

00B015I

Project Number: MSF-0101 - 44

## Sustainable Growth Patterns

An Interactive Qualifying Project Report Submitted to:

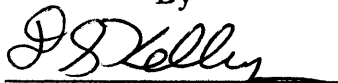
The Faculty of

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

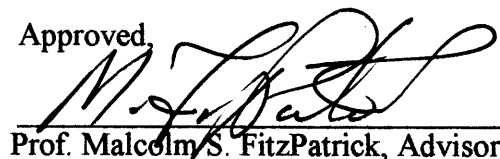
Degree of Bachelor of Science

By



David S. Kelley

Approved,



Prof. Malcolm S. FitzPatrick, Advisor

1. Land Planning
2. Environmental Protection
3. Civil Engineering

December 15, 2000

This project report is submitted in partial fulfillment of the degree requirements of Worcester Polytechnic Institute. The views and opinions expressed herein are those of the author and does not necessarily reflect the positions or opinions of Worcester Polytechnic Institute.

This project is the product of an education program, and is intended to serve as partial documentation for the evaluation of academic achievement. The report should not be constructed as a working document by the reader.

## **Abstract**

The development of land in America has gone unregulated for decades. The country was developed without concerns for the future of the land or the environment. Many still consider, a design method for development is not deemed necessary. In order to help future development, it is necessary to create a method that is more efficient and environmentally friendly than the current sprawl of today. A sustainable growth pattern must be employed if we want to ensure a high quality of life for years to come.

# **Table of Contents**

<b><u>1. INTRODUCTION</u></b> .....	<b>4</b>
<b><u>2. DEVELOPMENT</u></b> .....	<b>5</b>
<u>2.1 PAST DEVELOPMENT METHODS</u> .....	5
<u>2.2 CURRENT DEVELOPMENT METHODS</u> .....	6
<b><u>3. ENVIRONMENTAL EFFECTS OF DEVELOPMENT</u></b> .....	<b>7</b>
<u>3.1 PHYSICAL EFFECTS ON THE ENVIRONMENT</u> .....	7
<u>3.2 BIOLOGICAL EFFECTS ON THE ENVIRONMENT</u> .....	8
<u>3.3 CHEMICAL EFFECTS OF THE ENVIRONMENT</u> .....	8
<u>3.3.1 Effects on Water</u> .....	8
<u>3.3.2 Effects on Air Quality</u> .....	9
<b><u>4. SUSTAINABILITY</u></b> .....	<b>10</b>
<u>4.1 DEFINITION OF SUSTAINABILITY</u> .....	10
<u>4.2 ALTERNATIVES TO SPRAWL DEVELOPMENT</u> .....	11
<u>4.2.1 Village Method</u> .....	11
<u>4.2.2 Comprehensive Planning</u> .....	13
<u>4.2.3 Various Anti-Sprawl Rules</u> .....	15
<u>4.2.3.1 The Use of Boundaries</u> .....	15
<u>4.2.3.2 Transportation</u> .....	15
<u>4.2.3.3 Town Center</u> .....	16
<u>4.2.4 Constellation Development</u> .....	17
<u>4.3 EFFECTS OF SPRAWL ON THE ENVIRONMENT</u> .....	18
<b><u>5. MAKING SUSTAINABLE DEVELOPMENT</u></b> .....	<b>19</b>
<u>5.1 ENVIRONMENTAL SOLUTIONS</u> .....	19
<u>5.1.2 Solution To Car Pollution</u> .....	20
<u>5.1.2 Solution To Fossil Fuel Pollution</u> .....	21
<u>5.1.3 Solution To Water Pollution</u> .....	21
<u>5.2 SOLUTIONS TO SPRAWL</u> .....	21
<u>5.2.1 Personal Space</u> .....	22
<u>5.2.2 Pattern Development</u> .....	22
<u>5.2.3 Zoning</u> .....	23
<u>5.2.4 Transportation</u> .....	24
<b><u>CONCLUSION</u></b> .....	<b>25</b>
<b><u>ENDNOTES</u></b> .....	<b>26</b>

## **1. Introduction**

The development of the United States has been happening since the Europeans first settled the continent in the early 1500's. Early villages were not designed like the modern cities of today; small houses were built where ever it was easy to build or where ever it was conveniently located near water. Development began by people creating small informal towns along rivers. The towns were built without the thought of longevity or practicality. The reason that the first settlers resided on waters edge was because of the importance of water in survival. In that era settling around rivers or lakes was the only way to survive. Water bodies not only brought drinking water, but were also a source of food, in the form of aquatic life. Water also attracted other mammals, which could be trapped and used for food. At this time, boats were the main mode of transportation. Since boats could travel up and down rivers, villages began springing up all along rivers and adjoining lakes.

As other forms of transportation were invented, such as the train, people were then able to settle further away from the water and the now crowding towns. As people moved away from the riverside towns, new inland towns and suburbs were formed. As these towns grew more populated and crowded. In the early nineteen hundreds, the newly invented car allowed people to travel away from these cities and live wherever they wanted.

Through the years development of rural land has increased. More and more people do not want to live in the crowed cities; they want to live on there own piece of land, in their own house. The problem with this is that the land is being usurped at a higher rate than ever. When developing these suburbs, the land was not used efficiently. The use of zoning requires houses a certain distance off the road, with a specific distance between houses resulting in wasted land. This land is only used as a lawn, which must be maintained begrudgingly by the homeowner. The lawn serves no practical purpose other then to show off to others what a particular person possesses.

In recent years zoning laws have been created to help slow down the development of land. Although the zoning laws have been created to slow development by creating strict guidelines by which building must comply, it seems as though they have actually

speedup some aspects of residential building. These guidelines and rules can be changed in the design process, whether by a zoning amendment or through a variance process.

## **2. Development**

### ***2.1 Past Development Methods***

Suburban development in the United States is an old story. By the 1820s, it was possible to identify a suburban trend. City residents no longer feared Indians, wolves and catamounts<sup>1</sup>. With Andrew Jackson's view of land as a resource for exploitation and with the machines of the Industrial Revolution to help, people moved from the city to the country and created the suburban expanse. In the countryside, the rural farmers scattered across the land instead of creating urban dooryards, neighborhoods and villages. By the 1870s, one can identify the pattern of today's suburban pattern and density of land use.

The Industrial Revolution urbanized most human activity, including much of agriculture, and an ever-growing urban population was creating a new suburban form. Those with the economic ability were using new transportation technology to maintain proximity to the evermore-urban society while using time and money to insulate themselves from the negative aspects of the city. Suburban areas first formed around horse car tracks and later around stations on tracks carrying steam trains<sup>2</sup>.

The commuter train, the electric trolley and the urban streetcar all required compact development walking distance to a station or trolley stop. First trolleys and then commuter trains were eclipsed by the automobile, which, because of its greater speed, created a different pattern and density of land use. Even on suburban streets an automobile averages five times the speed of a pedestrian.

The use of the automobile allowed urban workers to live five times as far from the station and get there in the same amount of time<sup>3</sup>. Further, since the automobile was soon made weatherproof and one could travel in comfort for much longer times and therefore greater distances from the station. Most important, the automobile gave people the option of driving all the way to work and not bothering with the train at all.

From about 1920 to 1941, the ever-lower density and more dispersed auto-suburb trend continued, although slowed by the Depression. From 1946 to 1956, the trend was

accelerated and driven by the capacity to build automobiles and the pent up demand for housing created by the Second World War<sup>4</sup>. After the War, people were encouraged to buy houses by the use of G.I. Loans. Loans were given to war veterans who wanted to purchase a house.

In 1955, a new era of auto-dependent development began. Extensive construction of a national system of limited-access expressways under the Interstate and Defense Highway Act of 1955, extended the radius that an urban worker's automobile could travel, by a factor of 2.5, to reach a suburban home in a given amount of time<sup>5</sup>. The automobile increased dispersion in urban pattern and decreased the density of land use, by increasing the radius of acceptable housing opportunities from a given employment site.

## ***2.2 Current Development Methods***

The current land-use distribution is a pattern of use that cannot be sustained over a long period of time. Suburban patterns are created in areas where the institutional capacity of local governments, which control the use of land, is weakest<sup>6</sup>. It takes place in areas where there is a relatively low resistance to change and where there is relatively cheap land. Therefore, development spreads out, or as some describe the phenomenon, it sprawls.

Edge City is now refocusing some of this sprawl<sup>7</sup>. As they mature, Edge Cities become more intense with a higher density and tend to look and act as urban nodes in the regional system. In turn they create a market for housing several miles further into the once rural countryside. Current suburban development is a form that everyone loves to hate. While many believe they want low-density development for themselves, almost everyone dislikes it if they have to live in it. Almost everyone would dislike the suburban pattern if they had to pay the true cost of the development pattern they have chosen<sup>8</sup>.

By developing the land in such a haphazard and unplanned manner for so many years, certain resources have been abused and destroyed. They were destroyed because at the time it was never imagined that the population would get so large, so quickly, and the effects on the land were never considered. Since this happened, the easiest way to

keep people in houses and to make room for the ever expanding population was to quickly designate land to people and let them build in a manner that they like. The downside to this method is that it only solves the short-term problem of housing people and not the long term. The impacts of these developments, which are not always considered, are the effects on the habitat, endangered species, water quality and open space.

### **3. Environmental Effects of Development**

Sprawl is a major problem with the current method of development today. It is impossible to develop a self-sustaining or sustainable society with the phenomenon of sprawl going on. The impact of sprawl and the current philosophy on development has three forms, although they interlock: a physical transformation, when people alter their environment by clearing forests, draining wetlands and opening up grazing lands for livestock; a direct biological change, such as extinction of prey species and plant life; and finally, chemical changes to the environment in the form of water and air pollution<sup>9</sup>.

#### ***3.1 Physical Effects On The Environment***

The effects of physical transformation can be seen every time one looks around the land. In the Eastern United States, where a field now exists, was once a large forest hundreds of years old. When the first settlers came to America they clear-cut, removing all of the trees from the land for three reasons: to use wood to build houses; to use wood in fires to produce heat; and to create farmland for crops and open fields for livestock grazing. The problem that this created was that it depleted the amount of topsoil. As the depth of topsoil is reduced, the amount of nutrients and minerals that are needed to make life necessary are reduced, making the land less productive. The amount of natural land that existed before the days of agriculture was phenomenal. The grasslands have been reduced by about thirty percent and forests by twenty-five percent<sup>10</sup>. This means that humans have altered over fifty percent of the natural land in the United States. If this rate is not slowed down or if new alternatives are not implemented, then the earth will be completely unlivable.

### ***3.2 Biological Effects On The environment***

Direct biological change is affected by the loss of habitat for the wild animal. The physical transformation of the land diminishes habitats, decreasing the number of animal and mammal species. The number of species that have been made extinct, due to human impacts, as of 1600 were only about three percent of all mammals, birds and plant life<sup>11</sup>. Many of the species have been deemed island endemics, being especially vulnerable due to their isolated and restricted living habitats<sup>12</sup>. Of the above percentages, about thirty six percent of the extinctions have been directly related to and caused by loss of habitat. Thirty nine percent of the extinctions have been blamed on the introduction of animals not native to the area. The introduction of European predators such as dogs, cats and foxes, and the introduction of herbivores such as goats, sheep and pigs to America have had an effect on the native species. The new animals upset the balanced environment and the conditions that have existed for hundreds of years. When new species are introduced, the environment changes, and in many cases species cannot adapt since the change happens so quickly. If humans want to live in harmony with the earth, then steps need to be taken to control the introduction of alien species of plants and animals.

### ***3.3 Chemical Effects of The Environment***

#### **3.3.1 Effects on Water**

Chemical changes to the environment are usually over looked and not considered to be a major impact on the environment. The effects of pollution were not thought to be a global, national or regional problem since they were mostly direct and localized to a specific city sized area. Pollution was originally a local problem, when raw sewage would pollute a pond or lake or when smoke stacks would create a blanket of smog over a city. They have now become a more worldwide problem; as the number of cities and towns increased, the amount of pollution increased. As population has grown, and the world has become dependent on the burning fossil fuel, air pollution is a worldwide problem today.



In the past, sewage was piped directly into bodies of water with no treatment. Often this was occurring in most major cities and the amount of sewage being dumped into the natural environment was so high that it was destroying the ecosystem. The plant life and the animals and mammals that lived in these water bodies, were all dying off due to the pollution. This problem of sewage pollution has promoted action by various environmental groups. Today water quality is at its highest level since before the industrial revolution. By the use of new technologies and new process of water treatment, people are able to now drink cleaner water in many countries in the world. The sewage that is produced by this country, by the largest population the country has ever seen, is now being treated and disposed of in ways that are cleaner than ever. Effluent is either allowed to percolate through the earth naturally through the use of septic systems, or it is pumped to a large wastewater treatment plant and then released into a river or lake. Both of these processes reduce the effects of sewage on water quality. By using a septic system the aquifer (under ground water source) is kept full and recharged by the water filtering down through the ground. Water treatment plants help keep the water levels of lakes and streams from getting too low by releasing its water into the natural ecosystem.

### **3.3.2 Effects on Air Quality**

In the past hundred years, humanity has created and released more chemicals into the atmosphere than ever existed naturally. These chemicals have caused the recent problems with the ozone layer, a thin layer of gas in the atmosphere which protects the earth against the sun's harmful ultra-violet rays. Specific chemicals that have been released into the air have weakened and thinned this layer. The depleted ozone, although it has not been proven, it is believed to be the cause of an increase in skin cancer.

The average temperature of planet earth has risen an average of three degrees Celsius<sup>13</sup>. This has caused the polar ice caps to start melting which has raised the water level of the oceans. These impacts have resulted from a world driven by a fossil fuel economy. Coal, oil and other fossil fuels are the main source of energy. As coal plants burn and produce electricity for the millions of people in America, they also produce massive amounts of toxic carbonic pollutants that have created the smog that blankets

much of the land. Another source of hydrocarbons is the internal combustion engine, primarily the automobile. The automobile is one of the leading causes of air pollution in the world today. The pollutants over time settle down to the ground, blanketing the plants and water bodies and contaminating them with very toxic chemicals. If the pollutants do not settle naturally, rainfall will “grab” the smog particles and create acid rain, acidifying the ground, the rivers, lakes and oceans.

These pollution issues are serious. It is impossible to live in a sustainable world, when the pollution is destroying everything. In order to control pollution alternative methods of fuel and transportation must be developed to produce less pollution.

To help the problem of air pollution the federal government has had to step in. In 1963, the Clean Air Act was administered through the Department of Health Education and Welfare. This act provided an opportunity for State and local governments to join the Federal government in a national attack on air pollution<sup>14</sup>. Since 1963, several amendments have been made to the Clean Air Act. The reason for the amendments is because pollution has become worse than it was first perceived to be. Since pollution has been going unregulated for so long, it will take strict regulations to stop the pollution that exists today.

## **4. Sustainability**

### ***4.1 Definition of Sustainability***

Before looking at sustainability and trying to determine the specifics of how to make towns and cities self-sustaining, a broader look at sustainability and its true meaning should be examined. Sustainability should be treated within the framework of a total system, taking into account all of the components of the system<sup>15</sup>. It is impossible to sustain one part of the total system without the others being involved. Attempts to find a definition for sustainability seem to be quite futile; there are too many nuances sprouting from the particular applications and implementations of the term. In such a situation it might be more productive, if instead of giving precise definitions, to implement an approach and focus on describing the conditions to which the system has to comply in order to achieve sustainability<sup>16</sup>. The approach is widely used in abstract sciences such

as mathematics or logic and result in many productive applications. Deciding about the necessary conditions for sustainability instead of defining it may make clear the common ideas that sustainability implies. Such necessary conditions may be formulated as follows:

1. The system of sustainability does not cause harm to other natural systems, both in space and time;
2. The system of sustainability maintains living standards at a level that does not cause physical discomfort to the human component;
3. Within the system of sustainability life-support environmental components are maintained at levels of current conditions, or better<sup>17</sup>.

The first and most difficult challenge is to create a sustainable alternative to sprawl and random development. A sustainable alternative must be found so that the land does not continue to be squandered, and so that in the future the land will still be functional. By using the land more efficiently the land will last forever and can be sustained.

## ***4.2 Alternatives to Sprawl Development***

### **4.2.1 Village Method**

One of the alternatives is to make sure not to replicate the city of today. Aesthetically speaking, the city is an alien place where by definition middle-class Americans refuse to live. One alternative is to look at the older versions of a city, the village, and try to replicate it. The definition of a village was a cluster of houses around a central place that is the focus of civic life. There are some basic rules that must be followed in order to achieve this type of development. These rules can be summarized by three principles, density, opens space and zoning codes.

The density of a typical modern suburb may have one or two dwelling units per acre, and is laid out entirely for the convenience of the automobile. A sustainable development strives for dozens of units per acre, including a mix of housing types: detached houses, row houses, apartments and "granny flats" tucked away above garages. These villages would extend no more than a quarter-mile from the center to the edge and

include a transit stop and a corner. A quarter mile is a good distance because this is a distance that is capable of being traversed by foot, without the need for automobiles. Without automobiles, streets can be made people friendly and people would walk around more.

Except for the streets, suburbs consist of almost exclusively private space, much of it devoted to the single most useless form of plant life in all botany, the ornamental lawn. A suburb is a place that's two-third grass but with nowhere for kids to play, except in the streets. Communities need parks and outdoor public spaces in which people can gather and interact. These spaces would be strategically placed in the development where access which is easy, convenient and centralized.

When land is zoned, the relationship of the two zones that border each other is often not considered. No one with a choice in the matter would not want to look out his window at a retail store, factory or a commercial building. To prevent this, elaborate design and zoning controls intended to create harmonious streetscapes must be laid out prior to construction. Consideration of aesthetic beauty is what is needed to hold neighborhoods together at more than twelve units per acre.

This concept of planning is very effective and has the potential for being self-sustaining. The reason that this could be self-sustaining is that it is designed to be self-contained. Each of these small neighborhoods would be placed side by side, which would create a chain of small towns, each with different stores and various forms of commerce. Power would be generated by one local plant, be it solar, wind or water powered, and shared between the towns to minimize pollution. Land would also be dedicated for farmland. Farmland would be designated as the areas bordering each neighborhood to act as a buffer between them to maintain the individuality of towns. These towns would all be laid out on paper prior to construction, which would allow for a very smart use of land. Now the amount of wasted space would be minimized.

This concept has been around since the turn of the century. Planners liked this concept and it was widely used prior to the World War. Post war development was done in a different manner. Post war development of the suburbs employed the same principles that were used in creating army bases. This meant quick, boxy, inefficient subdivisions scattered among the countryside<sup>18</sup>.

## **4.2.2 Comprehensive Planning**

A different method that could be implemented to reduce or eliminate sprawl is by planning entire communities at one time using comprehensive planning. Instead of just developing the residential aspect and making the other aspects of life fit into the neighborhood, it is more effective to plan, designate and design all aspect of a community at once. This method of community planning would be circular in design. A major beltway, or interstate highway would be laid out in a circle or horseshoe shape<sup>19</sup> and the community would be contained within. In the circle, would be clusters of residential neighborhoods, apartments, schools, community centers and parks. These would all be connected with smaller rural roads. The roads would be directed radially inward toward the center. In the center a large park space would be set aside and dedicated as public land to be used by all of the people. Walkways or sidewalks would line all streets to allow pedestrian traffic to flourish. The distances from the residential areas to the school, parks or community centers should not be further than about a quarter of a mile. Again this is a good walking distance for people. This would also help to eliminate the need to drive or take mass transit everywhere. By eliminating the need to drive everywhere a sense of community is instilled among the residence, who are proud of where they live. The different aspects of the community would all be laid out in a convenient and methodical way. For instance, the commercial areas would not be near the school, since there is no direct relationship. The residential areas should be placed closer to the center of the circle to keep them isolated from the surrounding highway<sup>20</sup>.

This model of a town is ideal for several reasons. One of the reasons is that when a certain piece of land is designated for the design, it is very easy to plan the entire region for maximum population. Another reason is that outward expansion is possible due to the location of the highway. By using the highway as a barrier, it is possible to expand outward, but only in a planned pattern. Sprawl communities would virtually disappear. As populations grow and the need for more space became an issue, the community could expand outward with the same style as the inner hub. If several of the communities are placed in line then there is no wasted space between towns and the land is optimized to its fullest. In order to make land allocation work, a complete and detailed plan of the

region must be drafted prior to any physical work in the area. Secondly, strict rules must be made about the zoning and regulations of development.

These rules must be held without variation in order to be effective. To keep two communities from being built next to each other with completely different styles of construction, these rules must be followed by each town or maybe by each state. When planning this community the density should be mixed. It should be mixed to keep variation in the development. If the whole area is row housing, or all apartments, then it becomes an eyesore, and no one wants to live in a place that is not aesthetically pleasing. With a balance of densities, monotony is broken up, and things look different and “pretty” to the people of the area. Any natural water bodies that might happen to be near this community would be incorporated into the area as a preservation of nature. In order to keep any local aquifers from becoming depleted, wells and septic systems should be used wherever possible. Where they are not possible, treatment plants should be erected and the water should recharge the ground water.

If this were to be implemented a plan would need to be created for a restoration and a rebirth of the old rundown inner city. This is a problem that planners are facing today, what to do with the inner city. Even after the inner city has been restored it will take a lot of persuasion to convince people to move back to the city. Once they are back in the city everything returns to how it was designed to be.

This form of society would be sustainable since it would have within it everything that people need to live. It would have jobs, housing, a source power, food and water. When this society expands it will not expand in a sprawl style. This would conserve the land, and not be a destructive force on nature.

A down side to this method of planning is that, as the city grows outward, the center becomes farther away from the new residential areas, becoming less used and starting to deteriorate. When this begins to happen, a new city should be built near the expanding city, with a new center and a new circular highway. The same will hold true with any of the other portions of development. This trend is what is happening now. As cities grow larger the outskirts become more popular, and the center of the cities become rundown and abandoned.

### **4.2.3 Various Anti-Sprawl Rules**

Another way of creating a society that curbs sprawl development, but does not involve direct planning is by creating rules for development. These are rules that if followed would create a sustainable and anti-sprawl society.

#### **4.2.3.1 The Use of Boundaries**

One of these rules is to draw boundaries. In a sense there is no real shortage of land in the United States; if the entire population lived on an acre of land per household, it would occupy less than five percent of the contiguous forty-eight states<sup>21</sup>. But in the regions where Americans actually want to live, they are swarming into the countryside, covering whole counties, with edge cities flung outward from the beltways as if by centrifugal force. To planners, this is the disastrous result of shortsighted planning government policies, such as the bias in the federal mortgage-guarantee program toward detached houses on large plots of land<sup>22</sup>.

In Europe and Japan, governments have proclaimed "urban-growth boundaries," beyond which development is prohibited. Even in a democratic country such as Holland, a businessman seeking to live on a farm and drive into the city to work would have to request permission from the government, and he might not get it<sup>23</sup>.

By drawing boundaries the limit of developing and the direction and rate at which development occurs can be controlled. By controlling the development areas, land can be better preserved for other more efficient uses. The land can be used for farming or possibly as public open space.

#### **4.2.3.2 Transportation**

Another way to stop sprawl is to use mass transit more effectively as a major mode of transportation. The problem is that mass transit needs a critical mass of people, and many metropolitan areas are just too spread out. Many commuters seem to think that if you have to drive to the train station anyway, you might as well just keep going to the office. Hence the idea Calthorpe, a land planner in Portland Oregon, for the "pedestrian

pocket": a relatively dense settlement within a quarter-mile walk of a transit stop<sup>24</sup>. In Portland, Oregon they're building the transit line first, putting stops literally in the middle of empty streets in the expectation that the development will follow. The idea behind this is to create a large population in a small area where mass transit would be the most logical mode of transportation.

This deters sprawl by making it impractical to live anywhere except for the areas near the stations that have been designated for residential development. In order for the public to accept this idea, the transit needs to be cleaner than ever; more buses or trains need to be added to the route, and most of all, the price needs to remain low.

The "pedestrian pocket" will only work in areas of new development, where there is currently not much population. If a community has already been developed, placing a new transit line through the heart of it would be a failure. Everyone already has cars, and a set way of life. These people would not likely change their lively hood that quickly. If a family were moving to a new community which had this transit system already installed, then the family would be likely to dispose of the car.

#### **4.2.3.3 Town Center**

Another change that has to be made is that the concept of the town center needs to be reborn. Nowadays towns lack a center meeting place, plaza, square or green that is a geographical reference point and a focus of civic life to bring about the community as a whole. This idea has been attempted in the form of shopping malls. But shopping malls are a poor substitute; the area they serve is too diffuse, and in any case their civic function is incidental to their real purpose, making money. Developers often provide some parkland in their subdivisions, but it's usually on leftover parcels that wouldn't be built on anyway, by the edge of the highway or wetland<sup>25</sup>. By placing a functional public park area in the center of the community, people will gather and form a close knit society, and people will not want to leave or move to a different neighborhood.

This helps sprawl because it gives a community one point to build around. If development occurs in a radial pattern around the center, then the land is being used very efficiently. When there is no land left within a certain distance of the center, then a new center would be declared, and more development would occur around that development.



#### **4.2.4 Constellation Development**

Constellation development is an alternative solution to the sprawl problems of today. Constellation development addresses and solves the problems of sprawl development that were previously described. Eighty-five percent of the people in the United States live within the boundaries of these constellation patterns<sup>26</sup>. In order to guide growth toward sustainability, the areas where future growth is to be directed is in the areas where constellations already exist. This does not mean that the constellations should be one giant city. Beginning with the rehabilitation of the core of the existing cities along the constellation corridor, new transportation, utility and communication systems should be installed in order to encourage and promote the redevelopment of the interior of the constellation. Once the interior is refilled and populated, then the outward growth would follow naturally. The center of the entire city, the park, would still retain its rural character of a recreational area within easy reach of the urban population<sup>27</sup>.

By carefully managing the process in this manner, the whole of each constellation would not become a huge high-density city, but would remain cities of medium to high density while at the same time promoting small to medium sized cities along the transportation arteries of the city.

By portraying the growth pattern as a constellation system, it becomes obvious that the local actions must be viewed in a regional context. By looking at development on a regional scale it becomes possible to see the requirements for guiding growth within the constellation boundaries. Meaningful growth strategies for constellation fringe and core areas involve the various components of urban mega systems. Therefore, guiding growth is a complex challenge composed of a mixture of interrelated rural and urban issues<sup>28</sup>.

The vitality of rural areas depends on a diverse set of factors. Pressure to develop agricultural land (and other rural land) for suburban home sites is a key issue that affects rural land use policy. The challenge for urban and rural areas is to maintain an economic base and agricultural production while preserving and enhancing the aesthetic, environmental and recreational resources of the area. The challenge in urban areas is to provide adequate housing and economic opportunity to support all members of the

population. For cities, higher livable densities, including ample recreation, natural beauty, and transportation mobility, are at the top of a needs pyramid<sup>29</sup>.

Constellations suggest criteria for guiding growth on a national and regional scale to meet the rural and urban challenges. By outlining areas in which growth should occur in order to preserve critical landscape patterns, constellations provide an important framework for planning for sustainability and providing a vision for the future. By examining each regional constellation in detail, identification of regional characteristics such as unique landscapes, distinctive building materials, transportation options and other regional characteristics are made to more accurately define needed changes within these urbanizing patterns<sup>30</sup>.

Constellations also suggest directions for future transportation developments. Instead of cutting across the constellations central core, generally parklands, and creating destructive impacts on the landscape system, rapid transportation corridors can be directed radially to connect the outer part of the constellation into the center, not through it. Further, constellation patterns provide a mechanism for guiding future growth dependent on the carrying capacity of the region. The carrying capacity of a region is the ability of a place to support population without sacrificing the resources that will be needed for future generations.

This view of urban systems has greatly altered the view of how these systems should be perceived, managed and designed. Constellations offer discrete, logical units for national and regional action<sup>31</sup>. By developing in this manner the population would be able to enjoy life with a satisfying sense of place and a plethora of options and the freedom of choice in as many ways as possible.

### ***4.3 Effects of Sprawl On The Environment***

The effects of sprawl on the environment are immense. Whenever and wherever development occurs, the environment is going to be altered; there is absolutely no way to prevent that from happening. The minimization of the effects on the environment by special planning can be done.

One way of protecting the environment is making the agricultural land more productive and less wasteful. To do this, farmland must be made more sustainable. The

reason that agricultural land must be made more sustainable and more efficient is because the amount of land that is available for agriculture is depleting rapidly. Presently, as the amount of land needed for urban use increases, the land for agriculture decreases. If the land were used more effectively through the use of technology and other concepts, the land would not be wasted and misused. Another reason farmland reform is needed is since the population is increasing, then the need for food increases, and then there is a demand for more agriculture. With a greater demand and less land, then the need for reform is obvious.

In terms of wild living resources, the IUCN, or World Conservation Union, has stated that a wild species is likely to be sustainable if:

- a) It does not reduce the future use potential of the target population or impair its long-term viability;
- b) It is compatible with the maintenance of the long-term viability of supporting and dependent ecosystems;
- c) It does not reduce the future use potential, or impair the long-term viability, of other species.<sup>32</sup>

To fulfill these guidelines, five requirements relating to information, management systems, legal frameworks, social or economic incentives to people, and acceptance of the precautionary principle and other safeguards must be met<sup>33</sup>. These are designed to apply to any plant or animal species used for the benefit of mankind. These rules are very general and cannot be used in specific situations. They are more of a basis for specific planning at a local level rather than a regional or national level.

## **5. Making Sustainable Development**

In order to fix the problem currently faced by people in creating a sustainable country, many steps must be taken. Environmental issues and sprawl issues must be solved.

### ***5.1 Environmental Solutions***

The first step is to control environmental impacts on the land. Since there is no one solution to the problem that will make everything better, several steps must be taken to control these effects. One of the issues that needs to be addressed is the issue of car pollution.

### **5.1.2 Solution To Car Pollution**

Since people are not willing to give up their cars for rapid transit, a car must be created that is more environmentally friendly. To create an environmentally sound car, or green car, it must have a cleaner burning or more fuel-efficient engine. This has been a task placed before car designers for almost thirty years. Ideas to produce cars that run on methane, ammonia and electricity have been designed and proposed in the past. Since these cars were invented as prototypes the costs to consumers were astronomical; people have not wanted to spend extra money on a car that might help the environment. Recently Honda and Toyota took the first step in helping the environment. Each company has released, in mass production, their versions of hybrid cars. These are the first mass produced gas/electric cars to hit the automobile market in years. The willingness of the consumer to buy these cars is tremendous. Since gas prices are near an all-time high, and people are driving further than ever to get to work, the need for a car that can get up to seventy miles per gallon is crucial. Since these cars only have sixty horsepower, many people are reluctant to buy these because they are not luxurious and fast sports cars. As long as people are going to think about comfort before practicality, than the idea of a hybrid car driven society will be far fetched.

The solution to this problem is to use both rapid transit and “green” cars for transportation. Stricter laws must be made regarding automobile emissions. As emission regulations become tighter, people will have to change over to “green” cars or switch their mode of commuting to rapid transportation, i.e. trains and buses. By laying out mass transit lines in a more useful and effective manner, people would be more willing to use mass transit. By placing train stations in areas of high population, people will not need to own or drive a car, they can simply take the train.

### **5.1.2 Solution To Fossil Fuel Pollution**

Another pollution issue is that of air and water pollution produced from power plants. To solve the pollution problem, alternative sources of energy must be implemented. The burning of fossil fuels to produce energy must be stopped. Water, sun and air power must be used more. Waterpower is a very efficient way of creating energy. Since most towns or cities developed on or near rivers, creating a dam to harness the power of water is easy. The energy created by the water will not have any adverse effects on the surrounding land or life. Not only will the dam create energy, it will also create an artificial basin behind the dam that aquatic life can live in. If an ever-expanding population needs more power, then windmills can be placed on the high points of the hills. The windmills will be used to harness the wind power to turn the generators to create electricity. This is not the final answer to the pollution problem. In order to help with pollution, the first step is energy conservation. People must learn to use less electricity.

### **5.1.3 Solution To Water Pollution**

To keep the water from getting polluted, sophisticated and high-tech water and wastewater treatment plants should be built. By cleaning the water before it is used, it helps keep people healthier. By keeping people healthier, society is better off. By treating all wastewater, including runoff from rainfall, the native water bodies will remain in their natural state for a longer period of time.

## ***5.2 Solutions To Sprawl***

In order to stop sprawl, other more sustainable methods of land development must be implemented. One of the problems in trying to create a sustainable community is that not everyone will agree with the ideas. The best thing to do is to compromise. By compromising, everyone will be happy with some aspect of the proposed development plan. One aspect of developing a sustainable community that needs to be addressed is personal space.

### **5.2.1 Personal Space**

Most people like the idea of having a lot of land. People like to have things that they can show off as a status symbol. This land, however, is not used; rather, it is displayed. The acres of grassland that people are proud to show off to their friends are basically a waste of space. If people want to own that much land, it should be regulated that a percentage, if not all of the land, should be used for farming, grazing etc. The land should somehow be used to benefit others. It is a selfish act to want to horde large amounts of land and not use it. On the other hand, some people do not want to have land and they would be happy living in high-density communities. The high-density communities are good; except they do not allow for any public space. If communities are built in high densities and land is set aside for public use, then land can be used more effectively.

In order to design a sustainable community it is more efficient and practical to have middle to high-level density housing with open land to be used by the public. Instead of only one house being built in the middle of a lot, multi family or apartments should be built with the surrounding land used as public open space for all those living within. By doing this, the amount of non-productive land, such as lawns, is decreased. This increases the amount of land available for farming. The amount of land that surrounds each “dwelling” would be based on the number of units in the “dwelling.”

### **5.2.2 Pattern Development**

The pattern in which a community is developed is very important in creating an efficient society. When cities and towns are formed they must be formed in a geometric pattern to reduce the amount of wasted space in between them. Also strict guidelines should be set to limit the size of communities, and where they can be created. Cities should be circular in shape. These circles should then be lined up linearly in a hexagon pattern so that their outer edges touch. When this happens a small gap is unused in between four cities. This land can be used as agricultural land. The limit of the building should be set as to minimize the amount of land that needs to be altered. These boundaries need to be drawn on a regional level and not a state and local level. This

needs to be done in order to create uniformity among states. If all states have one method of drawing limit lines, then it will be easier to protect the land.

### **5.2.3 Zoning**

Zoning goes hand in hand with pattern development. The land must be zoned for certain uses. By zoning the land, the uses become regulated. By regulating the uses of the land, then the land will be used more efficiently and only productive uses will be allowed. The land can be used more efficiently because similar uses will be grouped together. By grouping similar uses together, wasted land is reduced. Wasted land is reduced because the size and shape of buildings can be similar. If the buildings are similarly shaped then it is easier to place more structures in a small area. By only allowing uses that are productive, then all land is used to its maximum, and nothing is wasted.

When zones are created and laid over the community, some considerations have to be made. One of those is the natural features of the land. Certain uses such as industry, which requires large flat buildings, should not be zoned in hilly regions. Another consideration is the convenience of the zone locations. It is convenient to have a residential zone near a commercial zone. This is ideal because it minimizes the amount of travel that people would have to do in order to obtain goods. Further from the commercial zones will be the industrial zones. This zone should be as far away from the residential zones because people do not like to see or hear large industrial operations from their houses.

The pattern in which the communities should be zoned is as follows: In the center of the community is open space or parkland. This is land to be used by the public for recreation and other various things. Surrounding the open space will be the residential neighborhoods. Bordering the outside edge of the residential zone will be both commercial and school zones. This is done to keep the commute for kids going to and from school to a minimum. The same holds true for the people who want to go shopping in the commercial areas. The industrial zones will be on the outskirts. This is to keep the obtrusive and noisy factories away from the residential zone.

Connecting all of these areas of different development will be an elaborate transportation system.

#### **5.2.4 Transportation**

Mass transit should be a major influence on the design of a community. Cities should be arranged so that mass transit is the most convenient way of travel. By making trains and buses easily accessible to the public, people will not want to use cars helping the environment and minimizing the amount of land wasted on parking. Train lines should run through these communities, with stops placed near high-density apartment complexes, areas of commerce and industry. The lines should not be placed where they will impede or have a negative impact on already existing uses. Trains need to be aesthetically pleasing and quieter than they are now. People think of trains as loud and noisy and they do not want them in their neighborhood. To minimize the noise of the engine, electric motors should be used instead of noisy and toxic combustion engines. Using quieter electric engines helps to keep pollutants to a minimum. Another problem with trains is the amount of noise that is produced by the wheels and the track. To reduce this noise, other materials that would dampen the noise, need to be used for the track and wheels. An alternative technology is a levitating train. In Japan there is a train that hovers and is propelled above the track by a magnetic field.



## **Conclusion**

At one point in time the earth was natural and uninhabited by people. As time went on a destructive force took over the planet. That force was human beings and their widespread development of the land. In the past three hundred years humans have done so much harm to the earth through selfishness and the lack of planning that the earth is in the worst shape it has ever been in. By developing uncontrollably the land for years, no thought has been given to the possible effects of the development. These effects have been detrimental. Water, air and land pollution are at there highest and the rates are increasing astronomically.

Since land has been squandered and developed in such a random manner for so long, the amount of natural land that remains is dwindling. In order to preserve the natural lands the remaining land needs to be developed in a much more efficient, effective and sustainable way. By promoting more efficient development, people will be able to flourish on earth longer.

If people want to continue to live on this planet, building of the land haphazardly needs to stop and pollution needs to be controlled. The only way to continue life on earth is through sustainable development. Sustainable development would create a way of life that works with mother earth not against it.

## **Endnotes**

---

- <sup>1</sup> E.M. Risse, (July 1989). "Sustainable Communities Network." The American Settlement Pattern of the 21<sup>st</sup> Century, [<http://www.smartgrowth.org/library/risse.html>].
- <sup>2</sup> Ibid.
- <sup>3</sup> Ibid.
- <sup>4</sup> Ibid.
- <sup>5</sup> Ibid.
- <sup>6</sup> Ibid.
- <sup>7</sup> Joel Garreau, Edge City – Life on the New Frontier, (Doubleday, 1991)
- <sup>8</sup> Risse, [<http://www.smartgrowth.org/library/risse.html>].
- <sup>9</sup> Martin Holdgate, From Care To Action: Making a Sustainable World, (United Kingdom, Earthscan Publications Limited, 1996), p. 13.
- <sup>10</sup> Ibid., p. 18.
- <sup>11</sup> Ibid., p. 19.
- <sup>12</sup> Ibid., p 19.
- <sup>13</sup> Ibid., p 25.
- <sup>14</sup> Hy and Joan Rosner, Albuquerque's Environmental Story, [<http://www.cabq.gov/acs/s5air.html>].
- <sup>15</sup> Alexev Voinov and Courtland Smith, Dimensions f Sustainability, [[http://kabar.cbl.umces.edu/AV/PUBS/DS/Sust\\_Dim.html](http://kabar.cbl.umces.edu/AV/PUBS/DS/Sust_Dim.html)].
- <sup>16</sup> Ibid.
- <sup>17</sup> Ibid.
- <sup>18</sup> Risse, [<http://www.smartgrowth.org/library/risse.html>].
- <sup>19</sup> John Ormsbee Simonds, Garden Cities 21: Creating a Livable Urban Environment, (New York, New York, McGraw-Hill Inc., 1994), p. 57.
- <sup>20</sup> Ibid., p. 57.
- <sup>21</sup> Jerry Adler, (January 6, 2000). "Sustainable Communities Network." Bye-Bye, Suburban Dream, [[http://www.smartgrowth.org/library/bye\\_sub.html](http://www.smartgrowth.org/library/bye_sub.html)].
- <sup>22</sup> Ibid.
- <sup>23</sup> Ibid.
- <sup>24</sup> Ibid.
- <sup>25</sup> Ibid.
- <sup>26</sup> Philip H. Lewis JR., Tomorrow By Design: A Regional Design Process for Sustainability, (New York, New York, John Wiley & Sons, Inc., 1996), p. 35.
- <sup>27</sup> Ibid., p. 35.
- <sup>28</sup> Ibid., p. 36.
- <sup>29</sup> Ibid., p. 36.
- <sup>30</sup> Ibid., p. 37.
- <sup>31</sup> Ibid., p. 37.
- <sup>32</sup> Holdgate, p. 204.
- <sup>33</sup> Ibid, p. 204.