolving this conflict. (Ann Arbor's Natural Features Ordinance (Chapter 21 in Ann Arbor City Code) does not apply to single family lots--this sort of information would encourage homeowners, for their own interest, to plant reasonable trees (especially when coupled with the City list of [Invasive species](#))). Indeed, as cities age and get rebuilt, it is as important then, as it is for the emerging pristine development, to consider this problem.

The research question is to develop a strategy that minimizes or resolves the conflict between these two sets of systems (one natural, one human). One strategy that would address this problem is to map existing neighborhoods based on the geometry of the infrastructure of existing housing stock (footprint/rooftop and driveway), sidewalks, street curb, water and sewer lines, and (perhaps) overhead lines. Distance contours at a 1 foot (or other) interval from each of the chosen items would be the base from which a critical root zone map would be created. Follow-up with the Homeowners Association and posting of information on their website would encourage individual parcel owners to consider the merits of planting not only non-invasive species (with the list from the City) but also plantings with correct root ball size (information from local nursery personnel or land development coordinator) to avoid future difficulties with impervious surfaces.

The neighborhood for proposed pilot study is the Bromley neighborhood in Northeast Ann Arbor: 231 homes bounded by the south on Huron Parkway, the west by Nixon Road, the north by Bluett, and the east by Prairie.

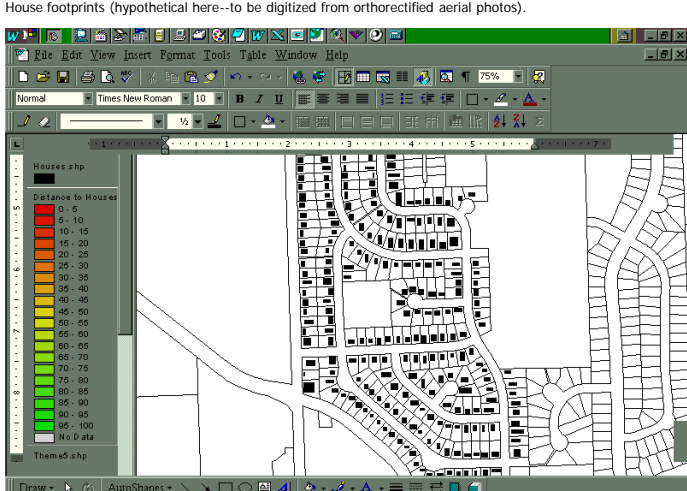
HYPOTHETICAL SAMPLE MAPS

Hypothetical analysis can often suggest how actual analysis will appear. There may well be merit in spending a few minutes in creating hypothetical maps prior to investing large amounts of time in creating actual maps. In this section, hypothetical maps are created. In the following section, Lloyd R. Phillips made actual maps.

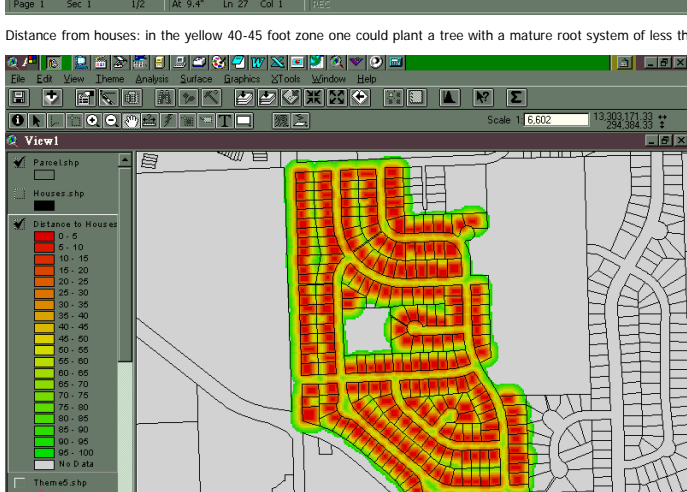


Bromley subdivision from the City of Ann Arbor parcel map

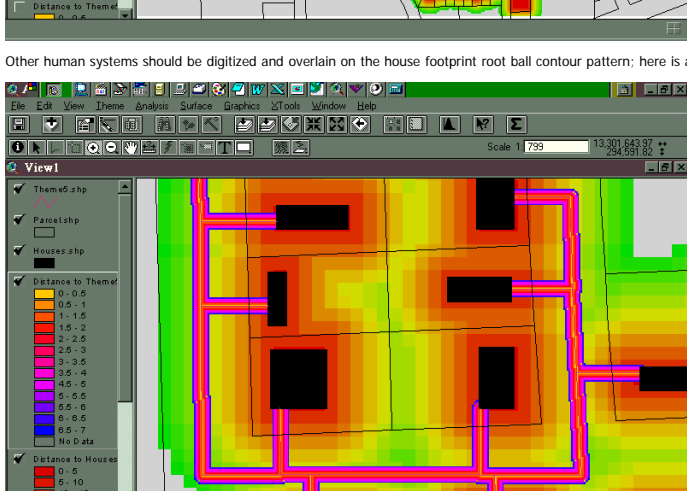
House footprints (hypothetical here--to be digitized from orthorectified aerial photos).



Distance from houses: in the yellow 40-45 foot zone one could plant a tree with a mature root system of less than 45 feet without having that system reach the nearest house.



Other human systems should be digitized and overlain on the house footprint root ball contour pattern; here is a sample with hypothetical infrastructure/sewer line.



In the detailed view above, one sees the gradation in away-from-the-house contours. The size of each is 5 feet. Homeowners who are aware of these distances and unseen difficulties would likely wish to choose planting patterns to avoid future harm/exposure to their impervious surfaces. Overlaying various layers creates a pattern that is more intricate than that shown here and it is that pattern, that tells where it is safe to plant trees with respect to root distance from impervious surfaces. The maps offer a critical root zone geographic-signature of the neighborhood. With such a long-range planning effort, the homeowner wins, the City wins, and the trees win.

ACTUAL MAPS OF BROMLEY

During the Fall of 2000, co-author Phillips worked to implement the strategy above for one neighborhood well-known to co-author Arlinghaus. While the purpose of the project was to offer a map of regions, as a pilot project, in which trees of varying sized rootballs might be successfully planted (without interfering with house foundations, sidewalks, or driveways), there was also the added benefit of producing a map of previously undigitized impervious surface and using the GIS to calculate percentage of impervious surface coverage. Impervious surface location, and percentage by watershed, is important in understanding regional stream health. Information of this sort appears to be becoming of increasing significance in coming to local policy decisions. Note the general impervious surface map, from SEMCOG (South East Michigan Council of Governments) for all of Washtenaw County (county containing Ann Arbor). The white areas are areas for which there was no data.

Rectified-orthophotos (raster data) were obtained from Merle Johnson, Information Services Division, City of Ann Arbor. In 1992, Woolpert of Ohio began the functions necessary to create orthophotos. The work was completed in 1993-1994. In 1997, an update was completed for selected areas and a complete fly-over of the city was undertaken. The image created is a 1" resolution digital orthophoto measuring 30" x 30" at a scale of 1" = 125'. Digitizing of the photo was done using ArcView 3.2 (ESRI) at a scale ranging between 1:200 and 1:300. For more detail on the photos, see the accompanying [Appendix](#).



City of Ann Arbor parcel map superimposed on aerial photo.

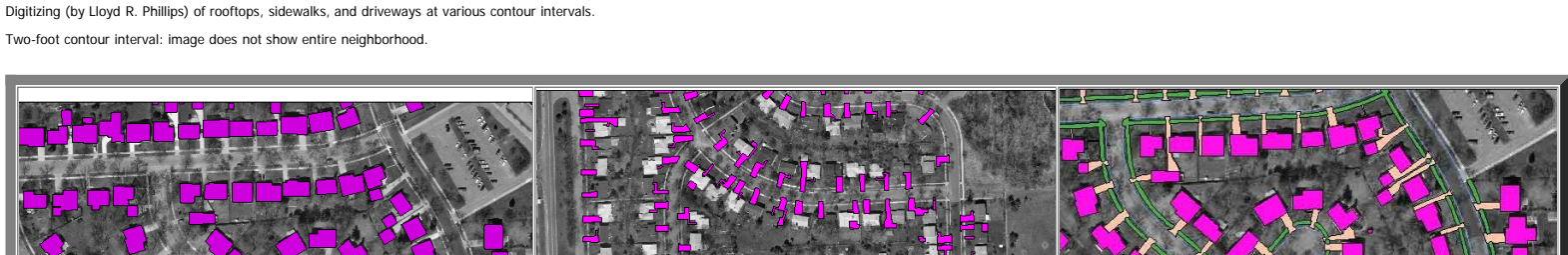


Taking a closer look reveals the sort of detail available.



Digitizing (by Lloyd R. Phillips) of rooftops, sidewalks, and driveways at various contour intervals.

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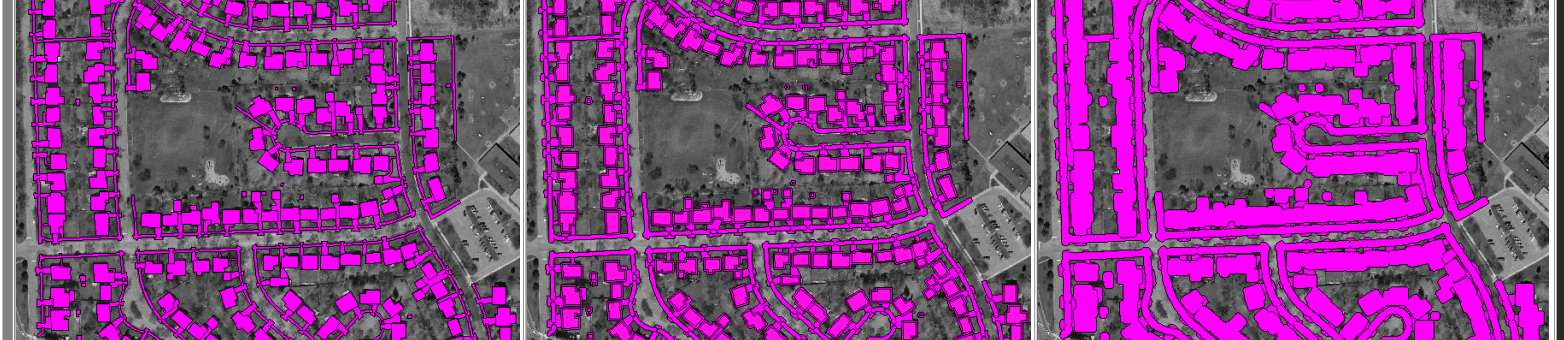
Ten-foot contour interval: image does not show entire neighborhood.



Twenty-foot contour interval, rooftops only: image does not show entire neighborhood.



All taken together, 2, 5, and 10 foot contour intervals: image does not show entire neighborhood.



Thus, one could choose a planting scheme, based on rooftop size, designed not to interfere with existing concrete. This choice would be made simply on distance. Mr. Phillips also discovered that there are business firms that recognize this difficulty and can install an underground shield so that trees larger than distance would suggest prudent, can be planted closer to concrete. In either case, once again, trees win, property owner wins, and City wins.

Appendix

In this region, there were no tall buildings or other structures to cause a problem with vertical displacement. One problem to be resolved, however, was the distortion of shapes due to the sun angle and the object-distance from nadir. The features that exhibit this phenomenon were sidewalks. The widths of the sidewalks often vary in shape: whereas, they were digitized as they were perceived.

Lack of photons (or energy) reaching the sensors in the aircraft due to obstruction, was a common problem, caused primarily by building or tree shadow. Thus, the image's spectral resolution becomes diminished. Exact shape and position of individual house rooftops were therefore difficult to determine. Additionally, the same shadows would, on occasion, obstruct the outline of the driveways and associated impervious structures.

These considerations were factored into the digitizing process. Further detail of the entire survey is available from the City of Ann Arbor. A few details of note include:

- The geographic extent of the digital orthophotos is 50+ square miles from M-14 on North to Morgan Road on the South. The range extends from Wagner Road on the West to Gale Road on the East.
- Standard digital orthophotos are cast on the Michigan State Plane - South Zone projection on the North American Datum of 1983 (NAD83) with coordinates in feet.
- The ordering of the data is by lines (rows) and samples (columns) with each line containing a series of pixels ordered from west to east. The order of the lines is from north to south. When displayed on a computer, the image projection grid north is at the top.
- The four primary datum (NAD83) corners are imprinted into the image as four solid white crosses with an image value of 255 and the four secondary datum corners as four dashed white crosses with similar intensity values.

[Back to text.](#)

ACTION

- Homeowners' [associations](#) offer a forum in which concerned individuals have opportunities of various sorts.
 - [Newsletters](#) offer one form of getting out the word based on the available inventory of information and analysis of it.
 - Master Plans offer a broad vision for the City; neighborhoods are a part of that vision and so should be informed as to what it is. Link to [Northeast Area Plan](#) of 1989 and to [Figures](#) for that document; produced originally in 1989. Currently, the City is upgrading the plan (see Planning Department part of City of Ann Arbor [website](#)).
 - Local planning: [trees](#) can cause problems when planted too near to concrete (sidewalks, driveways, foundations). This link offers an action plan, with real-world work done by Lloyd R. Phillips, for choosing where to plant trees of varying height.
-

Welcome to the Bromley Homeowners' Association Home Page!

[Newsletter Archive](#)

Space donated as part of research in community systems; established in 1994. First GIS map of Bromley is from 1989 (made using C-Map); most recent one appears posted on the home page of this NIS and is based on the City of Ann Arbor parcel map. The City has numerous GIS coverages (parks, wetlands, contours, butterfly inventory, and so forth) that enable overlays of maps, aerial photos, and data. These are employed at a variety of levels of decision making.

Remember: The City of Ann Arbor is a Bromley neighbor, too!

Send mail to the Bromley Homeowners' Association from here. Also, to gain access to Bromley On-Line (est. 1993) please send e-mail to address below.



Internet: sarhaus@umich.edu

LINKS:

WARD 2: Ann Arbor City Council Person

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City of Ann Arbor Website: <http://www.ci.ann-arbor.mi.us/>
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University of Michigan Gateway: <http://www.umich.edu/>
ArborLink: <http://www.arborlink.com/cityweb/index.html>

● [BY LAWS, BROMLEY HOMEOWNERS ASSOCIATION](#)

● [SUMMARY OF NEIGHBORHOOD ORGANIZATION SUGGESTIONS BASED ON EXPERIENCE: PERHAPS PARTICULARLY USEFUL FOR START-UP COMMUNITY ORGANIZATIONS.](#)

SUPPORT DOLPHINS, BROMLEY'S OWN SWIMMING POOL

- [Information on ways to support Dolphins Pool.](#)
 - [Bylaws of Dolphins Inc.](#) These Bylaws were scanned from paper copy and then passed through an Optical Character Reader. We have spent a good deal of time correcting errors introduced by scanning old paper copy; however, some may remain and we wish to correct them. So, please, bring to our attention any errors you note (that do not match the original paper copy).
-

FRIENDS OF HURON PARKWAY

- [Link to this organization.](#) Site includes entire text and set of maps for the North East Area Plan for the City of Ann Arbor; the component of the master plan for the City that applies to Bromley. Use this Plan as a reference guide for zoning and other matters related to the planning and development of parcels of land in the northeast area.
-

RELATED WEBSITES (please send us any you find):

ORCHARD HILLS/MAPLEWOOD HOMEOWNERS ASSOCIATION: <http://www.arboresearch.com/ohmha/>

ARCHIVES OF BROMLEY HOMEOWNERS' ASSOCIATION NEWSLETTER

Newsletters of Bromley Homeowners' Association, W. E. Arlinghaus, President and Newsletter Editor (with assistance from SA). Charles Engle, Compositor.

1998

• January, 1998	• April, 1998		
• February, 1998	• May, 1998		
• March, 1998	• June, 1998	• September, 1998	

1997

• January, 1997		• July, 1997	• October, 1997
• February, 1997		• August, 1997	
	• June, 1997	• September, 1997	

Newsletters of Bromley Homeowners' Association, S. L. Arlinghaus, President and Newsletter Editor. Charles Engle, Compositor.

1996

• January, 1996	• April, 1996	• July, 1996	
• February, 1996	• May, 1996	• August, 1996	
• March, 1996	• June, 1996	• September, 1996	

1995

• January, 1995	• April, 1995	• July, 1995	• October, 1995
• February, 1995	• May, 1995	• August, 1995	• November, 1995
• March, 1995	• June, 1995	• September, 1995	• December, 1995

1994**1993**

• January, 1993	• April, 1993	• July, 1993	
• February, 1993	• May, 1993	• August, 1993	
• March, 1993	• June, 1993	• September, 1993	

1992

• January, 1992	• April, 1992	• July, 1992	• October, 1992
	• May, 1992	• August, 1992	• November, 1992
	• June, 1992	• September, 1992	• December, 1992

• [Mayoral visit, March 12, 1992](#)

1991**1990****1989**

1988 and earlier years to come

ARCHIVES OF BROMLEY NEIGHBORHOOD WATCH

- [March, 1996](#)
- [September, 1995](#)
- [August, 1995](#)
- [June, 1995](#)
- [May, 1995](#)

N O R T H E A S T A R E A P L A N
ANN ARBOR, MICHIGAN

Adopted by, the Ann Arbor City Council
April 6, 1989
Gerald Jernigan, Mayor
Liz Brater
Ann Marie Coleman
Kathy Edgren
Jeff Epton
Larry Hunter

Terry Martin
Mark Ouimet
Tom Richardson
Jerry Schleicher
Ingrid Sheldon

Del Borgsdorf, City Administrator

Adopted by the Ann Arbor City Planning Commission
April 25, 1989
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The City Planning Commission wishes to thank each of the Northeast Area Plan Review Task Force members who participated in the plan review process, the over 130 residents who took the time to provide insight and comments, the City Department representatives and other local planning agencies who informed the Task Force about their planning efforts, and especially to Planning Department staff members Glenn Bowles and Wendy Rampson for coordinating this effort. Special thanks go to the staff of Community Access for their instruction and assistance in preparing the video production highlighting this planning process, to Joy Bisaro, who developed the graphics for the plan, and Jill St. John, who provided patient secretarial assistance throughout the process.

INTRODUCTION

Purpose

The City Planning Commission has resolved to periodically review and update the City Master Plan. The Northeast Area Plan is a sub-element of the Master Plan, serving to pull together and update the recommendations of previous plans and studies as they relate to the northeast area of the City. This plan document is meant to provide a guide for future decisions related to land use, circulation and public facilities in the northeast area. While concerned primarily with the future development of remaining vacant land, the plan also provides guidelines for redevelopment, infill development and the preservation of existing neighborhoods.

Process

This plan is the culmination of a year of review and citizen input. In December 1987, the City Planning Commission appointed a citizen task force to review and recommend changes to the Master Plan elements as they applied to the northeast area of the City. Staff completed an inventory of the land use and population in February, 1988. Following six months of review and discussion, the Northeast Area Task Plan Review Task Force presented its recommendations to the City Planning Commission on June 28, 1988. After two public hearings, the City Planning Commission voted to accept the Task Force report on July 26, 1988, and directed Planning Department staff to develop a plan document based on the current Master Plan and the suggested revisions. The time line shown in Figure 1 outlines the steps taken in this process.

Framework

The Northeast Area Plan is comprised of six main sections: background, guiding policies, land use, circulation, public facilities, and implementation guidelines. The background section provides a brief framework of the history and demographics of the northeast area. The core of the document outlines planning recommendations related to guiding policies, land use, circulation and public facilities. Strategies for implementation of the plan recommendations are outlined in the final section.

BACKGROUND

Study Area

The northeast area is bounded by M-14/US-23 on the north, US-23 on the east, Washtenaw Avenue on the south, and Ferdon Avenue, the Huron River and M-14 on the west. It contains approximately 7,313 acres, of which 2,267 acres, or 31 percent of the land area, is currently located in Ann Arbor Township's jurisdiction. Based on sanitary sewer agreements with Ann Arbor and Pittsfield Townships, this plan assumes that all land within the study area will eventually fall under the City's jurisdiction. Therefore, the sewer agreement boundary corresponds with the study area boundary.

For data analysis purposes, the study area has been divided into 15 planning neighborhoods (Figure 2).

History

The northeast area contains some of the oldest commercial buildings in the City. The "Lower Town" area, located on the north side of the river at the base of the Broadway bridge, thrived as a commercial center in the early 1830's, but its growth, and that of the surrounding countryside, was curtailed when the railroad was constructed on the south side of the river. What residential development did occur radiated north from Lower Town along Pontiac Trail and Traver Street to Barton Drive and along Broadway Avenue to Plymouth Road, which represented the City's northeasterly limits until the 1940's. Early residential development also occurred south of the river, expanding east from the campus area along Washtenaw and Geddes Avenues.

The remainder of the area west of the river was used largely for agriculture until the early 1950's, when the University of Michigan purchased 800 acres of land to establish the North Campus and the Michigan Department of Transportation started acquiring land for construction of a new highway, US-23. These two events, more than any other factors, spurred on the dramatic growth which has characterized the northeast area for the last 30 years. During the late 1950's and early 1960's, research firms located along Plymouth Road, due in part to active encouragement by the University and easy access to US-23. As these research sites developed, they were annexed into the City to allow connection with City services. This resulted in a patchwork pattern of City and township islands which exists even now in the northeast area.

The 1960's were boom years for the northeast area. Single-family subdivisions were established in close proximity to the Plymouth corridor, which continued to attract new research firms. The major commercial developments in the area, including Arborland, Plymouth Mall, North Campus Plaza, Plymouth-Green and the Washtenaw strip, were developed during this time. Several multiple-family projects were also developed during the 1960's, including dormitories and married student housing located on North Campus.

Development continued into the 1970's, particularly residential. The Arrowwood Hills Cooperative, a federally-subsidized residential development, was built in the early 1970's, as was the Traver Lakes development. This time period also saw the introduction of some constraints to the future growth of the City, as the waste water treatment agreements signed by Pittsfield Township in 1975 and Ann Arbor Township in 1976 identified township areas outside the freeway ring that could remain in the township's jurisdiction while receiving City sanitary sewer services.

In the 1980's, development of the northeast area has continued with the construction of a variety of new multiple-family, commercial, office and research developments.

Planning

Background

Although up until this time there has not been a comprehensive land use plan developed specifically for the northeast area, several approved City-wide plans contain recommendations for this area. These include:

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General Land Use Model - 1974
Transportation Plan for the Ann Arbor-Ypsilanti Urbanized Area 1975
Plan for Solving Circulation Problems - 1977
Plan for Transitional and Vacant Land Areas- 1981
1988-1994 Plan for Parks, Recreation and Open Space - 1988
North Main Street/Huron River Corridor Summary Land Use Policy Plan - 1988

A number of studies have also been done on specific aspects of the northeast area. These studies, in addition to providing an historical perspective, provide guidance in the framing of this plan's recommendations. They are:

Area Plan for Northeast Ann Arbor - 1953
Fuller-Geddes Study - 1964
Northeast Area Study Policy Report (Draft) - 1974
Plan for Northeast Area - Potential Issues - No Date
A Preliminary Opinion Survey For the East/Northeast Area Plan (Final Report) - 1978
Northside Character Study - No Date
Household Survey - 1981, 1984, 1986, 1988
Northeast Area Commercial Needs Study - 1982
North Campus Plan - 1984
Traffic Analysis for the Northeast Ann Arbor Area (Memorandum) - 1986
Green Road Impact Assessment - 1987

Demographics

According to a 1988 Planning Department land use inventory, the Northeast Area contains 13,607 dwelling units and an estimated 31,900 residents. The growth within the area is fairly recent. It has been spurred on largely by The University of Michigan's development of North Campus and active support of research activities, and the completion of US-23/M-14. In 1950, the United States Census shows the population of the northeast area to have been 5,400. By the 1960 Census, population had increased to 8,065. Following the major increase in development during the 1960's, the area's population mushroomed to over 22,000 by the 1970 Census. The population of the Northeast Area is projected to reach 38,800 people by the year 2005. It is possible that if the northeast area is developed according to current plans, the ultimate population may reach 46,500 people, a 46 percent increase over the present population of 31,900.

Residential neighborhoods within the northeast differ considerably from each other. As Figures 3 and 4 illustrate, the neighborhoods South of the Huron River are predominantly owner-occupied, with median household incomes nearly double that of the entire City. Households in this area tend to have a greater percentage of elderly people (over 60 years old), and residential developments have a relatively low density (less than two dwelling units per acre exclusive of right-of-way).

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The older neighborhoods west of the North Campus and the Ann Arbor Railroad, including Arrowwood Cooperative and the Huron Highlands Subdivision, tend to have lower incomes (generally less than 80 percent of the City median household level), a predominance of renter-occupied units, with residential densities ranging from about four units per acre to over

ten dwellings per acre. More multiple-family dwellings exist in Neighborhoods 4, 5, 6 and 7 than in any other northeast neighborhoods.

With the exception of the Northwood V and Greenbrier neighborhoods, housing in the area east of Nixon Road and Huron Parkway is predominantly owner-occupied. North of Plymouth Road, the density averages about five dwellings per acre. South of Plymouth Road, the single-family development density ranges from two to four units per acre and the multiple-family density ranges from seven to 15 units per acre. Income levels, with the exception of the Greenbrier and Northwood V neighborhoods, are well above the \$30,000 City median.

Currently, over 10,600 people are estimated to be employed within the study area. Over 80 percent of this employment is concentrated along the Plymouth Road corridor east of Broadway. Nearly 4,000 people are employed on the University of Michigan North Campus. Another 3,000 people are employed in the ten major research and development businesses located along Plymouth Road. The Arborland and Tuomy Hills commercial concentrations along Washtenaw Avenue employ nearly 1,500 people in retail commercial and office activities. Another 600 people are employed in the Lower Town service commercial center at Broadway and Maiden Lane.

Employment is projected to double to 21,300 with the ultimate development of the area. Over 9,000, or 84 percent, of these new jobs are projected to be in research and development. Nearly all of the growth in employment is expected to be on the north side of the Plymouth Road corridor in the Plymouth Professional Park, the research and commercial development near Plymouth and Nixon Roads, and the proposed research areas north of Dhu Varren and Green Roads.

Inter-Governmental Coordination

In developing a plan for the northeast area, coordination is required between a number of governmental agencies which have plans for the area. These agencies include The University of Michigan, Ann Arbor Township, Pittsfield Township, the Urban Area Transportation Study Group (UATS), the Ann Arbor Transportation Authority (AATA), and the Ann Arbor Board of Education. Several coordinating committees meet on a regular basis. These are:

- University of Michigan-City Coordinating Committee
- City-School Coordinating Committee
- UATS Technical and Steering Committees

Special meetings set up by the Washtenaw County Metropolitan Planning Commission provide additional opportunities for communication and coordination between planning jurisdictions. Wherever possible, elements of the plans and policies developed by these agencies have been incorporated into the Northeast Area Plan.

7

GUIDING POLICIES

The 1973 General Development Plan and the policy components of the elements of the City Master Plan provide guidance and direction for the City's planning decisions. These general policies for land use, circulation, public facilities, historical preservation, urban design and environmental quality set the tone for the specific recommendations contained in the Northeast Area Plan. Highlights from these plans are summarized below.

Land Use

Within residential areas, established neighborhoods must be protected from the intrusion of incompatible land uses, increased traffic, deterioration and other negative environmental impacts. Amenities such as public parks, public facilities, convenience stores and a mix of housing types should be made available to all neighborhoods.

Commercial use should be grouped into integrated units of mixed land uses, and new strip development along thoroughfares should be prohibited. Commercial centers must be consistent in scale and appearance with existing neighborhoods and sized to serve the needs of the market area for which they are intended.

Office, industrial and research uses should be planned to be functionally, visually and environmentally compatible with surrounding residential areas.

Public Facilities

All neighborhoods should be provided with developed City-owned parklands to meet local recreational needs. Land or easements for public use should be acquired to form an interconnected greenway system. A policy of acquisition of lands along the Huron River Valley should be followed.

The provision of municipal services should be provided to areas within the City sewer service area. Development of public facilities should proceed in a direction that will permit their eventual linkage to major regional systems if this proves advantageous to the City in terms of environmental quality economic considerations.

Circulation

The planning and funding of pedestrian, bicycle and public transportation systems should be emphasized as an alternative to automobile circulation. Land use patterns should be planned to minimize the need for private vehicular travel. Road patterns and alignments should respect major topographic features, contiguous developed areas and potential future neighborhood units. Local access roads should connect to minor arterials but not serve as short-cuts between them. Major arterials should not divide closely interrelated uses.

Historical Preservation

The preservation of historically and culturally significant sites, structures, streetscapes and neighborhoods should be supported.

Adaptive reuse of historically and culturally significant structures which would be compatible with surroundings uses should be encouraged.

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Urban Design

All development should provide a visual enhancement to the City. An intensified design and implementation program for the visual improvement of all public lands, including street rights-of-way, is necessary. A high density of tree-cover should be maintained.

Environmental Quality

Woodlands, wetlands, and wildlife habitats should be maintained through sensitive land use planning. Major developments should evaluate environmental impacts and comply with established environmental regulations. Surface water runoff should be detained to minimize direct flow into the Huron River. Noise generating activities should be isolated. Alternative waste disposal systems should be investigated to conserve the landfill capacity.

In addition to the policies described in above, guidelines related to annexation and affordable housing have been established by the Planning Commission and City Council since adoption of the 1973 General Development Plan.

Annexation

In the northeast area, all land within the City sewer service area should be annexed by the City in an orderly manner. Any property within this area should be serviced with municipal sewer and water if the land is developed for urban uses.

Affordable Housing

Because the northeast area contains concentrations of lower-income groups, such as college students, single-parent families, retirees, and low and moderate-income workers, housing opportunities should be encouraged to be made available to these groups. Private developers are encouraged to propose methods to reduce costs of housing while still meeting realistic building and land development standards. In selection of affordable housing sites, consideration must be given to accessibility to public services such as public transit, schools and parkland as well as shopping facilities. Planning techniques allowing greater open space and diversity of housing types should be encouraged.

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LAND USE

With the exception of the Lower Town and near-campus neighborhoods, most of the development in the northeast area has been guided by recent city plans and zoning regulations. As pressures to develop the remaining vacant land grow, it is particularly important to continue a consistent land use pattern for future development. The recommendations outlined in this section and illustrated in Figure 5 focus on the over 1,500 acres of undeveloped land which is within the City sanitary sewer service area. However, redevelopment proposals should also be evaluated with the plan in mind.

Residential Use

The study area has been divided into six planning areas, (Figure 6). Land use recommendations are discussed for sites within each planning area, recognizing that future land use must be viewed in relationship to the entire northeast area.

In total there are approximately 1,000 acres of planned, potential large-tract and infill residential land available in the northeast area. Excluding the existing residences in township island properties, this planned residential development could produce over 4,800 new dwelling units.

In discussing residential density, the ranges used to describe certain land uses can be translated into the residential zoning districts shown below. The zoning district densities are expressed as maximum permitted dwelling units per acre (DU/AC).

<u>Zoning District</u>	<u>Residential Density (DU/AC)</u>	<u>Housing Type</u>
R1A	2.2	Single-Family Dwelling
R1B	4.4	Single-Family Dwelling
R1C	6.0	Single-Family Dwelling
R1D	8.7	Single-Family Dwelling
R2A	10.2	Two-Family Dwelling
R3, R4A, R4A/B	10.1	Townhouse & Multiple-Family Dwelling
R4B	15	Multiple-Family Dwelling
R4C	20	Multiple-Family Dwelling
R4D	25	Multiple-Family Dwelling
R4C/D	75.1	Multiple-Family Dwelling

Area I

The Northside neighborhood contains the oldest residential and commercial structures in the northeast area. Conservation of existing neighborhoods should guide planning decisions for the area. Future development in this area is largely limited to residential infill projects on small parcels. Where development or redevelopment is proposed, residential densities should not exceed the existing range of three to six dwelling units per acre.

The residential areas south and west of Barton Drive and west of the University of Michigan North Campus should be explored as a potential historic district in order to conserve the existing residential scale and character and preserve the many good examples of early Ann Arbor residences (see Historic Preservation recommendations at the end of this chapter).

Area II

This area contains a number of vacant parcels, most of which are still in township jurisdiction. Because of their development potential, this area and the area to the east are anticipated to experience a significant increase in population, an increasing demand for City services and generate additional traffic. Therefore, careful site design and circulation planning is extremely important in this area.

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Single-family detached dwellings and attached dwellings such as townhouses and duplexes are suggested for the 140-acre Subarea "A" west of Pontiac Trail. The residential density of new development in this area should be within a range of four to eight units per acre. A design mixing detached single-family homes in clusters and several higher density attached single-family units should be considered. Buffering must be provided to minimize the highway impacts on residential uses.

In Subarea "B", the vacant land south of the City's Black Pond Park is currently zoned for townhouse and multiple-family development with a maximum density of ten units per acre. Because of the topography and significant natural features on this site, it is recommended that development be clustered on the south portion of the site, with environmentally-sensitive land and/or south of Black Pond being acquired for additional parkland. The township parcel located west of the Black Pond site is recommended for a mixture of single-family attached and single-family detached housing, with residential densities ranging from four to eight units per acre.

The approximately 155-acre Subarea "C" located directly north and west of Leslie Park offers the potential to expand community and neighborhood recreational opportunities in coordination with new residential development and an improved local circulation system. Residential development should include a mix of single-family and multiple-family dwellings with an average density of eight units per acre. New public streets connecting Dhu Varren Road, Pontiac Trail and Traver Road are strongly encouraged to disperse local traffic and provide alternative access points.

North of Dhu Varren Road and west of the Ann Arbor Railroad is the 55-acre Subarea "D", currently owned by the Washtenaw County Road Commission. If made available for private development, the east portion of the site should be developed for single-family attached and detached uses. Residential densities on this site should range from four to eight units per acre. Development of this site must provide buffering from the highway.

Area III

Much of the residential development in this area has occurred in the last 15 years. Of the undeveloped land in the north portion, a large amount is already in the City's jurisdiction and zoned for residential use.

Subarea "A" contains the previously proposed "Foxfire" development, a 245-acre site characterized by farm fields, woodlots and a major tributary of Traver Creek. Clustering of single-family detached and attached housing to preserve the creek channels and woodlots is proposed with residential densities ranging from six to ten units per acre. The 32 acres closest to US-23/M-14 is zoned for multiple family residential use at a density of up to 15 units per acre. As with all other residential sites adjacent to the highway, proper buffering and building orientation is necessary to mitigate the noise and pollution impacts.

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The 40-acre Subarea "B" north of Logan School is recommended for single-family detached and attached homes at a density of four to six units per acre. Clustering is encouraged to preserve the wetlands in the southwest corner of the site and provide additional recreation and open space to be acquired for Logan School.

In Subarea "C", the area between Leslie Golf Course and the proposed north/south collector street is recommended for multiple-family use with a density of up to 25 units per acre. The use of midrise buildings, consistent with development to the west, is recommended to preserve the significant wetlands, woodlots and landmark trees on the site. Duplex or multiple-family use is recommended as a redevelopment option for the two-acre automobile salvage site located at the intersection of Plymouth Road and Upland Drive, unless it is determined that soil contamination would make residential use undesirable.

Area IV

With the completion of Windemere Townhouses at the southeast corner of Nixon and Green Roads, the residential development of this planning area is nearly complete. Individual single-family homes may be added in the future on a few small infill sites and undeveloped platted lots in established neighborhoods. Infill development should not exceed the existing single-family detached density of four to five units per acre.

Area V

The approximately 80 acres of undeveloped land located north of Geddes Road is recommended for single-family detached development. Because of the nature of the existing residential development and the sensitive natural environment, residential densities in this area should be limited to no more than four units per acre. Development of additional housing for senior citizens is recommended on the Glacier Hills site.

Area VI

The west portion of this planning area is largely developed. The Geddes Avenue area contains nearly 120 acres of land in Ann Arbor Township, most of which contain single-family homes. Except for those properties which are connected to City sewer by special agreements, these properties will be annexed individually as their owners petition for City services.

Sub area "A" contains 42 acres on the west side of Huron Parkway, north of Washtenaw Avenue which are zoned for a mix of single-family detached and single-family attached uses. Site design should be sensitive to the wooded areas and protect the watercourse through the site. A significant setback from the Huron Parkway is also recommended.

A mix of dwelling types is recommended for Subarea "B", a 92-acre site north of the proposed Clark Road connection to Huron Parkway and east of Chalmers Drive. Multiple-family use at a density of up to ten units per acre is recommended for the east portion of the site adjacent to US-23 and the south portion adjacent to Arborland. Design of such a development must include buffering to reduce highway impacts. The west portion of the

site is recommended for

a mixture of detached and attached single-family uses, with single family detached being located adjacent to existing single-family development.

Because of the heavily wooded and hilly terrain of Subarea "C", single-family attached development is recommended. Clustered unit design with a residential density of six to ten units per acre should be used to preserve the natural features of the site.

Commercial Use

As both the residential and employment population of the northeast area grow, the need for commercial use increases. Because there is no authoritative formula by which to determine the amount or type of commercial use that will be needed to serve this growing population, recommendations for the location of commercially-zoned land contained in this plan are based on a range of the following rough projections, along with other standards of proximity, convenience and accessibility.

Percentage of land area.

Based on a February 1988 inventory, 2.27 percent of the developed City land in the northeast area is in commercial use. Applying this percentage to the total area of undeveloped or township land (2,267 acres), an additional 51 acres of commercial area would be needed to maintain the status quo.

Per capita floor area.

The amount of existing commercial floor area per resident in the northeast area is 33.4 square feet. This compares to an average of 61.8 square feet of commercial floor area per capita for the entire City. Using the existing 33.4 square feet per capita figure, population growth of 6,000 people by the year 2005 would indicate a need of 200,400 square feet of additional commercial floor area. Assuming an average floor area to lot area ratio of 22 percent, this amount of commercial floor area would require 21 acres of land. If the City-wide average of 61.8 were applied to the additional 6,000 people, this would result in a need for 39 acres.

Shopping center standards.

The Urban Land Institute (ULI) describes shopping centers in general categories of neighborhood, community or regional, although distinctions between these categories are often blurred. In general, neighborhood centers provide convenience goods and services and include a grocery store. Community centers may also provide convenience items, but provide a greater selection of merchandise than a neighborhood center. A community center usually includes a variety of department store or strong specialty store. A regional center is characterized by a major department store and a great variety of general merchandise. Each of these categories of centers is observed to exist within a general range of floor area and acreage, and requires a certain threshold of population to survive.

Based on general ULI standards, 21 acres of community commercial could be supported at this time in the portion of the northeast area north of the Huron River. This area is currently not served by a community commercial center. The standards also indicate that the existing development in the northeast area is adequately served by neighborhood commercial.

Assuming a population growth of 6,000 people by the year 2005, an additional 6 acres of neighborhood commercial and 4.5 acres of community commercial will be necessary to serve the new population. This then results in a total need for 25.5 acres of community commercial and 6 acres of additional neighborhood commercial for the study area. It should be noted that these figures may be reduced by combining community and neighborhood functions into single centers.

Two neighborhood commercial sites are recommended to serve the northern portion of the study area: a five to eight-acre site on one quadrant of the Pontiac Trail/Dhu Varren Road intersection, and a five to eight-acre site on the northwest corner of Dhu Varren and Nixon Roads.

Because of its central location and proximity to three arterials, the ten to 15-acre site at the northwest corner of Plymouth and Nixon Roads is recommended for commercial use. Development of this site for commercial use will create a unified community-type commercial center for the northeast neighborhood. This commercial center should provide pedestrian and bicycle linkages to surrounding residential areas, generous landscaping, and provision for general community services.

Research, Office and Industrial Use

Since the establishment of the University of Michigan's North Campus in the 1950's, the northeast area has become known as a research center. In addition to providing a stable employment base, research development contributes to the open, campus-like feeling which characterizes the area. In order to enhance this reputation, planning decisions should preserve and enhance the existing research and office development in the Plymouth Road corridor.

Additional sites for research and related uses are recommended in several locations: the 50-acre site directly north and west of the Environmental Protection Agency, the 70-acre site west of Nixon and north of Dhu Varren Roads and the 93-acre site east of Nixon and south of M-14. In addition, a 77-acre planned unit development site north of Green Road is currently zoned for office and research development. Heavy industrial use is not recommended for the northeast area.

Research and light industrial developments often allow the opportunity for a more environmentally-compatible design than other types of uses because of the large lot size preference and the

ability to concentrate buildings, parking and other site development impacts. All of the sites listed above contain wetlands and other significant natural features which should be considered in any development proposal.

Institutional Use

University of Michigan

The University of Michigan follows the guideline contained in the North Campus Plan in making land use decisions for this area. The plan, adopted by the Regents in 1984, calls for a central academic/research core area of 100 acres north of Fuller Road between Murfin and Beal Avenues, and eventually extending east to Huron Parkway. This core area is to be surrounded by a campus housing area of 173 acres. The plan calls for 6,500 dwelling units in both married student and dormitory units. Presently, there are nearly 3,900 dwelling units on North Campus. The area of North Campus located east of Huron Parkway, which currently consists of service facilities and vacant land, is proposed to be used for open space, research and campus support facilities. Continued coordination between the City and the University is encouraged to assure compatible development.

Veteran's Administration

Due to a growing demand for space, the Veteran's Administration has developed plans to expand their hospital and parking facilities to the east. These plans involve the realignment of Fuller Road and the development of an improved traffic pattern in the area.

Careful coordination is required between the City, Veteran's Administration and the University to insure that the expansion is consistent with City plans and policies for the area.

Concordia College

Concordia College, a private four-year institution associated with the Lutheran Church, is situated on three parcels totaling 400 acres which surround the intersection of Geddes and Earhart Roads. The school's master plan recommends retaining athletic fields north of Geddes and limiting development on the northeast parcel to residential uses, such as housing for married students. Academic buildings are to be concentrated between Geddes and the river.

Because of the presence of significant natural features on or near the Concordia site, it is recommended that future development preserve these features.

Other Recommendations

Historic Districts

Historic preservation has become the catalyst for the revitalization of entire neighborhoods, spurring private investment in older central neighborhoods. In Ann Arbor, historic preservation regulations have taken the form of overlay districts, supplementing the building code and zoning ordinance. In such districts, historic preservation standards are applied to certain types of exterior alterations of structures.

The northeast area currently contains one historic district, the Northern Brewery District, which contains a landmark structure on Jones Drive. The establishment of historic district ordinances for two neighborhoods located within the study area, Washtenaw-Hill and Northside, should be considered (Figure 7). The Washtenaw-Hill district is proposed to encompass the residential neighborhoods north and south of Geddes Avenue and extending east along Washtenaw Avenue. The Northside district would contain the residential neighborhoods south of Barton Drive between Longshore Drive on the west and Broadway on the east. Regulations for these districts should closely resemble those for existing residential historic districts, such as the Old West Side and the Old Fourth Ward.

The establishment of residential historic districts has generally resulted in a very positive effect. Home ownership percentages and property values have increased in certain districts. However, since older neighborhoods have traditionally housed lower income, elderly, and minority families, care must be taken that the regulations do not result in displacement of these residents.

Natural Features

The northeast area contains a number of natural features on both developed and undeveloped land which should be preserved. These woodlots, wetlands, watercourses, and steep slopes provide a colorful, relaxing environment in which to live and work and can absorb many impacts of urban development if they are accounted for properly. New public and private development or redevelopment of sites containing these features should be designed to preserve as much as possible in undisturbed form. If properly designed, new urban development can coexist in close proximity to natural features without major negative impacts.

The City of Ann Arbor has inventoried sites in the northeast area and identified a number of significant natural features which are of particular importance (Figure 8). These include the 30-acre wetlands north of Green Road and east of Nixon Road; landmark trees, woodlots, and wetland in the area between Traver Lakes and Dhu Varren Road; the woodlot west of Black Pond Park; the significant vegetation and wetlands east of Ruthven Park; and the wetlands and woodlot on the Traverwood site.

CIRCULATION

Framework

Historically, northeast Ann Arbor has been served by four entry corridors: Washtenaw Avenue, Fuller/Geddes Roads, Plymouth Road, and Pontiac Trail. These corridors led into the downtown from outlying areas. These corridors, with the addition of the north/south Nixon Road/Huron Parkway corridor, continue to provide the basic circulation framework for the northeast area.

The road network for the northeast area has been classified by dividing it into several categories:

Regional Route - a route providing continuity and access to and from other parts of the state and region.

Major Route - a route providing major access to regional routes and between parts of the Ann Arbor urbanized area and region.

Intermediate Route - a route which "feeds" major routes and serves a general sector of the City of Ann Arbor.

Minor Route - a route which collects local traffic and "feeds" intermediate routes

Residential Collector Street - a street which conducts traffic from local streets to the above routes.

Local Street - a street whose principal purpose is to provide vehicular and pedestrian access to property abutting the public right-of-way.

Figure 9 illustrates the recommended road functional classification system for the year 2005. In large part, the vehicular circulation pattern for the northeast area has already been established. This plan provides recommendations for the refinement of these patterns. Major aspects of this plan are detailed below.

Clark Road Extension to Huron Parkway

US-23 restricts east/west access into Ann Arbor to five major routes. They are Plymouth Road, Geddes Road, Washtenaw Avenue, Packard Road, and Ellsworth Road. Traffic projections for the year 2005 estimate average daily trips (ADT) for Washtenaw Avenue to be 74,000 ADT, or 34,000 ADT over capacity. The extension of Clark Road west across US-23 to Huron Parkway is proposed in the Urban Area Transportation Study Committee Plan to add another route to the east-west street system. This additional route would carry some of the future traffic that will be using the Washtenaw corridor.

The Clark Road extension over US-23 would function as an intermediate route, "feeding" major routes in the area if built. In addition to extending Clark Road, other traffic improvements should be pursued to address the problem of east-west traffic congestion. These include completion of the extension of Golfside Drive from Washtenaw to Huron River Drive, widening of Hogback/Dixboro from Washtenaw

Avenue to Plymouth Road, improvements to Huron River Drive west of Hogback Road, and improved traffic control at the Washtenaw/Carpenter intersection.

Fuller/Geddes Corridor

Fuller/Geddes Road is classified as a major route, serving as a significant entry corridor into The University of Michigan and the downtown area. Existing trips are from 12,000 ADT west of Huron Parkway to 11,600 ADT on the segment just west of US-23. This represents a use approximately 20 percent above the estimated capacity for the existing two-lane roadway. Because of this capacity problem, Fuller/Geddes Road is considered to be a deficient corridor.

Improvements should be made to this corridor to relieve some of the pressure on the Washtenaw Avenue and Plymouth Road corridors.

In order to improve the capacity and safety of the corridor, Fuller Road should be realigned to provide a two-way street north of the Veterans Administration Hospital and east of Oakway Drive. The entire street should be widened from a point west of the bridge over the Huron River to the Geddes/US-23 interchange. Special care must be taken in improving the capacity of this corridor to protect residential and historic structures fronting on the road and to reduce potential environmental impacts.

Coordination is also required with Concordia College to insure that pedestrian access between the north and south portions of the campus is preserved.

Huron Parkway/Inner Belt System

During the 1950's, state and federal agencies developed the concept of a circumferential highway skirting the east side of Ann Arbor and proceeded to acquire right-of-way for its construction. City officials subsequently convinced these agencies to relocate the highway path further east and north in the present US-23/M-14 configuration. The concept of Huron Parkway was originally proposed in the 1959 Thoroughfare Plan as an "inner belt" for the northeast area, utilizing the right-of-way acquired for the original US-23 route. This parkway was to act as an intermediate route, providing access to major routes in the area.

Traffic counts conducted by the City Transportation Department in 1985 showed traffic on Huron Parkway to be 10,810 ADT between Baxter and Plymouth Road and 4,090 ADT between Plymouth Road and Nixon Road.

This plan recommends revision of the Huron Parkway "inner belt" concept, making use of existing roads to serve future development in the northwest portion of the study area and minimize disruption to Leslie Golf Course and adjacent residential developments. Under this concept, the Huron Parkway/Nixon Road corridor serves as a major north-south route bisecting the northern portion of the study area. The revised inner belt would consist of Nixon Road, Dhu Varren Road and Pontiac Trail, defining a large super-block north of Plymouth Road. East-west traffic movements through this area are considered to be less critical to efficient traffic movement than the north-south movement.

The segment of Huron Parkway proposed to extend from Nixon Road to Thebigen Parkway is to be reduced to a collector street and the segment proposed to extend across Leslie Golf Course eliminated from the plan. A portion of the existing right-of-way east of Pontiac Trail should be retained in case there is a need for a residential collector to gain access to the property to the southeast. This access street would only be built to serve a public or private development after a review of possible neighborhood impacts.

In order to function, this revised circulation system requires several

additional north-south connections: Traver Road should be connected to Dhu Varren Road west of the railroad right-of-way, and Tuebingen Parkway should be connected to Dhu Varren Road east of the railroad right-of-way. Another proposed north-south connection would connect the Huron Parkway extension to Plymouth Road west of the Environmental Protection Agency property. Nixon Road between Plymouth Road and Huron Parkway should remain in its current configuration until a City traffic analysis indicates vacation of the street would improve traffic circulation.

Highway Interchanges

Currently there are four interchanges which provide access to the northeast area from regional routes: M-14/Barton Drive, and US-23/Plymouth Road, US-23/Geddes, and US-23/Washtenaw. Further development of this area calls for an additional access point somewhere between the Plymouth and Main Street interchanges, in addition to improvements to the operation and/or location of the existing interchanges. Because final approval of these projects rests with the Michigan Department of Transportation (MDOT), the City and the Urban Area Transportation Study Committee need to coordinate local plans with MDOT officials and attempt to obtain a funding commitment.

The Barton Drive/M-14 interchange is inadequately designed for the amount of traffic it services, and funnels a large amount of traffic through the adjacent residential neighborhood. The North Main Street/M-14 interchange is also inadequate for the volume of traffic it currently handles. Any improvements to the North Main Street/M-14 interchange might consider the construction of a connection from Pontiac Trail to M-14 utilizing the right-of-way that the City owns. A detailed study of the highway access problems in this area should be included as a part of the City's Transportation Plan Update.

The Plymouth Road/US-23 interchange is inadequate for the volume of traffic it currently handles. To prevent further congestion of the Plymouth Road corridor, this interchange needs to be improved.

An interchange should be considered in the Nixon Road and M-14/US23 area to provide an additional access point to the northeast area and reduce pressure on the two existing interchanges. However, the traffic impact of Ann Arbor Township development along the M14/Dixboro corridor must be evaluated for its impact on the need for a Nixon Road interchange. If constructed, the interchange should be located between the two US-23/M-14 junctions, west of existing Nixon Road.

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Mass Transit

The five entry corridors within the northeast area are experiencing capacity overloading. The optimistic mass transit capture rates used in the 1977 Plan for Solving Circulation Problems have not been realized. With the continuing urban development within and surrounding the northeast area, alternatives to continued road construction must be explored and encouraged. Mass transit routes should be expanded into the surrounding townships. A fixed rail system utilizing existing railroad right-of-way should be examined. Official park-and-ride facilities should be established at easily accessible locations such as shopping centers and public buildings by the Ann Arbor Transportation Authority and The University of Michigan. Most importantly, the 1977 circulation plan needs to be updated to provide a comprehensive transportation strategy and implementation guidelines.

Corridor Design

Since modern urban systems are predominately automobile oriented, many urban design issues pertain to transportation systems. Private development and public road construction along major entry corridors such as Plymouth Road and the Fuller/Geddes Road corridor should follow specific design policies.

The Fuller/Geddes Road corridor may be designed with a boulevard center section provided where possible. Tree plantings and sidewalk/ bicycleways should also be part of the design. Access should be limited to existing curb cuts where possible. Road design of this corridor must respect the historical and residential structures and environmental features which front on portions of Fuller and Geddes Roads.

The Plymouth Road corridor is one of the fastest growing areas in the City. Large amounts of open space provided by research facilities and the University of Michigan provides the distinctive appearance of the corridor. This park-like setting is further emphasized by the corridor's smooth, rolling horizontal and vertical alignments. The image of the park-like setting on the entire corridor should be preserved by 1) maintaining expanded front setbacks to both buildings and parking along the road frontage, 2) expanded earth berming and tree plantings in the front setbacks, 3) eliminating unneeded curb cuts, and consolidating cuts where possible, 4) where structures and parking lots intrude with 250 feet of the street right-of-way, the density of tree materials should be increased.

The established Huron Parkway standards of large setbacks and limited curb cuts should be continued as much as possible along Nixon Road, which is proposed to serve as the northern extension of Huron Parkway.

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PUBLIC FACILITIES

Utility Systems

Storm Sewer (Figure 10). Within the study area north of the Huron River, Traver Creek and the North Campus system are the most significant drainage areas. The developed area is serviced with an extensive, underground piped system. The undeveloped portions of the basins are served with open drains.

The Traver Creek Valley system is the largest system. It drains most of the area between Pontiac Trail and Nixon Road south of M14/US-23. West of the Traver basin are three small urban systems, Huron Highlands, Huron River and Argo, which empty directly into the Huron River. The Fleming Creek drains the eastern fringe of the study area.

South of the Huron River, the Pittsfield-Ann Arbor Drain is the most significant organized system. Swift Run drains the far eastern fringe. Because of the low-density residential use on generally hilly terrain, the area between the Huron River and the Pittsfield-Ann Arbor basin is not served by an underground storm sewer system.

Coordinated with improvements to Plymouth Road in 1989, the Traver Creek culvert under the roadway will be improved to correct drainage deficiencies. As development occurs in each drainage basin, each proposal will be required to provide on-site storm water detention designed to limit storm runoff to pre-development levels.

Water Distribution (Figure 11). The older residential Northside neighborhood and the areas south of the Huron River are served with six and eight-inch mains, while the remainder of the area is serviced by 12, 16 and 20-inch water transmission lines.

The northeast area is served by one storage facility, a five million gallon underground facility on Beal. A 500,000-gallon elevated tank facility on Plymouth Road west of Green Road maintains pressure in the system. A major transmission main is planned to loop around the north part of the study area by 1990. This facility is needed to provide improved capacity and pressure.

Sanitary Sewer (Figure 12). Two main sewer trunklines, North Campus and Traver Creek, and two submains, Earhart/Greenhills and Northside, serve the area north of the Huron River. These systems generally correspond to the surface drainage basins and storm sewer districts. All of the existing urban development north of the Huron River in the City either is or can be served by the City sanitary sewer system.

South of the Huron River, the Pittsfield-Ann Arbor trunkline services the drainage basin. The area north of the service area is generally not served with a sanitary sewer system except for the area accessed by the small submains shown on the map. The residential densities range up to two dwellings per acre. Some of

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the township properties were allowed to tap into City utility lines without annexing into the City through special agreements.

Two major sewer mains are programmed for 1989, the Northside Submain Relief and the Traver Creek Sewer Extension. The existing Northside Submain downstream of Barton Drive does not provide enough capacity and a relief sewer is recommended to provide sufficient capacity for the present and future flows. An increase in the service area is predicted to provide service to Barton Hills. Extension of existing sanitary sewer along Traver Road will be necessary to serve future development along Dhu Varren Road. Other major sewer main extensions will be necessary for the area north of Arborland and the areas north of Dhu Varren Road.

Schools

The northeast contains four elementary schools (Northside Thurston, Logan and King), two middle schools (Clague and Tappan) and a high school (Huron). In addition to public schools, there are three private schools: St. Paul's Lutheran School (elementary), Greenhills School (secondary), and the Michigan Islamic Academy (elementary and secondary).

Statistics for 1986 show an elementary school enrollment of 1,490 students within the study area. The combined capacity of the four elementary schools serving the northeast area is 1,925 students. Ultimate residential growth projections would generate sufficient enrollment to create a deficit elementary school capacity. Part of this deficiency may be offset by reactivating Freeman School, located in Ann Arbor Township and presently leased to a day care operation. Middle school and senior high school capacities are considered sufficient for the planning period.

The idea of reserving another elementary school site in the north part of the study area should be studied. The City and the Board of Education should work in concert to identify the need for such a site to accommodate the number of elementary school students generated by ultimate northeast area residential growth.

Fire Stations

Presently there are six fire stations within the City. The northeast area (Fire District #5) is served by the Beal Station, located on The University of Michigan North Campus. The station serves both the North Campus and the northeast area.

Present fire service and response time in the northeast area is generally adequate, but future growth in the north portion of the study area may generate a need for an additional facility. Any plan for fire service in the northeast area must address needs generated by the maximum development of the area. Future expansion of City fire service facilities should explore sharing services with Ann Arbor Township.

Parks

The northeast area contains 600 acres of City-owned parkland. School property provides another 173 acres of recreational land available to residents. The University of Michigan provides 132 acres of programmed open space and recreational sites. The combined

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park and total of 905 acres represents 12.4 percent of the land within the study area.

Neighborhoods with either high demand or that are deficient in parkland have been identified. The Arrowwood and North Campus neighborhoods exhibit a high demand and the Bader/Ann Arbor Hills neighborhood is deficient in active neighborhood parkland. Neighborhoods with high demand tend to have larger household size, a higher percentage of households with children and lower median income.

All neighborhoods should be provided with active recreational space. Neighborhoods with identified recreational deficiencies should be targeted for priority park acquisition and development. In addition to active recreational area, parkland containing significant natural features should be acquired to provide for passive recreation opportunities within the northeast area.

The Leslie recreational complex should serve as the hub of parkland development north of Plymouth Road. This hub should be connected to other park and school facilities through a system of linear parks and pedestrian/bicycle trails. The Huron River and Gallup Park should serve as the hub for the area between Plymouth Road and Washtenaw Avenue. Huron Parkway and Traver Creek are important elements in providing linkages between these two park systems.

Specific parkland acquisition and development recommendations for the northeast area are contained in the 1988-1994- Parks, recreation and Open Space Plan and the North Main Street Plan (Figure 13). Because a joint responsibility to provide and maintain recreational space exists between the City of Ann Arbor and other local units of government such as the Ann Arbor Public Schools and Washtenaw County, increased coordination and communication between these different agencies is essential for a responsible park program.

Recycling

Currently, the only recycling facility located in the study area is a composting drop-off site at Leslie Science Center. Recycle Ann Arbor, in coordination with the City, provides curbside pickup of recyclable materials for residential households and collection programs for the commercial sector. City plans to expand the recycling program include development of small local collection sites to increase participation by residents of multiple-family developments. Additional programs and facilities should be developed to provide alternatives to landfill disposal of refuse.

Other Facilities

The northeast area contains several other facilities which are utilized by the public. A neighborhood branch of the Ann Arbor Public Library is located at Plymouth Mall. Northside Community Center, administered by the City Parks and Recreation Department, provides community services to low-income families and seniors. A privately-run community center, Green-Glacier, is operated by the Methodist Church and provides a number of neighborhood services.

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PLAN IMPLEMENTATION

Several methods may be used by the City to implement the recommendations contained in the Master Plan. These methods fall into two general categories: development of ordinances or regulations and the spending of public money on capital improvements.

Ordinances

State enabling legislation allows communities to zone land and adopt other land development regulations to protect the health, safety and welfare of its residents. The Zoning Ordinance (Chapter 55 of the Ann Arbor City Code) establishes regulations for the use of the land, its maximum density and the height, size and placement of structures on the land. In order to be enforceable, objectives outlined in Master Plan must be translated into specific regulations and adopted as part of a zoning ordinance or land development regulations.

In addition to the Zoning Ordinance, there are a number of other City ordinances which regulate the use of land:

Chapter 26 - Refuse	Chapter 61 - Signs
Chapter 47 - Streets	Chapter 62 - Landscape
Chapter 55 - Zoning	Chapter 63 - Soil
Chapter 57 - Subdivision and Land Use	Erosion
Chapter 59 - Off-Street Parking	Chapter 103 - Historic Preservation
	Chapter 104 - Fences

The City Council has also adopted development policies requiring the installation of street trees and sidewalks or bike paths, and guidelines for the provision of parkland or off-site improvements by new developments.

Because a development petition must be submitted to the City for review before land development regulations can be applied, their role in implementation of the Master Plan is limited. However, these guidelines also help shape other public decisions that relate to the development or improvement of City facilities or services.

Capital Improvements Plan

Regulations dictate what may or may not occur on a particular site, not if or when the development or redevelopment should occur. The timing of development can be influenced through the a City's capital improvement plan and the operating budget.

Each year, the City Planning Commission develops a plan which specifies the priority of City-financed capital projects over the ensuing six years. These projects include utility line extensions and improvements, parkland acquisition and development, street construction and other major projects on City-controlled land or right-of-way. Once adopted, this plan is used by the City Council in making budget decisions throughout the year.

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The 1988 Capital Improvement Plan identifies over 20 million dollars to be spent on projects located within the northeast area over the next six years. The table below indicates how these funds are proposed to be spent.

	1988	1989	1990	1991	1992	1993
Park and Rec	\$2,570	652	1,018	400	75	225
Sanitary Sewer	\$1,513	150	600	321	442	-
Storm Sewer	\$563	563	-	-	-	-
Water Mains	\$626	26	600	-	-	-
Street Improve	\$15,628	4,050	6,562	2,816	-	200
TOTAL	\$20,900	\$5,441	\$8,780	\$3,537	\$517	\$400
					\$400	\$2,225

Other Approaches

A variety of supplementary approaches are used to implement the recommendations contained in this plan. One is the encouragement of annexation within the sewer service boundaries in coordination with improvements scheduled in the Capital Improvement Plan.

Another important aspect of implementation is communication and coordination between planning agencies. Because development and circulation within the northeast area are impacted by the actions of the surrounding townships, the University, the Board of Education, the Urban Area Transportation Study Committee, Ann Arbor Transportation Authority, and a variety of regional and state agencies; coordination with these decision-makers is necessary to insure that objectives contained in the City plan are met. This in turn requires a commitment on the part of the City to participate in joint coordinating efforts.

Northeast Area Plan, figures. Document produced in 1989. Linked images are intermediate in size; right-click on them and choose to "view image" to see the figure in greater detail.

- [Document Cover.](#)
 - [Figure 1. Plan Review Time Line](#)
 - [Figure 2. Outline map of northeast area neighborhoods.](#)
 - [Figure 3. Northeast Area by Neighborhood: a table showing various demographic variables](#)
 - [Figure 4. Demographic Character. Sequence of small maps showing visual display of demographic variables.](#)
 - [Figure 5. Map showing Northeast Area Landuse Summary.](#)
 - [Figure 6. Outline map of Residential Planning Areas.](#)
 - [Figure 7. Outline map of Historic Districts.](#)
 - [Figure 8. Map of Major Natural Features.](#)
 - [Figure 9. Map of Circulation Pattern. Major, intermediate, and minor collector routes.](#)
 - [Figure 10. Map of Storm Sewers \(with drainage basins\).](#)
 - [Figure 11. Map of Water Distribution System.](#)
 - [Figure 12. Map of Sanitary Sewer System.](#)
 - [Figure 13. Outline map for Parks, Recreation, and Open Space.](#)
-



What do you need?

- Elections
- Farmers Market
- Golf
- Jobs
- Online Payments
- Parks & Recreation
- Pay a Parking Ticket
- Report a Problem
- Road & Lane Closures
- Trash & Recycling

City of Ann Arbor News

[Labor Day Holiday to Delay Solid Waste Collection and Close Municipal Offices](#)

August 26, 2014 - There will be no trash, recycling or compost collection services in the city of Ann Arbor on Labor Day, Monday, Sept. 1. The Monday pickups will occur on Tuesday, and the rest of the collections will occur one day later throughout the week. The normal Friday routes will be serviced on Saturday, Sept. 6. City of Ann... [read more »](#)

[Renovations Scheduled for Ann Arbor Fire Station No. 3, Followed by Stations No. 4 and then No. 5](#)

August 22, 2014 - Some Ann Arbor Fire Department stations will soon undergo renovations to their bathrooms and locker rooms. The project is included in the fiscal year 2015 adopted budget. Work at station No. 3 (2130 Jackson Ave.) is scheduled to begin... [read more »](#)

[Main Street Closures & Stadium-area Parking Restrictions Resume for U-M 2014 Home Football Game Days](#)

August 21, 2014 - Main Street closures will again be in place during the 2014 University of Michigan football season (click the map to open a PDF version). These closures will occur for all U-M home football games, beginning with... [read more »](#)

[Programs Temporarily Relocated During Ann Arbor Senior Center Construction](#)

August 15, 2014 - (*UPDATED Aug. 27, 2014) Ann Arbor Parks and Recreation has temporarily closed the Ann Arbor Senior Center, 1320 Baldwin Ave., due to an unscheduled construction project (*please see additional details at the end of this press release). The majority... [read more »](#)

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PLANNING FOR TREES:

GEOGRAPHIC NEIGHBORHOOD SIGNATURES BASED ON CRITICAL ROOT ZONES.

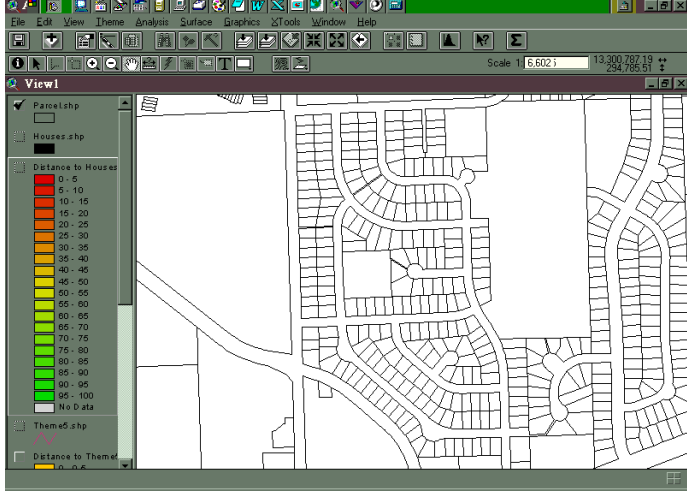
When tree roots and impervious surfaces meet each other, disaster is usually the result. First, the concrete house foundation, driveway, sidewalk, or sewer line gives way to the tree roots--disaster for the surface and its owner, and then in retaliation, the tree may well be cut. The problem of course is that the long-range pattern of tree root growth was not anticipated by the original developer of the parcel of land. Most people think only of how the trees and shrubs look, and how they will enhance property sales, at the time of construction. The cumulative effect of initial lack of consideration of this problem leads to disaster years later: disaster to homes, to sidewalks and sewer lines, and, to tax base that gets gobbled up in lawsuits. All of this could have been avoided by planning for trees that considered the problem of conflict between roots and surfaces and adopted a strategy for minimizing or resolving this conflict. (Ann Arbor's Natural Features Ordinance (Chapter 21 in Ann Arbor City Code) does not apply to single family lots--this sort of information would encourage homeowners, for their own interest, to plant reasonable trees (especially when coupled with the City list of [Invasive](#) species)). Indeed, as cities age and get rebuilt, it is as important then, as it is for the emerging pristine development, to consider this problem.

The research question is to develop a strategy that minimizes or resolves the conflict between these two sets of systems (one natural, one human). One strategy that would address this problem is to map existing neighborhoods based on the geometry of the infrastructure of existing housing stock (footprint/rooftop and driveway), sidewalks, street curb, water and sewer lines, and (perhaps) overhead lines. Distance contours at a 1 foot (or other) interval from each of the chosen items would be the base from which a critical root zone map would be created. Follow-up with the Homeowners Association and posting of information on their [website](#) would encourage individual parcel owners to consider the merits of planting not only non-invasive species (with the list from the City) but also plantings with correct root ball size (information from local nursery personnel or land development coordinator) to avoid future difficulties with impervious surfaces.

The neighborhood for proposed pilot study is the Bromley neighborhood in Northeast Ann Arbor: 231 homes bounded by the south on Huron Parkway, the west by Nixon Road, the north by Bluett, and the east by Prairie.

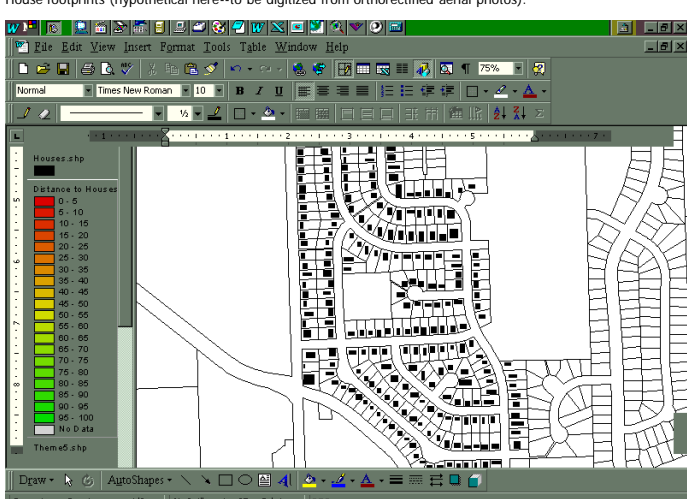
HYPOTHETICAL SAMPLE MAPS

Hypothetical analysis can often suggest how actual analysis will appear. There may well be merit in spending a few minutes in creating hypothetical maps prior to investing large amounts of time in creating actual maps. In this section, hypothetical maps are created. In the following section, Lloyd R. Phillips made actual maps.

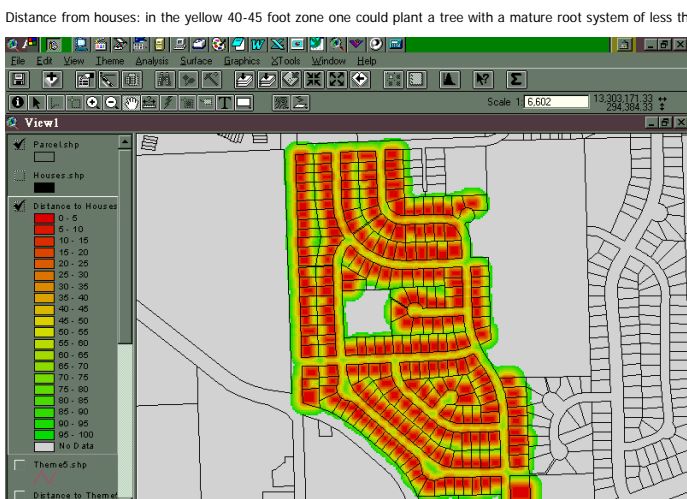


Bromley subdivision from the City of Ann Arbor parcel map

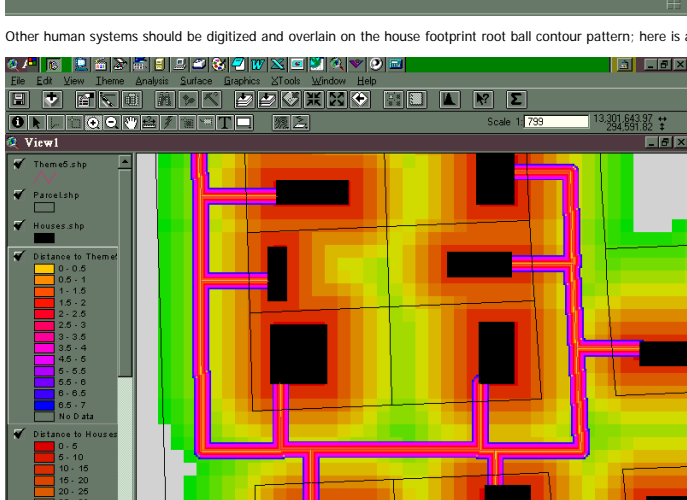
House footprints (hypothetical here--to be digitized from orthorectified aerial photos).



Distance from houses: in the yellow 40-45 foot zone one could plant a tree with a mature root system of less than 45 feet without having that system reach the nearest house.



Other human systems should be digitized and overlain on the house footprint root ball contour pattern; here is a sample with hypothetical infrastructure/sewer line.



In the detailed view above, one sees the gradation in away-from-the-house contours. The size of each is 5 feet. Homeowners who are aware of these distances and unseen difficulties would likely wish to choose planting patterns to avoid future harm/exposure to their impervious surfaces. Overlaying various layers creates a pattern that is more intricate than that shown here and it is that pattern, that tells where it is safe to plant trees with respect to root distance from impervious surfaces. The maps offer a critical root zone geographic-signature of the neighborhood. With such a long-range planning effort, the homeowner wins, the City wins, and the trees win.

ACTUAL MAPS OF BROMLEY

During the Fall of 2000, co-author Phillips worked to implement the strategy above for one neighborhood well-known to co-author Arlinghaus. While the purpose of the project was to offer a map of regions, as a pilot project, in which trees of varying sized rootballs might be successfully planted (without interfering with house foundations, sidewalks, or driveways), there was also the added benefit of producing a map of previously undigitized impervious surface and using the GIS to calculate percentage of impervious surface coverage. Impervious surface location, and percentage by watershed, is important in understanding regional stream health. Information of this sort appears to be becoming of increasing significance in coming to local policy decisions. Note the general impervious surface map, from SEMCOG (South East Michigan Council of Governments) for all of Washtenaw County (county containing Ann Arbor). The white areas are areas for which there was no data.

Rectified-orthophotos (raster data) were obtained from Merle Johnson, Information Services Division, City of Ann Arbor. In 1992, Woolpert of Ohio began the functions necessary to create orthophotos. The work was completed in 1993-1994. In 1997, an update was completed for selected areas and a complete fly-over of the city was undertaken. The image created is a 1" resolution digital orthophoto measuring 30" x 30" at a scale of 1" = 125'. Digitizing of the photo was done using ArcView 3.2 (ESRI) at a scale ranging between 1:200 and 1:300. For more detail on the photos, see the accompanying [Appendix](#).



City of Ann Arbor parcel map superimposed on aerial photo.



Taking a closer look reveals the sort of detail available.



Digitizing (by Lloyd R. Phillips) of rooftops, sidewalks, and driveways at various contour intervals.

Two-foot contour interval: image does not show entire neighborhood.



Five-foot contour interval: linage does not show entire neighborhood.



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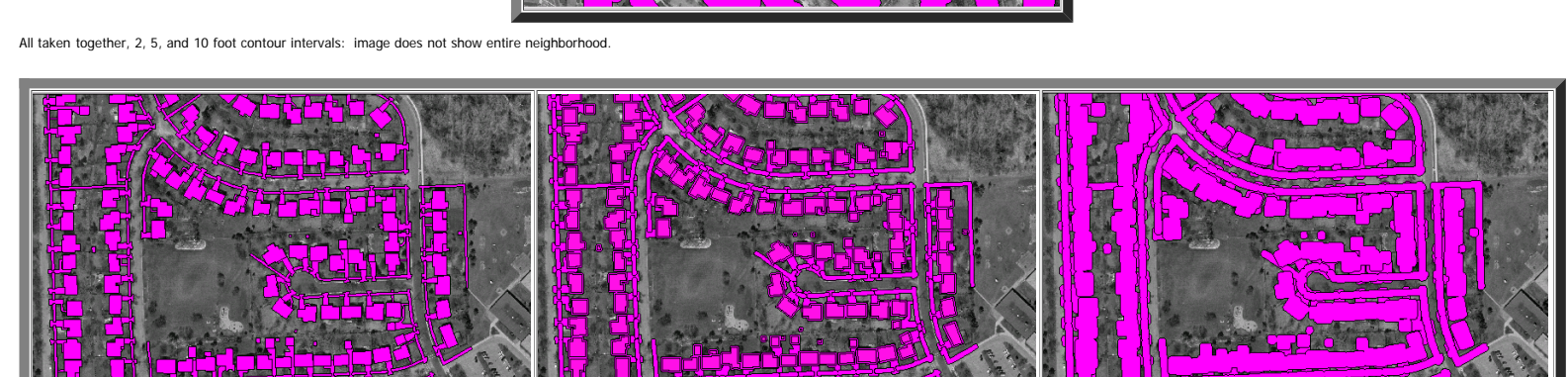
Ten-foot contour interval: image does not show entire neighborhood.



Twenty-foot contour interval, rooftops only: image does not show entire neighborhood.



All taken together, 2, 5, and 10 foot contour intervals: image does not show entire neighborhood.



Thus, one could choose a planting scheme, based on rootball size, designed not to interfere with existing concrete. This choice would be made simply on distance. Mr. Phillips also discovered that there are business firms that recognize this difficulty and can install an underground shield so that trees larger than distance would suggest prudent, can be planted closer to concrete. In either case, once again, trees win, property owner wins, and City wins.

Appendix

In this region, there were no tall buildings or other structures to cause a problem with vertical displacement. One problem to be resolved, however, was the distortion of shapes due to the sun angle and the object-distance from nadir. The features that exhibit this phenomenon were sidewalks. The widths of the sidewalks often vary in shape: whereas, they were digitized as they were perceived.

Lack of photons (or energy) reaching the sensors in the aircraft due to obstruction, was a common problem, caused primarily by building or tree shadow. Thus, the image's spectral resolution becomes diminished. Exact shape and position of individual house rooftops were therefore difficult to determine. Additionally, the same shadows would, on occasion, obstruct the outline of the driveways and associated impervious structures.

These considerations were factored into the digitizing process. Further detail of the entire survey is available from the City of Ann Arbor. A few details of note include:

- The geographic extent of the digital orthophotos is 50+ square miles from M-14 on North to Morgan Road on the South. The range extends from Wagner Road on the West to Gale Road on the East.
- Standard digital orthophotos are cast on the Michigan State Plane - South Zone projection on the North American Datum of 1983 (NAD83) with coordinates in feet.
- The ordering of the data is by lines (rows) and samples (columns) with each line containing a series of pixels ordered from west to east. The order of the lines is from north to south. When displayed on a computer, the image projection grid north is at the top.
- The four primary datum (NAD83) corners are imprinted into the image as four solid white crosses with an image value of 255 and the four secondary datum corners as four dashed white crosses with similar intensity values.

[Back to text.](#)

Bromley Subdivision

Full-sized maps and aerials showing entire neighborhood
Versions first from article as well as variations on those.
(Digitizing done by Lloyd Phillips.)

Rooftops, driveways, and sidewalks digitized along with 2 foot buffers of each. Plants with root balls of 2 feet or more in diameter may interfere with concrete foundations, driveways, and sidewalks if put in the red zone.



Rooftops, driveways, and sidewalks digitized along with 5 foot buffers of each. Plants with root balls of 5 feet or more in diameter may interfere with concrete foundations, driveways, and sidewalks if put in the magenta zone.



Rooftops, driveways, and sidewalks digitized along with 10 foot buffers of each. Plants with root balls of 10 feet or more in diameter may interfere with concrete foundations, driveways, and sidewalks if put in the yellow zone.



Rooftops, driveways, and sidewalks digitized along with 20 foot buffers of rooftops and 10 foot buffers of sidewalks and driveways. Plants with root balls of 20 feet or more in diameter may be planted only in areas not colored orange (if they are not to interfere with concrete foundations, driveways, and sidewalks).

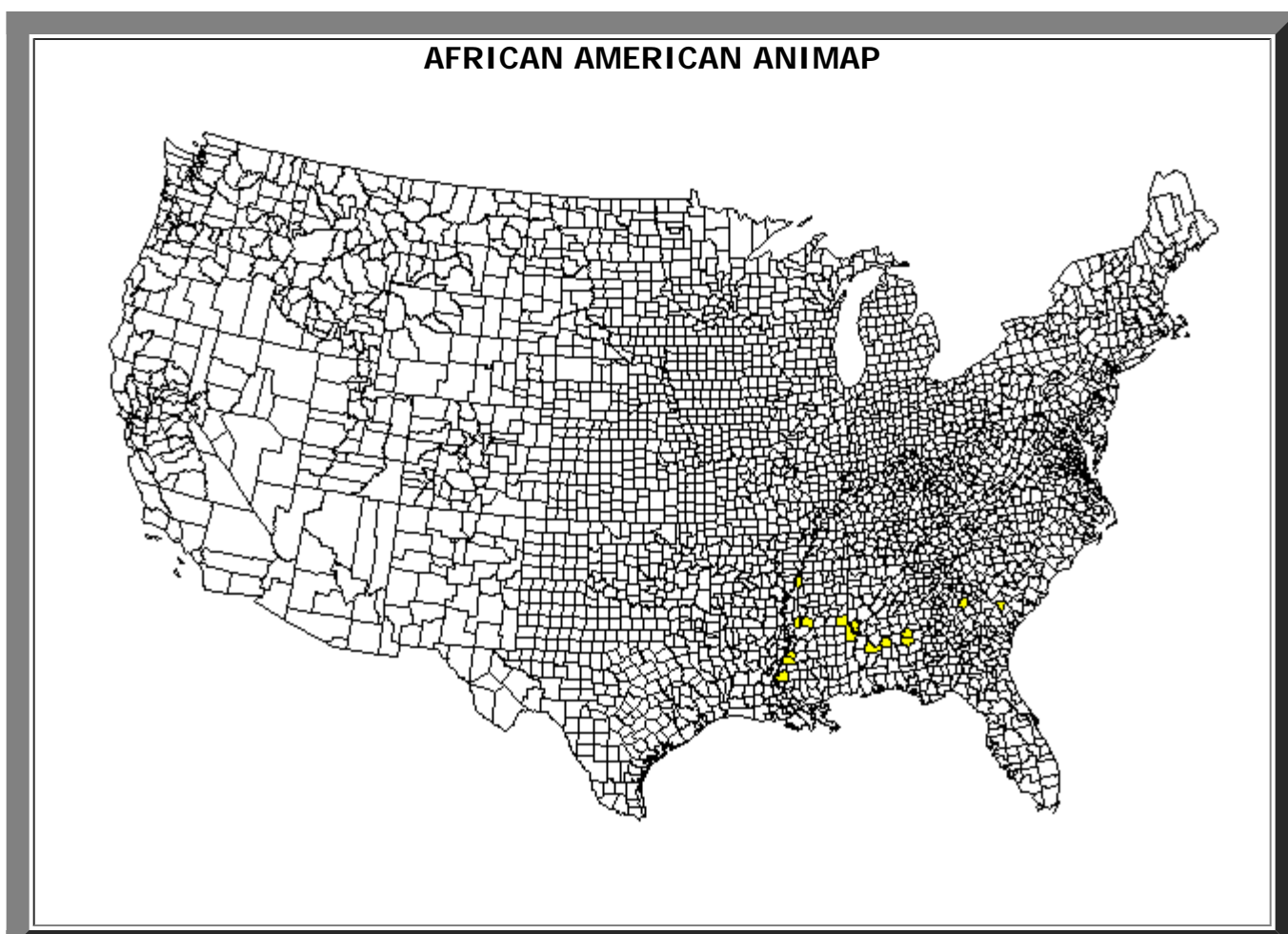


Animaps, Again
 Courtney Gober
 The University of Michigan
 Student, Master of Art and Certificate Program in the Graduate Division of
 The School of Education

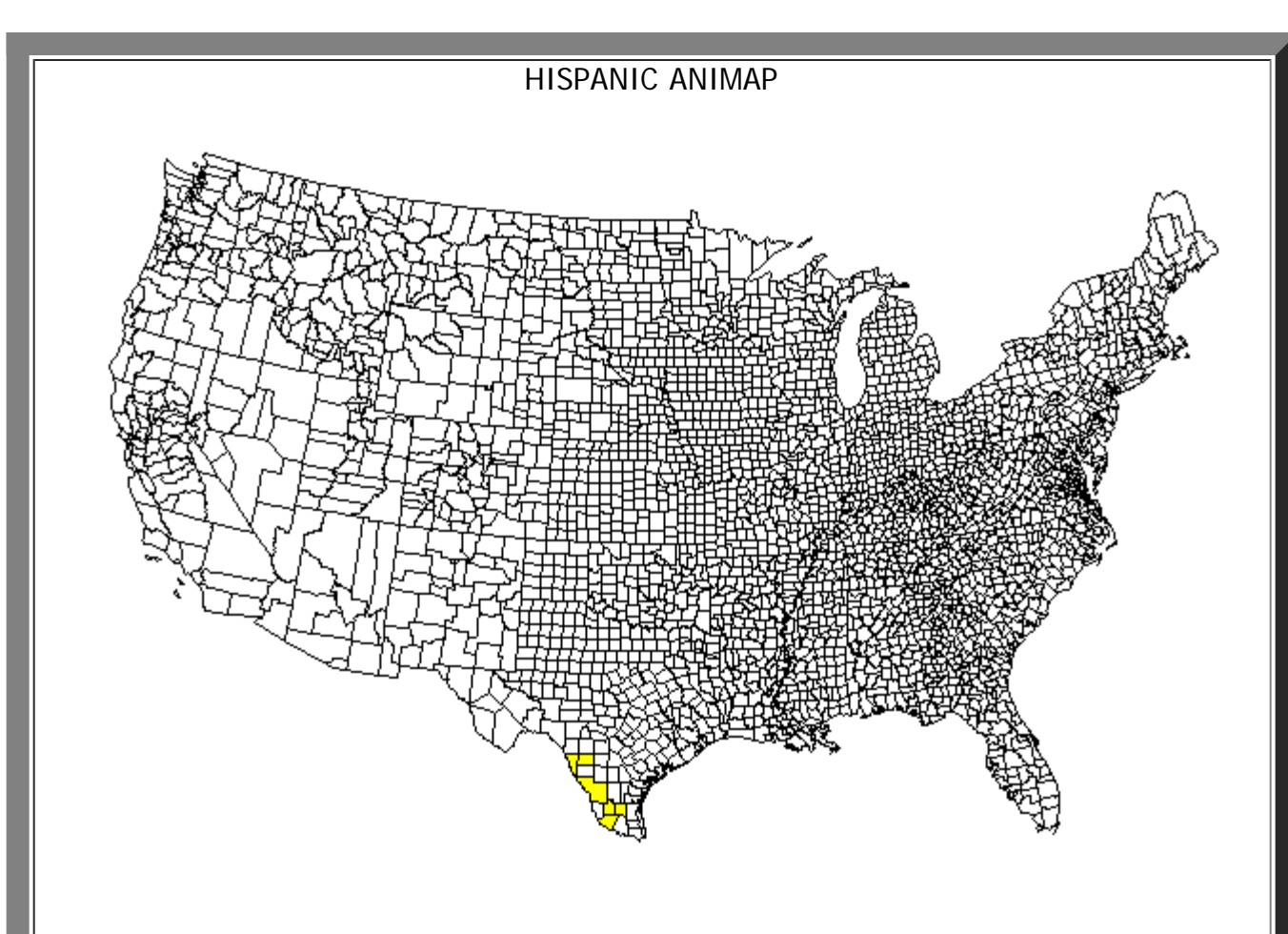
An earlier article in [Solstice](#) constructed an Animated Map, "Animap," from current data to suggest pattern that might exist if actual data were available. To quote from that article:

Sometimes it is difficult to acquire data over a period of time. With a bit of imagination, one may instead be able to use a surrogate variable to capture easily what might otherwise have been difficult to capture. To illustrate this sort of technique, in a time-dependent framework, consider the following animap. When African-Americans first came to North America, they entered often along the south and southeastern shores of modern-day U.S.A. Over time, population migrated and moved throughout the country. If one considers as a surrogate to having year by year data for that movement, the fact that not many people move over time all that far from their point of entry to the country, then one might capture the temporal movement pattern over centuries by the spatial density pattern at a single time slice. To test this idea from the standpoint of simple mapping, the U.S. was mapped by county according to density of African-American population (1990 Census data) (S. Arlinghaus and A. Laug). The mapping of this initial test-run was kept simple: the default lat/long framework, rather than a conventional projection, were used in the GIS (Atlas GIS, version 3.03) for eventual ease in switching to other projections. As had Nystuen, Laug wished to color percentages from previous frames all in one color, with percentages in the current frame colored in a different set of colors. She also wanted to track the advancing edge, as had Nystuen, but in addition wanted to see gradations in that edge. There is a tradeoff in clarity: how many categories should one use on the edge?

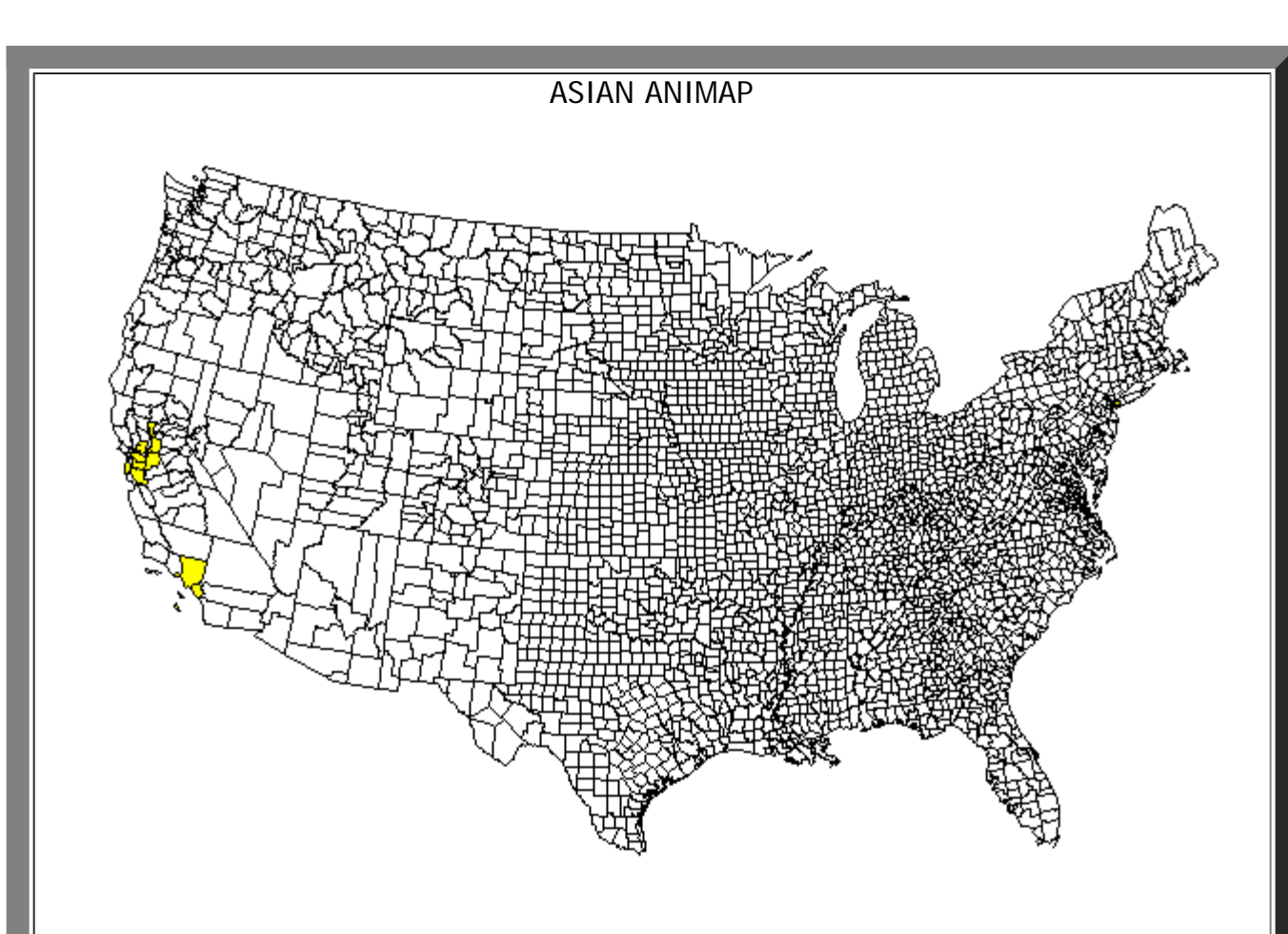
In this article, the map from the previous article is recast using an Albers projection, and the edge gradations are removed in favor of a single edge color. Thus, counties shaded burgundy are ones for which the density has been measured. The edge counties colored yellow are those introduced at that particular time frame. Those left as white have not yet entered the picture.



As in the [previous case](#) the counties with highest percentage African American populations (as measured in 1990 Census data) enter the map first. The manner in which they do so is reminiscent of actual migration patterns. The premise is that people, even over a substantial time interval, do not, as large groups, move quickly from their original ports of entry. Does this idea extend to other ethnic groups? The maps below show the same analysis applied to 1990 Census data for percentage Hispanic and percentage Asian populations by county.



The Hispanic Animap also suggests a pattern of diffusion that reflects (but does not exactly replicate) reality. The heavy early populations are along the U.S. Mexico border, followed by Florida and large cities in the northeast and midwest. One issue with creating animaps is to decide when to stop the process; otherwise, the whole nation will eventually become burgundy. There is a tradeoff in process and meaning.



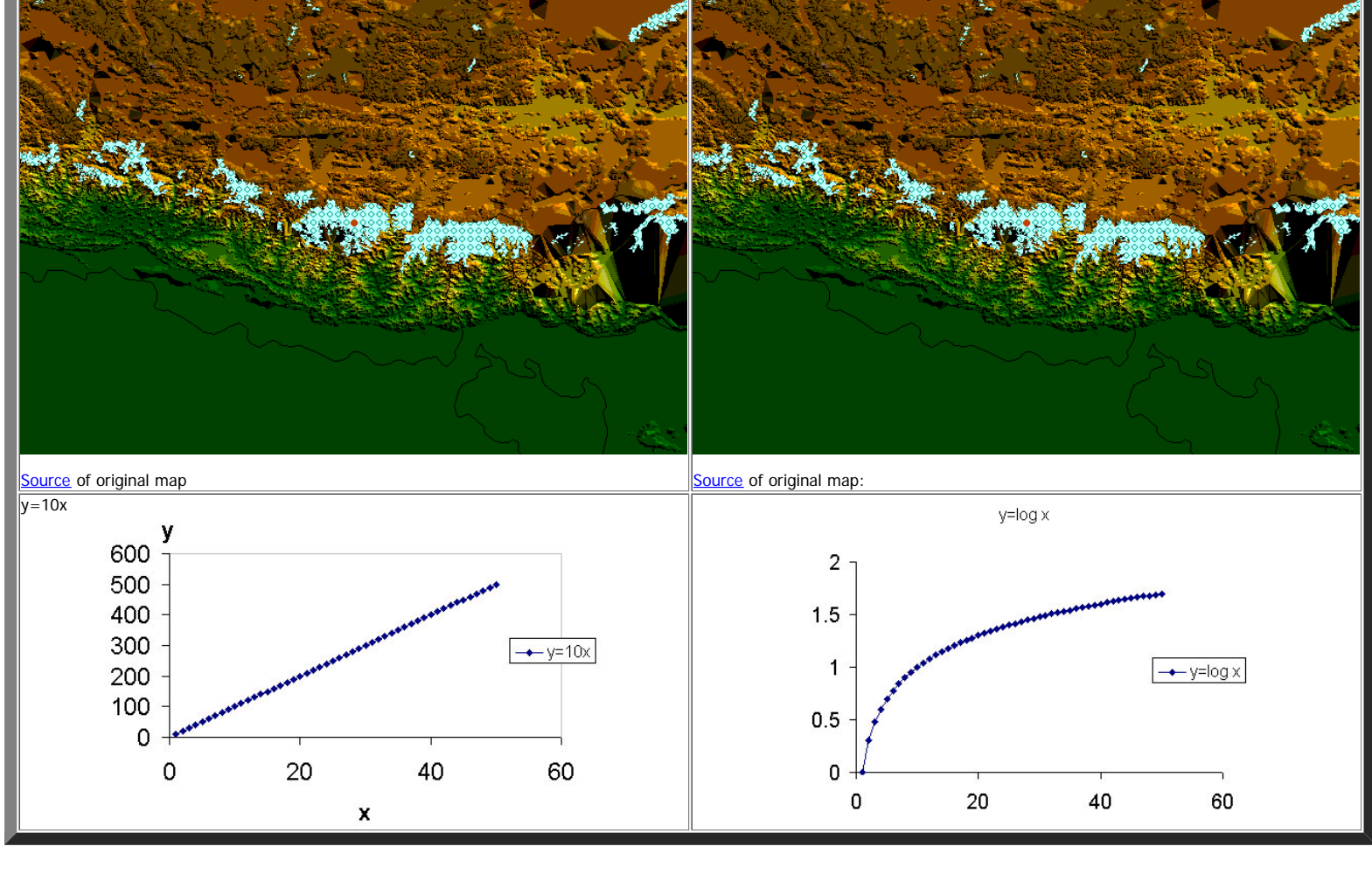
The case of the Asian Animap is a bit different. In the early frames, one sees the "expected" pattern with high densities on the west coast. In the next stage, one sees high densities enter in large cities across the nation, and, at the same time, high densities in what appear to be counties far removed from the largest cities. When those "unexpected" counties are checked, all contained large (mostly public) universities. In the case of the Asian population, the American university system appeared as a measurable agent fostering diffusion of population, even in this simulation.

How nice it is to have an easy-to-use strategy to capture movement general movement patterns. It would have been a monumental task to gather data on a county by county basis, from the first entry, for each of these populations. Instead, use of a well-chosen surrogate variable permitted creation of animated maps in a matter of a few hours.

Animap Sequences
Nakia D. Baird
The University of Michigan
Student, Master of Art and Certificate Program in the Graduate Division of
The School of Education

An earlier article in [Solstice](#) examined the merits of an animated sequence of Triangulated Irregular Networks (TINs) to introduce an element of order into complicated pattern. In that earlier [map](#) (takes time to load on a slow modem), the time distance between successive frames was constant (12/100 of a second between successive frames in the set of 50 frames "in" and 50 frames "out"). Views such as this offer a way to clarify geographic ideas. They might also be used, however, to make mathematical concepts come alive.

It is this latter idea that is examined here. When a constant interval is chosen between successive animation frames, a linear equation is portrayed: in this case, for ease in generalization, suppose $y=10x$ --- the time-spacing between successive frames ("in" only) is 10/100 of a second. The left column in the table below shows half of the map from the previous article along with the graph it might be viewed to represent. Unit changes in x values produce a constant difference between corresponding y values: the viewer is set down on Earth at an apparently uniform rate.



Suppose instead of using $y=10x$, one "mapped" $y=\log_{10} x$. The results would appear as in the right hand column of the table above. As values of x get larger, the successive differences between the corresponding values of y get smaller. Hence, the viewer is "smashed" more rapidly to Earth!

This procedure need not be limited to continuous functions. The sequence of maps appears continuous but is in fact discrete. Animaps can easily be used as well to model discrete series.

What can be used in one direction to shed light on geographic ideas can be turned around to make possibly difficult mathematical ideas more appealing to learn. This sort of idea is just a beginning--the reader might try numerous other interesting variations on this theme.