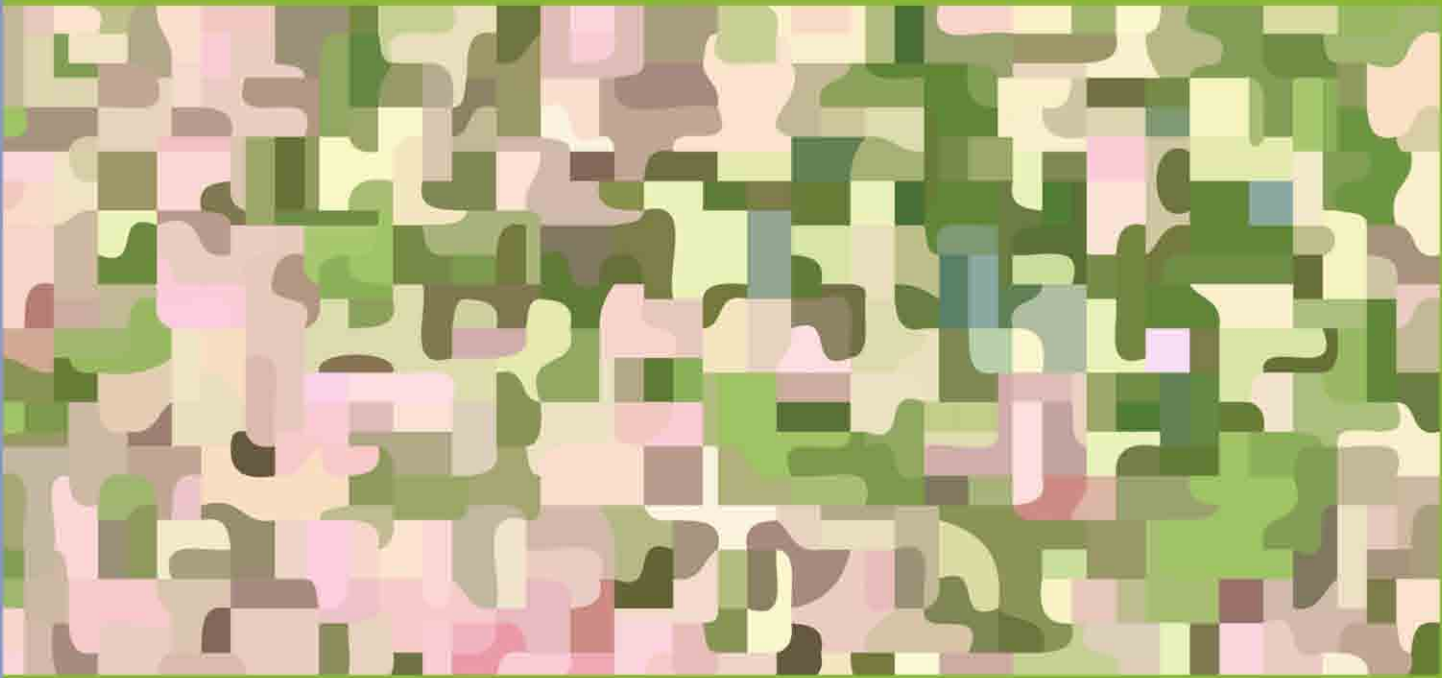
# AN ALTERNATIVE FUTURE

## Florida in the 21st Century 2020 2040 2060



PennDesign

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## Florida in the 21st Century 2020 2040 2060

Prepared for the Metropolitan Center for Regional Studies at the University of Central Florida
by the City Planning 702 Urban Design Studio at the University of Pennsylvania

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Acknowledgements

Many different people and organizations helped us develop this project. Throughout the semester, experts shared their time, knowledge, and technical data with our studio. Their contributions were vital to the completion of our project, and we are grateful for the generosity of all those who offered their assistance.

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GeoPlan briefing: Dr. Paul Zwick , Director, GeoPlan Center and Chair, University of Florida, Department of Urban and Regional Planning.

Environmental briefing: Randy S. Kautz, Senior Scientist, Breedlove, Dennis and Associates, Inc.

Economics briefing: Dr. Sean M. Snaith, Director, Institute for Economic Competitiveness, College of Business Administration, University of Central Florida.

Water resources briefing: Mark Elsner, Director, Implementation Division, Water Supply Department, South Florida Water Management District.

Transportation briefing: Robert Romig, Director, Office of Policy Planning, Florida State Department of Transportation.

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## About this Report

This report is the product of the City and Regional Planning Program in the School of Design at the University of Pennsylvania. This project was prepared by sixteen School of Design graduate students, guided by Professor Jonathan Barnett and assisted by Andrew Dobshinsky.

The Metropolitan Center for Regional Studies at the University of Central Florida commisioned the PennDesign team. The center operates as a forum for addressing key regional issues including economic prosperity, social cohesion, environmental protection, and individual well-being. 1000 Friends of Florida commissioned the GeoPlan Center at the University of Florida to prepare trend projections based on current population growth and land use patterns. This trend describes the likely outcome if current population growth and development patterns remain the same in 2020, 2040, and 2060. This data has been made available to the studio team and serves as the baseline and point of departure. This study serves as an illustration of an alternative way of growing compared to this trend model. Though not a specific plan, this model represents an alternative future for Florida in the 21st century.

### Approach

The project's scope was statewide. The population projections prepared by GeoPlan were utilized to develop an alternative to the trend model that suggests measures the state should implement to secure an enjoyable quality of life, economic competitiveness, and a desirable development pattern in the future that takes into account environmental systems, transportation elements, land preservation, and climate change. Urban design of the development forms is also important to the alternative scenario.

### Process

The first phase of the studio began in January 2007. The studio team examined GeoPlan's population projections and model of development patterns. The team then prepared a draft alternative model for population distribution and urbanization in 2020, 2040, and 2060. The alternative assumptions took into account several important factors for illustrating the future of the state. These included the preservation of environmentally sensitive land, a balanced, multimodal transportation system, and targeted density around transit stops. The studio also looked at the impacts of climate change, such as rising sea level, which are likely to have a substantial influence by 2060. The depletion of natural resources such as water supply and open space was also considered. The use of innovative building typologies was factored into the model. Additionally, though not directly included in the alternative model, environmentally sound technologies were examined to look at ways to make any future development more sustainable.

The second phase started on March 5th, 2007. The studio took part in a five-day workshop led by Florida urban design and planning professionals , where the inputs and assumptions used in the alternative model were reviewed and revised. The basic design and planning principles for the alternative were articulated to be incorporated into the computer model. The ideal conservation network was evaluated as well as the proposed routes for high-speed rail. During this week, a sketch design for a local transit system was prepared for each of the stations on the proposed high-speed rail line. These design concepts are the basis for the estimates for local transit capital costs that the studio prepared. The net residential densities along transit corridors were also considered during this workshop and illustrated by prototypes. Sketch designs illustrating development at high-speed rail stops and along a transit corridor were also prepared.

When the studio returned from Florida, the alternative model was refined and completed, and the report, final maps, and a PowerPoint presentation prepared.

# Table of Contents

# Executive Summary

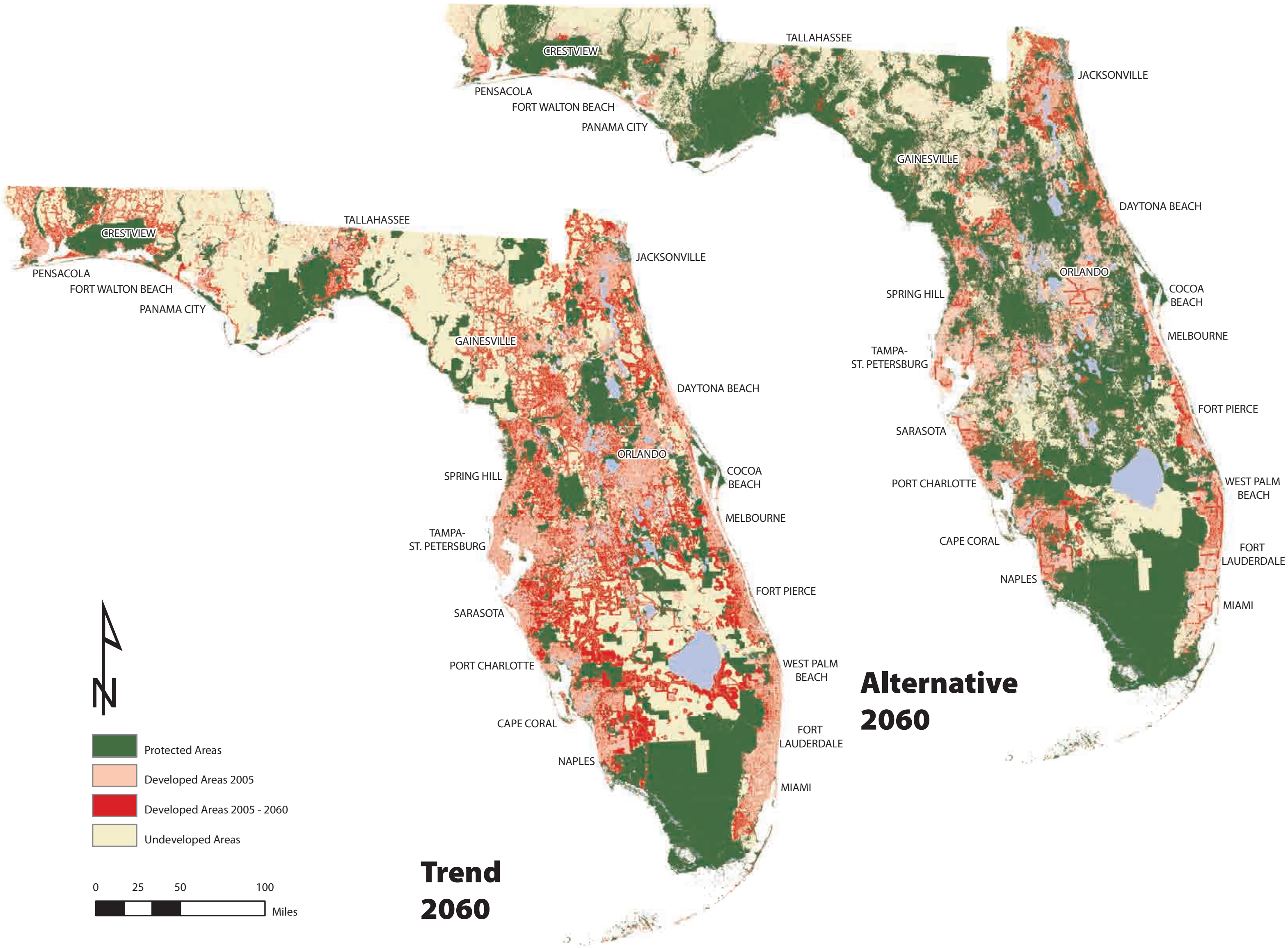
Population projections prepared by the GeoPlan Center at the University of Florida predict that Florida's population will double in size from 17.9 million people in 2005 to 35.8 million people in 2060.

A trend model for land development prepared by GeoPlan indicates that by 2060, 7 million additional acres of land will be consumed by development to serve the predicted increase in population. This study makes no estimate for conserving additional environmentally sensitive, high priority conservation lands. In the GeoPlan scenario, our studio estimates that 2.5 million acres of highest priority lands for conservation will be lost to development. In total, the cost of urbanizing land in the trend model would amount to $695 billion by 2060. In addition, if highways remain the primary transportation system, at least another $85 billion will be needed for additional highways and major roads to serve dispersed, newly urbanized areas.

The studio used GeoPlan's population trend projections to prepare an alternative. The alternative to the trend predicts for 2060, given the same population increase, 1.6 million acres of newly developed land and 250,000 acres of higher density infill development. 8.5 million acres of highest priority lands for conservation will be preserved in this alternative, and only 37,000 acres of these highest priority lands will be lost to development. By 2060, the cost of urbanization in this alternative scenario will be $174 billion, $526 billion less than the trend.

To achieve these savings in urbanization costs, Florida would need to secure the development rights to 8.5 million acres of highest priority conservation land, construct a high-speed rail network for the entire state, and develop a local rail system to connect at every high-speed rail stop. The alternative study estimates the total cost of land conservation and the construction of a statewide high-speed rail network and related local transit systems will total $265 billion, plus $21 billion in highway expenditures to serve newly urbanized areas. The costs of the high-speed rail, local transit, and additional highways in the alternative will be less than the expenditure for new highways alone if development follows the trend.

The bottom line: Florida can achieve a far better future, which saves the essential character of the landscape and creates more compact and livable communities, for far less money than it will take to let the trend take its course. In fact, the trend may well be unsustainable, leading to a point in the future when the money spent trying to accommodate the trend will be seen to have been wasted, and the costs of creating a good alternative will be far higher.

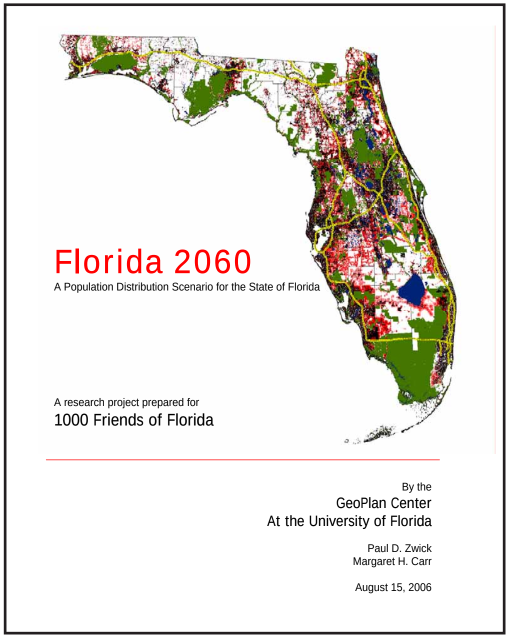



Can Florida accommodate doubling its population by 2060? 36 million people will put a significant strain on Florida's resources, even with improved development patterns recommended in the alternative. The state must immediately adopt comprehensive resource efficiency, reduction, and conservation policies. These solutions will not solve all the resource challenges the state will face. However, only by proactively implementing initiatives with the goal of maintaining current rates of consumption will Florida be able to sustain the needs of future residents.

# The Trend Model

## How Will Florida Look if Current Population and Land Use Trends Continue?

The trend model, "Florida 2060: A Population Distribution Scenario for the State of Florida," illustrates one potential scenario of Florida's future land use and population growth. Commissioned by 1000 Friends of Florida and prepared by the GeoPlan Center at the University of Florida, the model uses GIS to spatially analyze an extrapolation of current growth trends out to 2060, assuming that future population will be distributed in much the same way as the current pattern of land use. This section will examine the methodology behind the population projections, analyze assumptions behind the population distribution in the GIS model, describe the process, and summarize the results of this trend model.


Florida 2060

A Population Distribution Scenario for the State of Florida

A research project prepared for

1000 Friends of Florida

By the

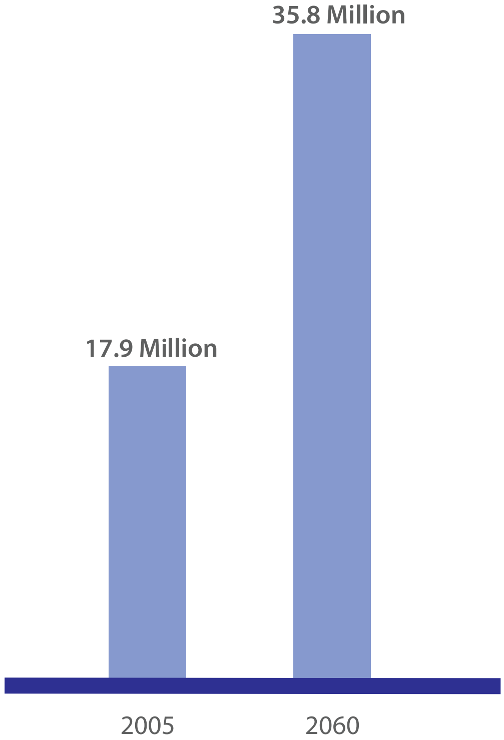
GeoPlan Center

At the University of Florida

Paul D. Zwick

Margaret H. Carr

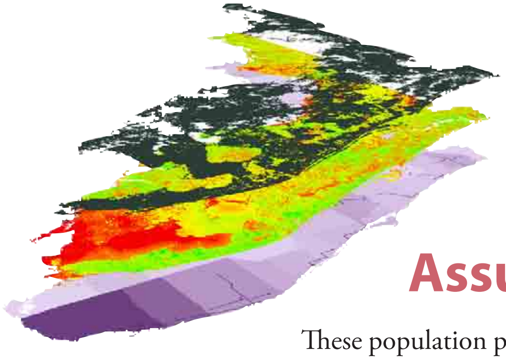
August 15, 2006




Florida Population Forecast

# Population Projections

The first step in the preparation of the GeoPlan model was to determine population projections out to 2060. These figures were based upon existing population projections by county from 2005 to 2030 prepared by the Bureau of Economic and Business Research (BEBR), which premised its projections on assumptions about birth rates, death rates, immigration, and emigration. Using the moderate projection prepared by BEBR, the GeoPlan Center determined the average annual population change by county from 2005-2030. For each five year period after 2030, the average annual change was multiplied by five and added to the preceding population projection. Essentially, the trend line was extended in five year increments out to 2060. The results of this methodology determined that Florida's population will double in size from 17.9 million in 2005 to 35.8 million in 2060.



# Assumptions

These population projections were then entered into a GIS model that assumed rules about development suitability, masked lands unsuitable for development, and used existing gross urban density by county.

## Development Suitability

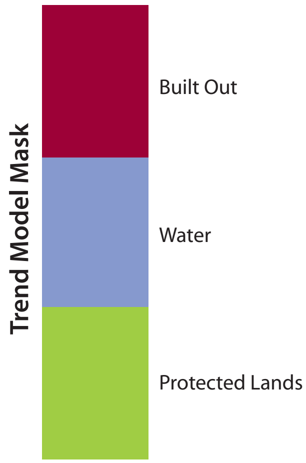
Not all lands in the state are equal when it comes to their likelihood of development. Eight weighted criteria (please refer to graphic) were used to determine the most suitable areas for new development. Proximity to existing urban areas, presence of wetlands, and road density were considered the most important criteria.

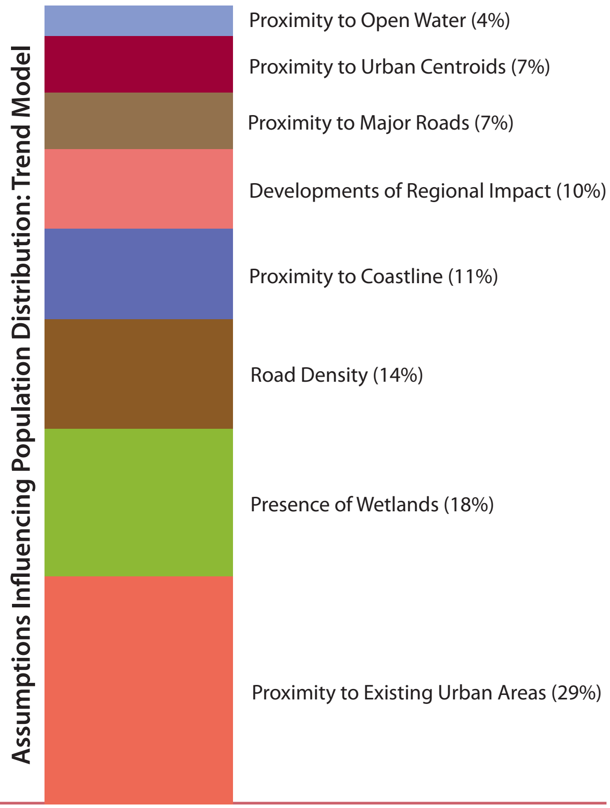
## Mask

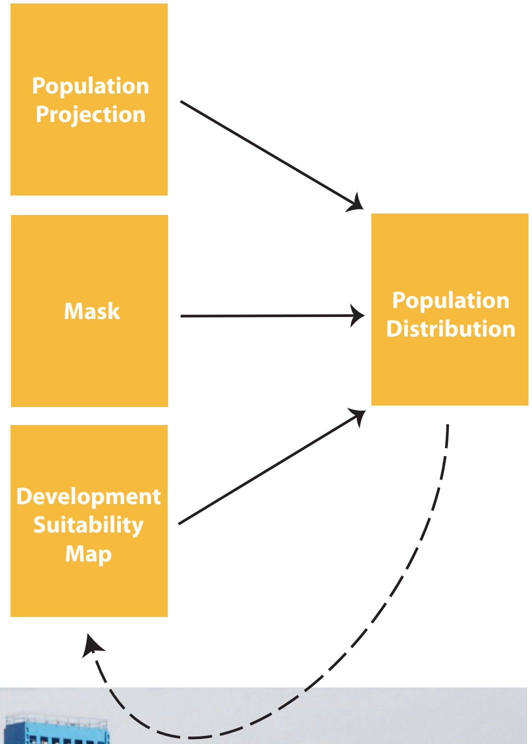
A mask was also created so the GIS model would not distribute the population into areas where no development can occur. Included in this mask were open water, existing urban development, and existing preserved natural areas.

## Existing Gross Urban Density

The model assumed that the gross urban density in 2060 would remain the same as it was in 2005. This gross urban density for each county was used to determine the number of acres needed to accommodate the projected population.

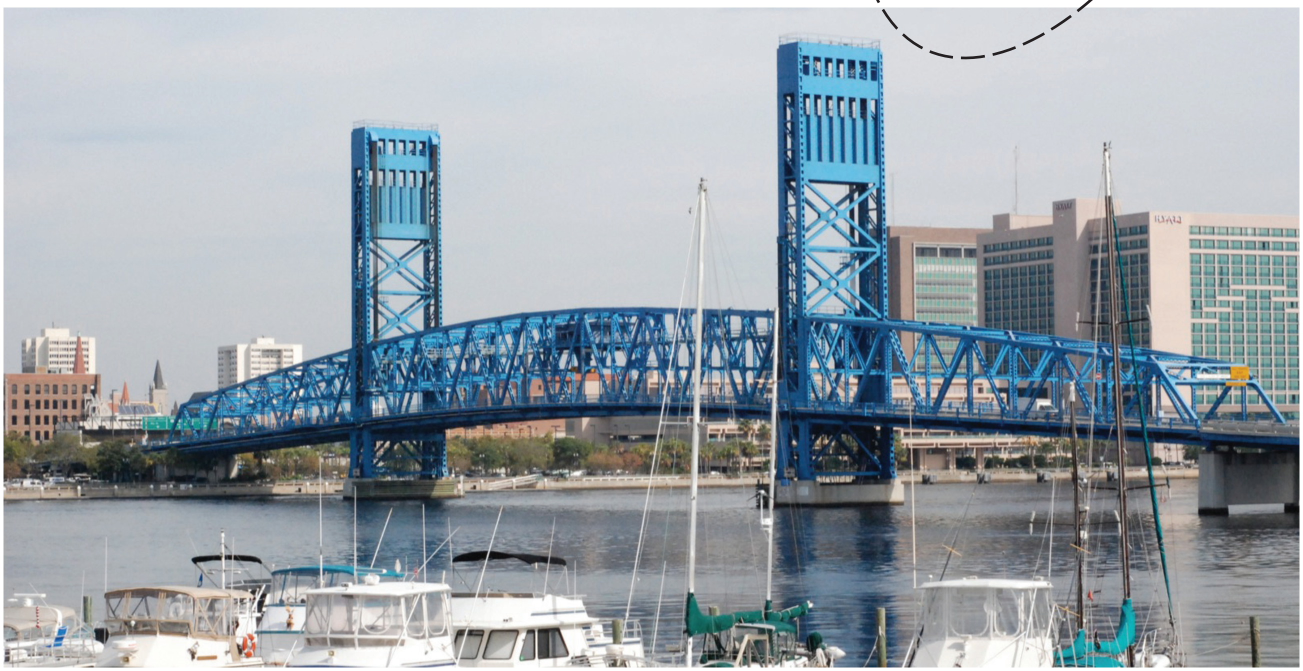


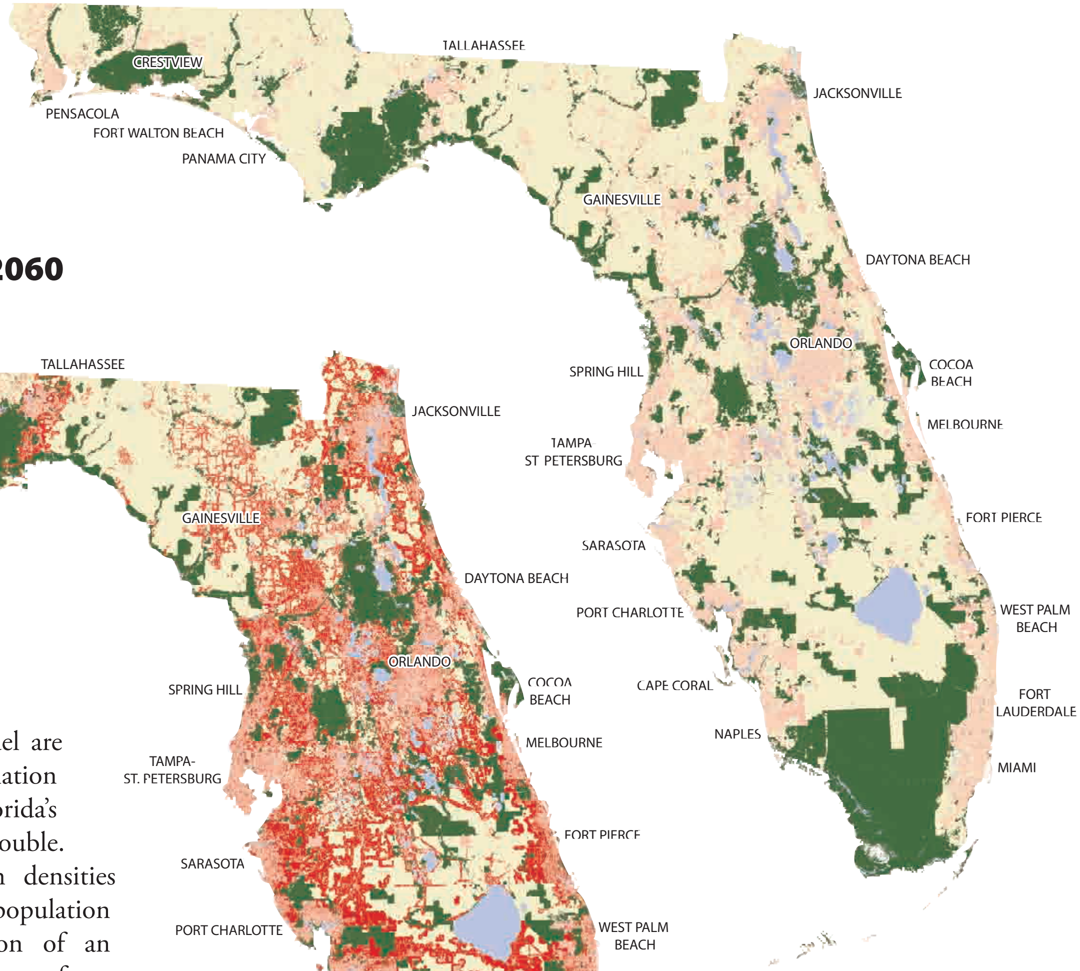



# Process

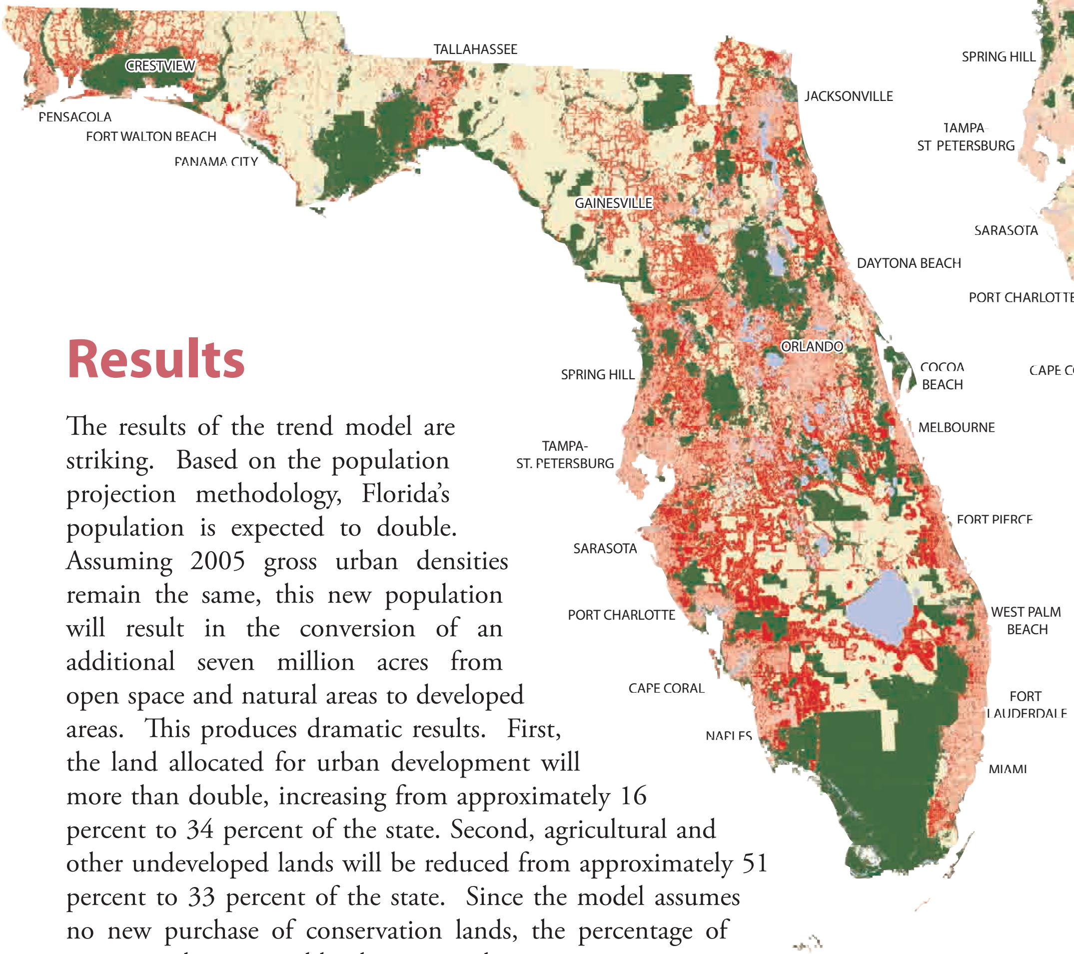
The model distributed future population based on the assumptions outlined previously for three different target dates (2020, 2040, and 2060). The model was also cyclical; once the 2020 population was distributed, the results were fed back into the determination of the 2040 development suitability, and the distribution was then fed back into the determination of development suitability for 2060.

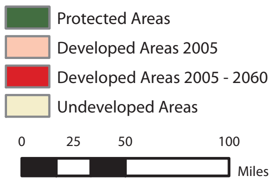


## Existing Urbanized Land: 2005




## Trend, Urbanized Land: 2060




# Results

The results of the trend model are striking. Based on the population projection methodology, Florida's population is expected to double. Assuming 2005 gross urban densities remain the same, this new population will result in the conversion of an additional seven million acres from open space and natural areas to developed areas. This produces dramatic results. First, the land allocated for urban development will more than double, increasing from approximately 16 percent to 34 percent of the state. Second, agricultural and other undeveloped lands will be reduced from approximately 51 percent to 33 percent of the state. Since the model assumes no new purchase of conservation lands, the percentage of permanently protected lands remains the same at 28 percent. Visually, the results are remarkably apparent. One can see the urban areas consuming many parts of the state, particularly in central Florida and along the northeastern coast.

# Existing Patterns of Development

## What is Florida building?

During the past decades, trends have been moving toward creating larger structures and segregating uses. Detached building typologies are very prevalent throughout Florida. These trends substantially increase vehicle dependency and commuting time. Reducing density per acre also means disproportionate energy consumption per acre. Sprawl is deeply embedded in developed areas, and policymakers should take serious action to encourage more efficient land use.

### Current Typologies

The studio has explored the current building typologies in Florida and concluded that the current development patterns result in low-density, sprawling development. Gross urban density in 2005 ranges from 15.45 people per acre in Dade County to as little as 0.45 people per acre in Gilchrist County. (1000 Friends of Florida, p.26)

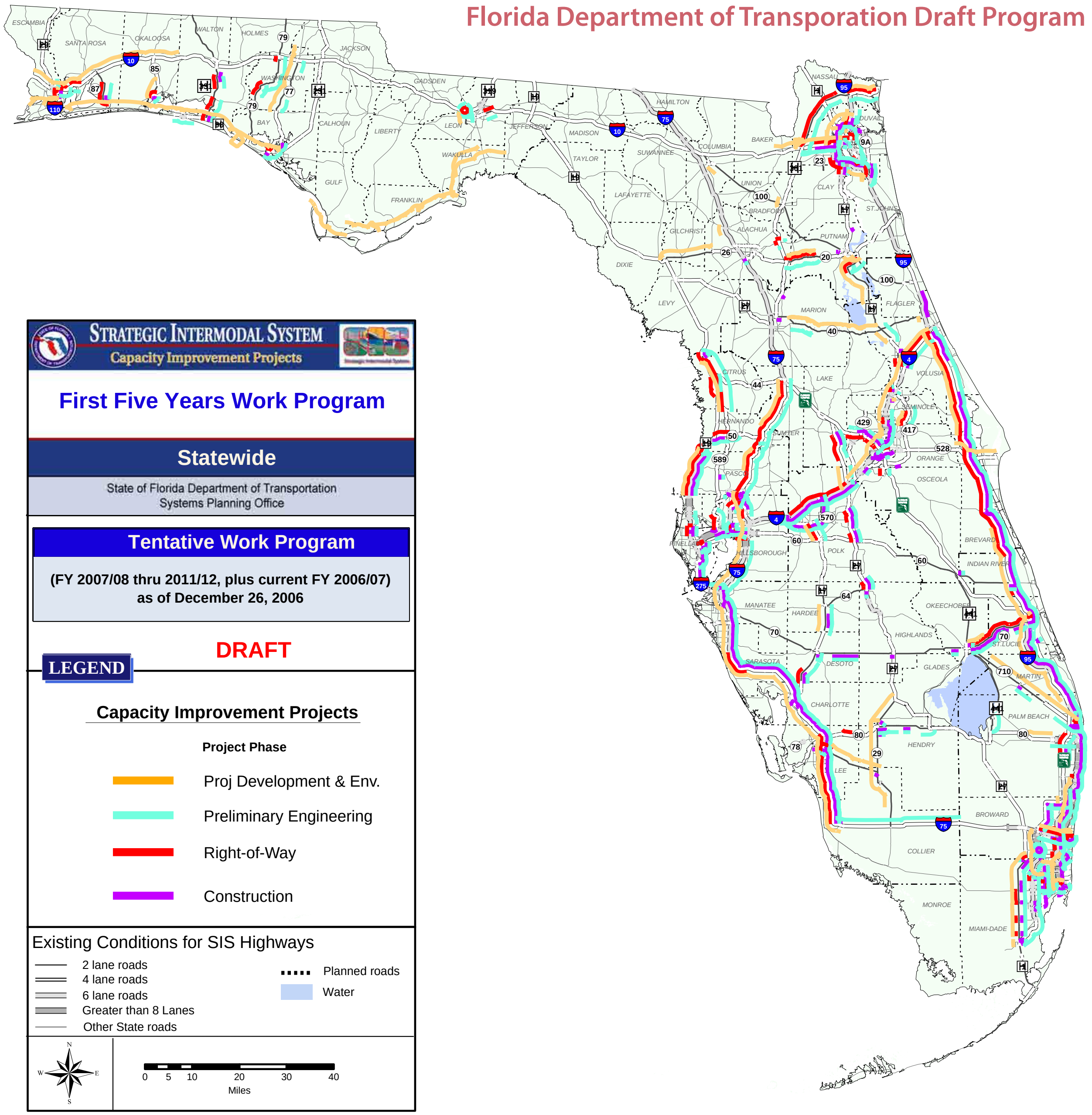
While population is sharply increasing, the development patterns continue in their current state—larger and more spread out. It is vital to be aware of Florida's planning decisions and move towards typologies and trends that are more conscious of consumption of vulnerable resources.

### Highways

Like many other states, Florida is designed and developed around automobile transportation. Traveling by car is generally the most convenient way to travel and commute in Florida. Public transportation is available almost exclusively in cities and larger towns, and even then it may provide infrequent or inadequate service. Because highways are the main form of transportation throughout the state, building developments must consume an enormous amount of land for parking spaces. In fact, several typologies have emerged that rely on this highway infrastructure, such as motels that are typically located along highways or regional shopping malls that provide surface parking, thus utilizing large parcels of land.

Florida has built vast highway networks, road infrastructure, and parking lots that compel residents to rely on personal vehicles, causing the primary development form to be sprawl. In general, while it is known that every development has associated efficiency and sociological costs, sprawling development may in fact exacerbate these costs. Social costs include more time spent in isolated settings, particularly in the car while traveling many miles along highway networks. Economic costs center around automotive costs, including tax dollars applied towards road maintenance and development instead of focusing tax dollars on education, civic programming, or developing public transportation alternatives. The environmental costs associated with sprawl are divided between pollution from automobiles and the consumption of open space for housing and road development. Lastly, the health costs related to sprawl include increased levels of stress from traffic congestion, air pollution, higher obesity rates, and an increase in automobile accidents.

## Florida Department of Transporation Draft Program



# Costs of the Trend

**Transportation, Land Development, Land Use**

Over a third of the state (13 million acres) is developed by 2060 in the trend model. All 7 million acres of the undeveloped land lost in the trend model is lost to development.

*See page 87 for cost assumption chart.


## Cost: Trend Transportation

| Years | Trend Highways (miles) | Trend Highways Costs |
|---|---|---|
| **2005-2020** | 2,540 | $25,402,702,961 |
| **2020-2040** | 3,081 | $30,814,319,002 |
| **2040-2060** | 2,878 | $28,782,978,037 |
| ***Total*** | ***8,500*** | ***$85,000,000,000*** |

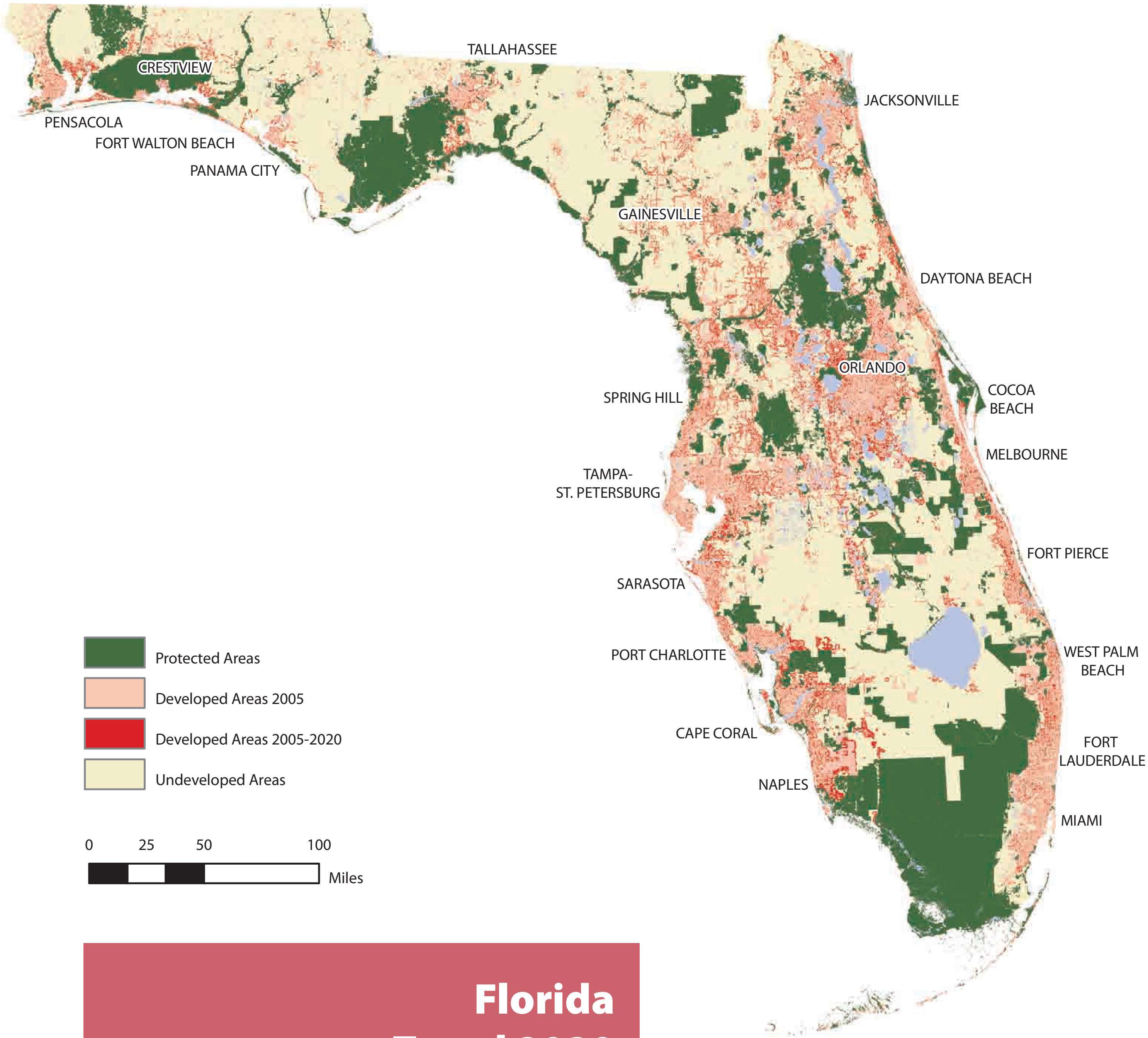
## Costs: Trend Land Development

| Years | Population Increments | Trend Land (Acres) | Trend Costs |
|---|---|---|---|
| **2005-2020** | 5,021,845 | 2,078,020 | $207,802,000,000 |
| **2020-2040** | 6,309,702 | 2,520,707 | $252,070,700,000 |
| **2040-2060** | 6,610,732 | 2,354,537 | $235,453,700,000 |
| ***Totals*** | ***17,942,279*** | ***6,953,264*** | ***$695,326,400,000*** |

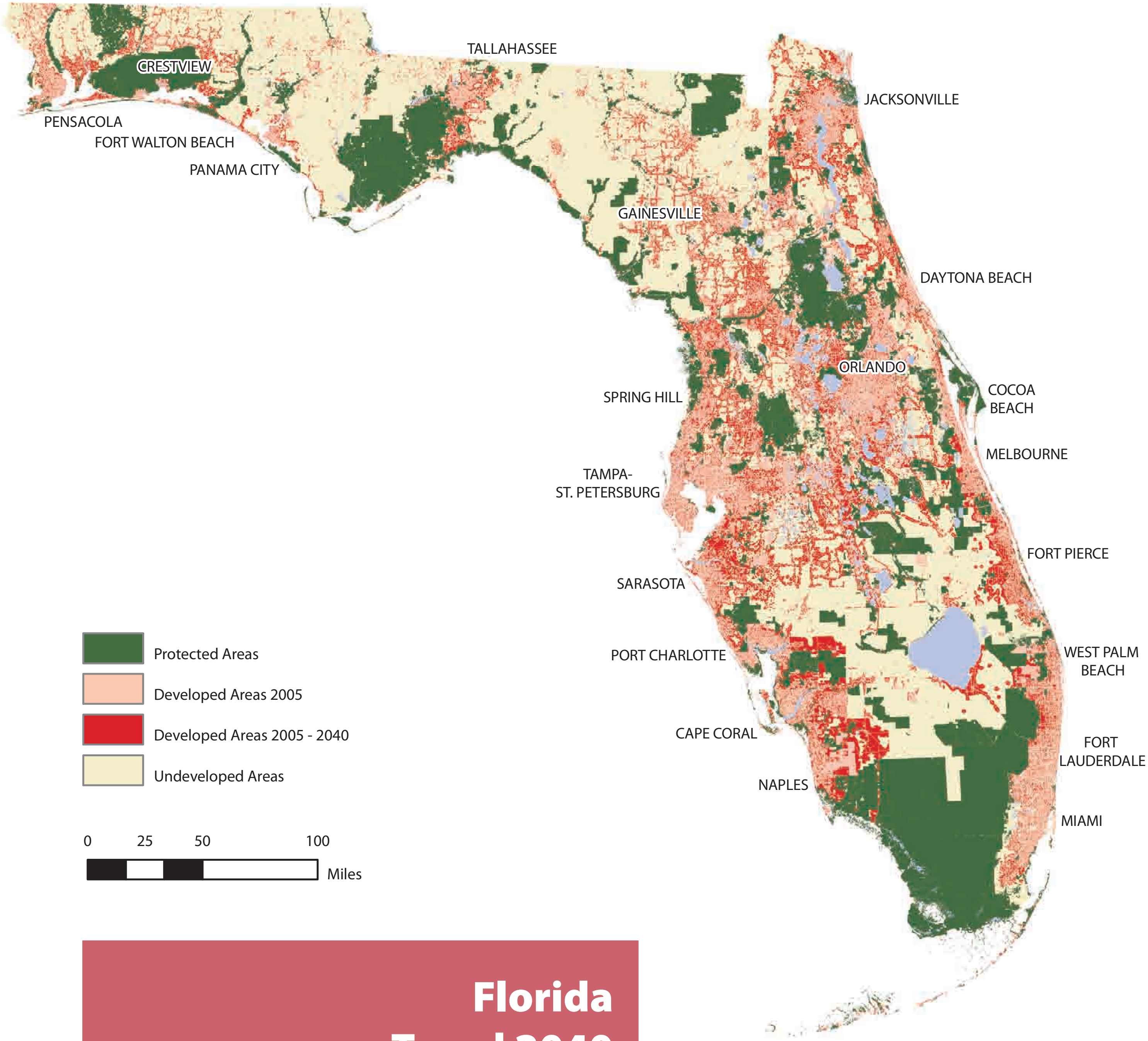
## Detailed Land Use Results: Trend (acres)

| | 2005 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| **Water** | 1,924,368 | 1,924,368 | 1,924,368 | 1,924,368 |
| **Redeveloped Acres** | 0 | 0 | 0 | 0 |
| **Developed** | 5,971,509 | 8,048,806 | 10,568,897 | 12,923,265 |
| **Developed in Ideal Conservation** | 0 | 519,204 | 1,534,170 | 2,490,654 |
| **Conservation** | 10,074,537 | 10,074,537 | 10,074,537 | 10,074,537 |
| **Preserved Ranch Lands*** | 13,231 | 13,231 | 13,231 | 13,231 |
| **Agriculture & Other Land Uses** | 19,874,498 | 17,797,201 | 15,277,110 | 12,922,742 |

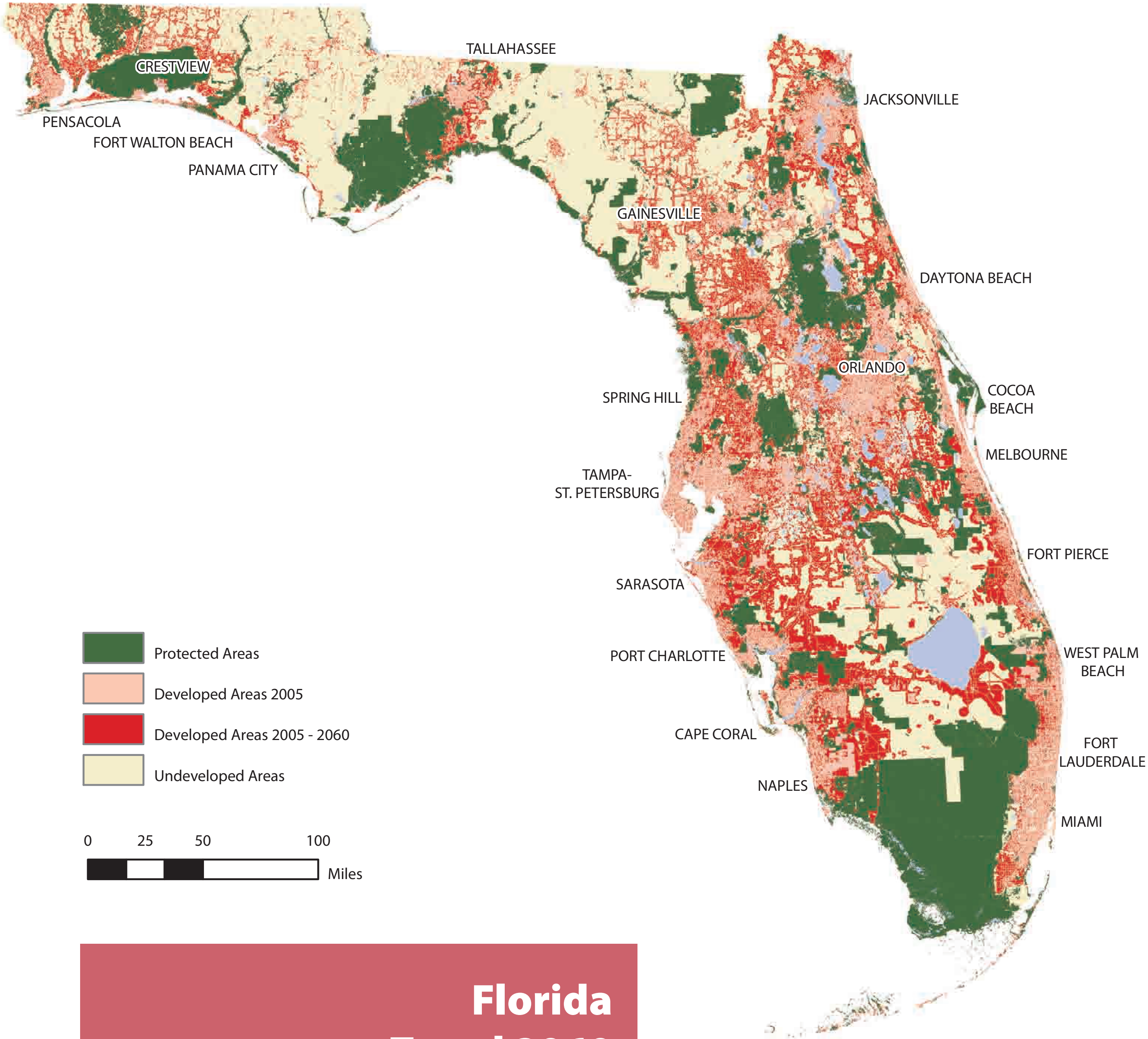
*Source: Kenneth Murray, Natural Resources Conservation Service (acres preserved through the Farm and Ranch Lands Protection Program)




# Florida Trend 2020




# Florida Trend 2040




# Florida Trend 2060


Old
Hyde
Park
Village
April Cornell

# Alternative to the Trend

The trend scenario anticipates the amount of urbanized land will more than double, agricultural and other undeveloped lands will be significantly reduced, and no additional lands will be permanently acquired and protected. Given these assumptions, proposing principles for an alternative to the trend provides a framework for methods that regional planning commissions can use to achieve balanced and manageable growth, keeping in mind protecting the health, safety, and welfare of current and future Floridians.

# Principles for an Alternative Future

## Regional Planning

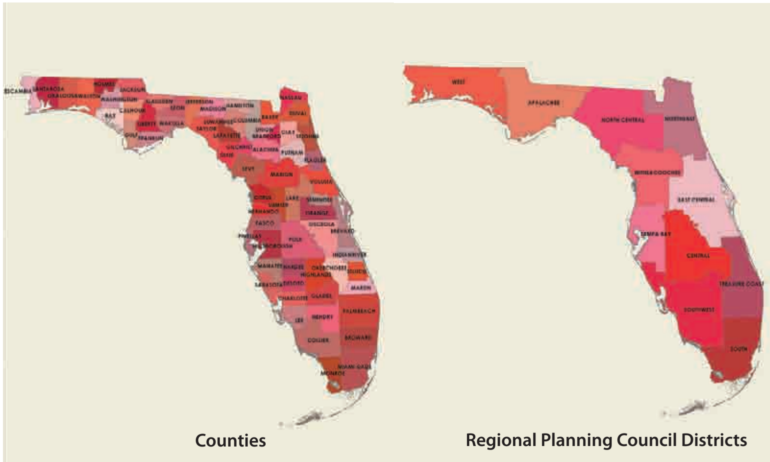
Regional planning has the capacity to manage growth at a meaningful scale through organized leadership that is guided by a shared regional vision. The proposals suggested in the implementation of the alternative can be successfully realized through the regional planning process already in place in the state. This regional coordination is critical for ensuring that new development in Florida is built in a sustainable and efficient manner.

Chapter 186, Section 505 of the 2006 Florida Statutes delegates Regional Planning Councils (RPCs) with numerous powers and duties related to the economic, political, social, and environmental welfare of the State. RPCs are charged with coordinating among other regional entities to prepare and regularly review the strategic regional policy plan; establishing and conducting a negotiation process with local governments intended to resolve inconsistencies between applicable local and regional plans with voluntary local governments participation; and coordinating land development and transportation policies in a manner that fosters region-wide transportation systems.[1]

RPCs face many challenges in managing the growth of the state. The following guidelines and strategies may guide policy makers in the right direction by giving them appropriate tools to approach key issues within a regional context.

These principles are interconnected and contingent upon a coordinated approach for implementation and regulation. Coordinated efforts will protect large contiguous habitat corridors and open space, create more equitable land use, encourage reinvestment in older cities and suburbs, provide for natural disaster planning, and allow for a balanced multi-model transportation system. Therefore, it makes the most sense that these principles are evaluated concurrently across jurisdictions. The seven principles proposed in this section are as follows:

1. Protect Florida's Essential Land
2. Invest in Balanced Transportation
3. Plan for Climate Change
4. Don't Waste Land
5. Design with Nature
6. Encourage Compact Development
7. Rebuild to Create Great Places



# Principle 1: Protect Florida's Essential Land

**Critical habitat, land needed for aquifer protection, wetlands, significant natural landscapes, and prime agricultural land should all be identified and protected by purchase of development rights or other effective measures**

Florida is a state rich with biodiversity and boasts a wide variety of natural landscapes, ranging from cypress everglades to pine forests. These natural lands not only provide scenic vistas for residents but also fulfill important environmental functions such as wildlife habitat and clean air and water. Working landscapes such as farms preserve open space in addition to producing important crops.

## Conservation Components

The alternative to the trend sought to identify sensitive and vital environmental lands in the state to protect them from development. To identify these lands, a conservation agreement ranking method was used, taking into account five factors: habitat, water, wetlands, agriculture, and the contiguity of existing conservation lands.

## Habitat

Protecting natural land from development is important because it preserves natural wildlife habitat. The studio used data from the following plans to identify important wildlife habitat:

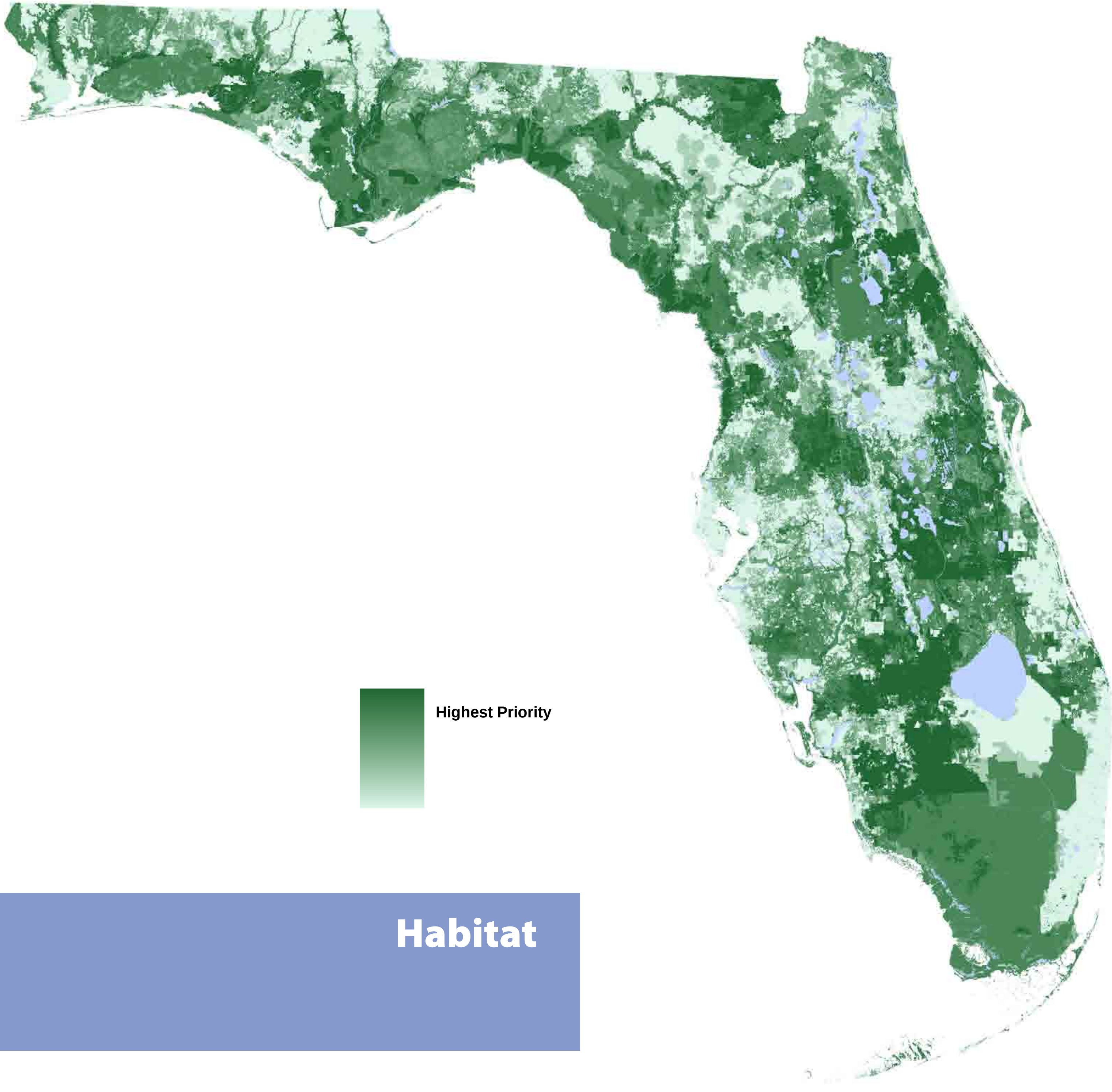
1. Closing the Gaps in Florida's Wildlife Habitat Conservation System (1994); a plan completed by the Florida Game and Fresh Water Fish Commission which identified minimum lands for biodiversity.

2. Florida Forever Conservation Needs Assessment (2000); a study prepared by the Florida Natural Areas Inventory which identified and ranked lands for acquisition by the state.

3. Mapping Wildlife Needs in Florida: The Integrated Wildlife Habitat Ranking System (2003); a project completed by the Florida Fish and Wildlife Conservation Commission which ranked Florida lands based upon wildlife needs and assessed the potential impacts of road and development projects.

4. Designing a Geography of Hope: A Practitioner's Handbook to Ecoregional Conservation Planning (2000); a portfolio prepared by the Nature Conservancy that includes conservation sites in each eco-region of the United States.

Data from the four plans were overlaid, and lands were ranked according to the degree of agreement between them. Lands that were identified for protection by all of the plans received the highest score and were thus considered the highest priority for permanent wildlife habitat protection.




# Habitat

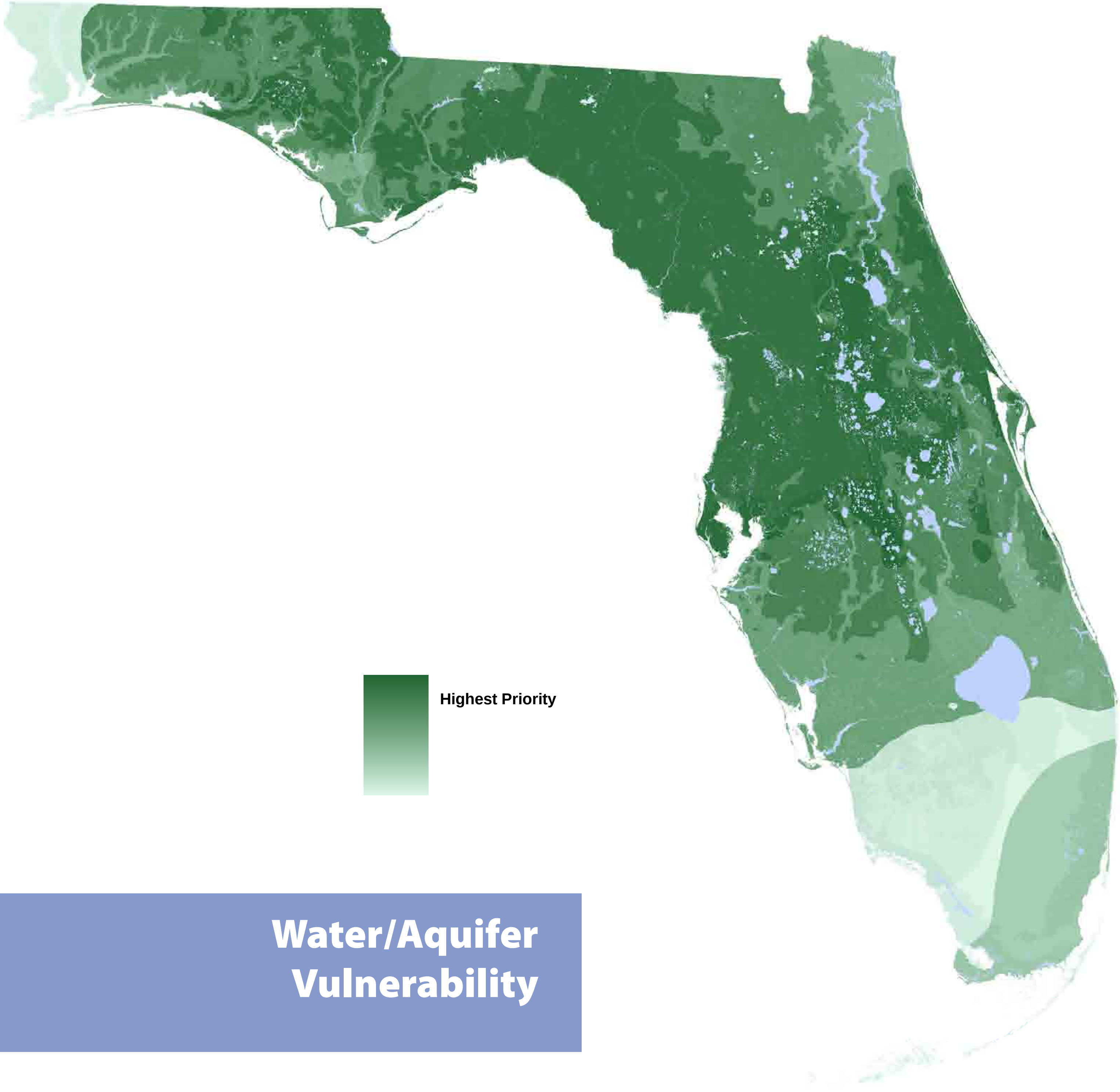
## Water / Aquifer Vulnerability

Floridians obtain nearly all of their water from underground aquifers. There are four main aquifers in the state: the Floridan, Intermediate, Surficial, and Biscayne Bay.

Aquifers become more vulnerable to pollution as land becomes developed. Pollutants can seep down into groundwater and contaminate it. It is important that the state's aquifers are protected from pollution to protect the state's water supply.

To rank the aquifers according to their vulnerability, data from the Florida Department of Environmental Protection's Florida Aquifer Vulnerability Assessment (FAVA) was used. The FAVA model applied a variety of measures, such as soil permeability, depth to water table, and karst geology to assess the vulnerability of the state's aquifers to pollution.

For the alternative model, each aquifer was ranked according to the FAVA model assessment for vulnerability, with the most vulnerable aquifers receiving scores for highest priority for protection. The FAVA model did not include data for the Biscayne Bay aquifer; however, it was assigned a high priority protection ranking by the studio. In addition, each aquifer was weighted according to the amount of water it provides for the state's residents. The Floridan aquifer provides the most water for the state, therefore it was given the largest weight of 70 percent. The Biscayne Bay received a weight of 20 percent, while the remaining two received a weight of 5 percent.

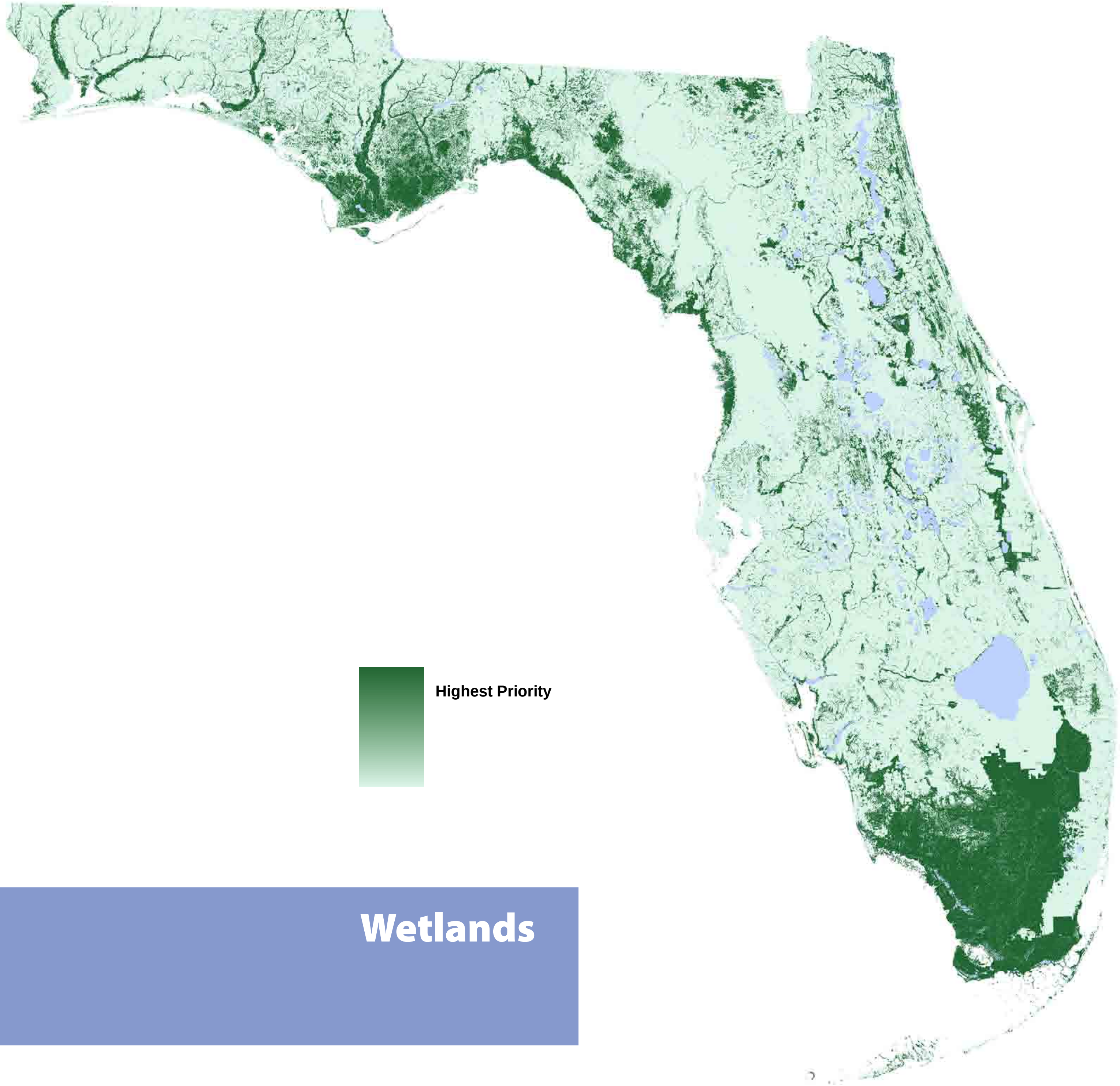



# Water/Aquifer Vulnerability

## Wetlands

Wetlands are one of the Earth's most valuable natural resources because they are responsible for ecological functions essential to the performance of ecosystems. Wetlands not only provide habitat to fish and wildlife species, but they also help moderate the impacts of human development through pollutant filtration, flood control, and stormwater management. As lands surrounding wetlands become developed, this increases the vulnerability of wetlands to pollution and decreases their functionality.

The alternative model identified lands that should be preserved from development to preserve vital wetland ecosystems. Those lands closest to wetlands larger than 25 acres were identified as the highest priority for protection.




# Wetlands

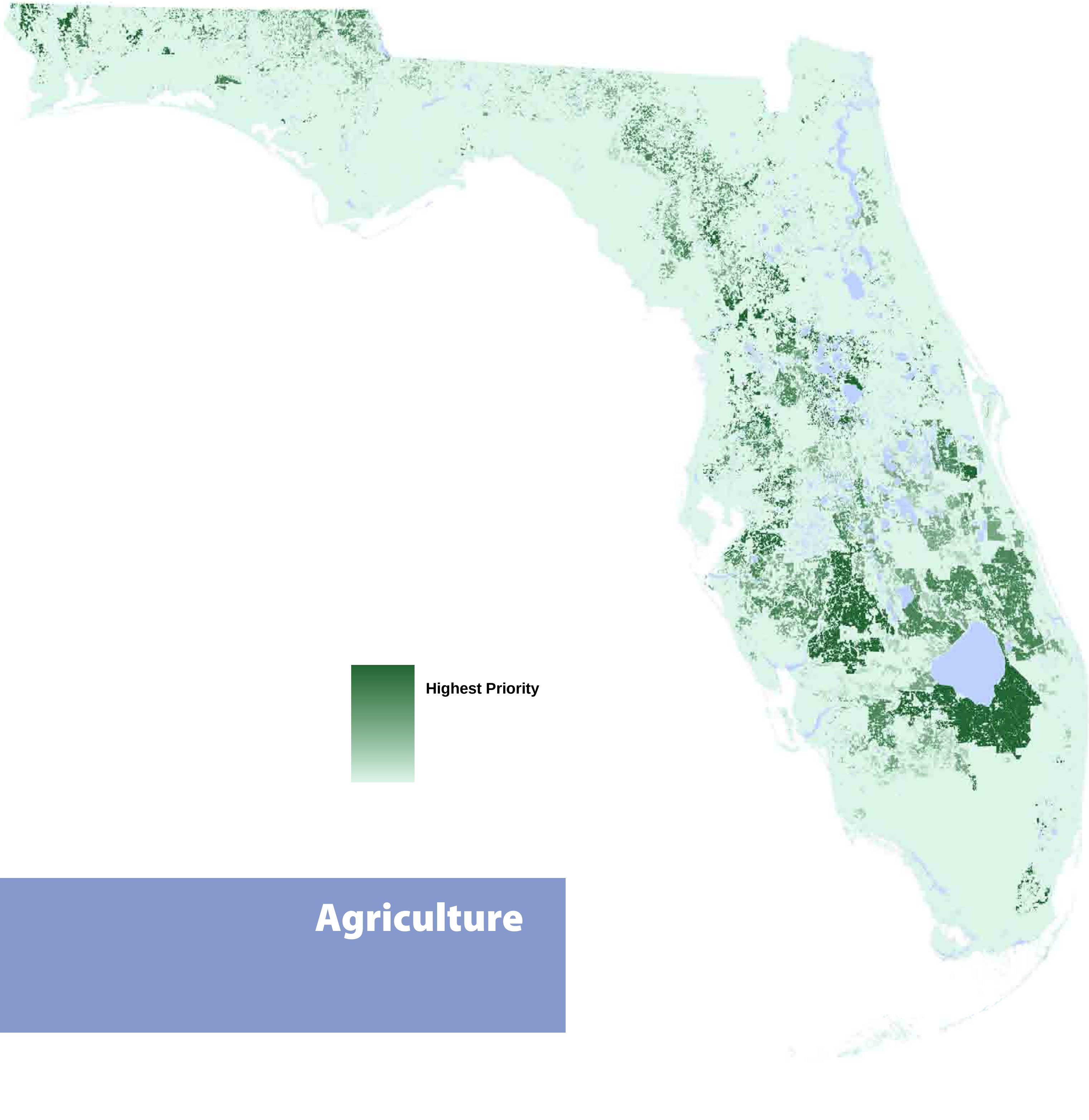
## Agriculture

In addition to natural landscapes, agricultural landscapes serve many important functions. Benefits of keeping local farms in use include the protection of rural communities, decreased dependence on foreign oil, security of the food supply, and accessibility to fresh, nutritious food. The protection of these landscapes can also come with potential downsides such as overuse of water for irrigation, eutrophication of lakes and rivers, and overgrazing of pasture land. However, the purview of this analysis is to identify large agricultural landscapes with little fragmentation from development.

The Conservation Agreement Ranking did not account for the farming type or practice. This type of detailed information is not easily found on a statewide level. Furthermore, this analysis was primarily concerned with the productivity of the land. However, Florida lawmakers should pursue incentives to make farming more compatible with the surrounding natural landscapes. Florida lawmakers must link sustainable agriculture research to practice through vital county extension services.

Because of the limited soil quality information, this analysis used sales per acre by county from the 2002 USDA agriculture census as a proxy for productivity. The weakness with this approach is that sales may over-represent productivity for crops that receive subsidies. It also does not capture whether the farm is productive by nature of the soil and climate or through the application of fertilizers and excessive irrigation. Despite this weakness, the agriculture census offers us the only consistent measure for each county in Florida.

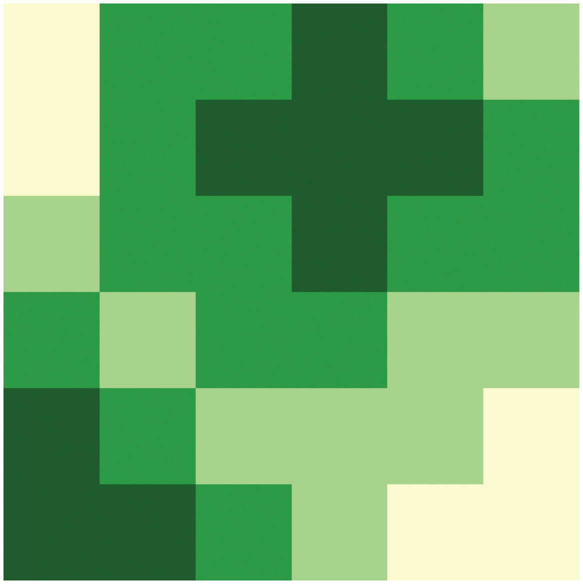
After analyzing the sales data, we ranked the counties into five categories, using the mean sales per acre for the state as a baseline: one being the best and five being the worst. Then, we ranked each acre in agriculture from one to five based upon whether it belonged to a large, uninterrupted agricultural landscape. For example, an acre that was part of 1000 contiguous acres of agriculture would have a higher rank than an acre that was part of 100 contiguous acres. Finally, these two rankings became the basis for a composite agriculture ranking of size and productivity so that large landscapes with the highest sales per acre would have the highest rank and small landscapes with lowest sales would be the lowest rank.

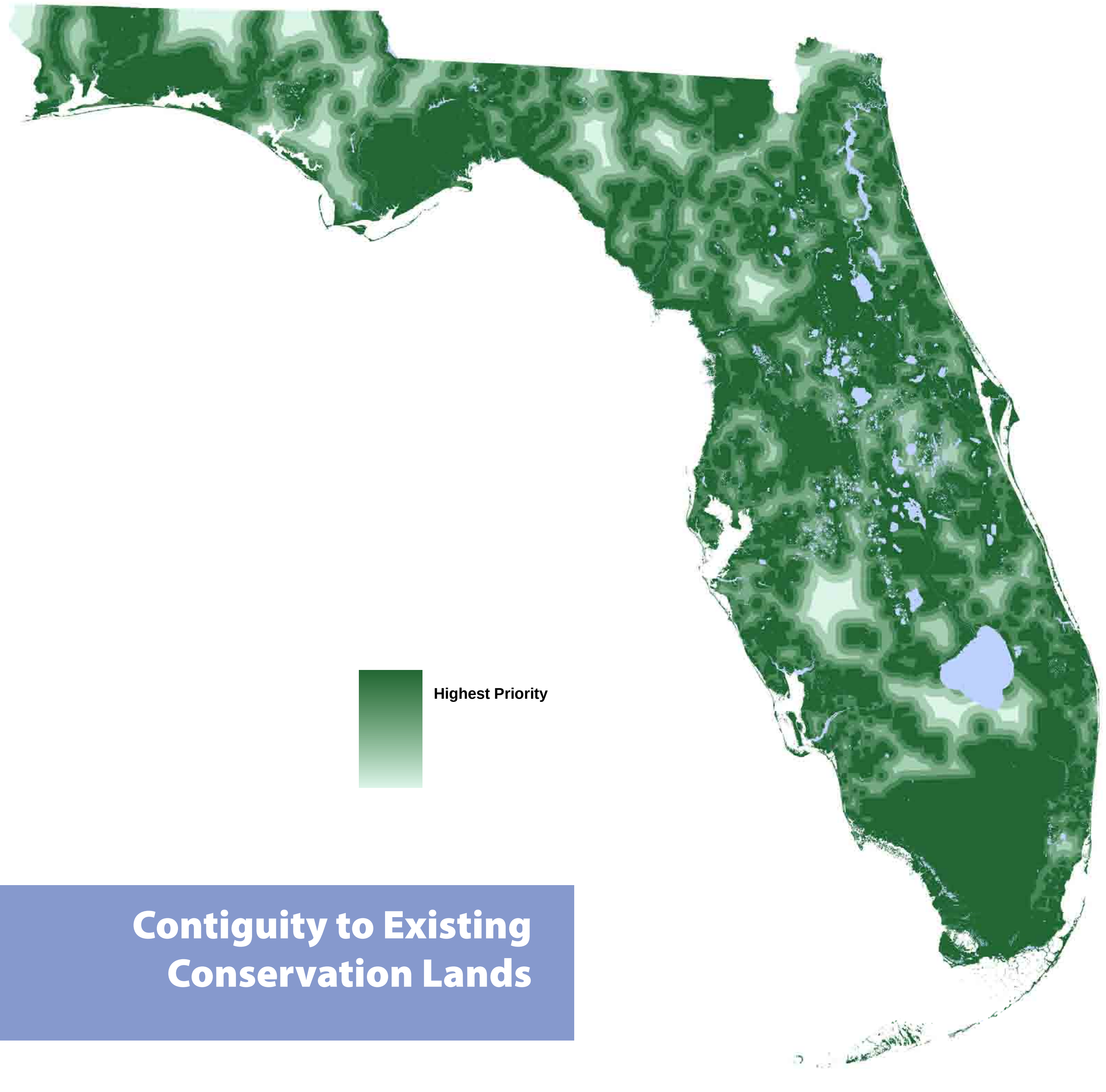



# Agriculture

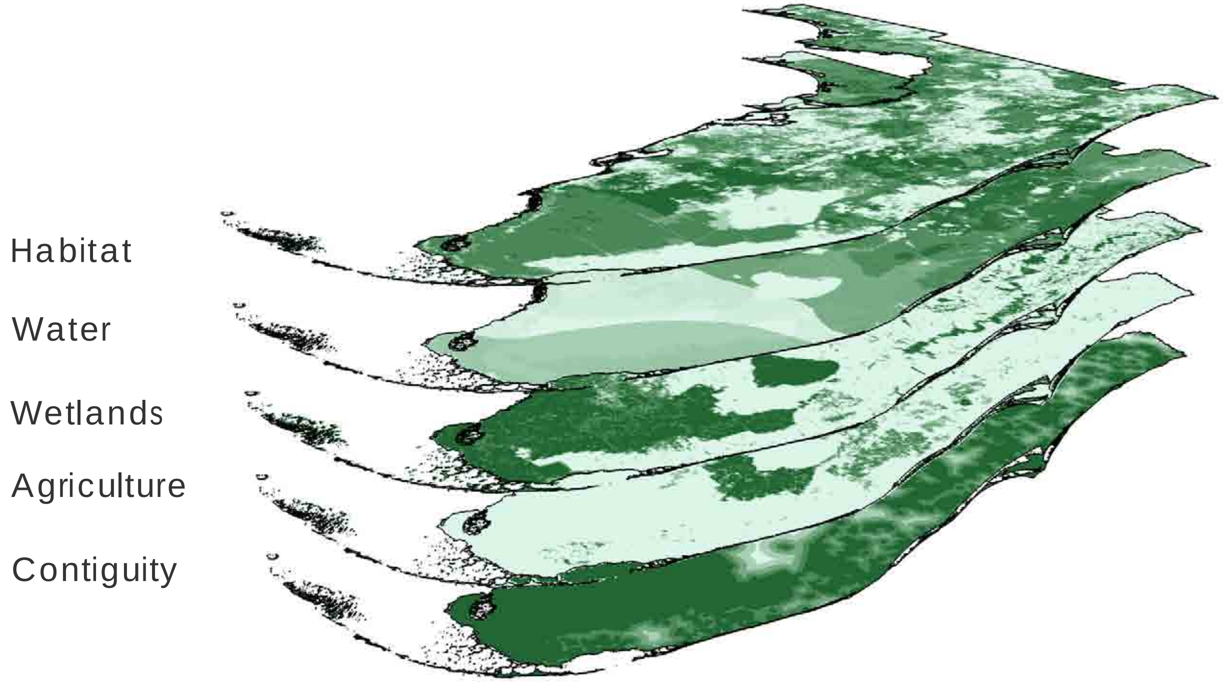
## Contiguity to Existing Conservation Lands

The final component of the  Conservation Agreement Ranking was contiguity to existing conservation land. In theory, Florida should also look to increase the size of contiguous conservation lands over time.  This is because large conservation areas are likely to insulate their natural communities from outside disturbances and stresses better than small areas.  Lands closest to existing conservation lands in 2006 were ranked highest. Those lands furthest received  the lowest ranking.





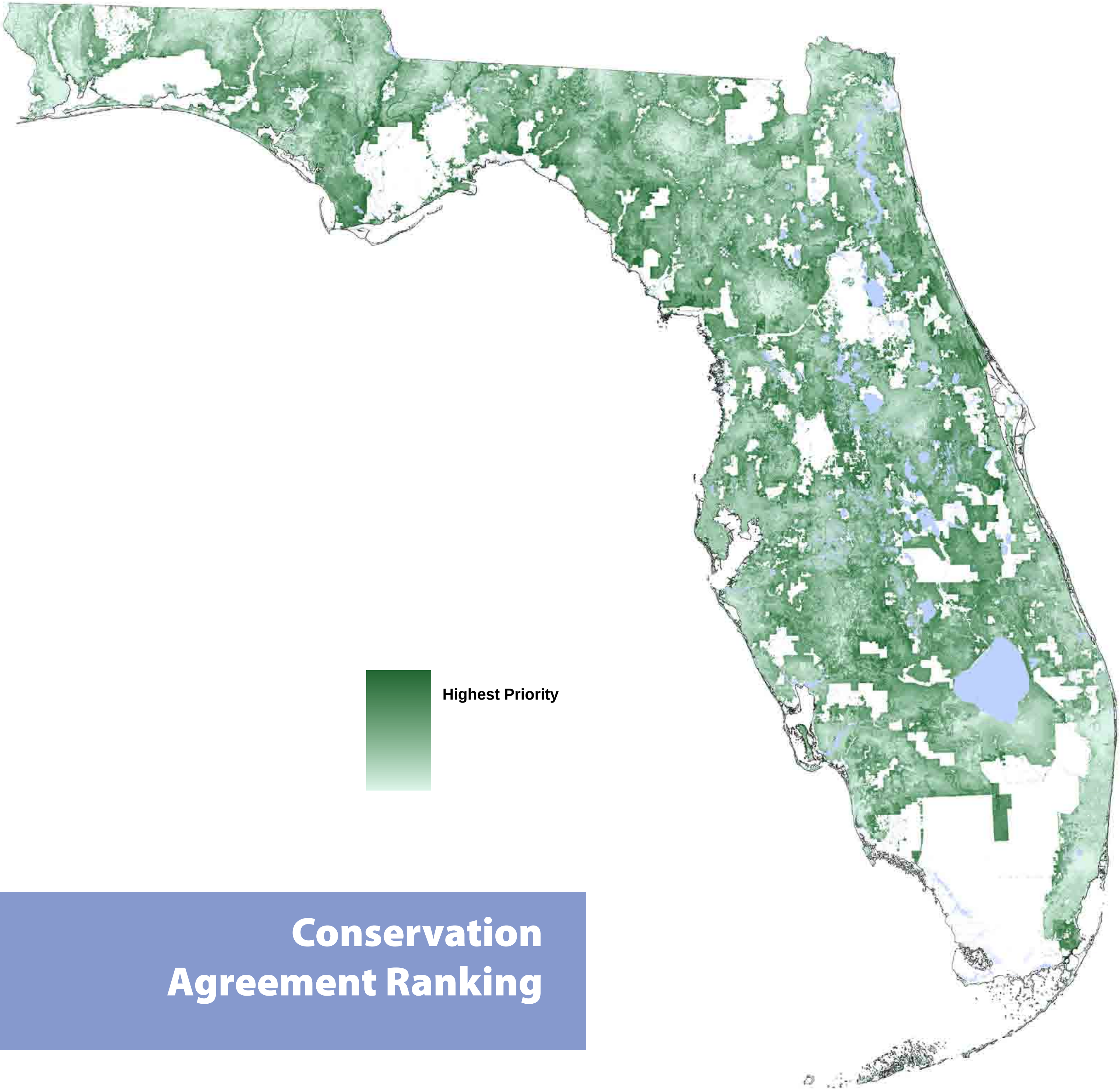

# Contiguity to Existing Conservation Lands



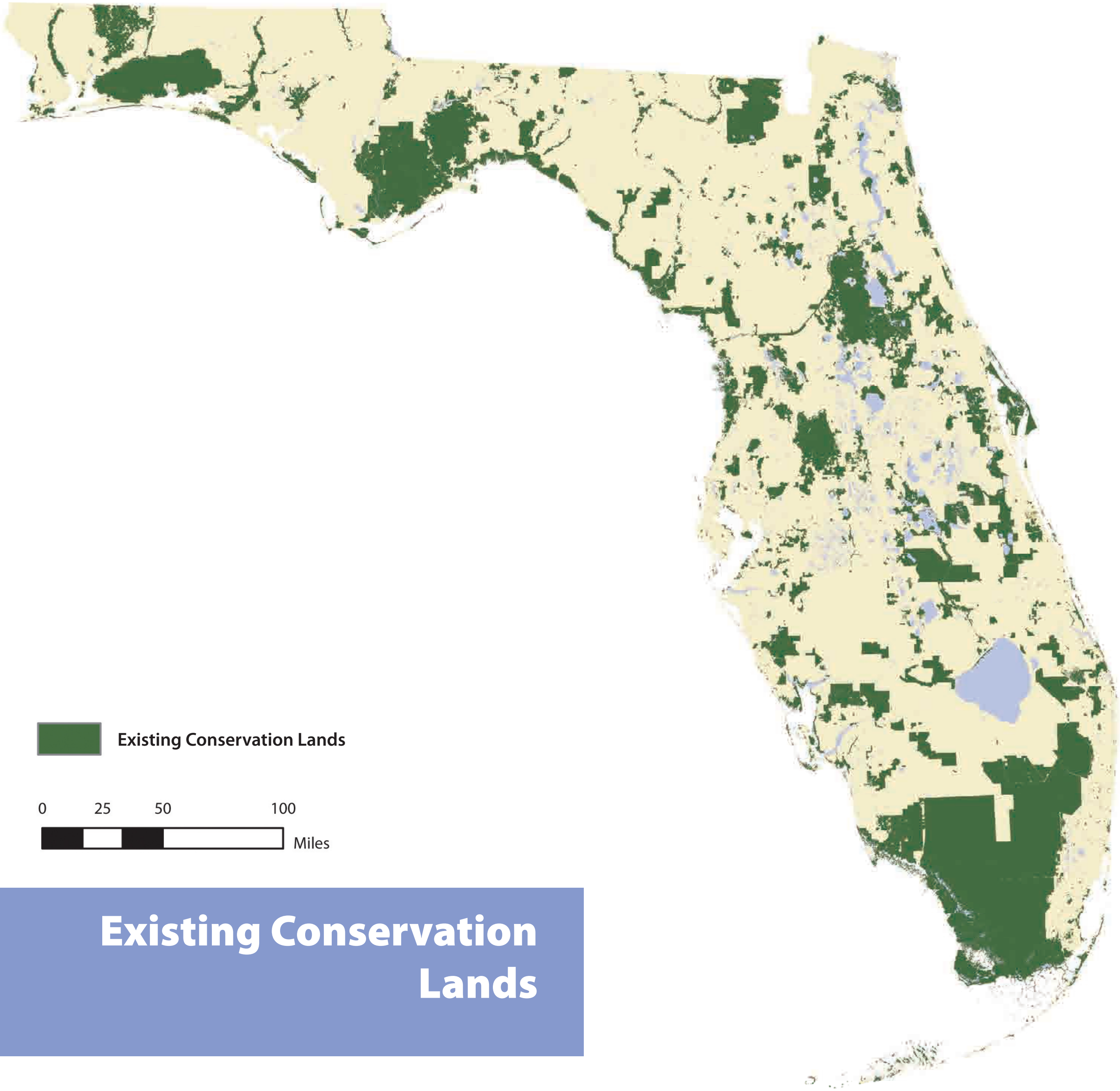

# Implementation of Principle 1

## Conservation Agreement Ranking

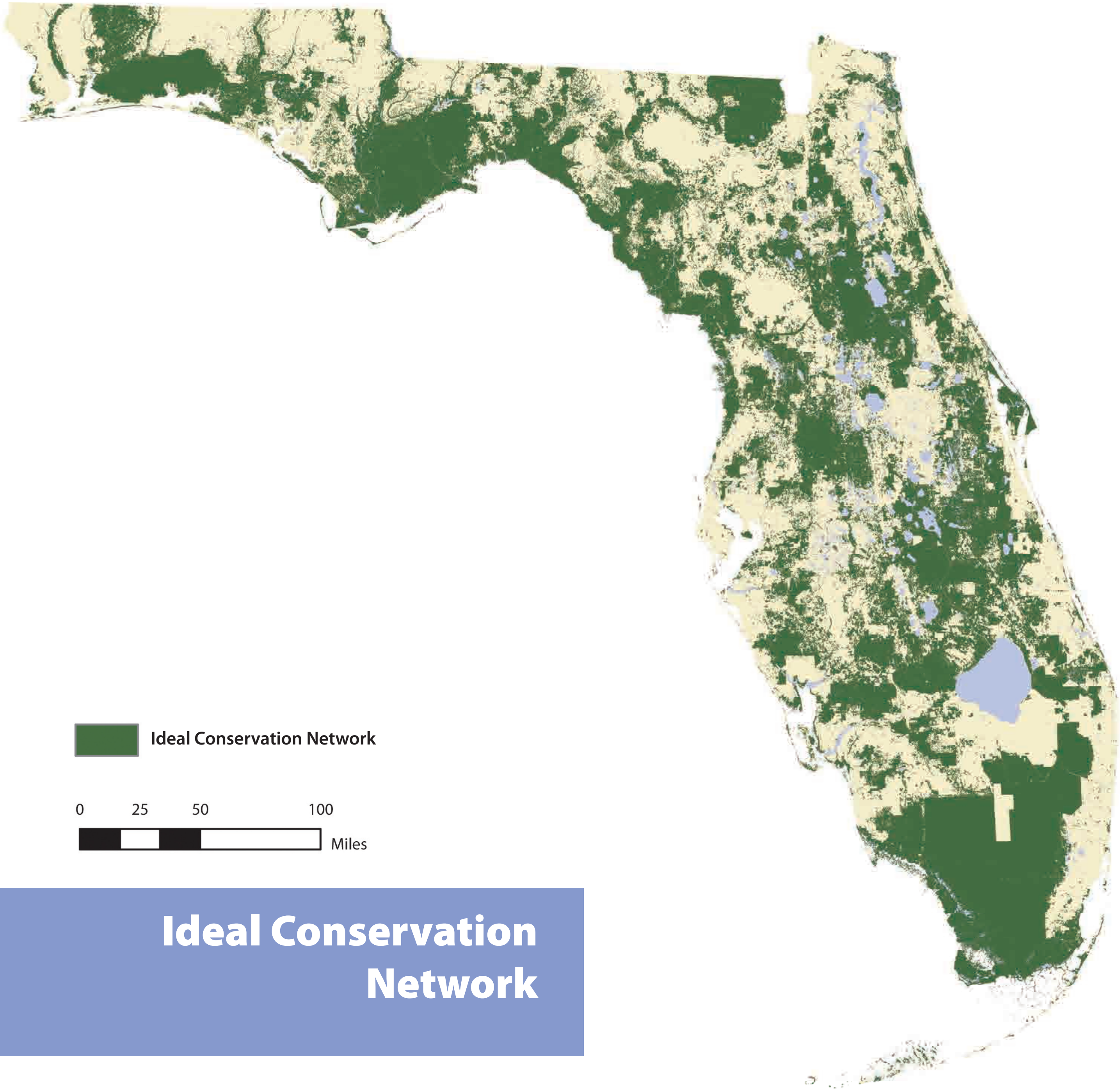
Each component ranking represents that specific factor's priority of conservation for every acre of Florida. By overlaying each acre's ranking, the studio found the mean priority for conservation on an acre-by-acre basis. This overall mean ranking represents the final input for our conservation decisions: the conservation agreement ranking. Essentially, the acres ranked closest to one are those that have the most immediate priority; those ranked closer to five have a lower conservation priority. The PennDesign team used this composite ranking to inform decisions about which lands to save in each of the three planning periods. Please see Appendix A entitled "Conservation" for details about this conservation land selection process.




# Conservation Agreement Ranking




# Existing Conservation Lands




# Ideal Conservation Network

# Principle 2: Invest in Balanced Transportation

**Florida should have a balanced statewide transportation system that includes high speed passenger rail, rail freight, commuter rail and light rail, as well as highways and airports.**

Areas that depend on the automobile as the dominant form of transportation tend to develop along low-density, sprawling highways or freeways, as the space necessary to move people in private cars is much larger than space needed to move people in buses or trains. As a largely highway-oriented state, Florida essentially developed in this scattered fashion. As Florida's population grows, the land needed to accommodate new residents will expand as well, threatening fragile ecosystems as well as adding to air pollution and related effects of global warming. Proposing a new direction for transportation in Florida involves creating a hierarchical, easily accessible transit system that provides residents with alternatives to automobile-oriented travel.

This system is based around a statewide high speed rail network. High speed rail moves large amounts of passengers at speeds greater than 120 mph while taking up much less space on the ground. Capacity of this mode is high. With 15 trains per hour and 800 passengers per train, 12,000 passengers can be carried per hour in either direction. By way of contrast, the Highway Capacity Manual gives a maximum capacity for a single lane of highway of 2,250 passenger cars per hour (without any trucks or RVs). Assuming an average vehicle occupancy of 1.57 people, a standard twin track railway has a capacity 3.3 times greater than a six-lane highway while requiring less than half the land. The fundamental difference between automobile and transit systems in relation to increased travelers is that with an automobile-oriented system, highway quality of service goes down as gridlock ensues, whereas transit quality of service goes up as trains run more frequently to accommodate increased ridership. As population increases, Florida will require higher-capacity modes of transportation to avoid congestion and escalating highway construction costs.

Stops on the high speed rail network are based around existing and projected future population centers. Since high speed rail navigates long distances quickly, it is an attractive alternative to short-haul plane flights. Stops in major metropolitan areas are placed near existing airports to enable easy transfers from rail to air travel. The rails themselves would run either on highway medians or on power line corridors. Many highways in Florida already have large medians capable of


accommodating rail modes. The advantages of using these power line easements for transportation include their linear form, proximity to population centers, and the opportunity to avoid costly land acquisitions.

While high speed rail provides connections between cities, this plan also proposes smaller transit systems to move residents within cities. These networks would consist of medium capacity modes such as light rail and, in some situations, regional rail. Following existing road corridors, these transit systems provide alternatives to car travel for daily commuting, shopping, and recreational activities. For each city on the high speed rail network, a transit network is also proposed to provide connections between the rail stop, downtowns, airports, and other places of interest, such as major shopping centers and stadiums.

Transit systems, which have greater capacity and permanence than bus travel, substantially reduce car trips and subsequently reduce congestion, pollution, and the need to expand road networks. Communities also have the opportunity to design themselves in a way that works with transit systems, creating places based on centers and walkability, rather than on automobile access and parking.

# Implementation of Principle 2


Research to date indicates that we cannot pave our way out of congestion. Increasing the number of lane miles only induces more traffic to use the improved roads, leaving older highways underused and decrepit. Each additional automobile on a highway reduces the quality of ride for every other vehicle on that highway. Conversely, transit vehicles with fixed routes and larger vehicles take the burden of passengers off of the highway system. Up to a point, additional passengers on a transit vehicle increase the quality of the ride. As transit agencies can allocate more vehicles to heavily traveled routes, more transit passengers always results in more frequent service in the long run.

In order to direct Florida's growth away from its natural and working landscapes, we recommend an immediate transition from a transportation policy dependent on roads to one based on roads and rails. Developing a network of light, commuter, and high speed rail throughout the state will take the pressure off of the existing highway network, reducing the need for additional highway corridors. Furthermore, the focus of development around transit will allow land conservation gains, which are impossible with a program of highway expansion.

## Phasing

Both the high speed rail as well as intracity transit systems will be phased to allow for construction timing and costs. The southern part of the high speed rail network is anticipated to be completed and operational by 2020, while the remaining northern section will be completed by 2040. Within the model, the effects of the high speed rail system on the southern section are shown in 2040, and the effects on the entire state are show in 2060.

In some cities, the smaller city systems are planned to be in place prior to completion of the high speed rail network. The alternative model takes into account some transit networks in the larger cities such as Miami, Tampa, Orlando, and Jacksonville in 2020, with the remaining cities' transit networks and more extensive networks present in 2040 and 2060.

## Staging Plan

### 2010

In order to affect population, land use and conservation changes due to occur in the trend by 2020, all current metro plans for light rail must be initiated by 2010.

### 2020

To connect major metropolitan centers and further focus development away from Florida's natural lands and aquifers, the studio recommends starting construction on the high-speed rail network to be completed by 2021. As some of the greatest growth is occurring in south Florida, we advocate a loop be completed between Miami, West Palm Beach, Orlando, Tampa, Sarasota and Naples. The Naples to Fort Lauderdale link should be completed in coordination with the improvements to Alligator Alley and occupy the same alignment as I-75. Light rail networks should be present or initiated in 22 of Florida's major cities, connecting downtowns, airports, and high speed rail stations along existing major corridors.

### 2040

By 2041, 26 metros in Florida should have full prescribed buildout of their light rail network, totaling nearly 900 miles of corridor. The high speed rail network should be completed to connect the entire state in a double loop, with possible connections to Mobile, Montgomery, Atlanta, and Savannah. We developed this part of the high speed rail network later to reflect the slower growth in the north of the state. The growth in north Florida is substantial by this stage, requiring the same redirection of transportation infrastructure as in the south.

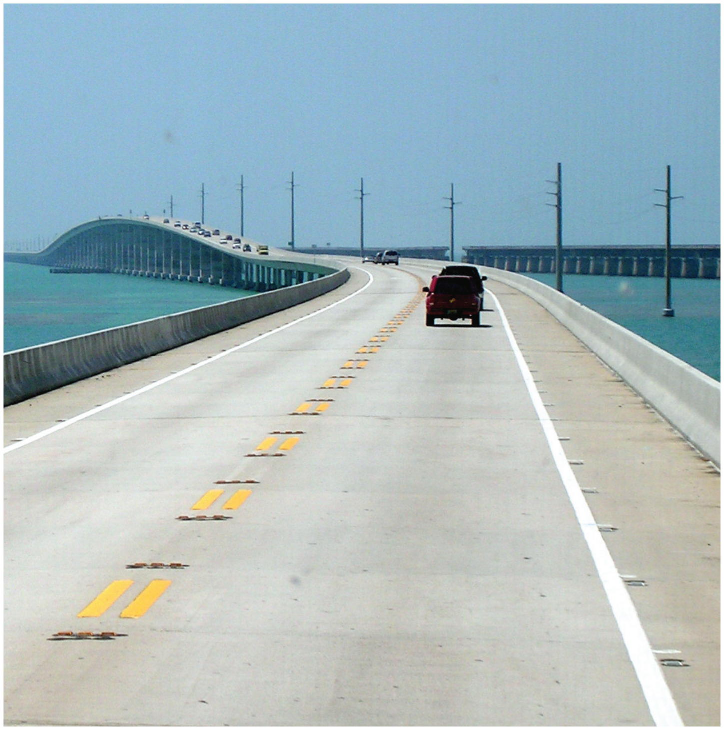
**(top) Miami, Florida**
**(bottom) Japan Rail Shinkansen**

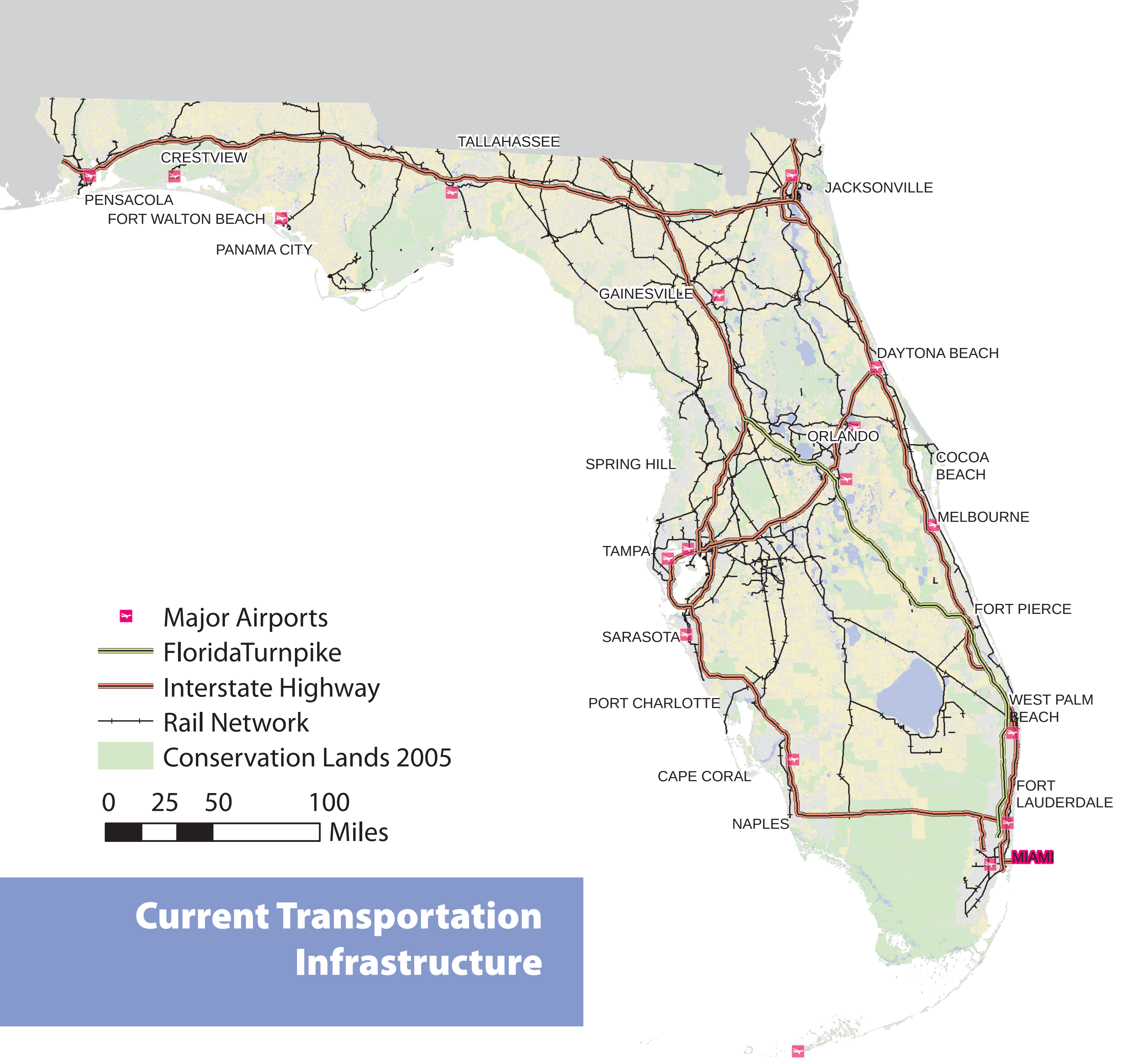
## Financing

The current annual budget of Florida's Department of Transportation (FDOT) is 8 billion dollars. This represents a baseline maintenance cost, with routine maintenance and incremental expansion of the highway facilities in place. If the state were to embark on a program of corridor expansion, it would incur several billion dollars per annum for additional capital improvements. Our proposal of a rail-based complement to highway improvements will offer greater urbanization benefits and allow the state to accomplish conservation goals while accommodating explosive population growth. By leaving more of Florida's land as agricultural or preservation land, the state can save money otherwise spent on development of infrastructure and protecting freshwater resources.

Based on correspondence with those involved with domestic high speed rail projects[1], the studio assumed that the cost of the high speed rail network will sum to 30 million dollars per mile. This incorporates right of way acquisition, track, engineering, roiling stock, control systems, and station facilities, even though these are not all financed on a per mile basis. We have chosen the high speed rail routes along powerline corridors, abandoned rail rights of way, and freeway medians to minimize the cost and difficulty of acquiring right of way.

Costs for developing light rail networks vary more widely but range between 10 million and 50 million, with an average of 30 million per mile[2]. Because many of the cost overruns result from the need to traverse hilly terrain, we propose an average light rail capital cost of 20 million per mile. Because of the simpler needs for right of way, less frequent stations and simpler rolling stock, we budgeted 15 million dollars per mile for all regional rail.

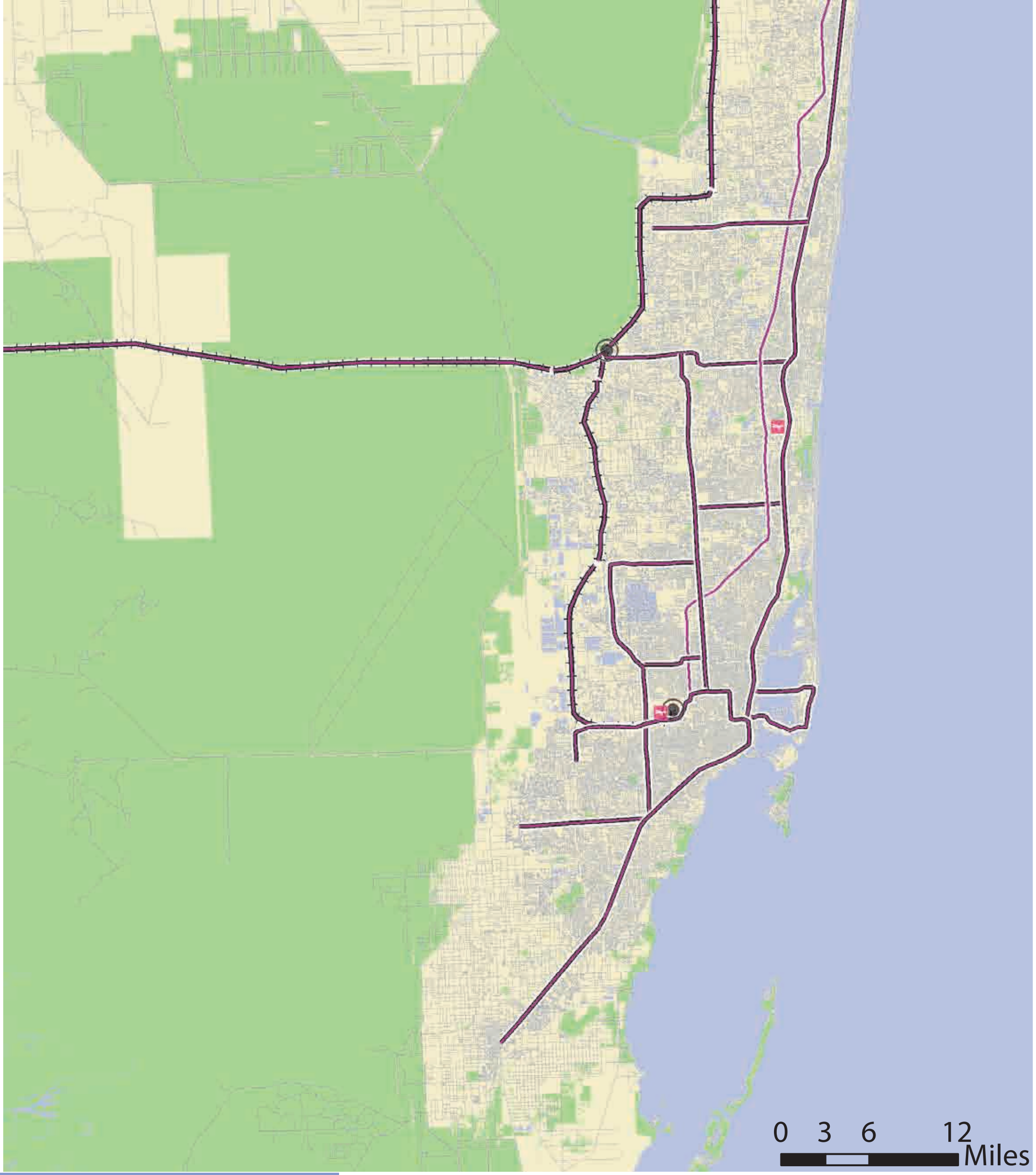




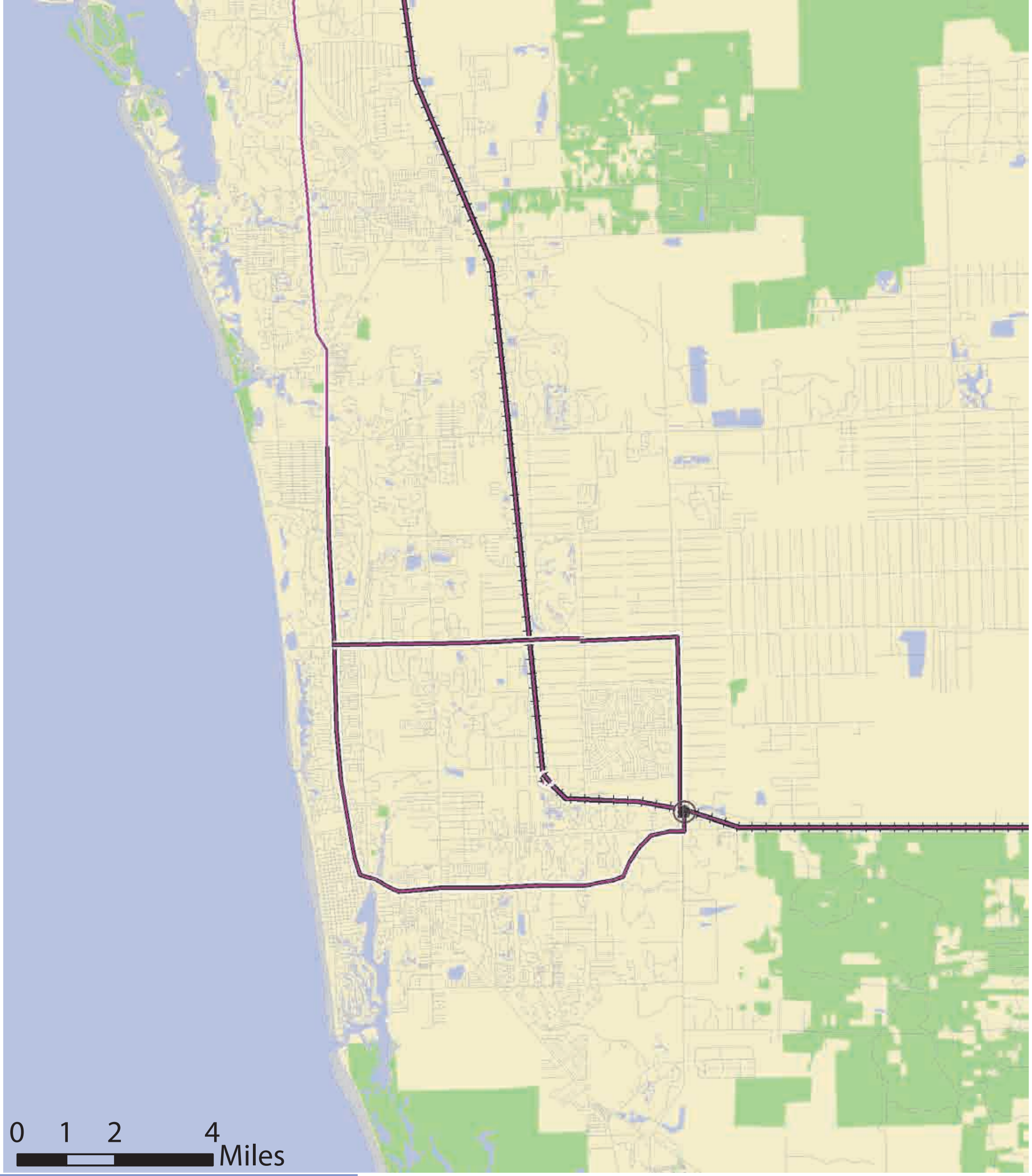

# Current Transportation Infrastructure


# Proposed Statewide High Speed Rail

These maps show conceptual local transit networks developed during the studio workshop in Orlando. Systems such as these were designed for each community with a high speed rail stop and planned based on feasible alignments, such as commercial corridors and access to downtowns and airports. While these maps represent possible local transit networks developed with local knowledge, they are not intended to be definitive.



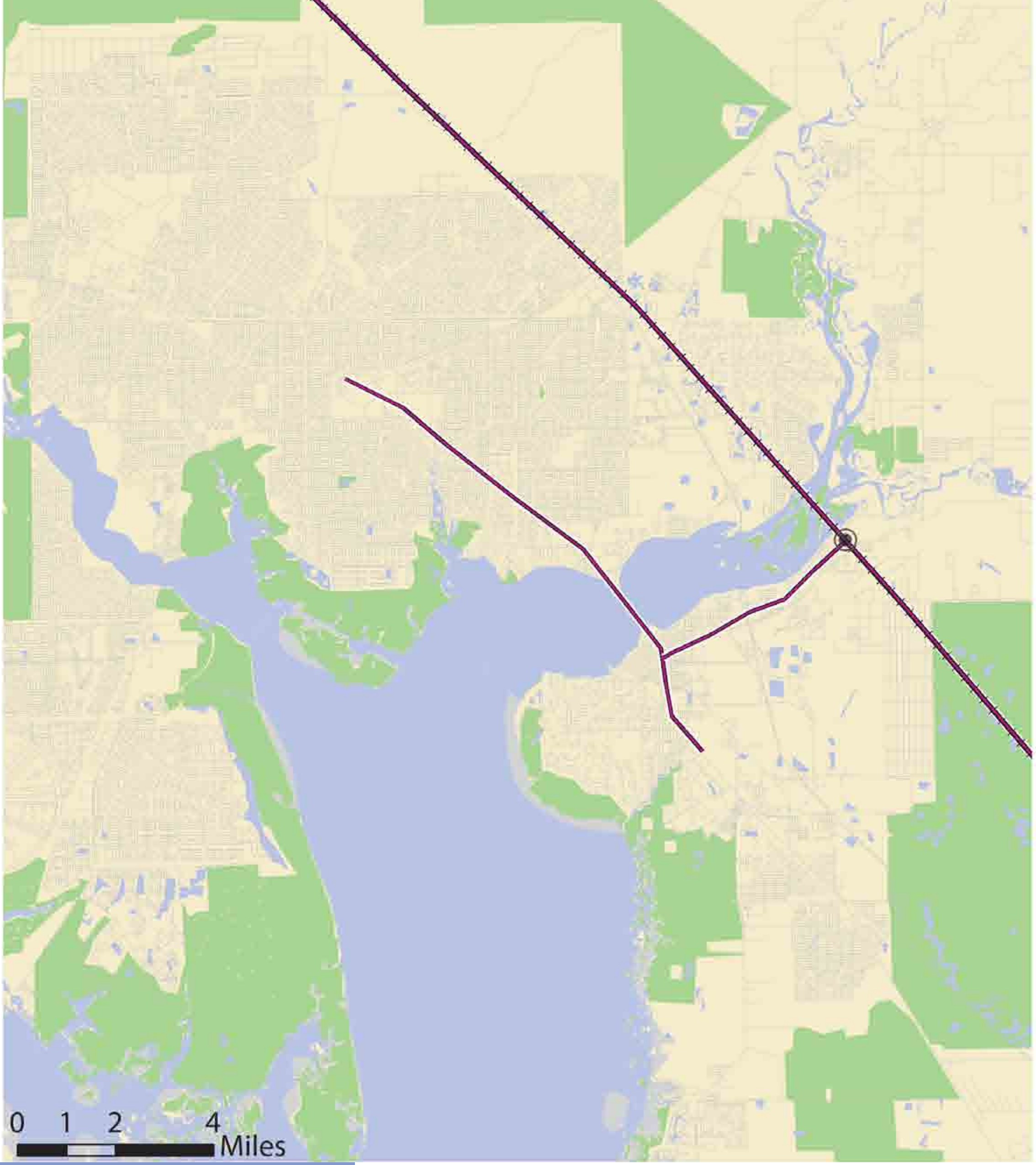

## Local Transit
## Miami - Fort Lauderdale




# Local Transit
# Naples

Light Rail Transit
Commuter Rail
High Speed Rail / Station
Major Airports
Roadways
Conservation Lands 2005


# Local Transit
# Pensacola

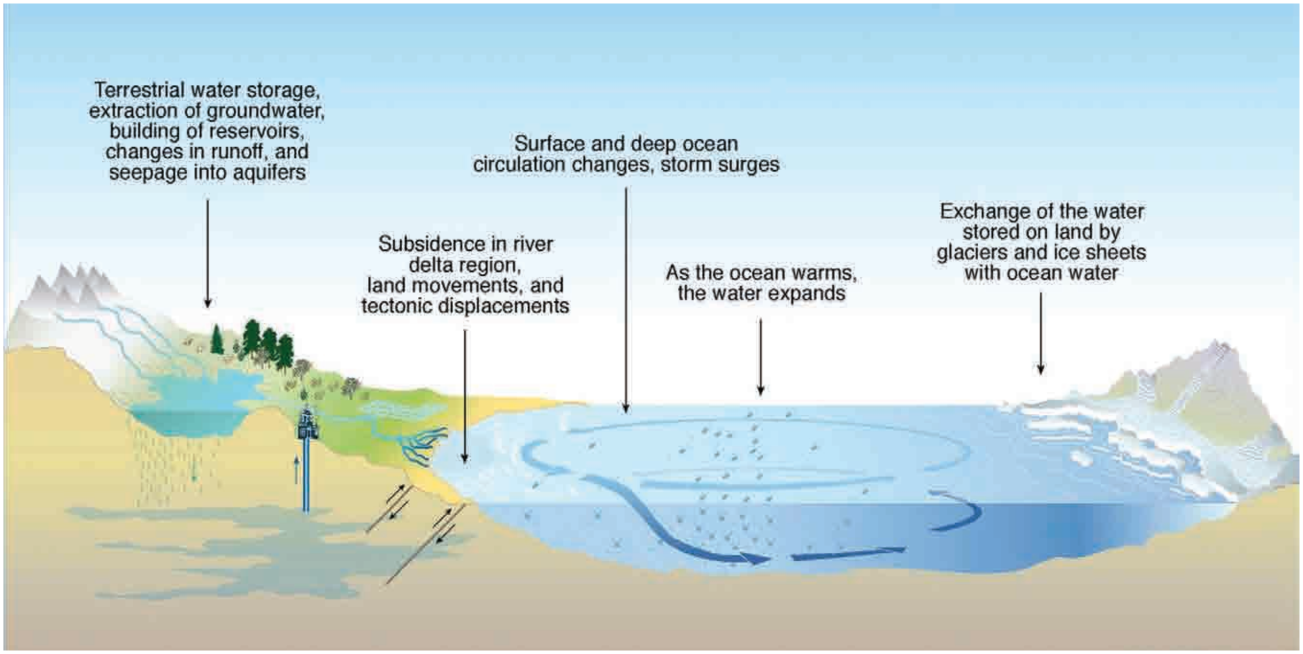



# Local Transit Punta Gorda

# Principle 3: Plan for Climate Change

**Areas subject to increased flood surges as a result of predictable climate change should be identified and appropriately protected – or not approved as locations for new development**

Climate change is the greatest example of anthropogenic alteration of environmental conditions. The scientific implications of climate change include effects on temperature, precipitation, snow cover and glaciations, sea level, and extreme weather events. Each of these elements will undoubtedly affect social, economic, environmental, and political aspects of communities across the world, especially in areas located near coastal waters. It is therefore timely for the citizens of Florida to acknowledge climate change and all its potential impacts to prepare properly for their consequences.

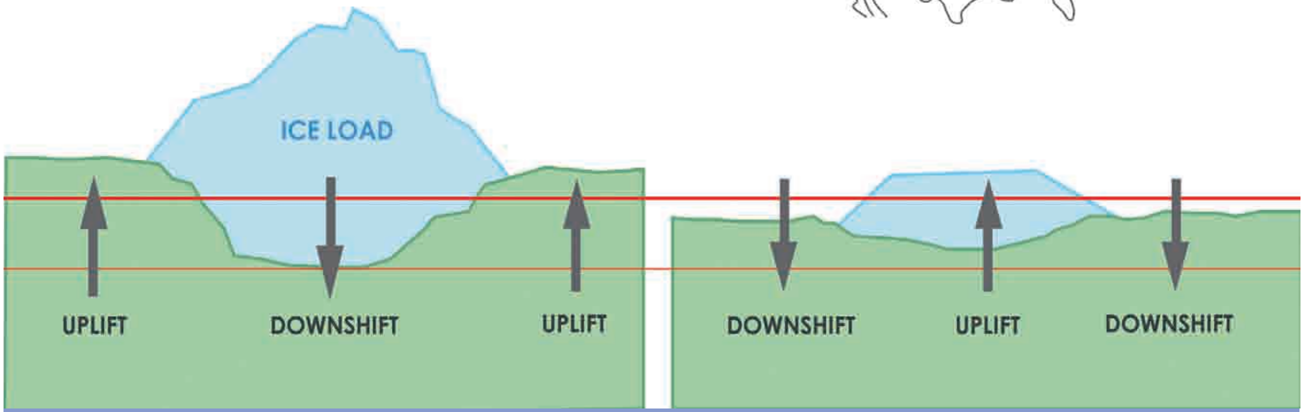



## Temperature

Humans began to significantly affect climate during the Industrial Revolution. Since that time, factors including the increase of CO2 emissions, rapid deforestation, and land use patterns have contributed to the rise in global temperatures. Within the last century, the earth's temperature has risen one degree Fahrenheit.[3] Although this number may not seem significant, the effects associated with this alteration are substantial, resulting in sea level change and the shifting of species habitats and migration, which can greatly influence natural processes.

## Sea Level

In its most basic definition, sea level is a product of the earth's climate and is the point where the ocean meets the land. Sea level rise may effect one coastline and not another. Geographic location, ocean cycles, wind and wave patterns, and salinity have regional affects on the thermal expansion of the ocean and consequently the relative sea level change in a region. Additional anthropogenic factors that contribute to the rise in sea level include the exaction of groundwater, construction of reservoirs, runoff patterns, and the melting of glaciers.[4] With sea level rise, the devastation of water inundation from storm surge is magnified by tropical storms and hurricanes that commonly occur in Florida.




## Land Subsidence

A less well know natural process is land subsidence.  As ice sheets melt, the land masses below the ice sheets experience crustal rebound as the land rises vertically to maintain equilibrium. Equilibrium is compromised because glaciers put pressure and weight on the land.  In short, any  pressure added to one area of the earth must be compensated by a reduction in pressure in another part. During the last glacial period, Florida was subject to a vertical uplift in land. Now, as ice sheets are dissipating, the state is experiencing a downshift in land mass to sustain equilibrium.  As a result, the Florida Keys and areas near the state's coastal zones are at a greater risk of water submersion and flooding in the future.


ROOM FOR RENT
CHEAP


# Statewide Sea Level Rise 2060


Extreme coastal hazard areas are coastal lands that are more likely than other lands to experience inundation during severe weather. See Appendix C for details.

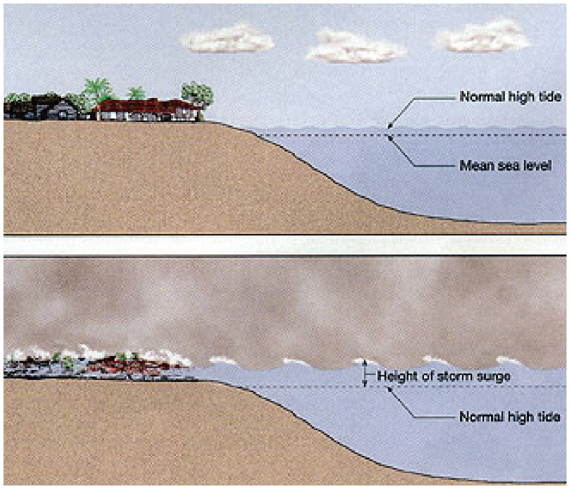
# Extreme Coastal Hazard Areas 2060

# Implementation of Principle 3

## Building Requirements

Florida statewide building codes were first established in the 1970s but were later amended in the 1990s after a series of catastrophic natural events. As a result of Hurricane Andrew and other particularly destructive storms, the Florida Building Code, mandated in 2002, required that buildings in Florida wind zones be designed to withstand certain wind pressures. Florida is the first state in the nation to create building codes that address extreme wind conditions that occur during tropical storms in coastal regions.[5]

For the safety of residents and condition of building structures, reinforcing these codes is crucial if development continues to occur near hazardous, hurricane-prone areas.




## New Flood Zones

The rise in sea level coupled with more frequent and intense storms will potentially result in storm surges that will cause more flooding and damage in areas along Florida's coastline. Hurricane winds can be as high as 200 mph,[6] causing the oceans to rise into a surge that travels inland. Storm surges are the most deadly aspect of hurricanes, claiming nine out of ten lives lost in hurricane events.[7] With the increase in sea level, it is important to evaluate the impact that sea level rise will have on storm surge flood inundation. These events highlight the need to create new flood zones for Florida where the amount of suitable land for development will be reduced in order to protect public safety.

## Sea Walls

If sea level rises over the next sixty years, developed areas along the coast must be protected from storm impacts. Many of Florida's major cities are located along the coast, including Miami, Jacksonville, and Tampa. These areas are important to preserve because of their role as economic centers of the state. Seawalls are a viable option for the state to protect these vulnerable regions. They would help reduce the effects of strong waves created from tropical storms and other such natural events and minimize the effects of land erosion.[8] Funding will most likely come from public and/or private sources depending on the property, and seawall costs can range considerably depending on the site.

# Principle 4: Don't Waste Land

**Increase density of some new development to achieve a regional gross average density that is at least equal to the state's average**

**Promote infill development**

**Link building in rural areas to conservation**

## Density Management

The most important aspect of land conservation is density management and the allocation of land in order to preserve Florida's future landscape. To inspire the most appropriate land conservation strategy and to provide incentives encouraging increased density in the state, it is crucial to establish basic parameters for determining where new growth should occur.

Florida will be sustainable if some of the new development occurs at or greater than the state's average gross density of three people per acre. This does not require that all new development occurs at the state average density but that a portion of development is at a higher density to allow for choice in housing.

Several benefits are realized from this increase in new development. These include lower costs and increased efficiency of municipal services, healthier communities, less suburban sprawl, less overall pollution, and better waste management.

## Infill Development

The importance of a sound infill development strategy will have a profound effect on Florida's landscape in the future. This infill strategy should include both existing undervalued, distressed, or underutilized areas in urban and suburban locations. Most of these areas have existing infrastructure and services, thus making them ideal locations for new development. Certainly one of the biggest challenges will be promoting the benefits to developers.

While developing in areas with infill potential, it is important to recognize the possibility to revitalize not only the redevelopment area itself but also the surrounding areas. Infill development can create new districts that inspire connections between communities with paths, nodes, landmarks, and public spaces across neighborhoods. Regulating aesthetics will also play a major role in the development of urban regions. New construction can harmonize urban landscapes and unify neighborhoods.

## Link Building in Rural Areas to Conservation

One strategy to acquire additional conservation areas without a dramatic increase in the need for public funds is to link building in future areas to conservation. This can be done through a transfer of development rights (TDR) program that would require developers to purchase easements on a certain number of acres in a "sending area" for each acre developed in a "receiving area." The easements in the "sending area" protect the land from development. For example, statewide law could mandate that for every acre developed, the developer would be required to purchase development rights in four acres of proposed conservation lands located in the "sending area". This strategy would require a fairly sophisticated TDR program on either a regional or statewide basis. However, a TDR program could save a significant amount of taxpayer money while still allowing developers to profit from the construction of new homes.

# Implementation of Principle 4

## Transfer of Development Rights

TDR programs provide a mechanism for transferring increased development density to lands that are most appropriate for development.

Essentially, development rights are transferred from a sending area (generally areas targeted for conservation) to a receiving area where higher density is desired. Property owners in a sending area sell their development rights, allocating their land as permanently designated for lower-intensity development. Property owners in receiving areas purchase the development rights in order to develop their land more intensely.

For example, the right to build ten building units might be sold by a rural farm owner to a developer who is planning to build condos near a transit stop.

### Definitions for This Project

*Infill Development*

Newly developed acres that are between currently developed acres

*Redevelopment*

Acres urbanized as of 2005 that are rebuilt at higher densities along transit corridors

# Development Regulations

## Density

In order to affect how population is distributed in the trend model, building typologies must change from the existing sprawling typologies to ‘anti-sprawling’ typologies. By using general development regulations, the scenario may be possible to counteract the current unsustainable sprawling development trend as seen in the trend and to provide a high quality of life in Florida through compact, mixed-use development. In addition to using existing higher density residential typologies to accommodate additional housing in areas near proposed transit systems, we also propose utilizing new and alternative typologies such as lifestyle centers to create an environment that will maintain the quality of life Floridians enjoy today.

## Mixed Use Development

By modifying zoning ordinances to include mixed-use districts or buildings, cities will be able to accommodate more residents in places that will produce more compact and walkable environments. Mixed-use developments combine retail, office, and residential uses in towers, integrated multi-tower structures, or town centers/urban villages/districts.[9]

By using these typologies, it is possible to accommodate Florida’s growth and minimize the extraneous use of land and sprawl. Mixed-use structures are already frequently being constructed throughout the state, and Florida simply needs to continue in a similar manner by modifying existing zoning ordinances to allow for a development that will maintain a high quality of life.

**Towers:** Uses are layered vertically and include retail, office, hotel, and residential often in a single identifiable structure that helps market the development.[8]

**Integrated Multitower Structures:** Includes individual buildings and towers that are connected through atriums, paths, shopping areas, or through parking structures. Individual towers/structures typically rise from a podium or platform that contains parking, service areas, and retail space.[9]

## Lifestyle Centers

Communities should encourage the incorporation of lifestyle centers as a preferred substitute to the existing sprawling suburban shopping malls. A Lifestyle Center, according to the International Council of Shopping Centers (ICSC), is a shopping center that incorporates retail, cultural/entertainment, office, and residential uses in an open air configuration. Sizes of Lifestyle Centers typically range from 150,000 square feet to 500,000 square feet in leaseable retail area. This typology can be used to attract more compact and walkable development in urban areas by aiming to recreate the traditional town center or main street.[10] Furthermore, in order to minimize the amount of land used for parking, parking lots are typically obscured in structures or underground.[11]

## Mizner Park, Boca Raton, Florida

Mizner Park is a lifestyle center on a two block long main street with retail space and a linear park. The project has created an "instant downtown" in Boca Raton.

Retail Space: 235,000 SF
Office Space: 103,000 SF
Apartments: 272 units

Center for the Arts
Museum of Art
Amphitheater
Movie Theater

## Redevelopment

In addition to having development constructed according to new requirements and standards, it is important to consider how existing urbanized areas with new transit systems can be redeveloped. The added convenience of having transit systems will likely attract more people to areas around stops. Therefore, it is necessary to redevelop areas in a more compact way that incorporates housing and a variety of uses, creating an active environment used 24/7. While there is no single type of building typology that meets the needs of all environs with redevelopment, these neighborhoods in transit corridors will develop into areas with more residents and a mix of uses and building typologies that will continue to maintain a high quality of life for its residents.

**Mixed-Use Town Centers, Lifestyle Centers, Urban Villages, and Districts:** Involves stacking of uses (for example, residential or office over retail) in low- or mid-rise buildings and often includes a variety of individual buildings arranged along streets and around public squares or other open spaces.

## Parking Management

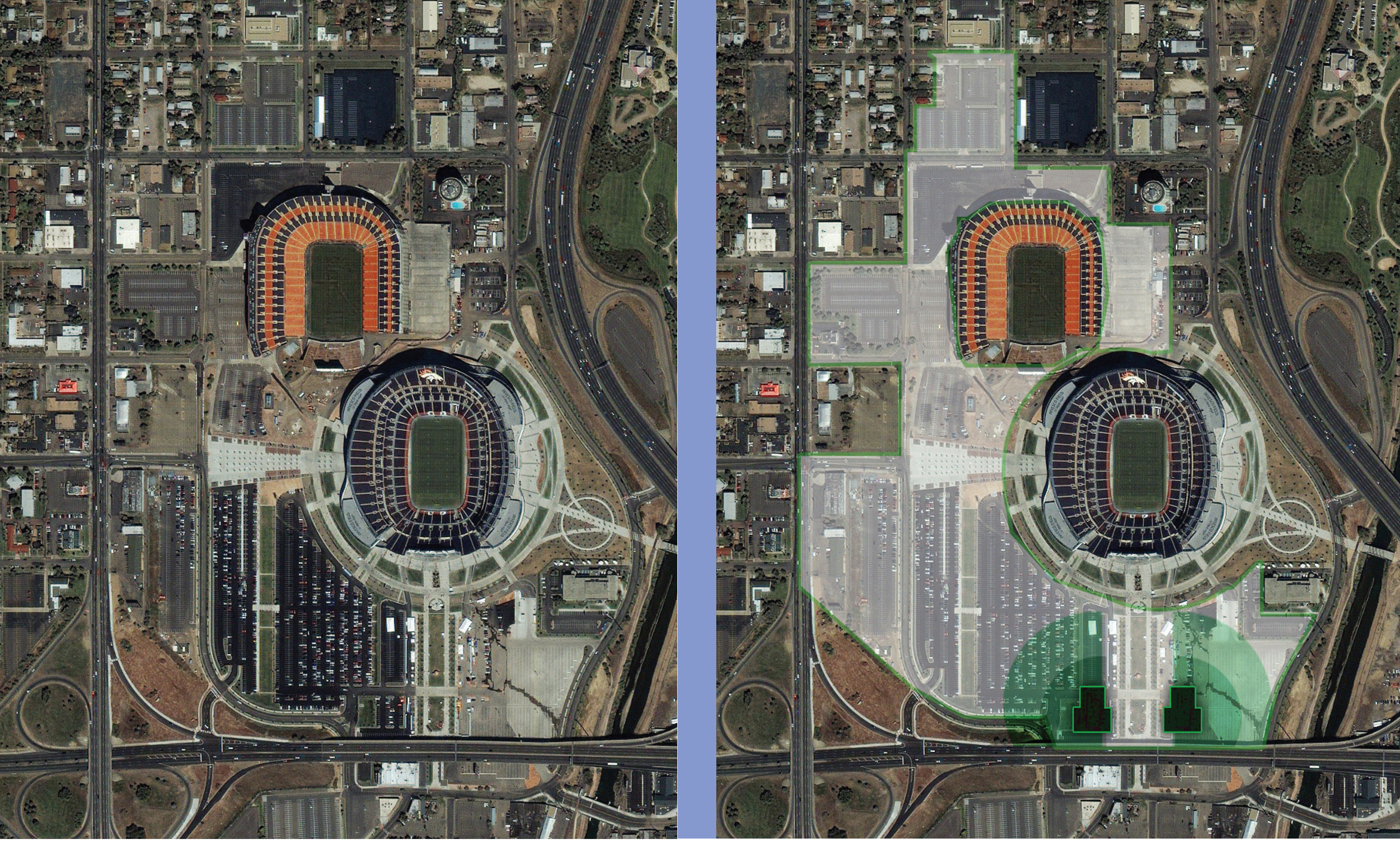
In order to manage growth throughout the state, especially in suburban areas, it is important to incorporate innovative shared parking management techniques to decrease land consumption. Many existing building types, such as stadiums, office parks, and large churches often have large underused or unused parking lots that consume large areas of land for parking that is only used part of the time during the week. However, through smarter development, these parcels can be more efficiently used if they are developed more intensely and in doing so will create walkable vibrant places.

A number of land uses have varying demand peaks that would be compatible for sharing parking spaces, such as combining offices, whose peak is during the daytime Monday through Friday, with entertainment, whose peak is in the evening and weekends. By combining uses that have different parking demand peaks, it is possible to reduce the amount of parking and land used by as much as 10 to 50 percent.[11] While there is no general rule towards how to account for shared parking, each new development should consider how to optimize parking management. Shared parking management techniques should be incorporated in the development of mixed-use developments and ordinances.

| WEEKDAY PEAKS | EVENING PEAKS | WEEKEND PEAKS |
|---|---|---|
| Offices | Auditoriums | Religious institutions |
| Banks | Restaurants | Parks |
| Schools | Theaters | Shops and malls |
| Distribution facilities | Bars and clubs | |
| Factories | Meeting halls | |
| Medical clinics | | |
| Professional services | | |

*Parking Maximum*

Rather than establishing parking space minimums in zoning ordinances, it is recommended that Florida adopt parking maximums. While parking minimums are typically established to meet the maximum space demand of the associated use and to cater to an auto-dependent community, this allotment tends to produce an oversupply of parking except during peaks, consuming large parcels of underused land. By incorporating maximums—and thus limiting the consumption of land for parking and allowing it to be developed more intensely with a mix of uses with varying demand peaks—mobility, quality of life, and the environment will be improved and congestion will be reduced, fostering the development of more compact pedestrian friendly environments.[12] In addition, incorporating parking maximums will allow people to consider alternative modes of transportation.



**By adding office structures to stadium parking lots, the large surface lots that are often used less than once a week for events will be used daily for office purposes and thus reduce the total demand for parking spaces and land.**

# Principle 5: Design With Nature

## New development should be designed to protect and restore natural systems whenever possible

The health and quality of life of Floridians are contingent upon understanding nature and its complex processes.[13] Urbanization alters natural systems in many ways: by increasing impervious surface, reducing water quality and supply, and modifying landforms and vegetative growth. The principle of design with nature is premised by the idea that new development should be designed to protect and restore natural systems whenever possible. Accounting for topography, slope, soils, and water tables, taking advantage of solar access through building orientation, using stormwater best management practices (BMPs), and minimizing impervious surfaces are ways to maintain and repair natural systems. The following suggestions should be considered as methods to balance development with the environment.

## Natural Features: Slopes, Soils, and Water

Steep terrain is not ideal for development due hazards such as landslides, erosion, velocity of runoff, and groundwater contamination. Although there are few steep slopes in the state of Florida, this is still something that needs to be considered. Therefore, contours and the pattern of landforms, such as slopes, circulation possibilities, access points, barriers, and visibility, should be assessed[14]. Developments should be properly graded to channel water away from structures.[15] Slopes exceeding 10 percent are considered too steep for development.

Ideal soils for development are well-graded, well-compacted gravels and sands with a high weight bearing capacity. The official state soil of Florida is Myakka, a fine sand typical of flatwoods soil. [16] However, this soil type, the most extensive in the state, has a low to medium bearing capacity of one and a half to three tons per square feet [17] and is poor to fair as a base course for a road. Soil type and condition influence development in many important ways, such as choosing suitable plant types, cleaning up contaminated soils, and pricing the amount for laying foundations.

An important subsurface variable is the location of the water table, affecting the presence or absence of water and the moisture content of the soil.[18] Fluctuations of the water table and flow direction have implications for water supply, vegetation growth, and soil composition. A high water table will cause basement flooding, unstable foundations, and added costs for development. [19]

## Orientation

Proper solar orientation and attention to wind direction and microclimate can measurably decrease the energy requirements of a dwelling.[20] Lots facing north or south receive much less heat gain from the sun.[21] Residential units can be oriented to take advantage of prevailing breezes from lakes, the ocean, or other geographical features. Proper landscaping can also mitigate seasonal climate effects.

### Stormwater Management

Swales and rain gardens are vegetated infiltration systems. They are broad, shallow channels that contain native plantings and vegetation designed to trap particulate pollutants, promote infiltration, and reduce the flow velocity of stormwater runoff.[22]

Water is captured and slowly filtered into the ground rather than it going directly into storm sewers, reducing non-point source pollution and controlling water

quality.[23] Swales and rain gardens are typically found along roadways or between residential lots. They are a vital part of surface water management systems of any development and should be treated as an integral part of stormwater management best practices. [24]

Microclimate elements such as light, temperature, and wind in addition to the size of the drainage area will influence the total size of the system and the plant selection process.[25] Retention ponds and constructed wetlands can be extremely effective BMPs to remove pollutants from storm water and improve water quality while providing aesthetic value and habitat for a variety of plants and animals.[26] Constructed ponds and wetlands are more difficult to operate because pre-treatment of runoff is required along with considerations of supportable habitat.

### Impervious surface

Increased impervious surfaces change natural drainage patterns and can negatively affect the quantity and quality of water in addition to causing other detrimental impacts to nearby land and water bodies. Impervious surfaces reduce the area of land available for infiltration and alter natural hydrologic patterns. Additionally, construction of impervious surfaces reduces the area of land that can support forest or other types of vegetation, reducing natural wildlife habitat. The removal of vegetation impacts stormwater management because trees and grasses trap silt and sediment, stabilizing areas susceptible to erosion and reducing surface runoff.

There are several ways to reduce the amount of impervious surface, including:

- Allow reduced residential street widths;
- Reduce parking requirements and encourage cooperative or shared parking arrangements;
- Encourage use of alternative pervious paving materials for sidewalks, parking lots, and roads;
- Encourage green roofs and green parking lots;
- Encourage cluster development and allow taller buildings;
- Avoid clear-cutting lots;
- Preserve existing vegetation and plant more vegetation to absorb extra runoff;
- Plant native species that require less maintenance and water than non-natives;
- Encourage infill development in existing built areas. [27]

Several of these recommendations overlap with the other principles to guide the implementation of the alternative to the trend. Integration of these principles is necessary to ensure a comprehensive approach to creating a sustainable alternative vision for the state.

# Implementation of Principle 5

## Environmental Preservation Within Development

The principles necessary to consider nature in developments must be included in the county's general and/or comprehensive plan. Regulations to ensure that the principles are carried out may take many forms. Euclidian zoning, performance based zoning, subdivision ordinances, and design guidelines are regulations that are used most often.[28] These documents should include requirements or suggestions for developing slopes, soil, building orientation, and impervious surfaces.

Components of zoning ordinances that relate to designing in an ecologically sensitive manner can include minimum standards for open space, height, lot coverage, and landscape requirements such as buffers. Subdivision ordinances can specify storm water runoff limits, open space, vegetation, lot configuration, and easement requirements that follow the design with nature principles. When there is a nexus between the comprehensive plan and a project's impact on the environment, exactions from the developer (a concession such as land donations or impact fees) can help alleviate adverse impacts.[29]

Sections of ordinances can become their own document to enhance their importance and applicability of implementation. Stormwater management ordinances can require porous pavement, vegetation swales, and limited construction on wetlands. Erosion and sediment control ordinances limit disruption of natural systems from development. Solar access ordinances ensure that new buildings do not block solar exposure to neighboring buildings.[30] This is especially important when buildings have solar panels.

Design guidelines are another method to implement the design with nature principle. The guidelines may cover orientation, lot coverage, landscaping, paving and impervious surface coverage, green roofs, and green parking lots. Landscaping guidelines may specify size, spacing, species of plants, and percentage of existing trees that must be preserved.[31] Results from a visual preference surveys in conjunction with environmental considerations are the basis for design guidelines. Design review boards can evaluate projects on a case-by-case basis to account for unexpected discrepancies with the guidelines.[32]

Performance based zoning emphasizes the impact of a development instead of the traditional emphasis on use. It is difficult to implement performance based zoning when the effects of a development cannot be determined until the development is operational.[33] However, the benefit of this type of zoning is that environmental impacts are of primary importance. Plantings and impervious surfaces can be regulated by requiring that certain areas

be landscaped, trees over a certain size cannot be cut down, and new trees be planted at a specified density. Regulations can also be imposed on stripping topsoil, building on wetlands, and displacement of soil, which affects drainage and groundwater. The costs of the regulations to preserve the environment should not be excessive because these expenses are often passed down to renters or buyers.[34]

Form-based codes are the final implementation mechanism. These codes focus on building type and relationships between buildings, mass, parking location, dimensions, and façade detail.[35] This code may be a more enforceable design guideline that can include the elements to reduce a development's impact on the environment.

# Principle 6: Encourage Compact Development

**All Florida development regulations should make compact, walkable, mixed-use communities a permitted alternative in appropriate locations**

**Provide incentives for this alternative**

**In transit corridors, communities should zone for higher density for a quarter of a mile from the line on both sides of the transit route**

**Transit nodes, where two lines meet, or at a high-speed rail station, should be zoned for higher density within a quarter mile radius of the crossing or station**

In order to make transit villages successful, Florida should work to encourage three main principles: density, diversity, and design. In regard to transit villages, density translates into having enough residents and workers within a reasonable walking distance of transit stations to generate ridership that is high enough for the public transit system and transit village to be sustainable. Transit villages must also be diverse. They should be comprised of different land uses, a mixture of housing types, and a variety of ways for residents and workers to circulate within the village. In the design of transit villages, attention must be paid to the physical features of the site and the way in which it is planned, ensuring that the layout is conducive to walking and biking in addition to transit ridership.[36]

First and foremost, transit villages must form dense, mixed use developments around their stations to make the station a destination for commuter and destination traffic. For a neighborhood to be rail supportive, it must have at least 36 residents to the acre[37] and 25 full times jobs to the acre.[38] Employment density is more important than residential density for a transit village, as it attracts commuters during high service peaks. Because of transit access and density, parking needs for a transit village will be lower than a suburban office park or neighborhoods. Typical Floor Area Ratios (FAR) for suburban areas are below 0.3, while the transit village should support FAR of 1 or more. Nearest the station, FAR and employment density should exceed 50 jobs per acre, 60 residents per acre, and FAR 3. The ideal form of a transit village is a "wedding cake", with the tallest buildings atop the transit entrance, and declining down to townhomes and single-family homes within a half-mile of the station.

Transit villages should also be diverse, incorporating a number of building types and uses to encourage walkability and add variety to the pedestrian experience. Mixed-use developments, such as ground floor retail with apartments or office buildings above, also increase walkability, as people no longer are forced to drive for each individual errand. To increase community services, a diversity of career opportunities, tenures and prices should be offered within the transit village.

There are a number of ways to use urban design to improve the quality of the pedestrian experience and subsequently the use of walking and public transit for mobility. These urban design elements include broad sidewalks, bulbouts, street trees in tree lawns, small to no setbacks for buildings, entrances on the street, street facing windows/entrances for retail, on-sidewalk seating for clubs, restaurants, and cafes, and parking skinned by retail, residential and commercial uses. Design is also vital to humanizing the scale of the transit village, with articulated buildings, pocket parks, plazas, and fingers of riparian forest through the heart of the transit village.

# Implementation of Principle 6

## Zoning Increases Along Transit

In order to create a visual and spatial representation of the effects of increasing residential densities in areas served by transit, it was necessary to input maximum gross residential densities for all the different transit conditions proposed for the state into the alternative GIS model. These densities were determined by what percentage of the area around a transit corridor or node would most likely develop as residential uses and then determining net residential densities and corresponding residential or mixed-use building typologies that would allow for the proposed maximum gross densities. The maximum allowable gross densities were determined by grouping all of the cities that would gain transit into three categories: small, medium, and large. The transit conditions were categorized as corridors or "nodes" (transit intersections) for each of the proposed transit modes: light rail, high speed rail, and commuter rail.

Ft. Lauderdale and Orlando are two examples of "large" cities. Examples of "medium" cities are Sarasota and Gainesville. Crestview and Ocala are two of the "small" cities. In selecting net densities and representative building typologies, the studio was careful to focus on building types already used in Florida and building programs that would promote desirable living and working spaces that would be consistent with the Floridian pattern of intense urban development in each size city. The net densities were determined by calculating what percentage of the land in each acre would be devoted exclusively to the residential development and subtracting out all roads, retail, and office uses. In the nodes, it was assumed that there would be a higher percentage of retail and office use than along the corridors. It was important to calculate net densities in order to assess whether the assigned densities related to building typologies that would be feasible and desirable at each proposed location. Both the gross and net densities were calculated in dwelling units per acre (dua) and then converted into people per acre (ppa).[39]

## Density Inputs along Transit Corridors, dwelling units per acre-dua

| City Size | GROSS Light Rail Corridor | NET Light Rail Corridor | GROSS Communter Rail Corridor | NET Commuter Rail Corridor |
|---|---|---|---|---|
| **Large** | 36 dua | 60 dua | 6 dua | 10 dua |
| **Medium** | 15 dua | 25 dua | 4 dua | 7 dua |
| **Small** | 9 dua | 15 dua | – | – |

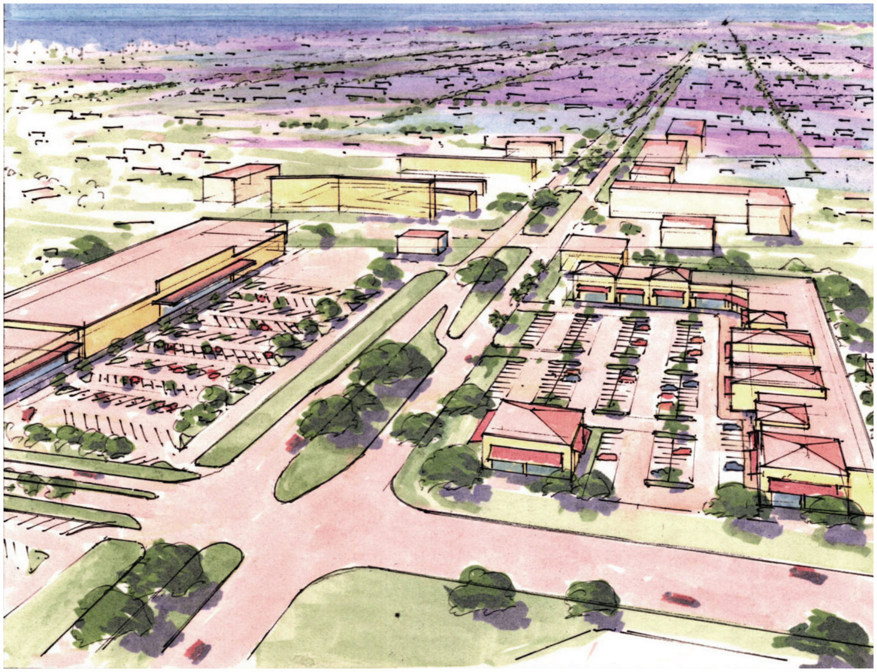
* These numbers represent the maximum allowable densities in the 1/4 mile area around each transit corridor


For the purposes of the model, a one quarter of a mile buffer around each corridor was assigned a maximum gross residential density in people per acre determined by the city size and transit condition of commuter or light rail. Densities around high speed rail corridors were not increased. A secondary zone, one quarter of a mile beyond the first buffer, was assumed to be at a density half that of the inner buffer. A zone of a half-mile radius around all nodes was assigned a specific maximum residential density with a secondary zone a quarter of a mile beyond this half-mile radius that is assumed at half the given density. The densities were determined by considering what type and size of development and redevelopment would most likely occur. For example, the residential densities around high-speed rail stops are relatively low because these areas will most likely develop as business centers. The highest projected density increases are at the intersections of two light rail lines since these will offer intercity conditions very favorable for residential development.

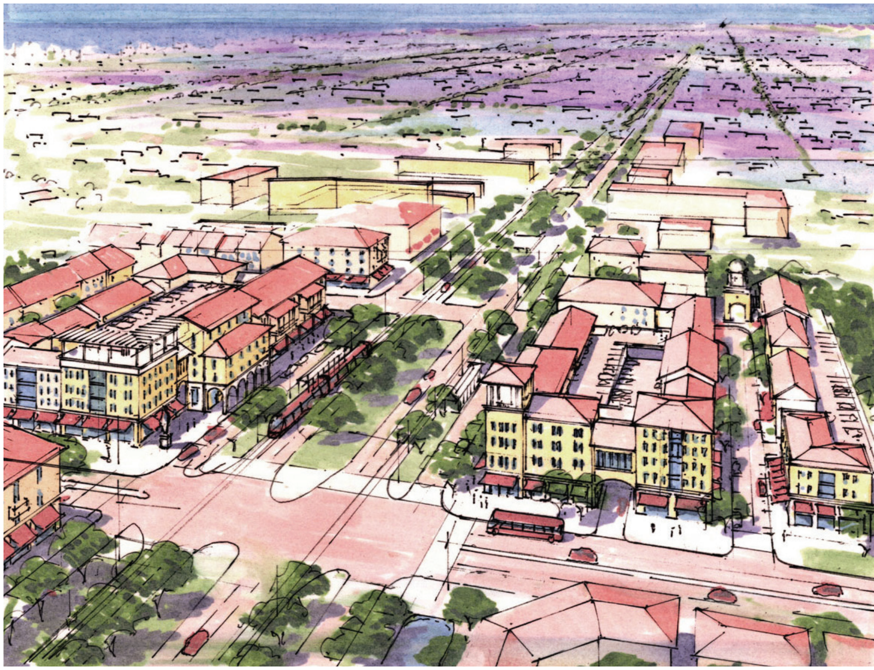
## Density Inputs at Nodes (Intersections), dwelling units per acre-dua

| City Size | GROSS Light Rail -Light Rail Node | NET Light Rail -Light Rail NODE | GROSS High Speed Stop | NET High Speed Stop | GROSS Light Rail-Communter Rail Node | NET Light Rail-Commuter Rail Node |
|---|---|---|---|---|---|---|
| **Large** | 56dua | 168dua | 30dua | 90dua | 9dua | 27dua |
| **Medium** | 24dua | 72dua | 12dua | 36dua | 7dua | 21dua |
| **Small** | 12dua | 36dua | 6dua | 18dua | 5dua | 15dua |

* These numbers represent the maximum allowable densities in the 1/2 mile radius around each node



**Hypothetical illustration:
Before corridor development**



**Hypothetical illustration:
Intensification of development
after corridor development**

*Drawings by James Dougherty, Dover Kohl and Partners*

# Dwelling Units per Acre: Sample Projects

↓The Crossings, 15 dua

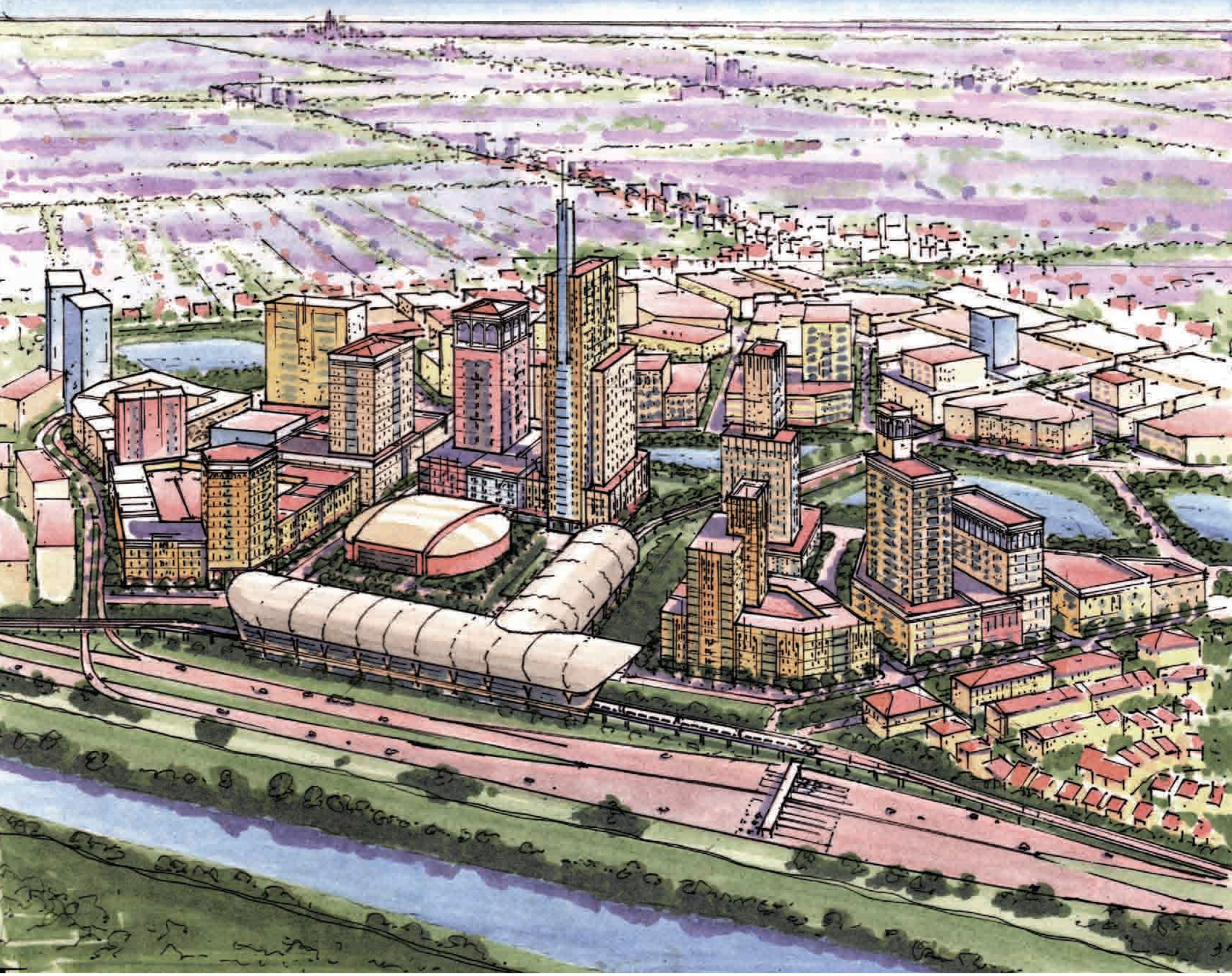
↑The Courtyards of Delray
Delray Beach, FL, 25 dua

↑Arbutus
Vancouver, BC
36 dua

←Addison Circle
Addison, TX, 60 dua

Portland→
Oregon, 72 dua

The Echelon at Uptown, West Palm Beach, FL, 168 dua ↓



**Hypothetical illustration: High speed rail stop, Sawgrass Mills, Fort Lauderdale**

*Drawing by James Dougherty, Dover Kohl and Partners*

**Hypothetical illustration: High speed rail stop, Airport City, Orlando**

*Drawing by Marcos Bastian, Glatting Jackson*

# Principle 7: Rebuild to Create Great Places

**The trend towards redeveloping under-utilized urban land should be encouraged, particularly within walking distance of transit lines or stops**

**Business centers and other high-intensity development should be encouraged at high speed rail stations**

**Historic districts and other stable neighborhoods should be protected from inappropriate intrusions**

# Implementation of Principle 7

## Redevelopment in Existing Urbanized Areas

In order to preserve rural lands and decrease the negative effects of sprawl, areas that are already urbanized should be the preferred areas for new development. In order to create desirable, stable communities, the recommended typologies for urban redevelopment are mixed-use structures incorporating residential, retail, and in some cases small office space. A nexus of activity where residents can commute to work without driving, walk to shopping and dining, and easily access other parts of the city is a place where people will want to live. Local authorities should increase the development capacity in transit areas and make it possible for mixed-use development to occur in areas served by transit.

## Rail Stop Potential

Transit promotes compact development with, special attention given to mixed-building and pedestrian oriented design. Successful transit oriented development requires increased density and new urban typologies that will not only support transit use, but also create a desirable place to live, work, and visit. Along light rail lines, development that will increase the number of residential units within a half mile radius (a 10- 15 minute walk) of the line or stop should be encouraged. The high speed rail stations that will be located outside existing urban centers offer the potential to develop unique new business districts served by intra- and inter-city transit. Some retail will be necessary to support the office development, and residential units should be incorporated into the area the support a growing number of people who desire to live near where they work. However, for the most part, high speed rail stops have the potential to develop into urban employment centers, while light rail and commuter rail stops will contain increased in residential development.

## Historic Districts

The alternative scenario took into consideration the need to preserve historic districts while encouraging urban infill and revitalization projects. Florida residents recognize the importance of historic preservation. According to a survey of more than 1,500 Floridians during in 2006, "the most threatened historic resources in Florida include historic homes and neighborhoods; and old downtowns."[40] Teardowns in historic residential neighborhoods has reached epidemic proportions across the country as families migrate into cities but still want to have the square footage of modern suburban homes. In order to prevent the loss of historic fabric and the construction of unsympathetic new construction, local historic districts or local conservation districts must be able to enforce the preservation ordinances that make them effective tools for historic preservation. Historic preservation helps to maintain property values in Florida. In many instances, property values in historic districts appreciate at a greater rate than comparable non-historic districts.[41] Florida has over 50 Certified Local Governments that oversee local historic districts. Maintaining the architectural and historic integrity of these historic districts, primarily residential districts, will not only improve the quality of life for district residents, but also increase local and state property tax rolls and in many cases promote heritage tourism.

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2 Intergovernmental Panel on Climate Change (IPCC), 20 March 2007, <http://www.ipcc.ch/>, (2007).
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13 Ian L. McHarg, Design With Nature. (New York: Doubleday/Natural History Press, 1971).
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22 U.S. Environmental Protection Agency, "Storm Water Technology Fact Sheet – Vegetated Swales," September 1999, <http://www.epa.gov/owmitnet/mtb/vegswale.pdf>, (25 March 2007).
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25 Virginia Department of Forestry, “Rain Gardens,” 10 January 2007, <http://www.dof.virginia.gov/rfb/rain-gardens.shtml>, (25 March 2007).

26 U.S. Environmental Protection Agency, “Chapter 5: Description and Performance of Storm Water Best Management Practices,” August 1999, <http://www.epa.gov/waterscience/guide/stormwater/files/usw_c.pdf>, (25 March 2007).

27 NOAA Coastal Services Center, “Impervious Surface Indicator Information,” Alternatives for Coastal Development, 16 October 2006, <http://www.csc.noaa.gov/alternatives/impervious.html>, (25 March 2007).

28 Lynch and Hack. Site Planning, 3rd Edition. (Cambridge: The MIT Press, 1984), 341.

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41 Center for Governmental Responsibility, University of Florida Levin College of Law, and the Center for Urban Policy Research, “Economic Impacts of Historic Preservation in Florida”, 2002, <http://www.law.ufl.edu/cgr/pdf/historic_report.pdf>, (2007).

# Modeling Methodology

Using the seven principles in the previous section, the PennDesign team's charge and challenge was to illustrate the principles' impact on the landscape of Florida over the next 53 years. The studio developed a set of modeling assumptions reflecting the seven principles in a program built with a Geographic Information System (GIS). These assumptions are integrated in a modeling process that iteratively illustrates land development over the three planning periods: the present to 2020, 2020 to 2040, and 2040 to 2060. This approach matches that used by GeoPlan to predict the trend over the same periods. However, the studio attains different outcomes by changing the assumptions to reflect key planning principles. The following briefly describes this methodology and accompanying assumptions.

The GIS modeling approach involves three basic steps:

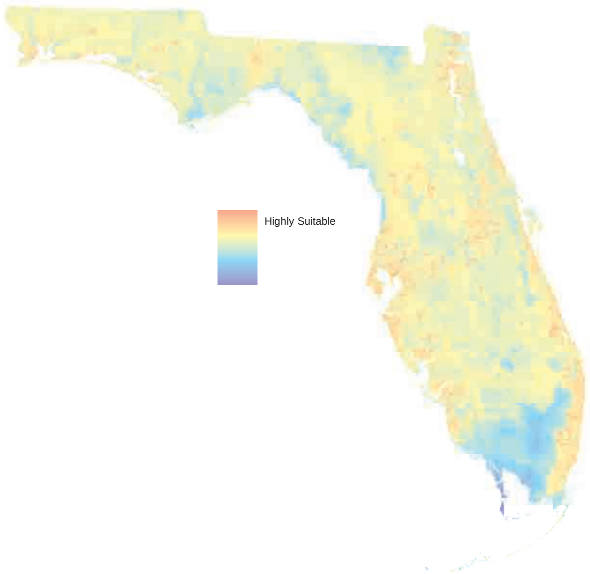
1. Rank each acre of Florida by its suitability for development.
2. Mask lands that should not be developed.
3. Determine the capacity for each acre of Florida, and distribute population based on the suitability rank.

These three steps are then iterated for each planning period so that the outputs of each period become the inputs for the next period.

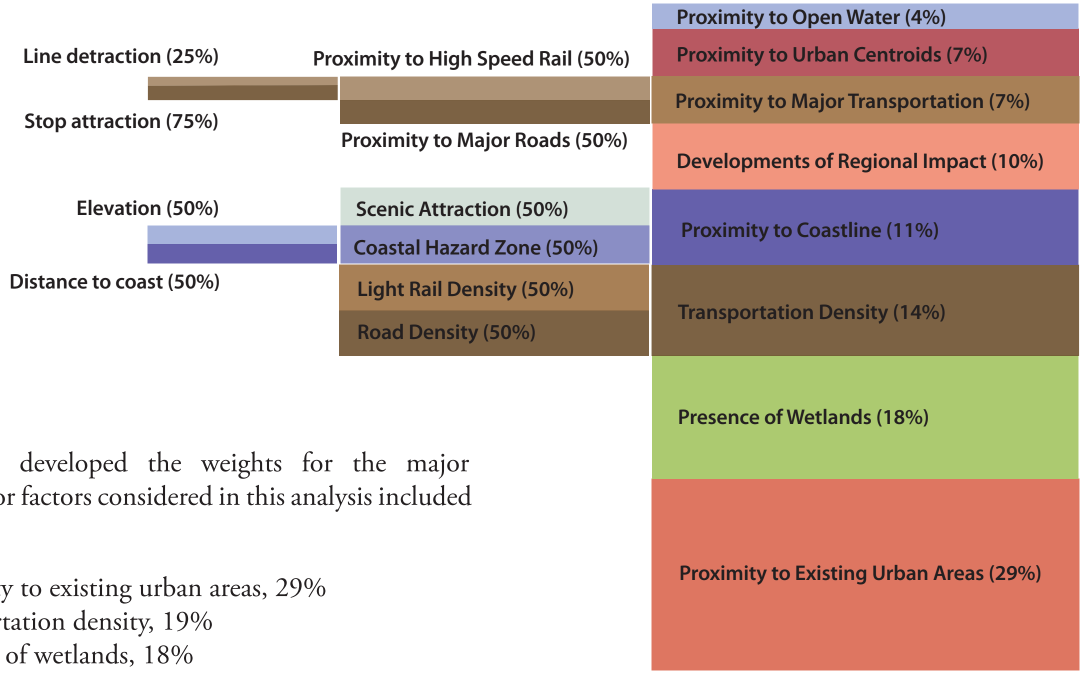
## Suitability

Using a set of spatial inputs, the studio created a map of development suitability, which represented the relative land development demand for each acre of Florida. The team calculated this suitability as a weighted average of ranks for eight major factors. Weights were based on the level of impact a certain factor has on development

| Principle | Modeling Interpretation |
|---|---|
| **Plan Regionally** | Aggregated counties into the 11 RPCs officially designated in Florida. Distributed population by region and used average regional densities. |
| **Protect Florida's Essential Land** | For each planning period, purchase highest priority lands for conservation so that land could not be developed. |
| **Invest in a Balanced Transportation System** | Phased high speed and local transit lines that focus the redevelopment of cities. |
| **Encourage Compact Development** | Around transit station nodes and local transit corridors, higher densities assigned to the density map. |
| **Plan for Climate Change** | Did not allow new development in 2060 sea level rise area and included changing coastline in development suitability layer. |
| **Don't Waste Land; Encourage Compact Development** | Regional densities increased to the state average (3 ppa) if currently below. (Does not preclude agricultural zoning.) |
| **Rebuild to Create Great Places** | Proximity to local transit and high speed stations ranked high in the suitability map. |



## Elements of the Suitability Layer and Weights




decisions. GeoPlan developed the weights for the major categories. The major factors considered in this analysis included (with weights):

1. Proximity to existing urban areas, 29%
2. Transportation density, 19%
3. Presence of wetlands, 18%
4. Proximity to coast, 11%
5. Presence of a development of regional impact, 10%
6. Proximity to major transportation, 7%
7. Proximity to major urban centroids (> 30,000 pop.), 7%
8. Proximity to inland open water, 4%

To adjust the outcomes, the studio developed sub-factors that would influence development decisions based on the team's principles. The team added an attraction effect for proximity to high speed rail stations and a detraction effect for proximity to high speed transit lines. These sub-factors went into the ranking for proximity to major transportation. The team also ranked local transit density as a sub-factor influencing proximity to transportation density. These changes to the ranking reflect the idea that new great places should develop around local transit nodes and corridors. If Florida implements the planning principles to Invest in a Balanced Transportation System, Rebuild to Create Great Places, and Encourage Compact Development, then the team believes more people will naturally choose these areas as places to call home.

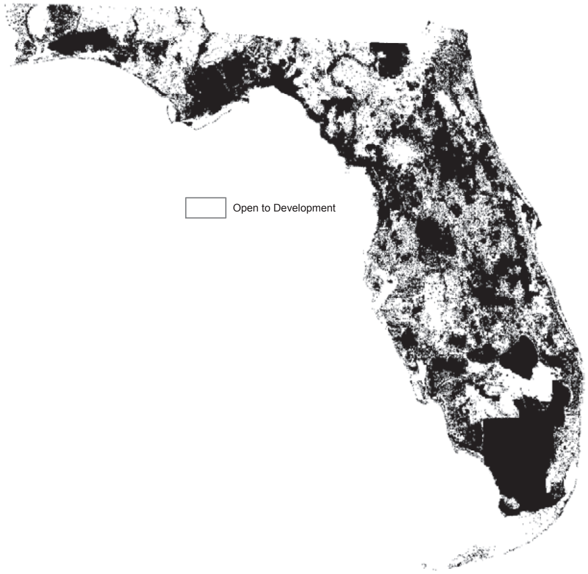
Additionally, the team added a detraction effect for coastal hazard areas as developed in Principle 3, Plan for Climate Change, that was a sub-factor for proximity to the coast. The team believes that as climate change impacts sea level and intensity of future coastal storms and hurricanes, fewer people will choose to live in areas susceptible to climate change impacts. This will happen as a combination of policy, planning, and market factors make it more expensive to build in these areas.

## Land Development Mask

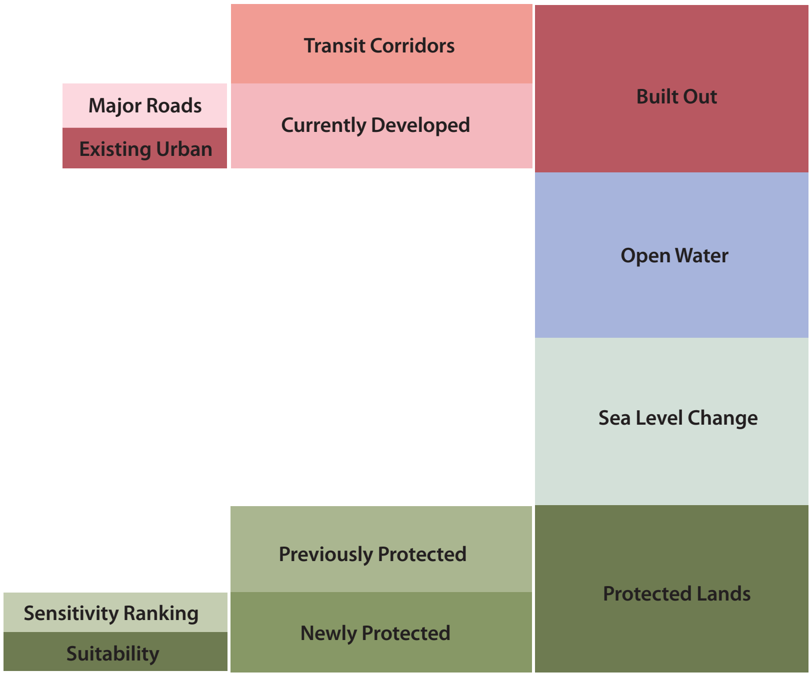
In order to distribute population, it was necessary to map all areas that were open to development. This meant creating a layer where every acre was either open to development or closed to development. Those places closed to development included:

1. Existing urban development
2. Open water bodies
3. Land under water by 2060
4. Permanently protected conservation land

Additionally, the light rail corridors and nodes were open to development within existing urban areas. This reflects the principle of encouraging compact redevelopment around transit nodes and corridors. The mask changed for each planning period to reflect new rail corridors as phased in Principle 2, Invest in a Balanced Transportation System, and new conservation purchases as recommended in Principle 1, Protect Florida's Essential Land.




## Elements of the Mask Layer



## Allocate Population Growth

The final major step in modeling was distributing population based on the projected population growth for each regional planning council. These populations were aggregated from the county projections computed by GeoPlan from the official BEBR analysis. This reflected the principle that RPCs should start thinking and planning like regions. A map of densities was also used where every acre had a maximum assumed density as one of our inputs. This density map reflected the varying densities around transit nodes and corridors as detailed in the Principle 6 section and the average regional gross residential densities.

Using special GIS modeling software (ModelBuilder from ArcGIS™), the studio could predict the placement of people on the Florida landscape. The modeling software placed people based on the inputs. Suitability acted as a rank for the order of settlement, density allowed the model to determine the number of acres needed to place the projected population, and the mask made sure no one ended up in the middle of a lake or on conservation land.

The team completed these steps for each planning period. The results can be seen following this section as a series of comparison maps representing the location of new growth. These maps represent an illustration of what could be based on some simple assumptions. However, it is not the only outcome for Florida. The goal is to show there is a possible different future that preserves Florida for all its current and future residents.

Given more time and a process involving more stakeholders, Floridians can build a future close to the one illustrated in this book. In fact, Floridians can realize a future better than the one seen here by using local knowledge and public participation toward a common goal. These illustrations and analysis show a potential common goal: one that invests in balanced transportation, protects vital natural landscapes, and provides choice to all of Florida's citizens. These maps can stimulate a new conversation and a new future for Florida, but they will not take the place of careful deliberate consideration and hard work by the people of Florida.

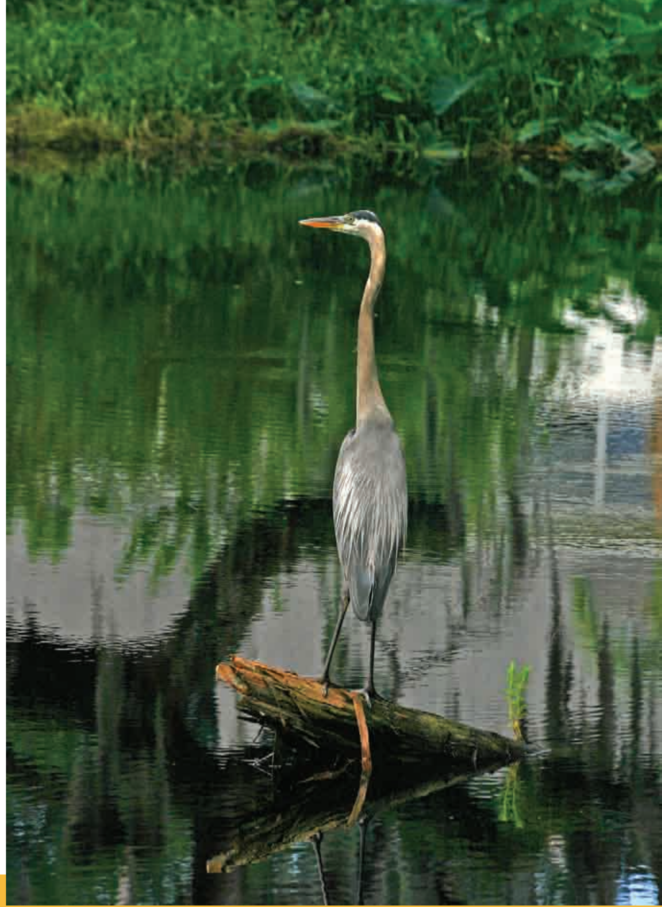

## Elements of Population Growth Allocation

# Results

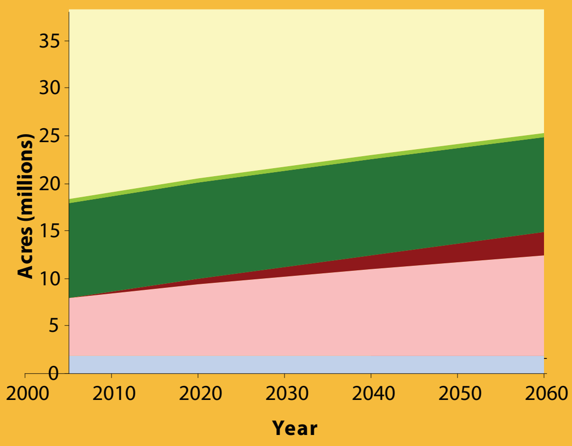
## Land Allocation

The alternative model conserves 8.5 million additional acres by 2060 than is currently conserved. 2.9 million acres of this is agricultural conservation land. By targeting the ideal conservation land most endangered by development, the alternative model loses only 37,000 acres of ideal conservation acres to development, which is 1 percent of the amount lost by the trend model to development (2.5 million acres).

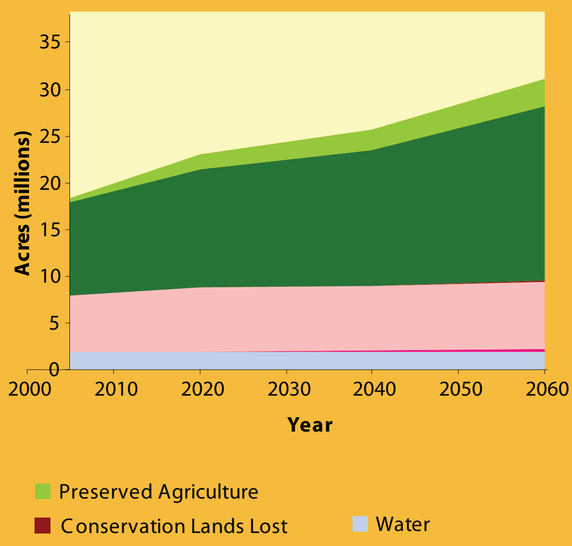
Over a third of the state (13 million acres) develops by 2060 in the trend model. The alternative model, by redeveloping 282,000 acres (0.7 percent of the state) in established urban cores using strong regional planning, develops only 20 percent of the state. This 7.5 million acres is a 26 percent increase over current development acreage, yet accommodates twice the population as today (35.8 million Floridians, compared with the current population of 17.8 million).



Trend Land Use




Alternative Land Use



## Detailed Land Use Results: Trend and Alternative (in acres)

| | | 2005 | 2020 | 2040 | 2060 |
|---|---|---|---|---|---|
| TREND | Water | 1,924,368 | 1,924,368 | 1,924,368 | 1,924,368 |
| | Redeveloped Acres | 0 | 0 | 0 | 0 |
| | Developed | 5,971,509 | 8,048,806 | 10,568,897 | 12,923,265 |
| | Developed in Ideal Conservation | 0 | 519,204 | 1,534,170 | 2,490,654 |
| | Conservation | 10,074,537 | 10,074,537 | 10,074,537 | 10,074,537 |
| | Preserved Ranch Lands* | 13,231 | 13,231 | 13,231 | 13,231 |
| | Agriculture & Other Land Uses | 19,874,498 | 17,797,201 | 15,277,110 | 12,922,742 |
| ALTERNATIVE | Water | 1,924,368 | 1,924,368 | 1,924,368 | 1,924,368 |
| | Redeveloped Acres** | 0 | 29,064 | 145,397 | 247,780 |
| | Developed | 5,971,509 | 6,845,521 | 7,132,775 | 7,652,879 |
| | Developed in Ideal Conservation | 0 | 27,674 | 37,118 | 37,118 |
| | Conservation | 10,074,537 | 12,565,191 | 14,486,671 | 18,659,421 |
| | Preserved Agriculture | 13,231 | 1,640,929 | 2,184,031 | 2,997,209 |
| | Agriculture & Other Land Uses | 19,874,498 | 16,509,832 | 14,301,098 | 9,608,244 |

*Source: Kenneth Murray, Natural Resources Conservation Service (acres preserved through the Farm and Ranch Lands Protection Program)
**Redeveloped acres are those acres urbanized as of 2005 that rebuild at higher densities along transit corridors.

### Financial Results

The alternative offers a land development savings of 521 billion dollars between 2005 and 2060. In order to achieve these savings, the state must secure development rights to the highest priority conservation lands and construct high speed rail and local transit systems. Because of the need to begin infrastructure improvements now, the first 13 years of the alternative plan are the most expensive for infrastructure costs. The total annual capital costs from 2005-2020 are $5.3 billion, from 2020-2040 are $3.6 billion, and from 2040-2060, $7.2 billion.

## Cost Comparison for Land Development

| Years | Population Increments | Trend Land (Acres) | Trend Cost | Alternative Land / Redeveloped (Acres) | Alternative Cost | Savings |
|---|---|---|---|---|---|---|
| **2005-2020** | 5,021,845 | 2,078,020 | $207,802,000,000 | 874,012* | $88,127,800,000 | $119,674,200,000 |
| | | | | 29,064* | | |
| **2020-2040** | 6,309,702 | 2,520,707 | $252,070,700,000 | 287,254** | $31,633,725,000 | $220,436,975,000 |
| | | | | 116,333** | | |
| **2040-2060** | 6,610,732 | 2,354,537 | $235,453,700,000 | 520,104*** | $54,569,975,000 | $180,883,725,000 |
| | | | | 102,383*** | | |
| ***Totals*** | ***17,942,279*** | ***6,953,264*** | ***$695,326,400,000*** | ***1,929,150*** | ***$174,331,500,000*** | ***$520,994,900,000*** |

*41,078 acres in transit corridors (some redevelopment, some newly developed); **138,613 acres in transit corridors (some redevelopment, some newly developed); *** 122,553 acres in transit corridors (some redevelopment, some newly developed)

## Cost for Alternative Conservation (no additional consevation land in trend)

| Years | Conservation Land Purchase (acres) | Conservation Land Cost |
|---|---|---|
| **2005-2020** | 2,491,290 | $24,912,900,000 |
| **2020-2040** | 1,921,480 | $40,351,080,000 |
| **2040-2060** | 4,174,931 | $137,772,723,000 |
| ***Total*** | ***8,587,701*** | ***$203,036,703,000*** |

## Cost Comparison for Transportation

| Years | Trend Highways (miles) | Trend Highways Costs | Alternative Highways (miles) | Alternative Highway Costs | High Speed / Light Rail / Commuter Rail (miles) | High Speed /Light Rail /Commuter Rail Cost |
|---|---|---|---|---|---|---|
| **2005-2020** | 2,540 | $25,402,702,961 | 1,068 | $10,684,337,600 | 556 | $16,680,000,000 |
| | | | | | 743 | $14,860,000,000 |
| | | | | | 171 | $2,565,000,000 |
| **2020-2040** | 3,081 | $30,814,319,002 | 351 | $3,511,529,262 | 754 | $22,620,000,000 |
| | | | | | 214 | $4,280,000,000 |
| | | | | | 32 | $480,000,000 |
| **2040-2060** | 2,878 | $28,782,978,037 | 636 | $6,357,998,201 | – | – |
| | | | | | – | – |
| | | | | | – | – |
| ***Total*** | ***8,500*** | ***$85,000,000,000*** | ***2,055*** | ***$20,553,865,063*** | ***2,470*** | ***$61,485,000,000*** |

## Cost Assumptions

| | |
|---|---|
| Urbanized land | $100,000 /acre |
| Re-development | $25,000 /acre |
| | |
| High speed rail | $30,000,000 /mile |
| Light rail | $20,000,000 /mile |
| Commuter rail | $15,000,000 /mile |
| | |
| Conservation land 2005-2000 | $10,000 /acre |
| Conservation land 2020-2040 | $21,000 /acre |
| Conservation land 2040-2060 | $33,000 /acre |
| | |
| Highway miles needed | 0.0012224 /acre developed |
| Highways | $10,000,000 /mile |

## Annual Costs Comparison

| | 2005-2020 | 2020-2040 | 2040-2060 |
|---|---|---|---|
| **Alternative** | | | |
| Infrastructure | $3,445,333,662 | $1,544,576,463 | $317,899,910 |
| Conservation | $1,916,376,923 | $2,017,554,000 | $6,888,636,150 |
| Development | $6,779,061,538 | $1,581,686,250 | $2,728,498,750 |
| **Trend** | | | |
| Infrastructure | $1,954,054,074 | $1,540,715,950 | $1,439,148,902 |
| Development | $15,984,769,231 | $12,603,535,000 | $11,772,685,000 |

# Alternative Annual Savings

| | 2005-2020 | 2020-2040 | 2040-2060 |
|---|---|---|---|
| **Total Land Development Dollars Saved** | $9,205,707,692 | $11,021,848,750 | $9,044,186,250 |
| **Land Development Savings (percent)** | 58% | 87% | 77% |

Costs are in constant dollars.
For details on increases in conservation land costs, see Appendix A

# Comparison of the Trend and Alternative

When the fiscal, physical, and social costs of the two scenarios are compared it becomes clear that the alternative scenario will save the state of Florida a significant amount of money in development costs. However, an in-depth comparison also reveals that the alternative scenario addresses several current issues facing the state as a whole: public health, water quality, sustainable transportation, and land conservation.

## Fiscal Costs of Urbanization

After careful research, the studio arrived at the figure of $100,000 as the present day cost of converting an acre of rural land to residential development. This amount includes the cost of access roads, internal roads with sidewalks, storm water drainage, and water, sewer, and electric utility installation. This figure does not include the cost of schools because it is assumed that the need to build new schools is determined by the growing population of school age children and not by the density of residential development. Therefore there will need to be the same number of new schools in the trend model as in the alternative model. However, it is important to note that many scholarly studies have concluded that it costs municipalities significantly more to provide bus transportation for students the further they are located from the school. Additionally, the cost of police and fire services increases substantially as residential density decreases. In the alternative, the fiscal costs are significantly lower; the cost to redevelop an acre of already urbanized land was determined to be $25,000.[1]

## Public Health

The connection between urban design and physical health has recently become an area of study for urban planners and public health specialists. It is already well documented that the increased levels of air pollutants caused by highway centric design are harmful to physical health. However, increasingly the link between compact, walkable urban forms and increased physical activity has become a driving factor in residential development planning. When people are not afforded safe or reasonable alternative transportation options for accessing jobs, shopping, and recreation, their level of physical activity may suffer. Many different strategies can be utilized to improve public health and urban design. Increased public transportation is one part of the solution. Equally important are walkable mixed-use zones that allow for an integration of building uses within one neighborhood. As one recent study concluded, "people living in neighborhoods characterized by higher residential density, a mixture of land uses (residential and commercial), and grid-like street patterns with short block lengths engage in more walking and cycling trips for transport than do people living in sprawling neighborhoods."[2] In a nation facing an epidemic of obesity, it is critical to adopt these land use patterns that are recognized as providing options that can lead to healthier lifestyles.

## COMPARATIVE COSTS

| | TREND | ALTERNATIVE | SAVINGS FROM ALTERNATIVE |
|---|---|---|---|
| ACRES | 6,951,756 acres of land are consumed by development | 1,681, 370 acres of land are consumed by development | 5,270,386 acres |
| DOLLARS | $695,326,400,000 will be spent on urbanizing land | $174,331,500,000 will be spent urbanizing/redeveloping land | $520,994,900,000 |
| PUBLIC HEALTH | When people are not afforded safe or reasonable non-car options for accessing jobs, shopping, and recreation their level of physical activity and therefore their health may suffer. | Walkable mixed-use zones that allow for an integration of building uses within one neighborhood will encourage more active lifestyles and lead to improved public health. | Increased opportunity for physical activity in everyday activities |
| WATER QUALITY | With more land being consumed for urbanization there will be an increase in impervious surfaces that will lead to the degradation of water quality, including problems with runoff, flooding, and contamination of groundwater. | The water quality within the alternative will most likely exceed that of the trend since more land is left undeveloped, and consequently those landscapes can naturally filter and recharge water for usage. | Improved water quality |
| TRANSPORTATION | Extensive new highway construction would be necessary and there would be marked increases in air pollution and commuting times. | High speed rail, light rail, and commuter rail will encourage compact development, address environmental concerns, and alleviate the need for new highways and short-haul air travel. | More efficient and environmentally conscious transportation |
| AGRICULTURE | No new acres of agricultural lands conserved | 2,997,209 acres of agriculture lands conserved | 2,997,209 acres |
| WILDLIFE HABITAT | No new acres of wildlife habitat conserved | 8,584,884 new acres of wildlife habitat will be conserved | 8,584,884 acres |

## Water Quality

The increased development in the trend model will also lead to an increase in impervious surfaces within the state. Development areas must be serviced with right-of-ways including major and minor roads and sidewalks, parking lots, buildings, and driveways. Additionally, the majority of new construction still uses impervious building materials, adding to the problem. These impervious surfaces lead to the degradation of water quality and quantity, a result of runoff, flooding, shifts in water resources, and contamination of groundwater.

The alternative scenario, which relies heavily on infill and redevelopment, will reduce the amount of newly urbanized land around the state, subsequently reducing the amount of impervious surface. Additional land is left undeveloped, and thus the natural landscape can filter and recharge water. The water quality within the alternative model will most likely exceed that of the trend.

## Transportation

The trend scenario assumes no additional transit systems in Florida through 2060; therefore, transportation within the state within the next 50 years is assumed to be automobile-based. Accommodating a doubling of population would call for aggressive highway and road network expansion; an increase of eighteen million residents translates to roughly 65 million more trips per day within the state. To double Florida's 8,500 highway miles would require an investment (at the conservative price of $10 million per mile) of over $85 billion. This would merely allow roads to remain at today's levels of congestion and gridlock. Meanwhile, the social costs of excessive automobile transportation involve air and water pollution, increased time required for transportation, a reduced sense of "place" within communities, and in some cases, adverse public health effects.

There is one fundamental difference between automobile-based transportation and mass transit: as more people use highway networks, level of service decreases, and gridlock ensues. However, as more people use transit, level of service increases, trains run more frequently, and increased revenues are reinvested to improve service. Florida's rapidly increasing population requires transportation networks with greater capacity and reliability than highways.

The proposed high speed rail network and intracity transit systems require higher investment cost per mile than highways; however, they have much lower environmental and social impacts and also greater capacity. At an estimated cost of $30 million per mile over 1300 miles, the high speed rail network would require an investment of $39 billion; the roughly 900 miles of intracity networks would require an investment of $18 billion at $20 million per mile. Together, the two systems have an approximate cost of under $60 billion—less than the highway expansion option.

Additionally, mass transit offers improved service. The high speed rail network also has the ability to take the place of short-haul plane flights, which reduces the need for airport expansion. The less quantifiable effects of reduced fuel usage, reduced pollution, improved walkability of communities, convenience, and choice in travel options are all results of the alternative scenario.

## Endnotes:

1 Sources consulted that verify the accuracy of this assumption include:

Coyne, William. The Fiscal Cost of Sprawl: How Sprawl Contributes to the Local Government's Budget Woes (Denver, Colorado: Environmental Colorado Research and Policy Center, 2003).

Frank, James E. The costs of alternative development patterns: a review of the literature, (Washington, D.C.: Urban Land Institute, 1989).

"Infrastructure Financing Study: Capital Cost of Growth Memorandum" Duncan Associates in association with Public and Environmental Finance Associates, Sept. 2000, <http://www.lincoln.ne.gov/city/pworks/ifs/bground/pdf/grwthcst.pdf>

"Reconnaissance of Utility Fees and Policies", Stillwater, July 21,1998 <http://www.stillwater.org/extras/tischler/utlrecon.htm>

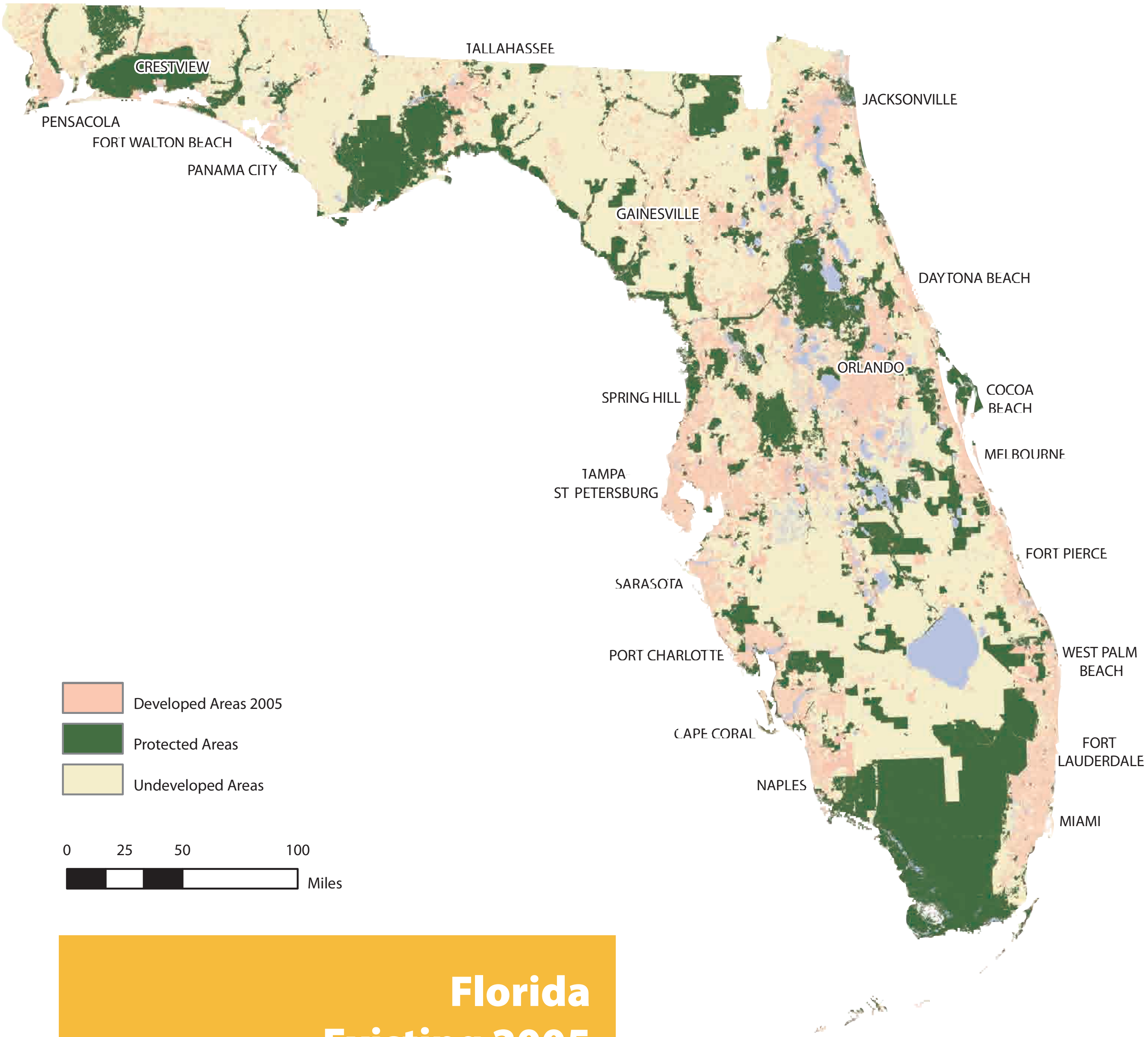
Taylor, James, "Technical Bulletin" No. 1, University of British Columbia, Aug. 2000<http://www.sustainablecommunities.agsci.ubc.ca/bulletins/TB_issue_01_Concord_edit.pdf>

Ulbrich, Holley Hewitt, Fiscal Impact of Conversion of Prime Lands (Clemson University, 2000)

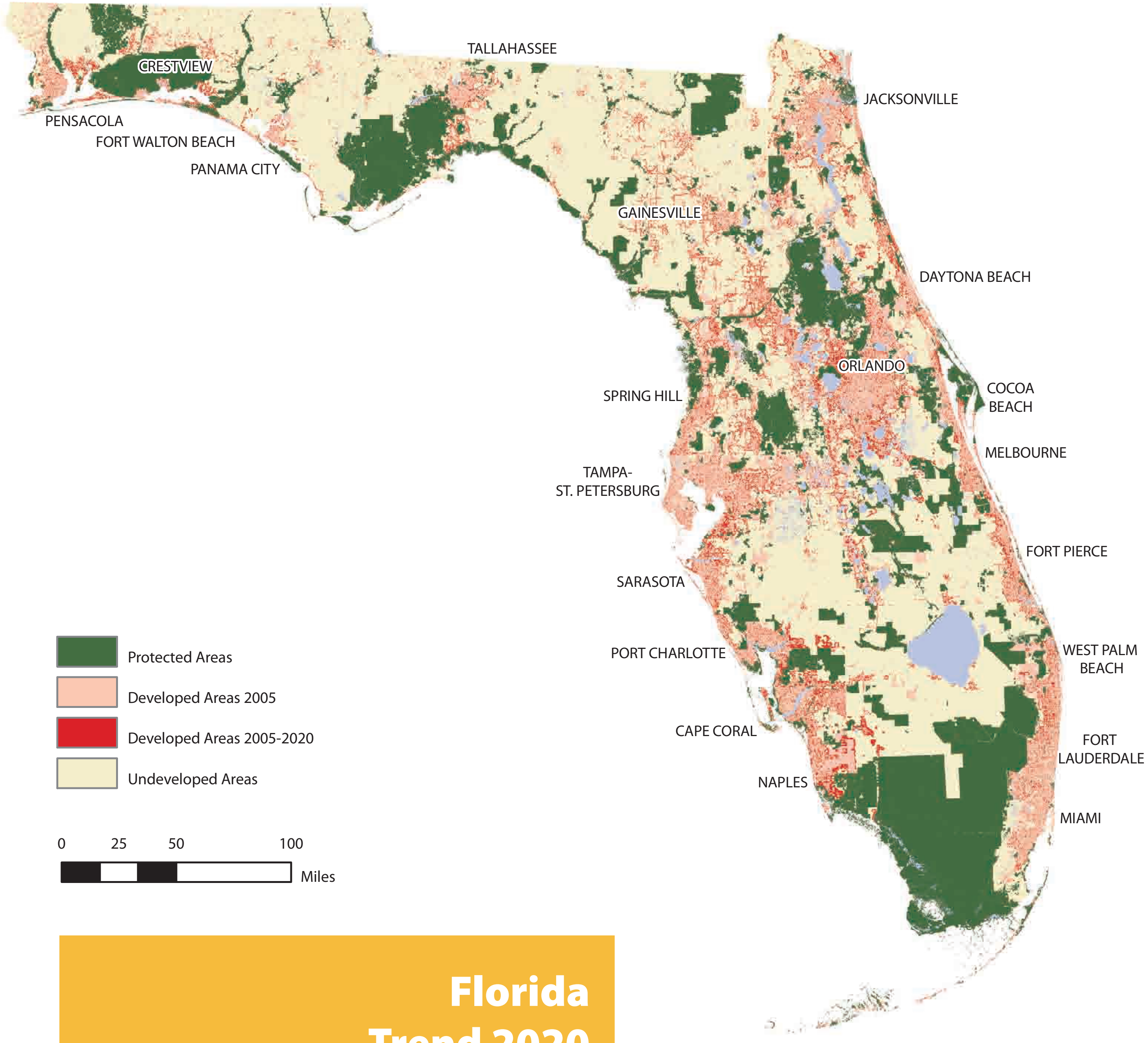
2 Brian E. Saelens, James F. Sallis, Jennifer Black, and Diana Chen, "Neighborhood-Based Differences in Physical Activity: An Environmental Scale Evaluation", American Journal of Public Health, Vol. 93, no. 9 (September 2003)

# Trend and Alternative Population Distribution Maps

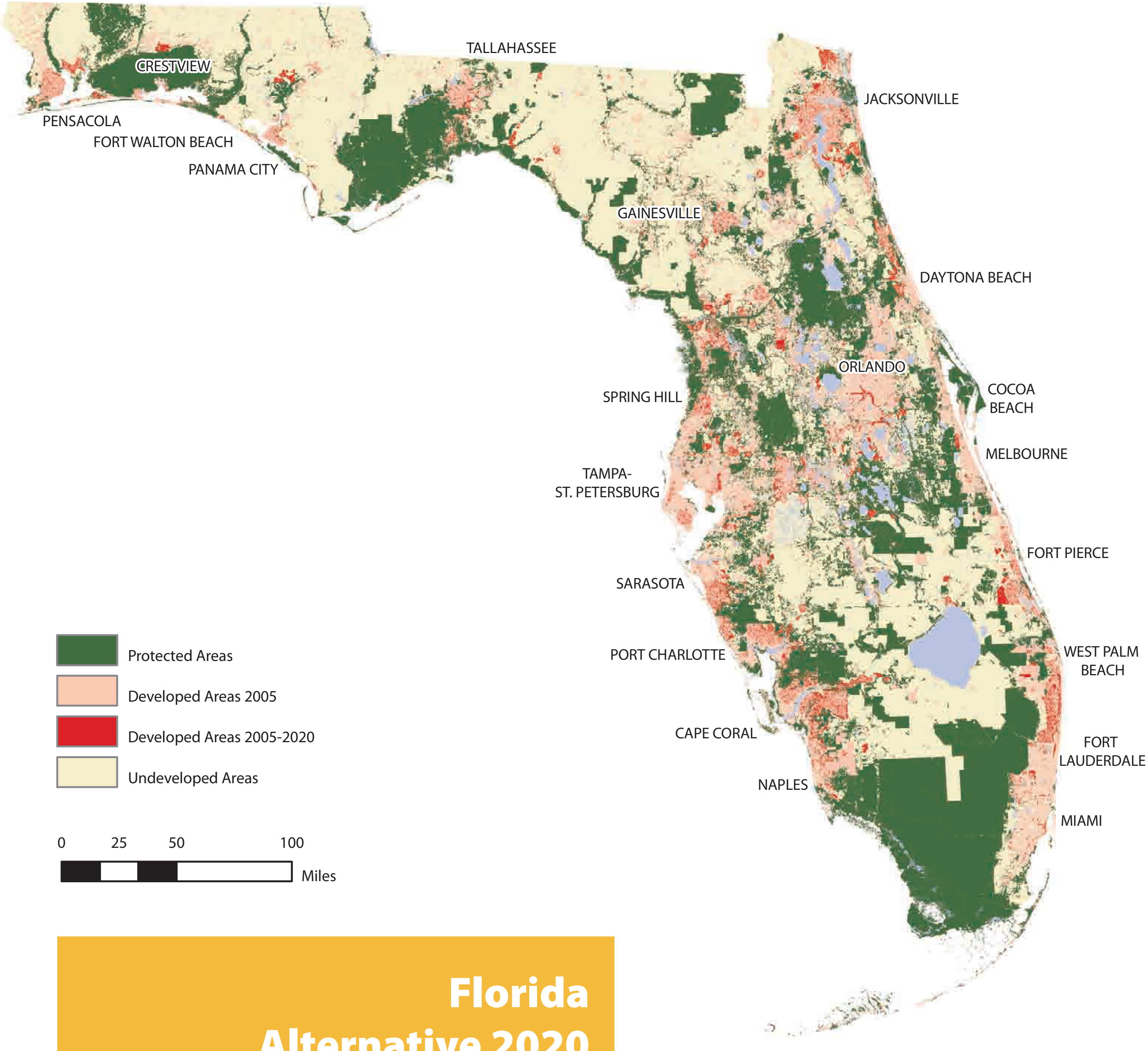
# 2020 2040 2060



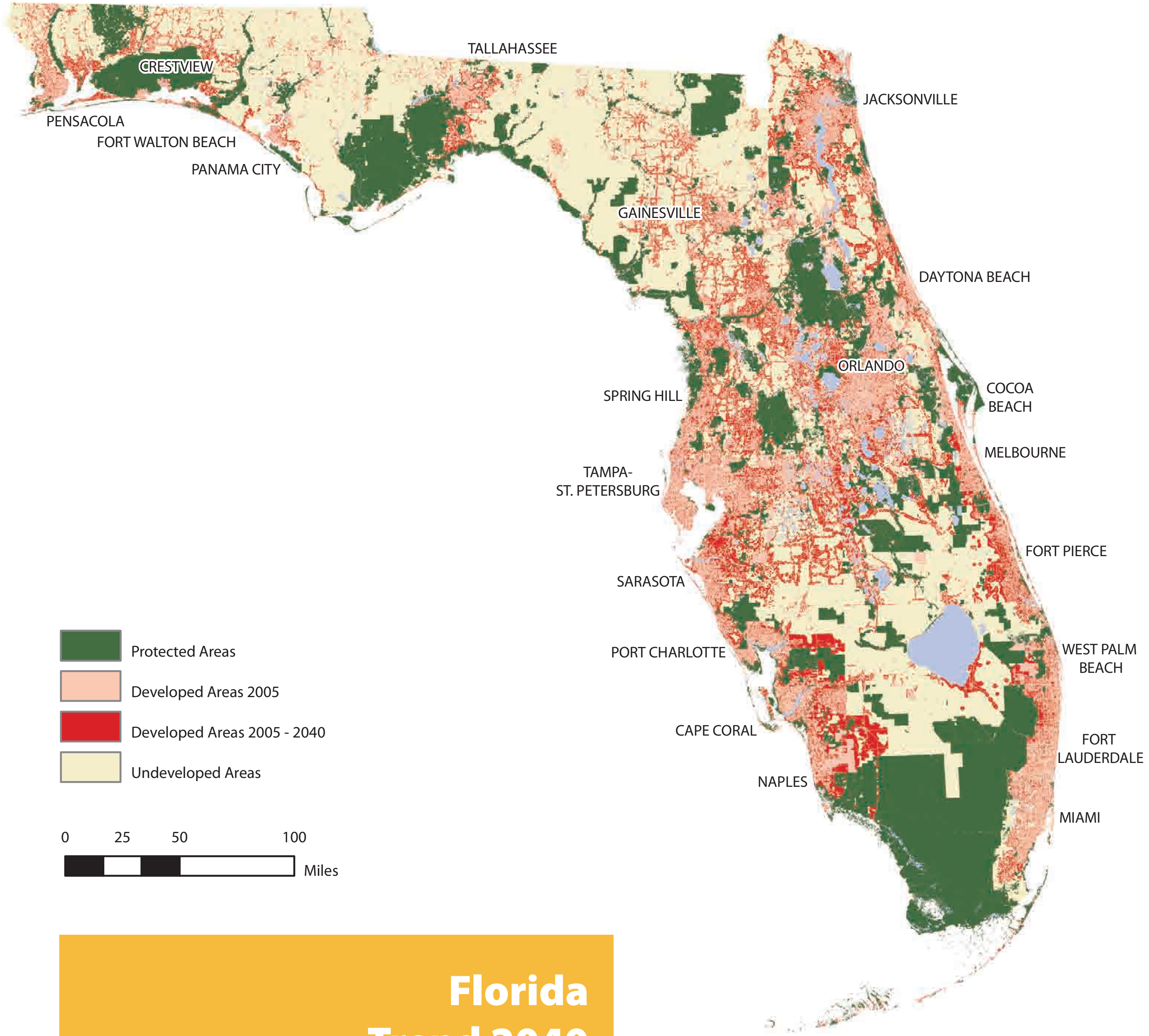

# Florida Existing 2005



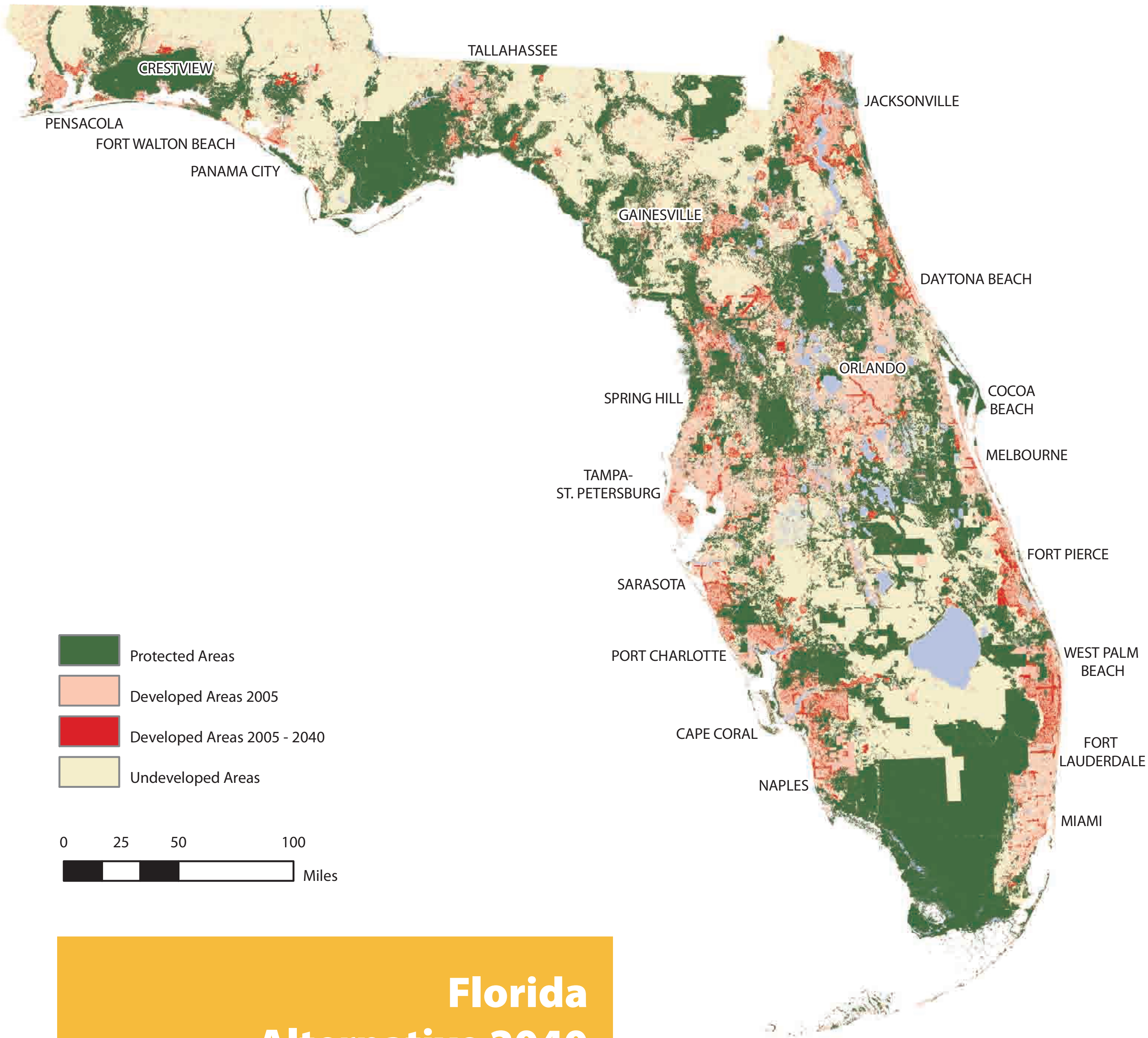

# Florida Trend 2020



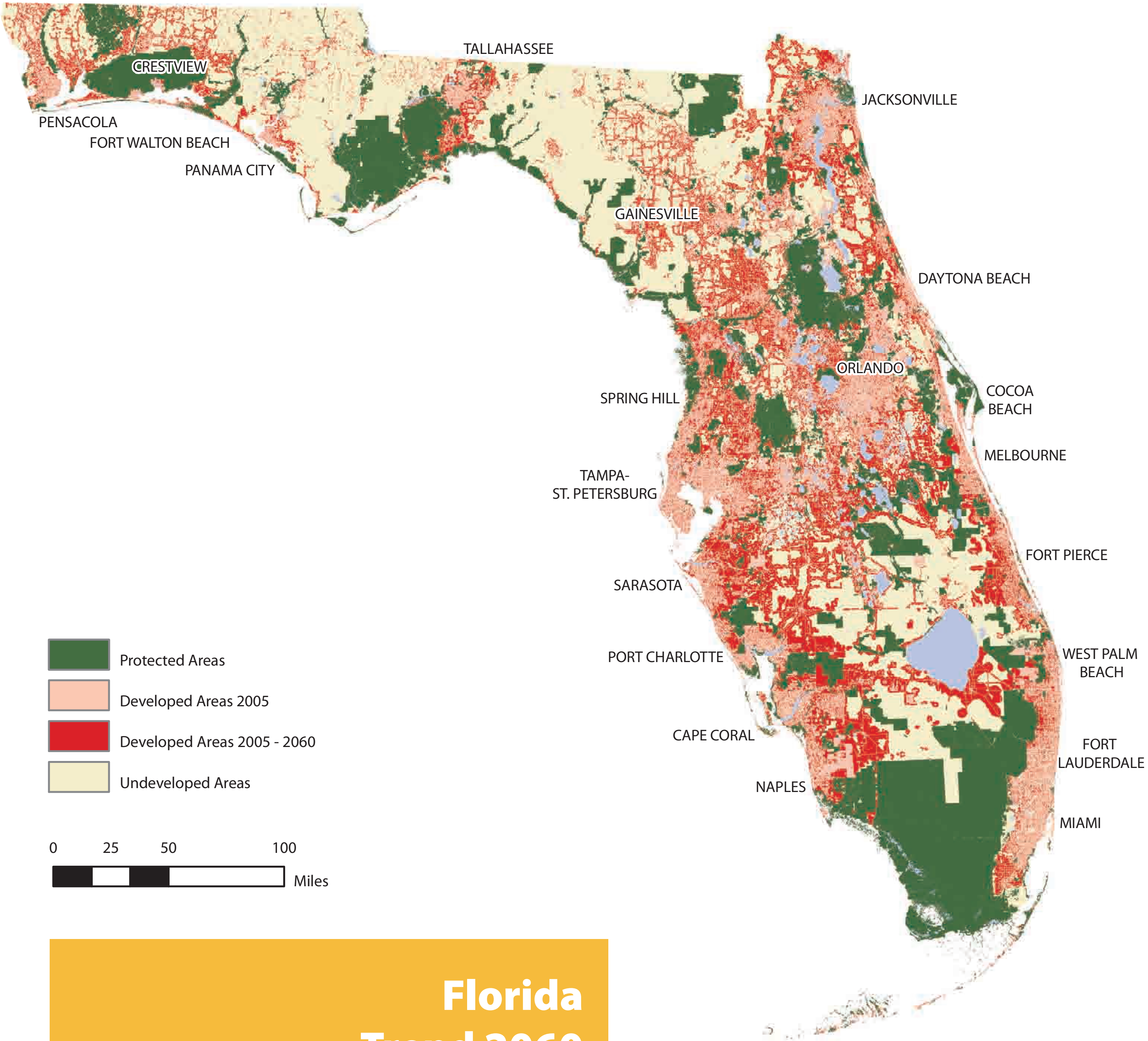

# Florida Alternative 2020




# Florida Trend 2040

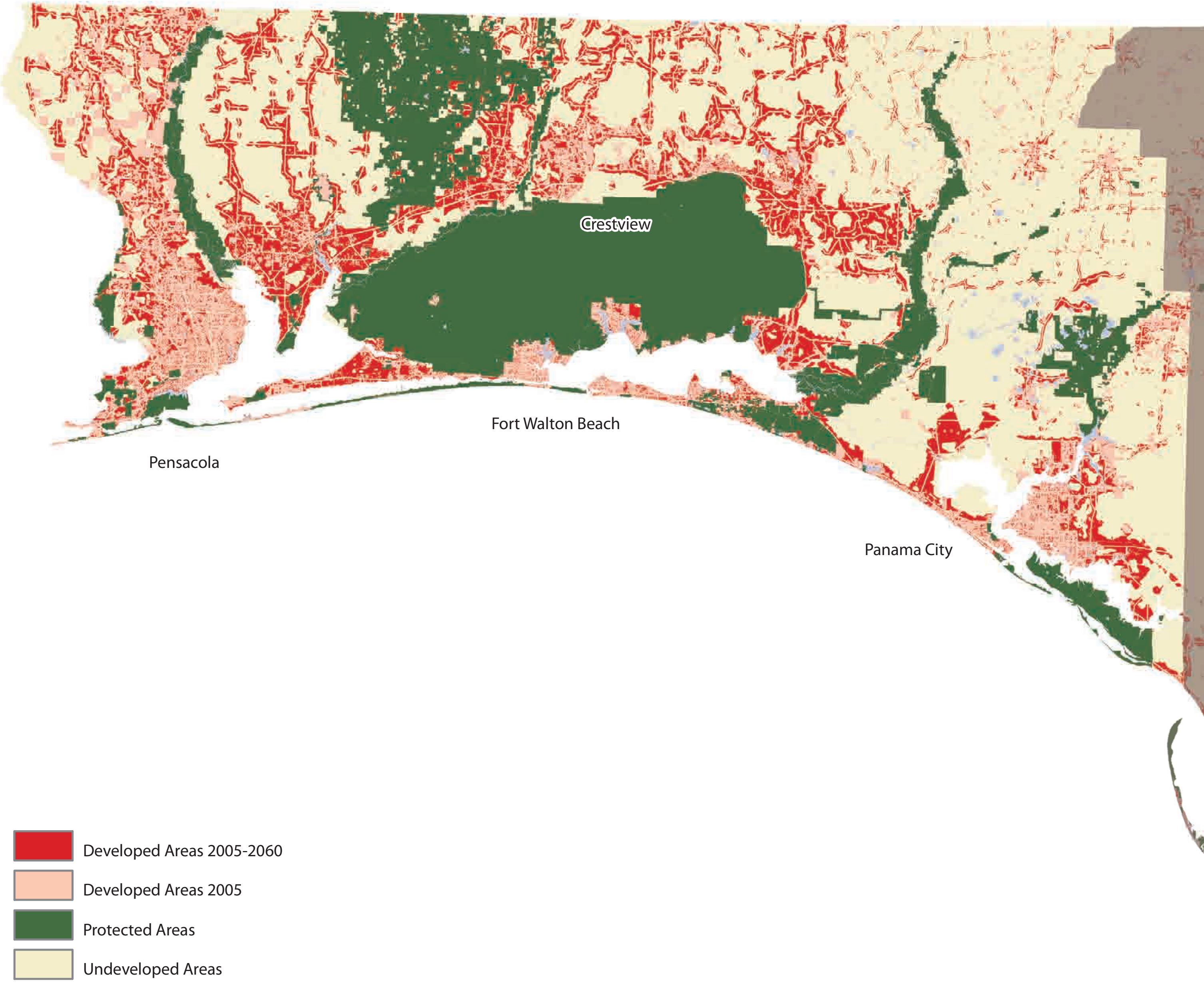



# Florida Alternative 2040



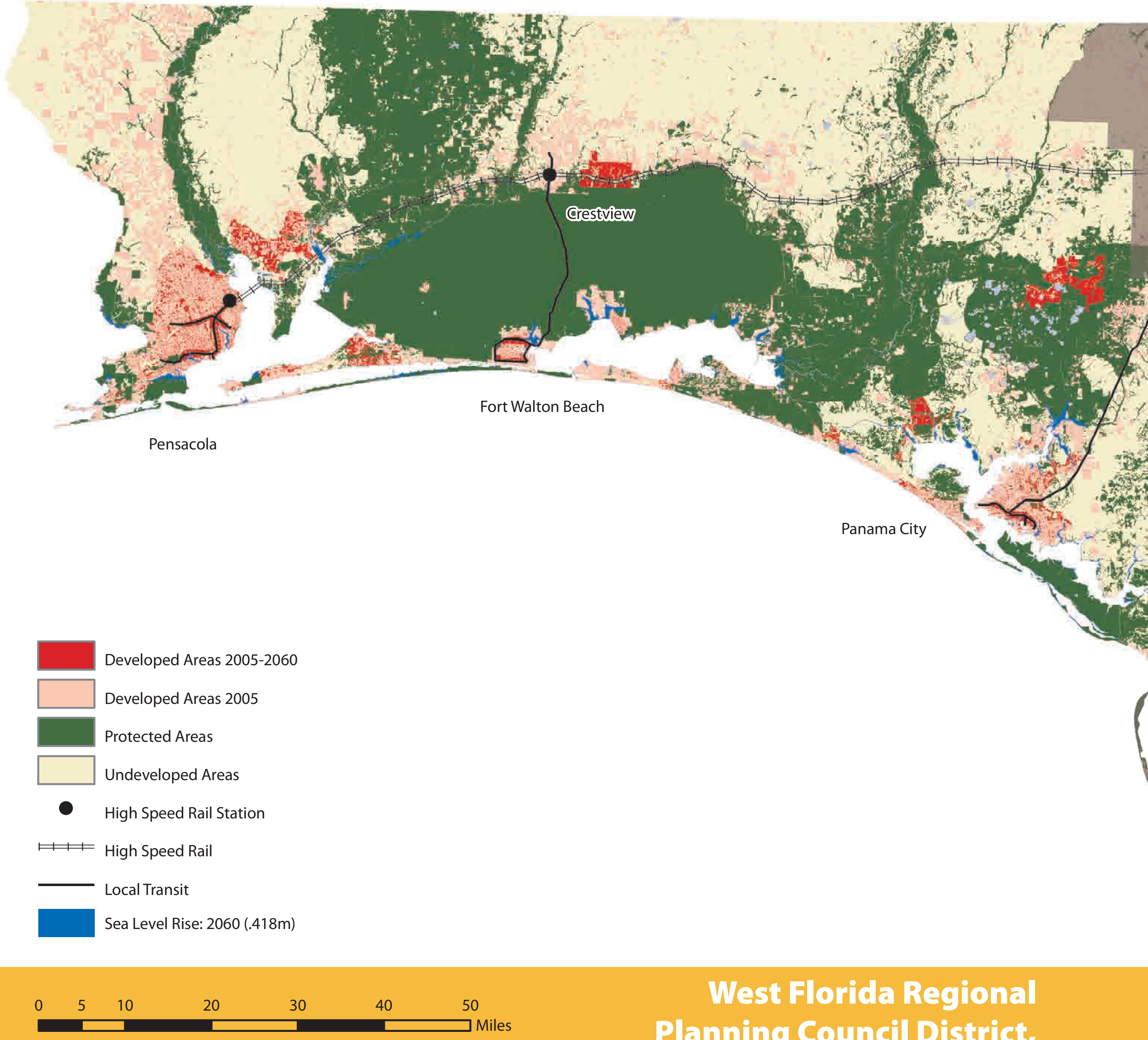

# Florida Trend 2060


# Florida Alternative 2060

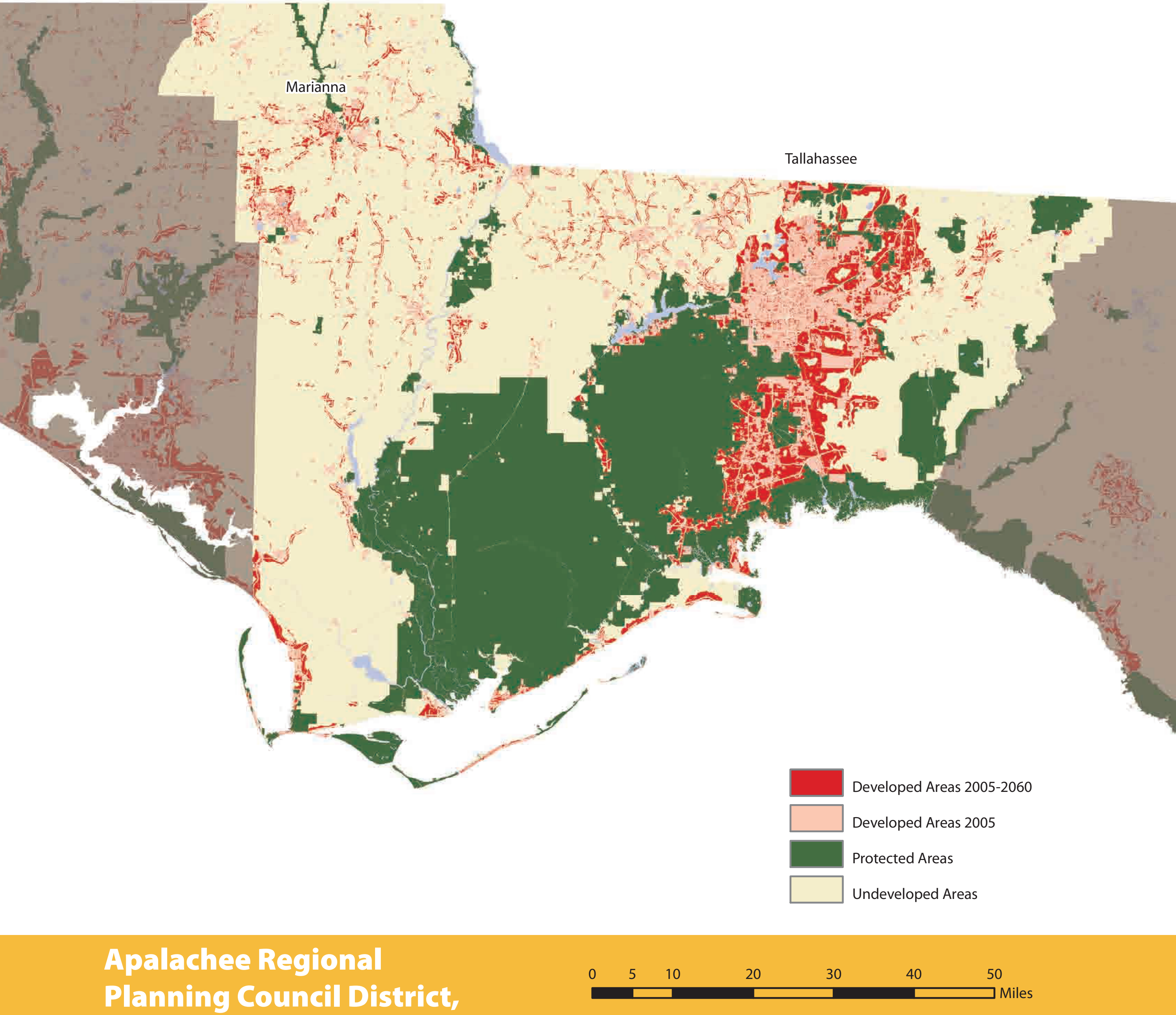



Note: Trend did not account for climate change

# West Florida Regional Planning Council District, Trend 2060

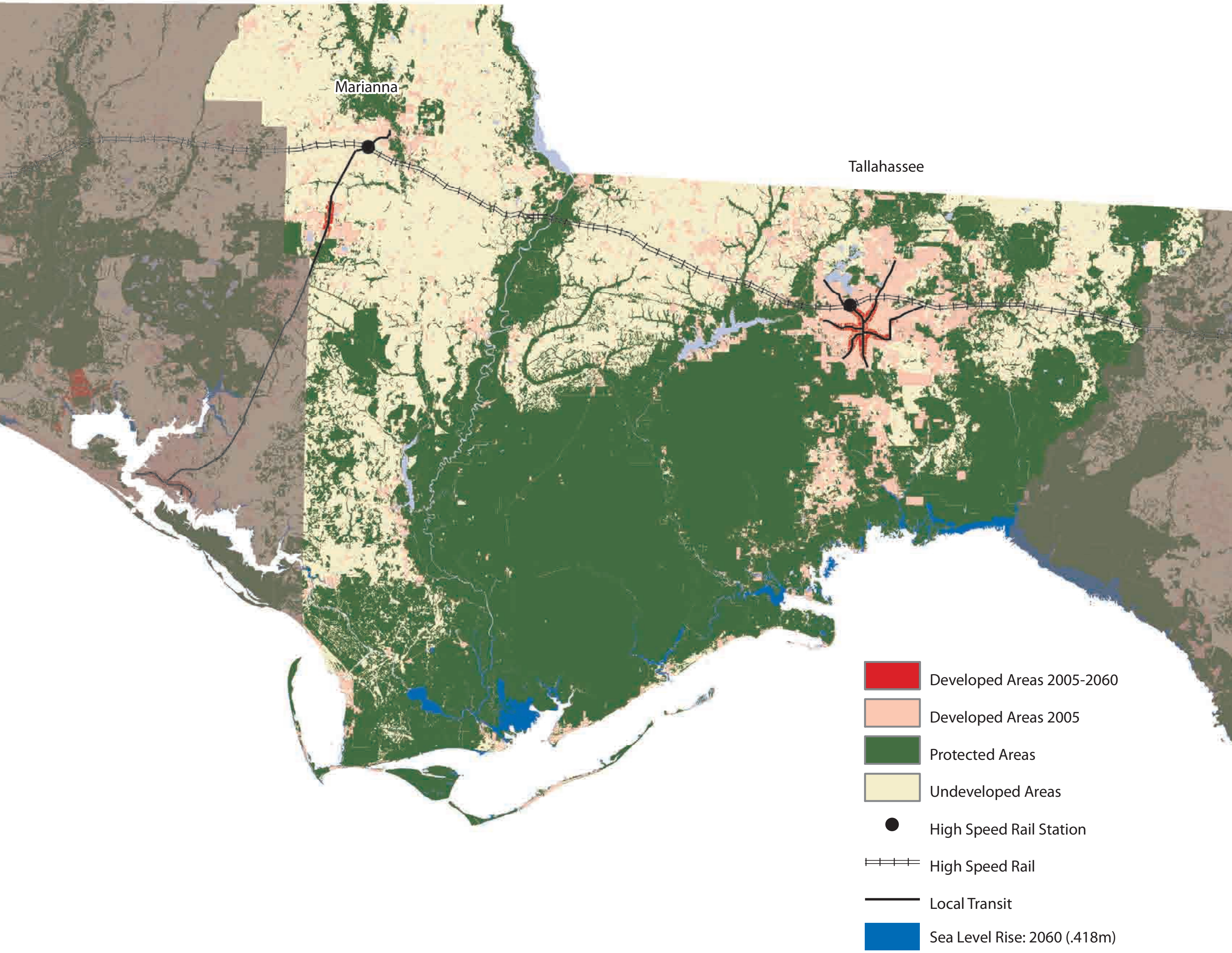



## West Florida Regional Planning Council District, Alternative 2060

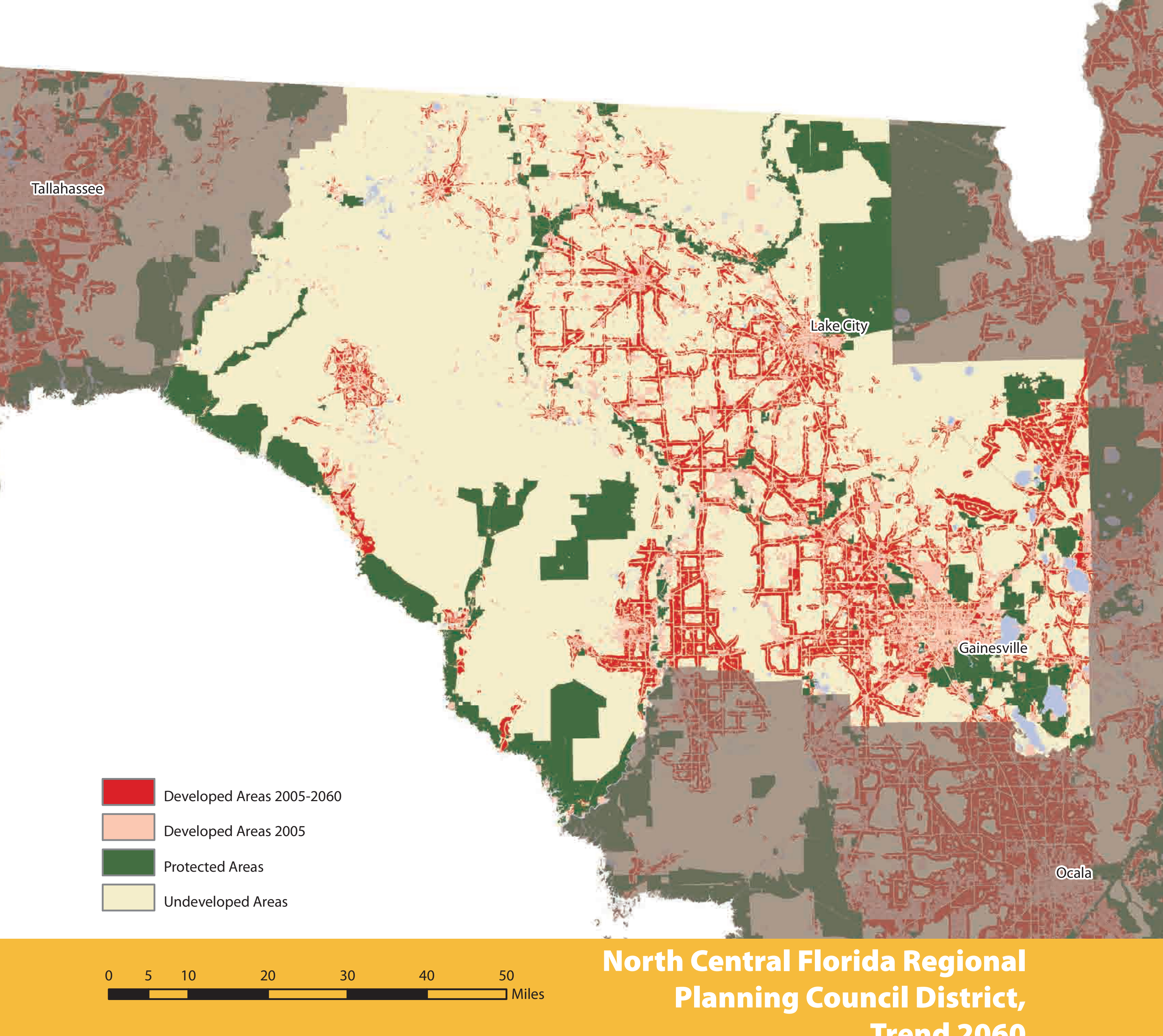



## Apalachee Regional Planning Council District, Trend 2060

Note: Trend did not account for climate change

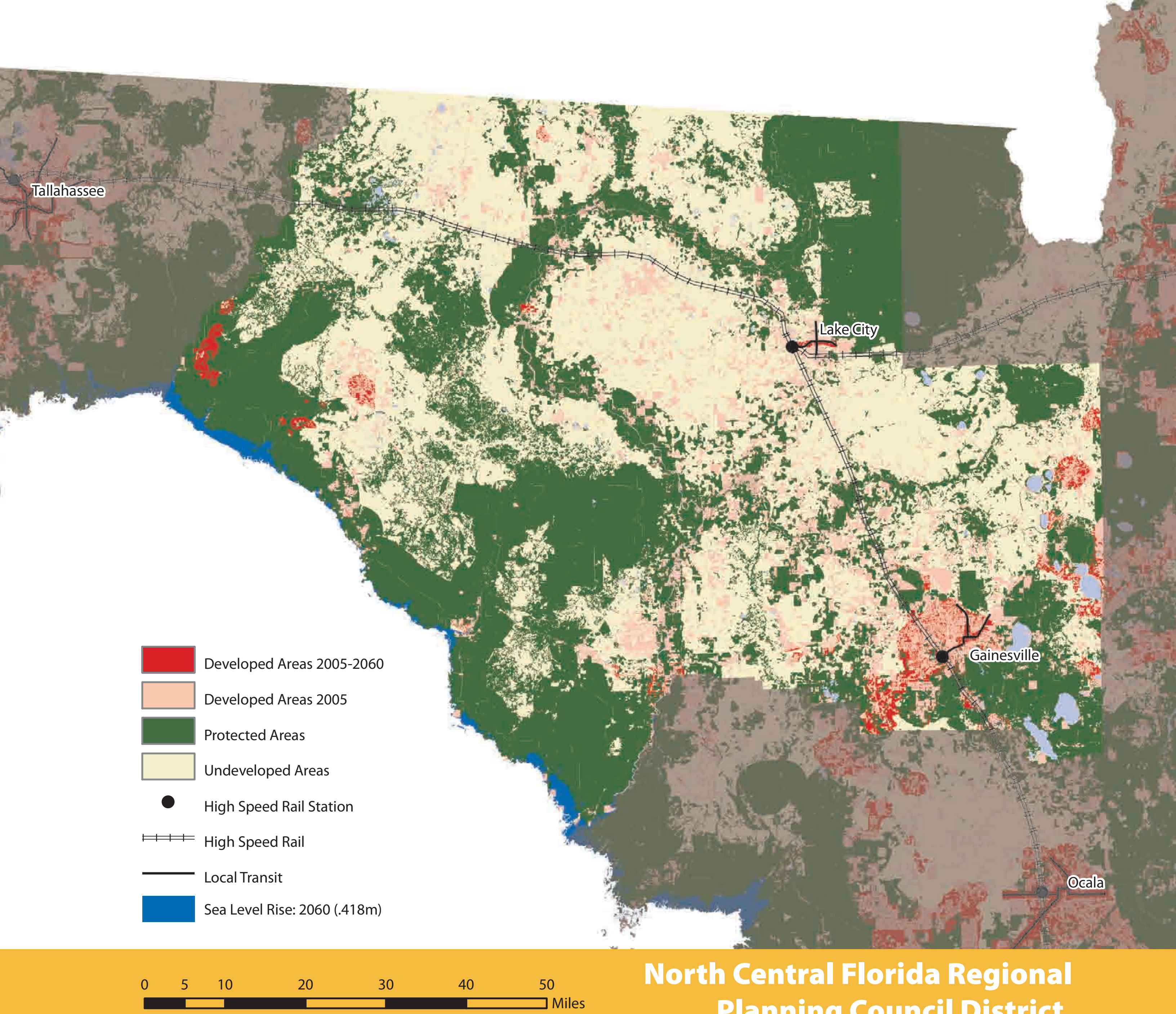



# Apalachee Regional Planning Council District Alternative 2060

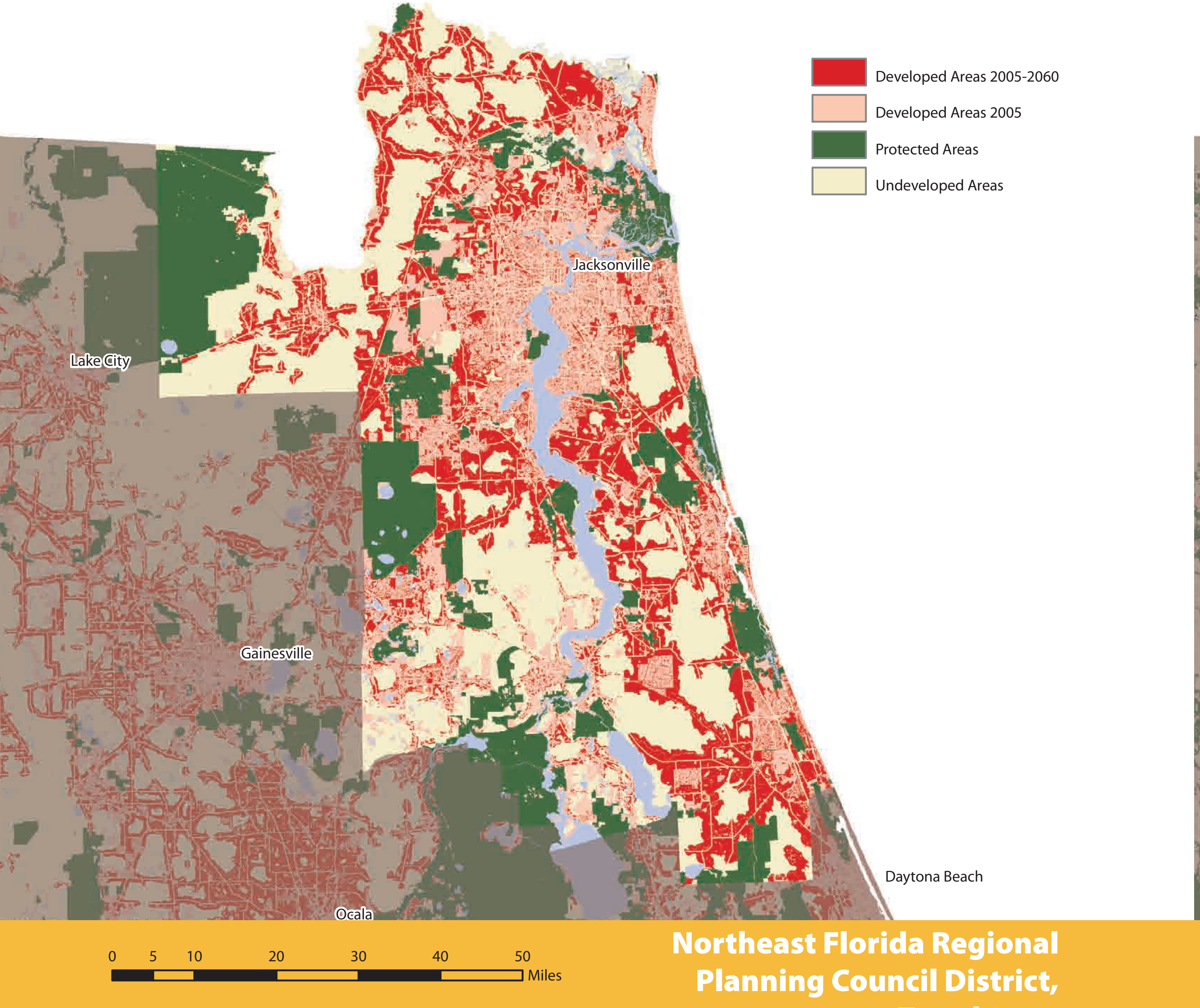



# North Central Florida Regional Planning Council District, Trend 2060

Note: Trend did not account for climate change

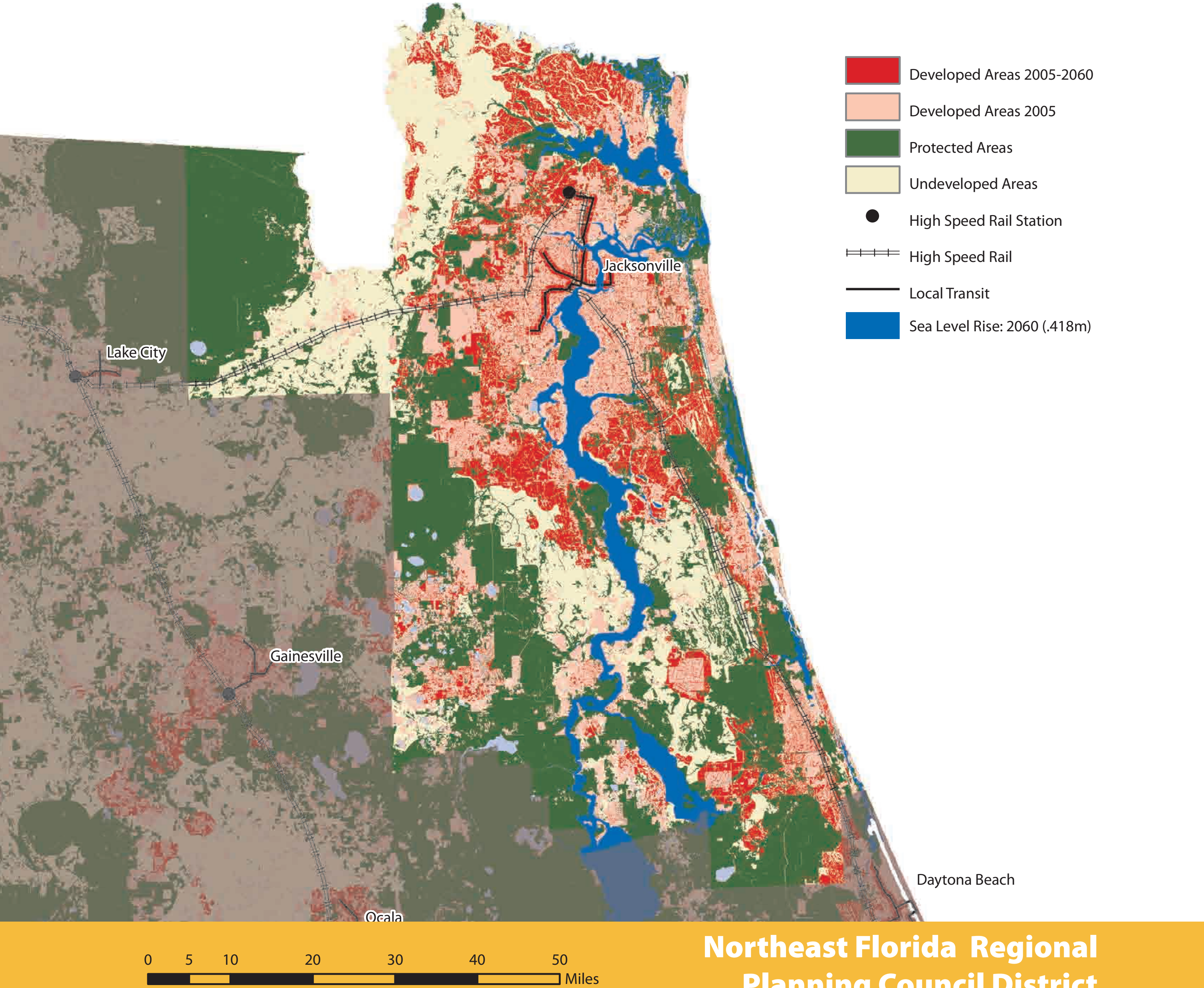



## North Central Florida Regional Planning Council District, Alternative 2060

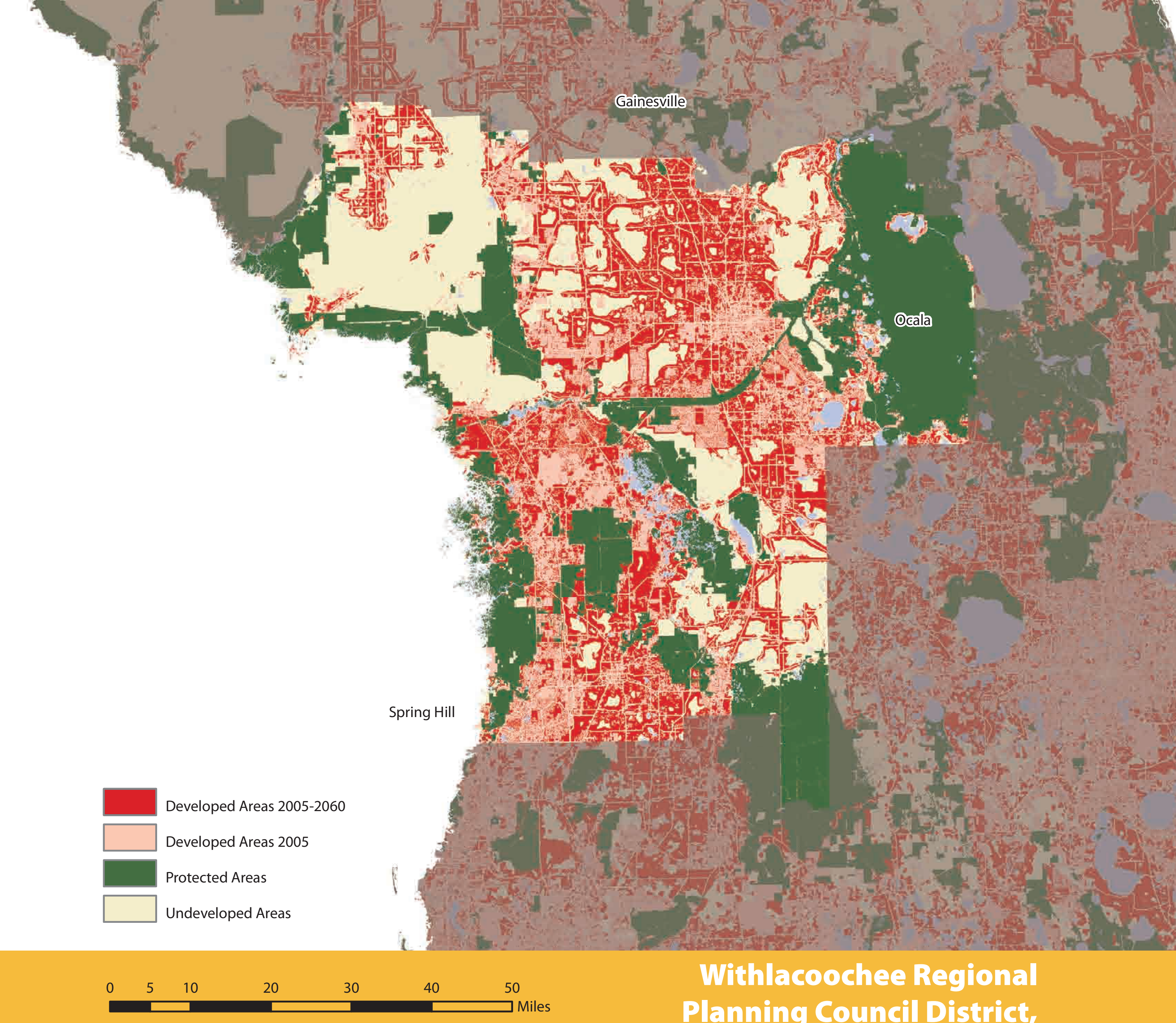



Note: Trend did not account for climate change

## Northeast Florida Regional Planning Council District, Trend 2060

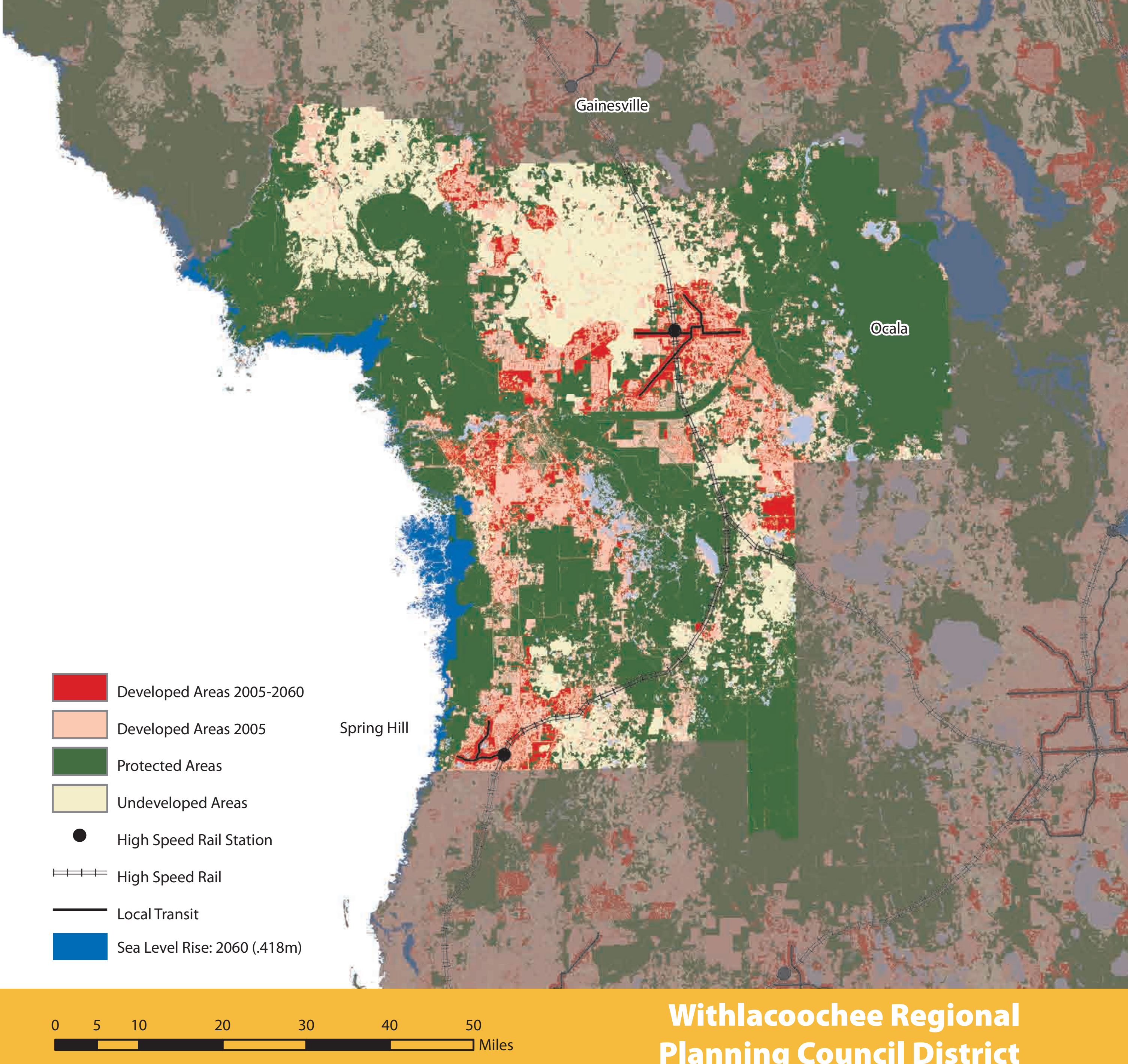



# Northeast Florida Regional Planning Council District Alternative 2060

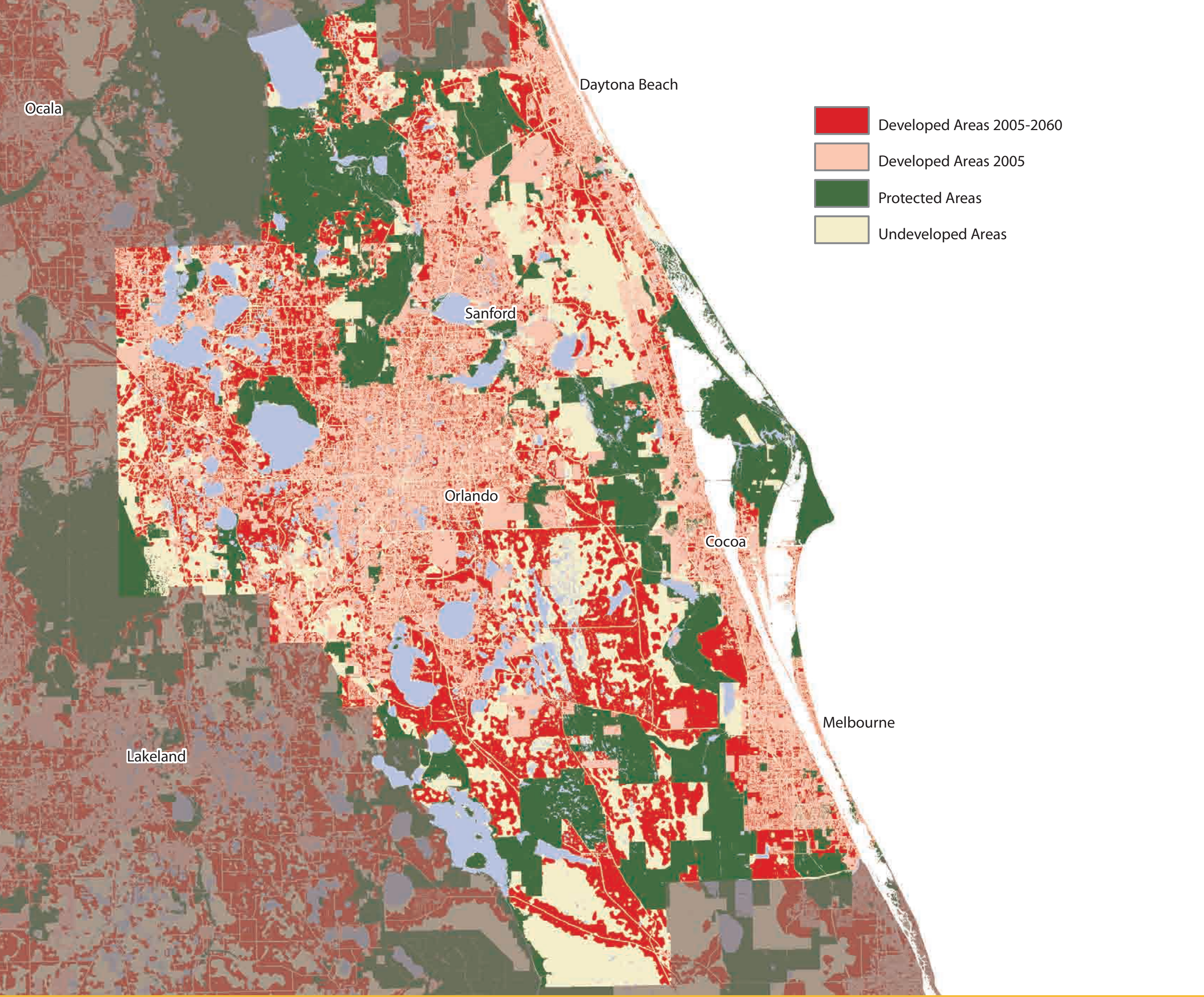



Note: Trend did not account for climate change

## Withlacoochee Regional Planning Council District, Trend 2060



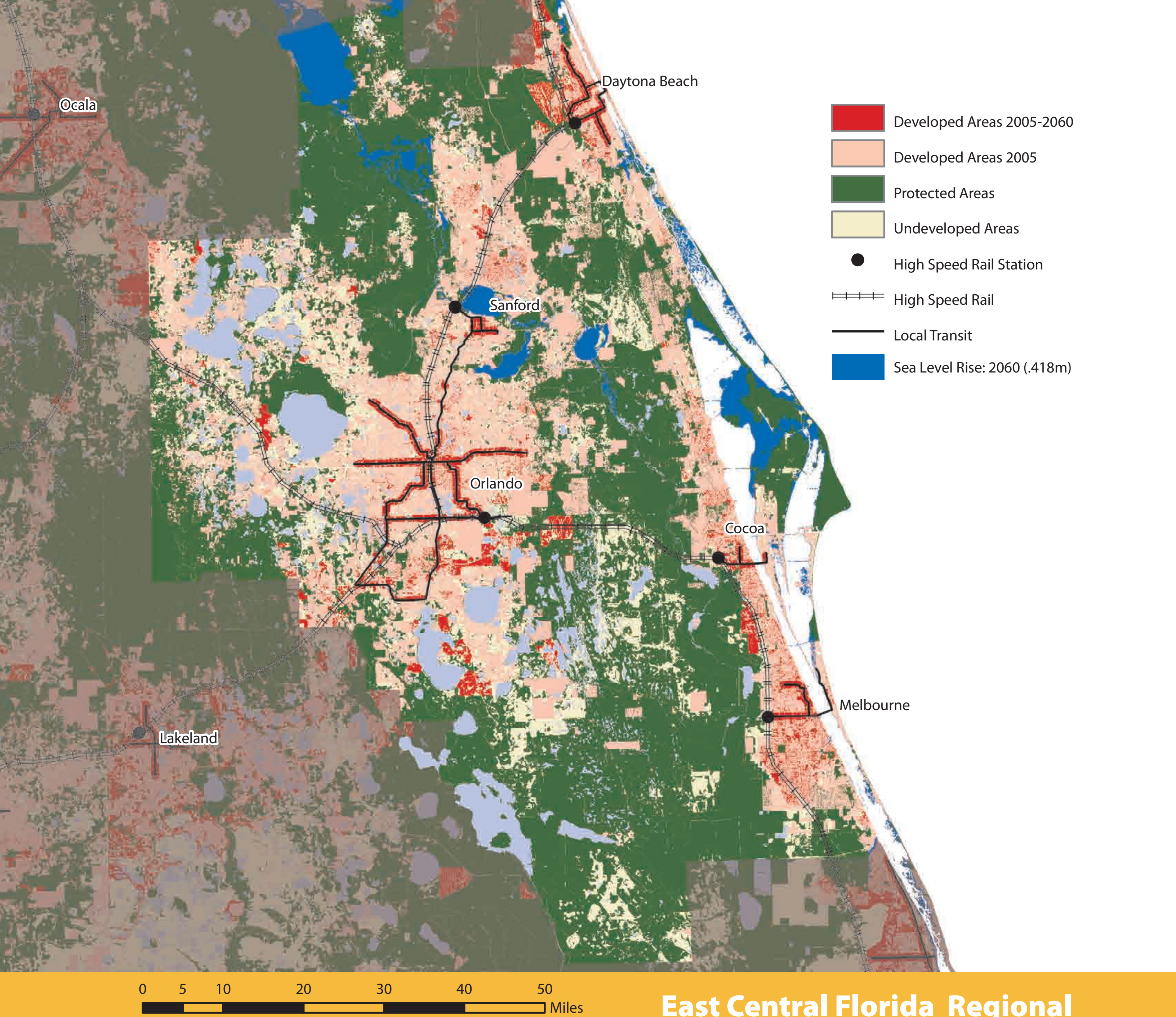

# Withlacoochee Regional Planning Council District Alternative 2060



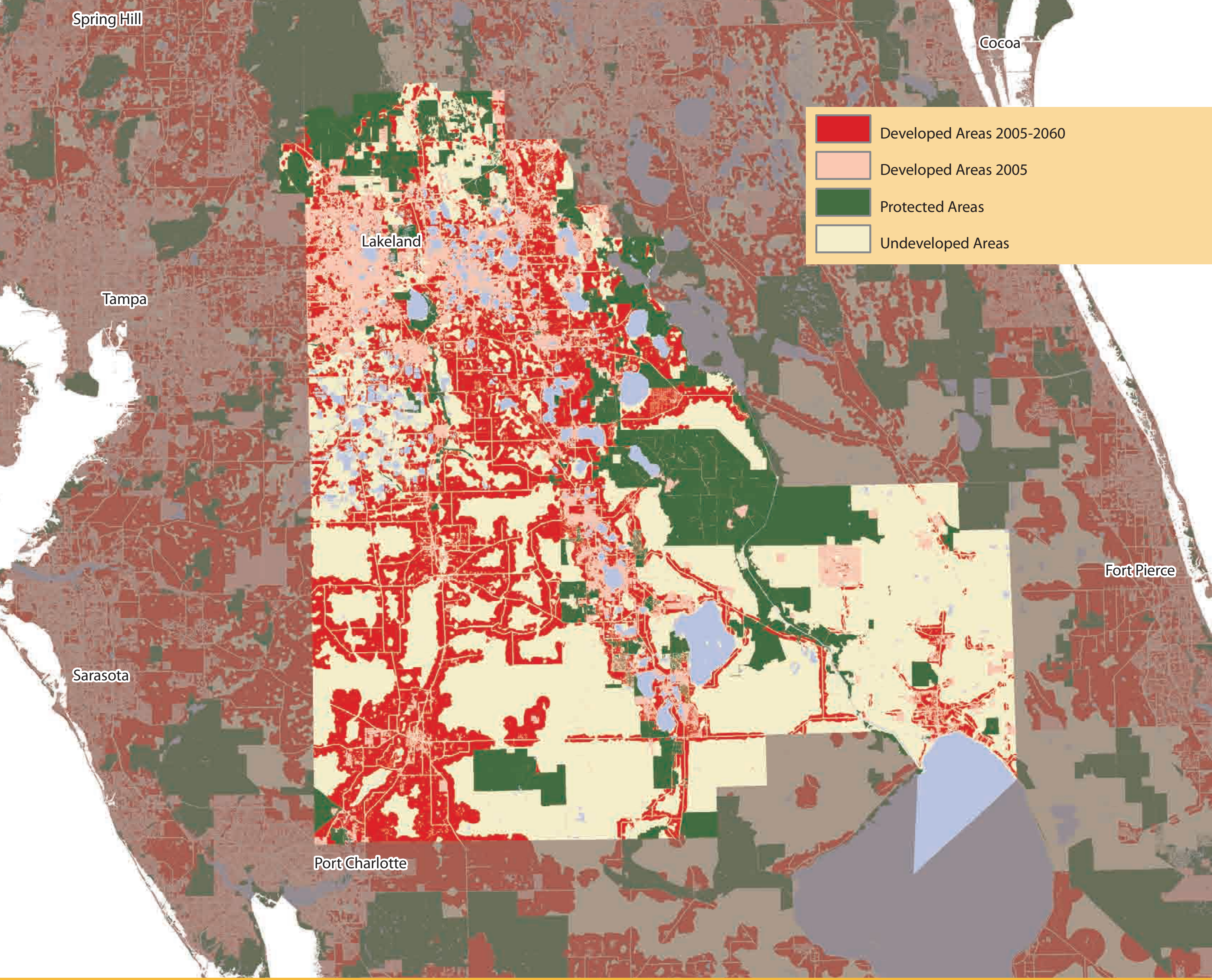

0 5 10 20 30 40 50 Miles

**East Central Florida Regional Planning Council District, Trend 2060**

Note: Trend did not account for climate change



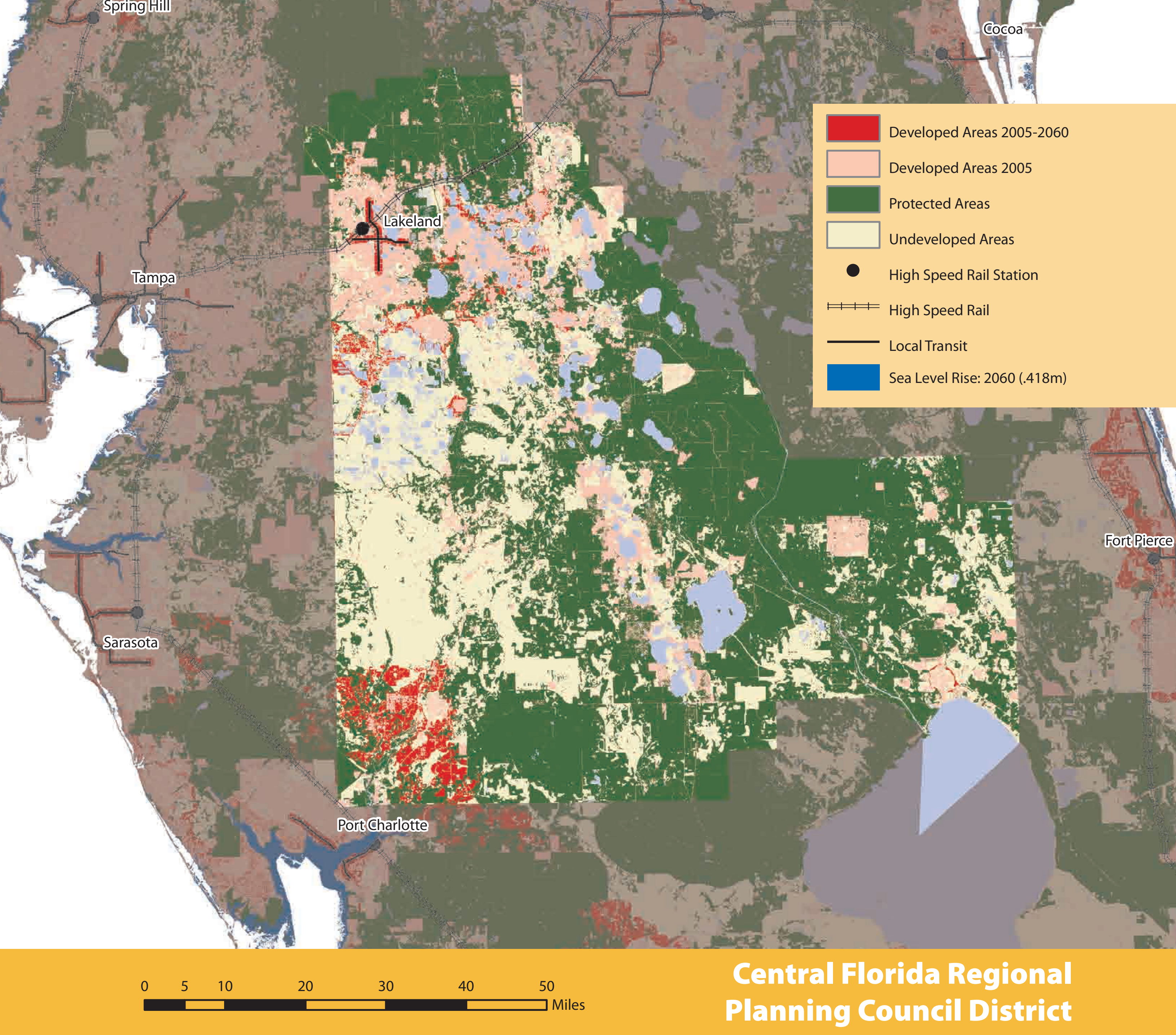

## East Central Florida Regional Planning Council District, Alternative, 2060



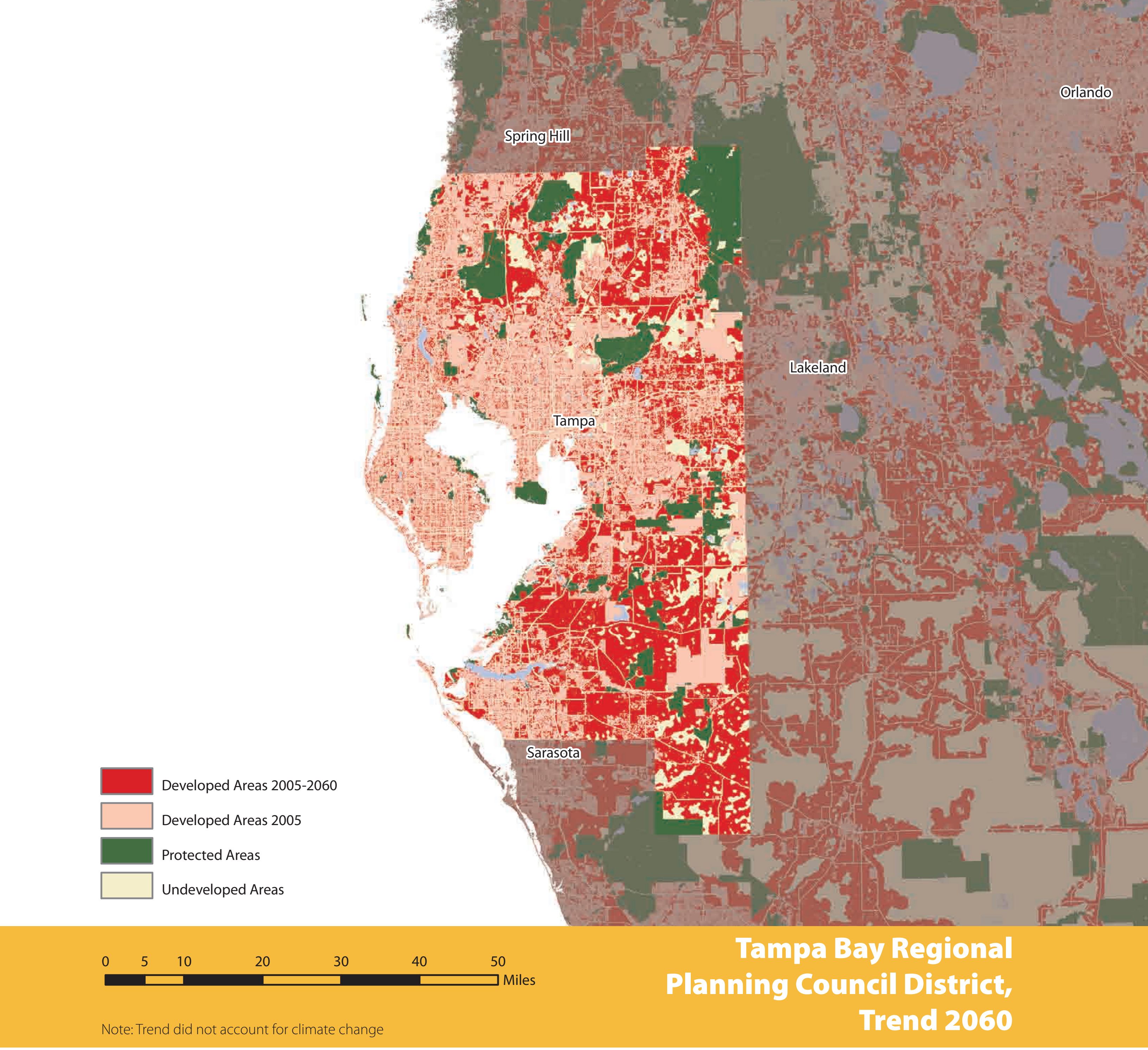

0 5 10 20 30 40 50 Miles

Note: Trend did not account for climate change

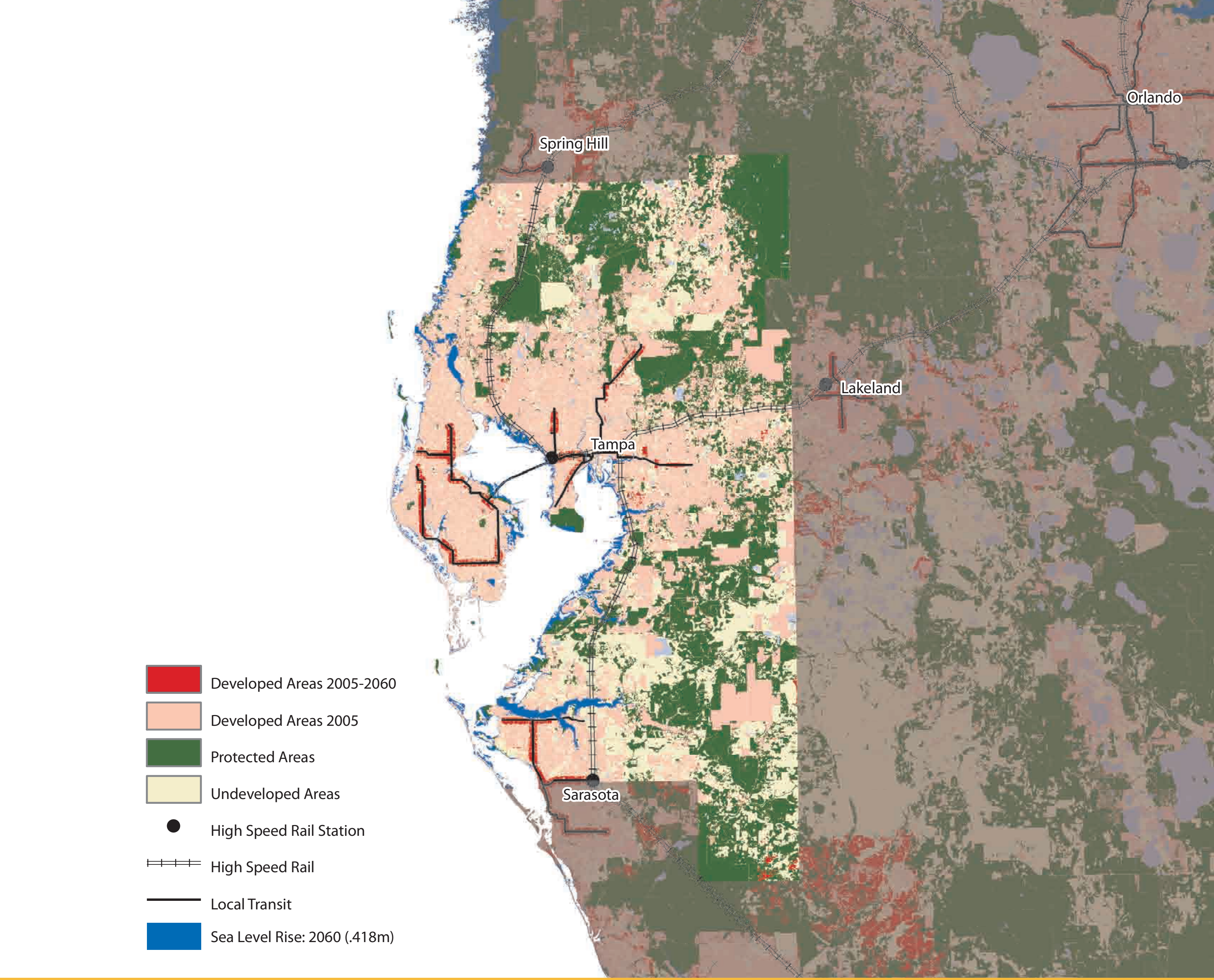
## Central Florida Regional Planning Council District, Trend 2060



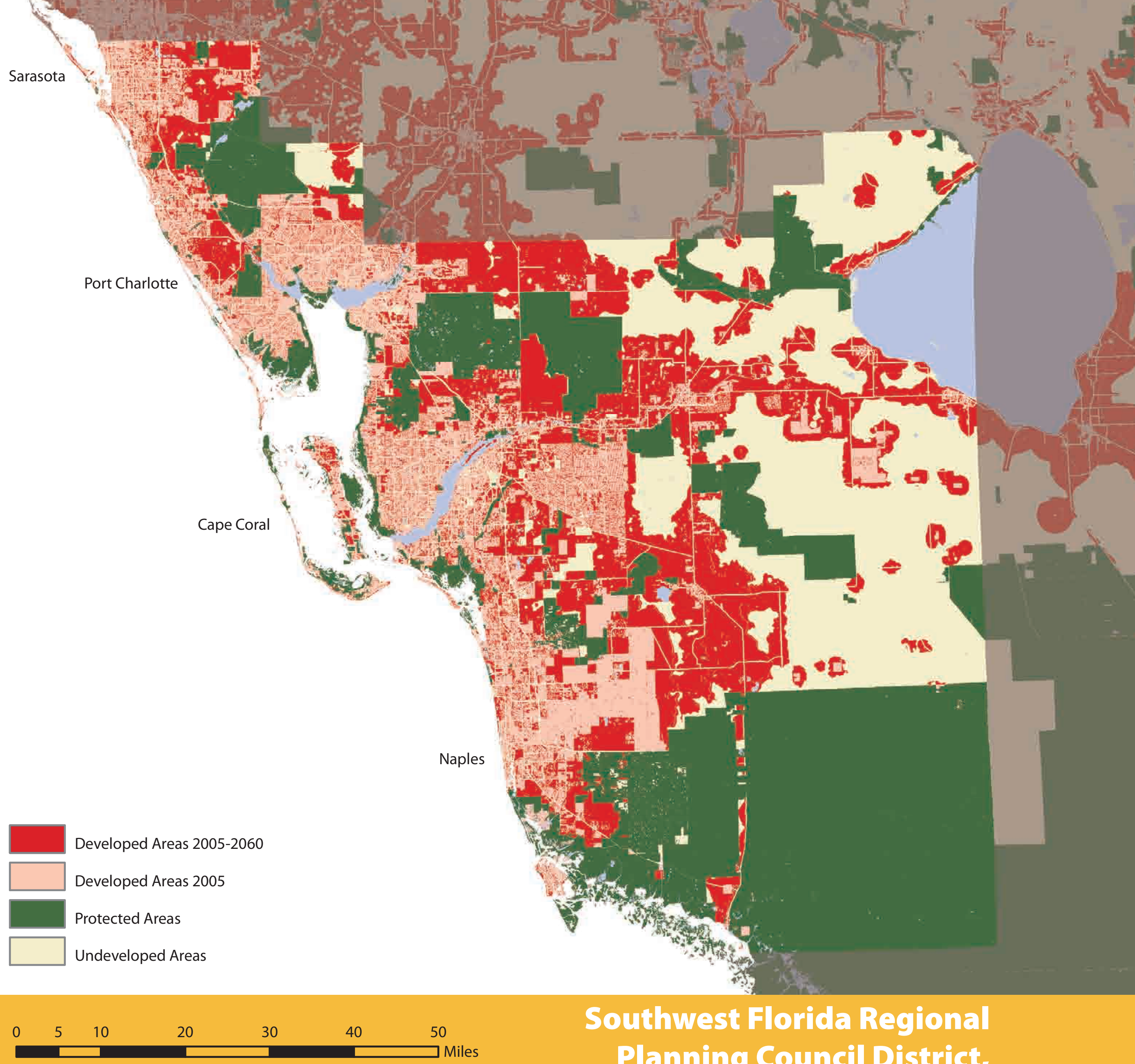

# Central Florida Regional Planning Council District Alternative 2060




**Tampa Bay Regional Planning Council District, Trend 2060**

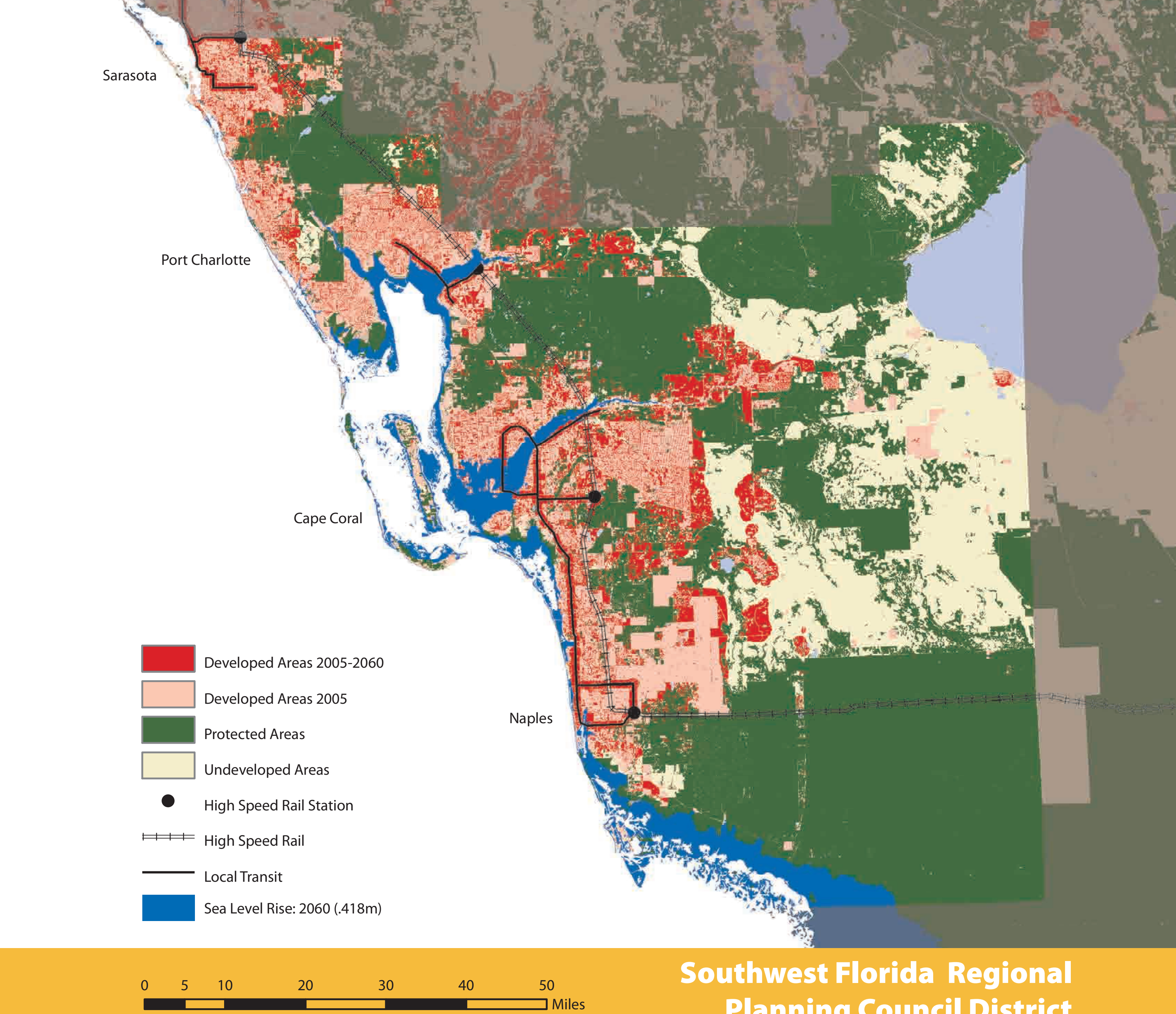



## Tampa Bay Regional Planning Council District Alternative 2060

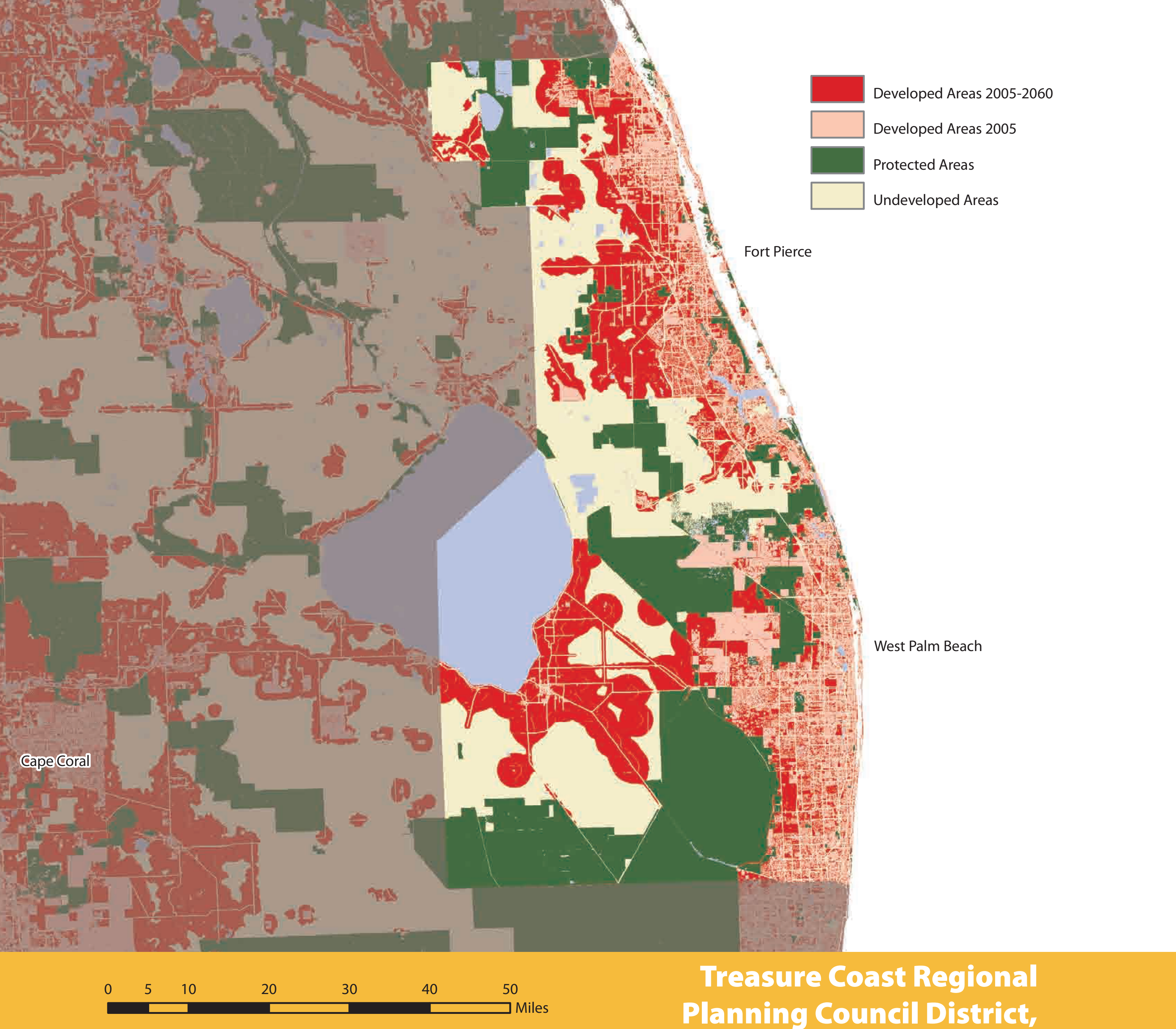



## Southwest Florida Regional Planning Council District, Trend 2060

Note: Trend did not account for climate change

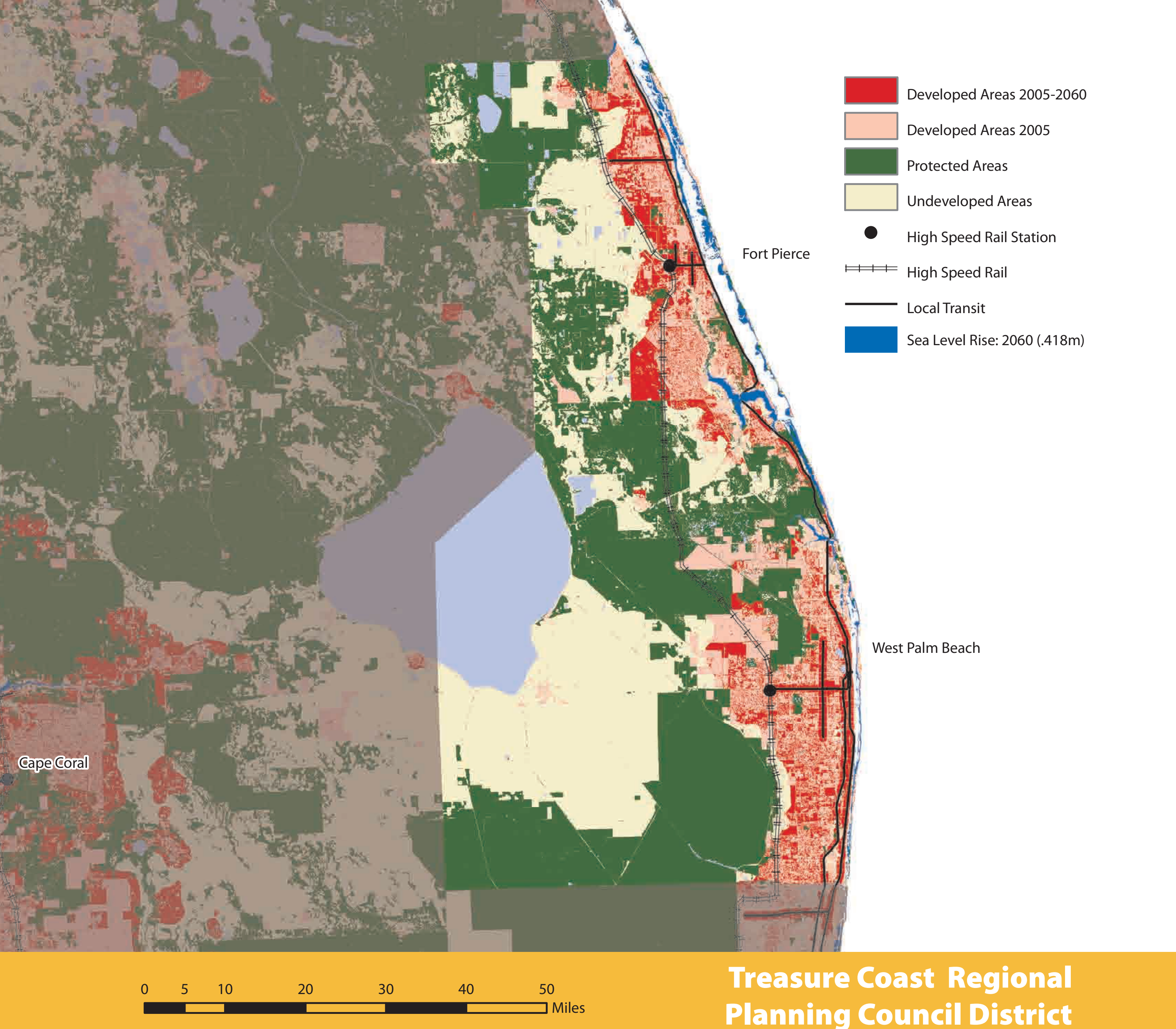



## Southwest Florida Regional Planning Council District Alternative 2060

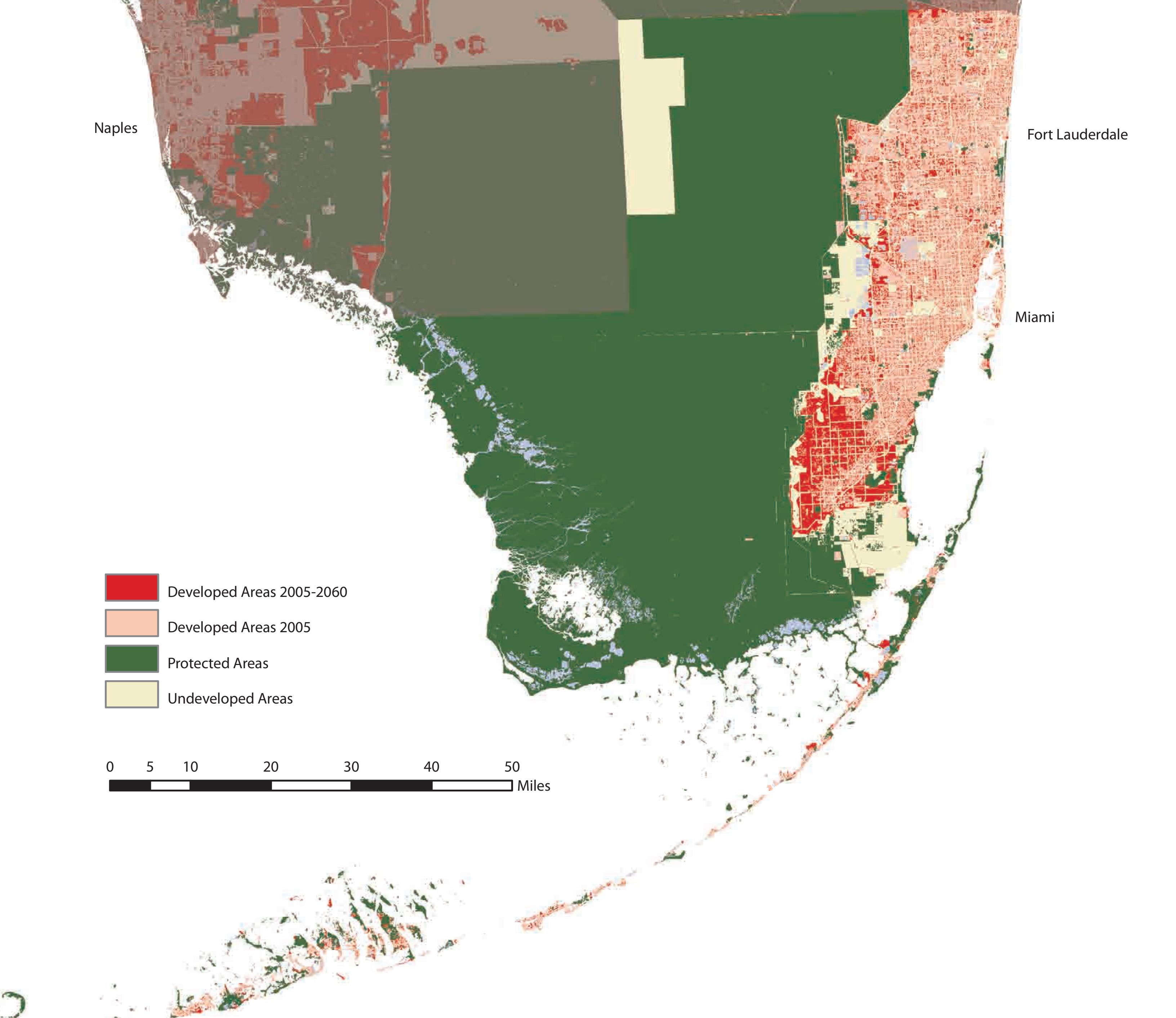



Note: Trend did not account for climate change

## Treasure Coast Regional Planning Council District, Trend 2060

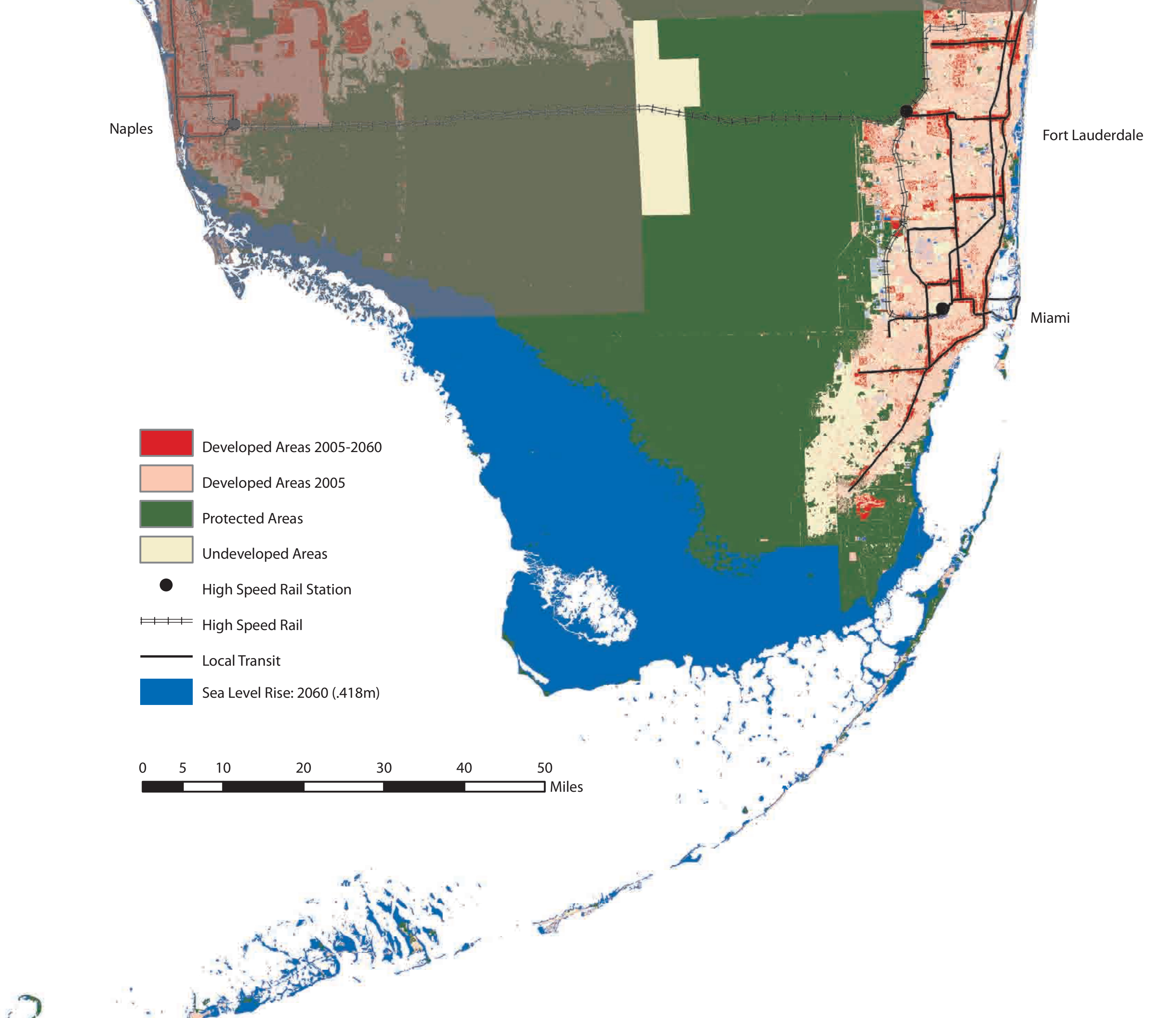



# Treasure Coast Regional Planning Council District Alternative 2060




## South Florida Regional Planning Council District, Trend 2060

Note: Trend did not account for climate change




## South Florida Regional Planning Council District, Alternative 2060

# Sustainability

## Benefits of Alternative Technologies for Environmental Sustainability

Will Florida be able to accommodate doubling its population by 2060? This fundamental question of environmental sustainability is implicitly tied to other factors such as climate change, alternative development typologies, transportation, and land use already discussed in this report. This section will address additional measures that must be adopted in order to ensure that the population growth is sustainable. Population growth along with harsh storms put significant strain on Florida's energy and environmental resources. If consumption levels remain high and continue to rise, resources will be jeopardized. Using renewable, clean technologies is important to ensure the needs of the future are not sacrificed to meet the demands of the present.[1]

Florida can manage population growth and improve quality of life for its residents if conservation measures are implemented and alternative technologies are widely adopted in the near future. The alternative technologies described here are more environmentally friendly than the current equivalent technologies. While other sectors, such as commercial, industrial, agricultural, and tourism need to take action as well, the focus is on technologies related to domestic water, energy, and petroleum consumption that can replace resource-intensive and inefficient practices dominant today. These technologies aim to:

- Utilize resources efficiently to decrease supply inadequencies
- Minimum damage to the environment
- Maintain quality of life for current residents, tourists, and future residents
- Reduce long-term costs
- Provide a mechanism for residents to take control over their future energy needs and environment

Common political issues related to alternative technologies include whether they are practical for widespread use and are cost-effective. State agencies and other stakeholders can provide information to the public about alternative technologies, creating the political support and momentum that will move these initiatives forward. Coupled with federal financial incentives, state legislation can be readily implemented.

The findings in this section address technologies that are existing and functional today in order to identify practical ways of maintaining Florida's environment without relying on advances in technology in the the future. Combining the land use benefits of the alternative to the trend with these greener technologies will provide a healthier, cleaner environment for future generations to live, work, and play.

The studio assumed that today's water, energy, and petroleum consumption are sustainable because the state is currenly able to provide these services. However, it is essential that the current consumption remains constant or decreases because there are current issues with supply and adverse effects of consumption. In order for Florida to keep consumption constant the following need to be achieved:

| | |
|---|---|
| **By 2020** | All new homes and 28 percent of existing homes will become low water consumption households. They will require a rainwater collection system, low flow appliances, and will reuse greywater.<br>All new homes and 50 percent of existing homes will have solar water heaters.<br>All new homes and 14 percent of existing homes will have photovoltaic systems.<br>40 percent of vehicles need to achieve on average 46 miles per gallon (mpg) |
| **By 2040** | All new homes and 47 percent of existing homes will become low water consumption households.<br>All new homes and 80 percent of existing homes need solar water heaters.<br>All new homes and 5 percent of existing homeswill need photovoltaic systems.<br>69 percent of vehicles need to achieve on average 46 mpg. |
| **By 2060** | All new homes and 95 percent of existing homes will become low water consumption households.<br>All new homes and 69 percent of existing homes need solar water heaters.<br>All new homes and 5 percent of existing homes need photovoltaic systems.<br>87 percent of vehicles need to achieve on average 46 mpg |

While these initiatives are primarily concerned with environmental sustainability, social and economic benefits such as community environmental stewardship, educational awareness, and job creation are some of the additional benefits from adopting these technologies. These solutions will not solve all the resource challenges the state may face. However, by proactively implementing initiatives with the goal of maintaining current rates of consumption, Florida will be able to effectively plan for the needs of future residents.

# Domestic Water Initiatives

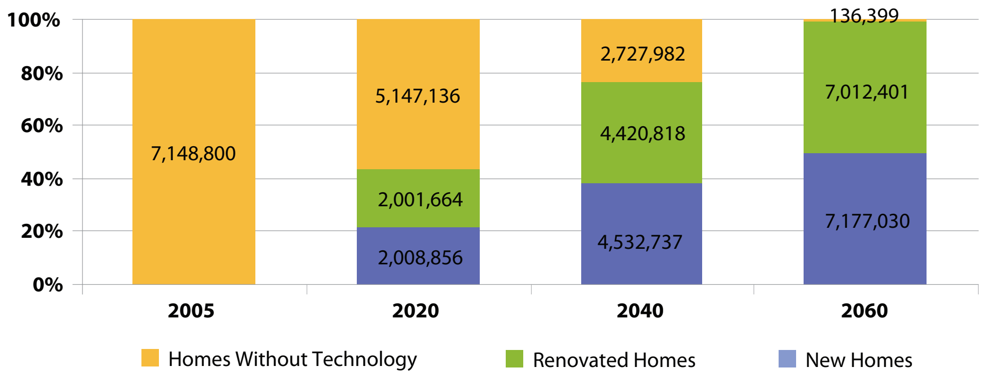
The issue of water supply requires urgent and immediate attention.[1] When using the projected consumption in 2060, demand increments for the use of water will escalate by about two percent per year in Florida. This change will be driven by population and economic growth, new development, and changes in the built environment. At this rate, the predicted growth in the state will not be sustainable unless drastic measures are adopted. The following methods were chosen as the primary systems for water conservation:

1. A rainwater collection system to collect rooftop rainwater for household usage. This solution is based on a decentralized water supply system, which would yield the most reliable, cost efficient, and environmentally responsible result;
2. Installation of water efficient appliances in residential units;
3. Wastewater and greywater reuse.

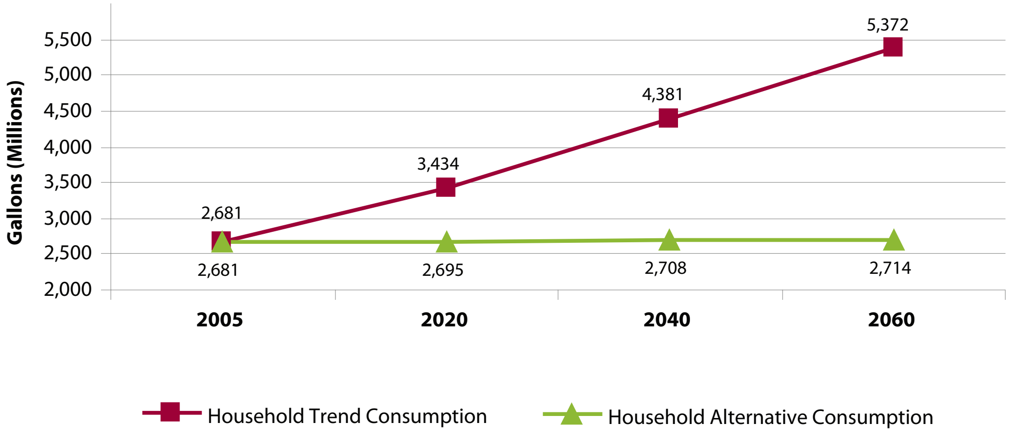
The possibility of adopting these sustainable systems will become plausible only if Florida decides to address these important issues carefully. An aggressive program must be implemented to change and adapt the majority of the households to these conservation systems. This would mean that all new construction will have the system, along with an increasing percentage of existing homes that will be renovated into low consumption households. Approximately, this accounts for 28 percent or 4 million homes by 2020, 47 percent of the remaining homes or 8.9 million by 2040, and 95 percent of the remaining homes or 14.1 million by 2060.

This approach would significantly reduce the impact of doubling the population by 2060. The trend model in water consumption indicates that water demand will grow parallel to population, and by 2060 residential uses will account to more than 5.3 billion gallons per day (GPD). This is twice as much as today's consumption of 2.6 billion GPD. By using the alternative systems suggested in this report, residential demand could remain constant by 2060. However, if demand from tourism, institutions, and agricultural uses also continues to increase without implementing similar technologies, consumption will not remain constant.

## Percent and Total Households Needed: Alternative Technology




## Domestic Water Consumption (per day)



## Water Demand and Uses

To calculate the total demand, we used an average per capita water use of 150 GPD, backed by the South Florida Water Management District (SFWMD).

### Rainwater Collection System

Rainwater collection systems are designed to capture rainwater from the roofs of buildings. The captured rainwater is then transported through gutters and other pipes into cisterns or tanks with filtering devices.

As a planning solution for Florida, rainwater collection systems can be easily accommodated by below garage structures. Almost 100 percent of the rainwater can be collected and can be used for:

Toilets, laundry, showers, sinks and faucets
Landscape irrigation
As much as 60 percent of a home's estimated annual water needs, consisting of 30 percent savings due to the rainwater collection system and 20 percent due to the installment of low consumption appliances, and the state's conservation programs.[2]

• Please refer to the section "Rainwater Collection System" for details regarding components of the system.

#### Negative Aspects of the Rainwater Collection System

Rainwater collection and its benefits do not correspond to water needs in all seasons. During the winter months when demand for water is greatest due to the lack of rain, the cisterns will have the lowest collection of rainwater and vice versa. Also, water yield efficiency is determined by climate, roof area, and tank collection capacity; therefore not everyone will have the same benefits.

### *Drinking Water Treatment Technologies*

In order to achieve potable drinking water standards for the water collected, the NSF Rainwater Catchment System Testing Program[3] reviews commercial products including gutters, roofing materials, and coating products to ensure they do not impart contaminants into the water at levels that exceed EPA health guidelines. In addition, the tanks and tank coatings that can be used to store rainwater must also be tested to ensure they meet today's public health standards. The "Filtration Methods" section of the Appendix outlines techniques that are used to achieve the desired water quality.

### *System Capacity and Physical Characteristics*

The capacity of a rainwater collection system depends on the amount of rainfall, size of collection area, storage capacity, and household water demand. On average, roughly 1,125 gallons of water can be collected for every 2,000 SF of roofing space (during every 1 inch rainstorm).

### *Reuse*

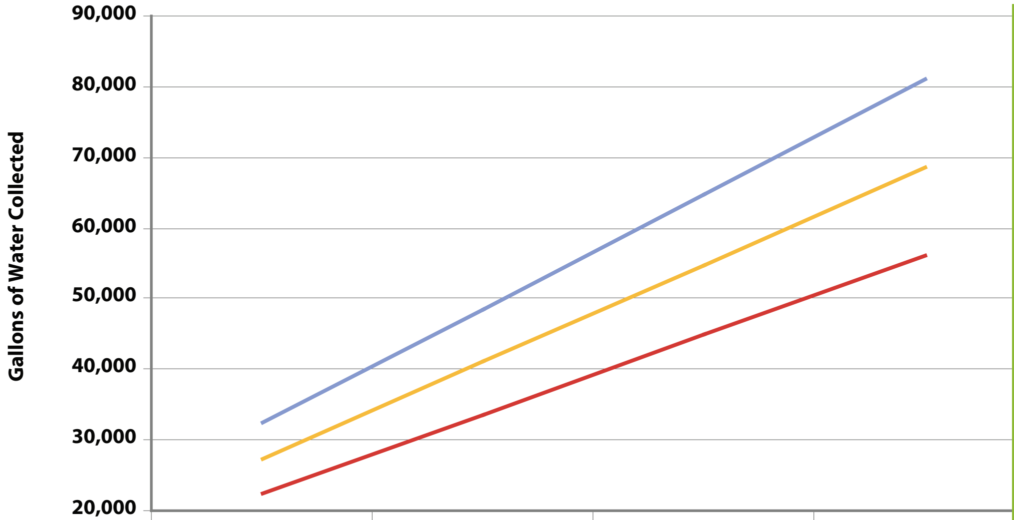
Reclaimed water use involves using treated wastewater from treatment plants for landscaping irrigation and industrial uses. The main purpose of this method is to conserve potable water for residential uses. Florida and California are national leaders in water reuse.[4] Florida should continue in this effort and increase the percentage of water that it reuses.

### Other Methods of Water Conservation

There are several additional methods of water conservation and reuse. They are detailed in the "Additional Methods" section in the Appendix.

## Financial Feasibility

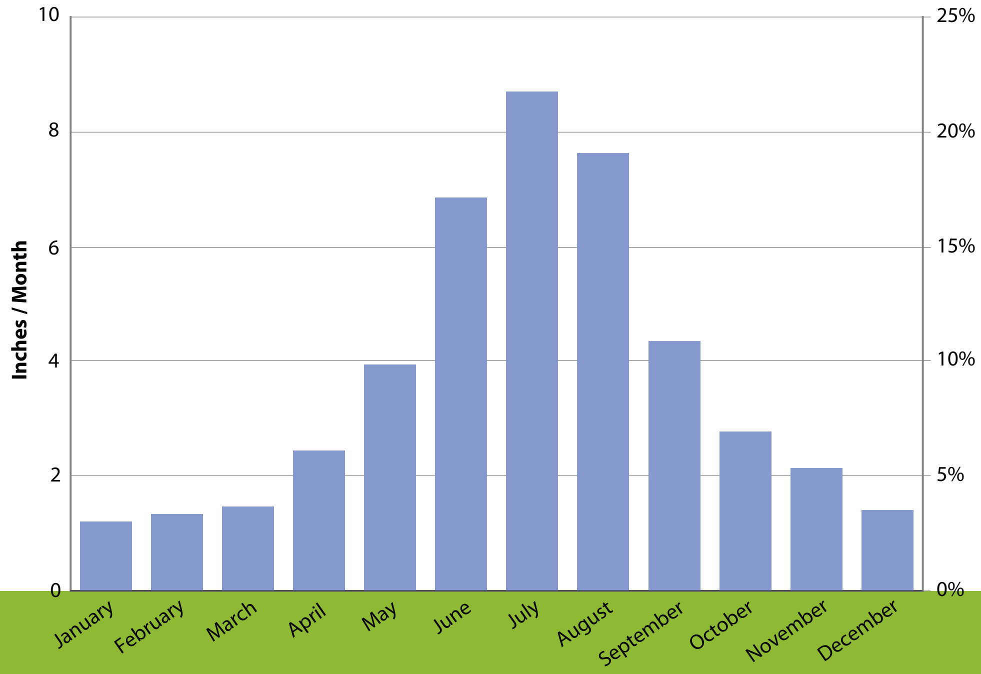
The state should consider financial incentives and funding options for rainwater collection systems. Some factors to consider include reduction in residential utility bills because of energy and water efficiency measures. These costs are expected to rise exponentially over the next decades making any conservation system more economically feasible. The cost of purchasing the technologies today should be compared to the total savings achieved from such systems.




| Roof Size → Annual Rainfall (Inches) | 1000 | 1500 | 2000 | 2500 |
|---|---|---|---|---|
| 36 | 22,442 | 33,662 | 44,883 | 56,104 |
| 44 | 27,429 | 41,143 | 54,857 | 68,571 |
| 52 | 32,416 | 48,623 | 64,831 | 81,039 |

**Annual Water Cistern Yields with Varying Roof Sizes and Rainfall Totals**

## Average Monthly Rainfall (Statewide), Total Annual Rainfall=44.25"




## The method of water supply and conservation chosen needs to contemplate the following steps:[5]

1. Evaluate trends for the region's population and demand analysis, including technical, managerial, and financial considerations

2. Locate the regions' most important bodies of water, natural resources, and include a protection plan for long-term conservation

3. Recommend the best solutions for delivering the service

4. Analyze the impact of the system in local comprehensive plans and capital improvement programs

5. Incentivize the use and adoption of the new system

6. Monitor the system's efficiency and conservation goals

# Domestic Energy Initiatives

Florida's demand for electrical generation is expected to grow by approximately 58 percent between 2002 and 2020.[1] Based on 2003 data, 51 percent of electric energy was consumed for residential uses, 32 percent by commercial customers, 12 percent by industrial users, and two percent for other uses.[2] Since a majority of electricity is consumed for residential uses, household energy efficiency and on-site power generation are strategic approaches to reducing energy consumption and decreasing the state's reliance on coal, natural gas, and oil imports, all of which are non-renewable, limited energy sources that contribute to the effects of global warming.

Solar technology holds great promise as a statewide renewable energy source for numerous reasons. Harnessing solar energy generates no noise pollution, air pollution nor hazardous waste. Solar power is a domestic energy source that replaces conventional fuel imports, freeing the United States from uncertainties surrounding energy dependency from politically unstable regions. Solar technology has been used for years with a decrease in cost and increase in system quality and reliability.[3] Currently, the two main types of solar technologies include solar water heating and photovoltaic systems. Each of these systems can be customized to fit an individual household's electricity needs. By aggressively pursuing residential building energy efficiency improvements and increasing research and investment into proven renewable energy resources, Florida can radically alter its energy use projections.[4]

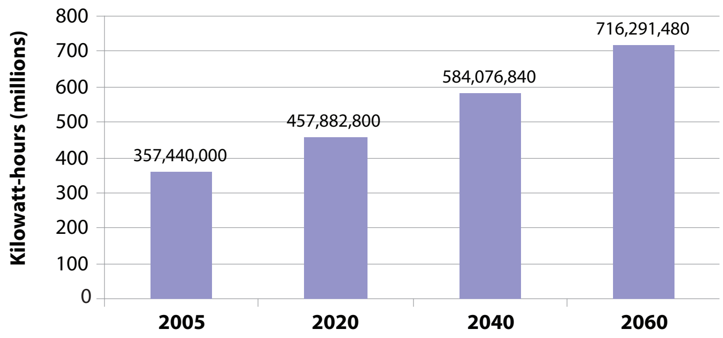
## Solar Water Heaters

Solar water heaters provide year-round hot water by using the sun instead of electricity or gas to heat water, ultimately reducing a homeowner's monthly utility bill.[5] Solar water heaters are more economical over the life of the system than heating water with electricity, dedicated heat pumps, heat recovery units, or propane.[6] They are the most efficient household appliance a homeowner can purchase, and are the most cost-effective solar technology on the market. Federal tax incentives and an accurate database of qualified installers make it convenient, safe, and affordable for homeowners to install this technology. The types of solar water heating systems used in Florida are pumped, integral collector storage (ICS), and thermosiphon.[7] Please refer to the section "Types of Water Heating Systems" in the Appendix for details.

### Type of system and costs

The cost of a solar water heater depends on factors such as the size of the household, the size and type of the solar system, the type of financing available, the type of roof on which the collector will be installed, the amount of rebate incentives, building code requirements, and professional versus Do-It-Yourself (DIY) installation.[8]

Domestic Electricity Demand



As a general rule of thumb, each person requires 10 square feet of collector area and 20 gallons of water storage.[9] Cost for parts and labor vary from $3,500 to $5,500 per system. It is important to note that solar water heating is economically competitive with electrical and propane heating.

### Savings

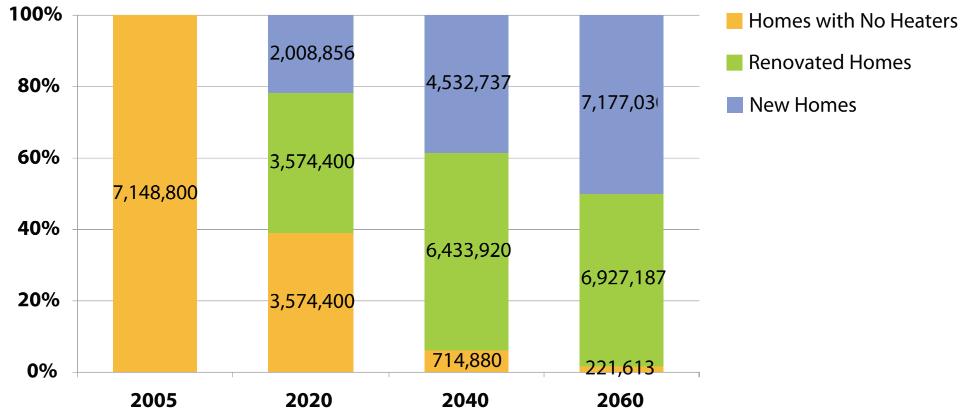
For the average household in Florida of 2.5 persons per household, a 20 square foot, 40 gallon ICS system will save over 1,600 kilowatt-hours per year (kWh/yr) and over $150 per month off the hot water portion of a household monthly utility bill. In general, a solar water heater should save between 50 to 85 percent of the hot water portion of monthly utility bill. In order to keep electricity consumption for water heating at the same levels as today, all new homes will have the system in addition to an increasing percentage of existing homes. In 2020, 3.8 million homes are suggested to have water heaters, 11.4 million homes in 2040, and 14.3 million in 2060. Please refer to the table “Solar Water Heating Calculations” in the appendix for details.

## Photovoltaic Systems

Photovoltaic (PV) systems are an important energy technology. As a relatively new high-tech industry, it helps to create jobs and strengthen the domestic economy.[10] Few conventional and alternative power-generation technologies have as little negative impact on the environment as photovoltaics. As PV systems cost increasingly less to produce and use, they becomes more affordable and available.

PV systems do not require liquid or fuels to be transported or combusted and because its energy source is free and abundant, PV systems can guarantee access to electric power. PV systems are highly reliable, need little maintenance, have virtually no environmental impact, are modular and flexible in terms of size and applications, can meet the demand and capacity challenges facing energy service providers, help energy service providers manage uncertainty and mitigate risk, and conform to both form and function in a building.[11] For the purposes of proposing residential alternative technologies, rooftop PV systems will be the focus of solar electricity generation. Two types of PV systems are grid-connected and stand-alone. Please refer to the section “Types of Photovoltaic Systems” in the Appendix for more information.

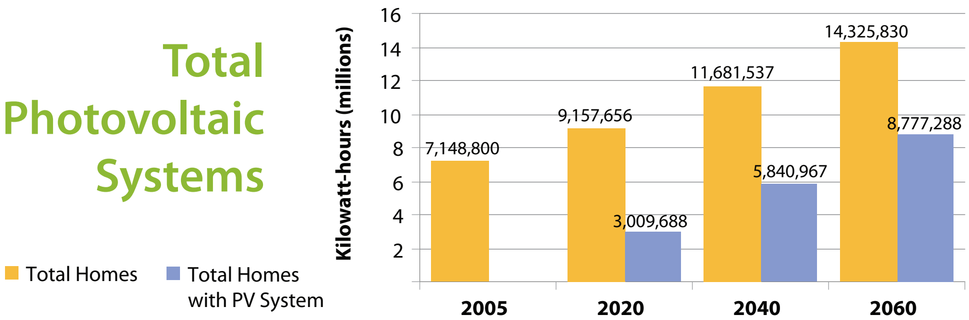
**Solar Water Heating**



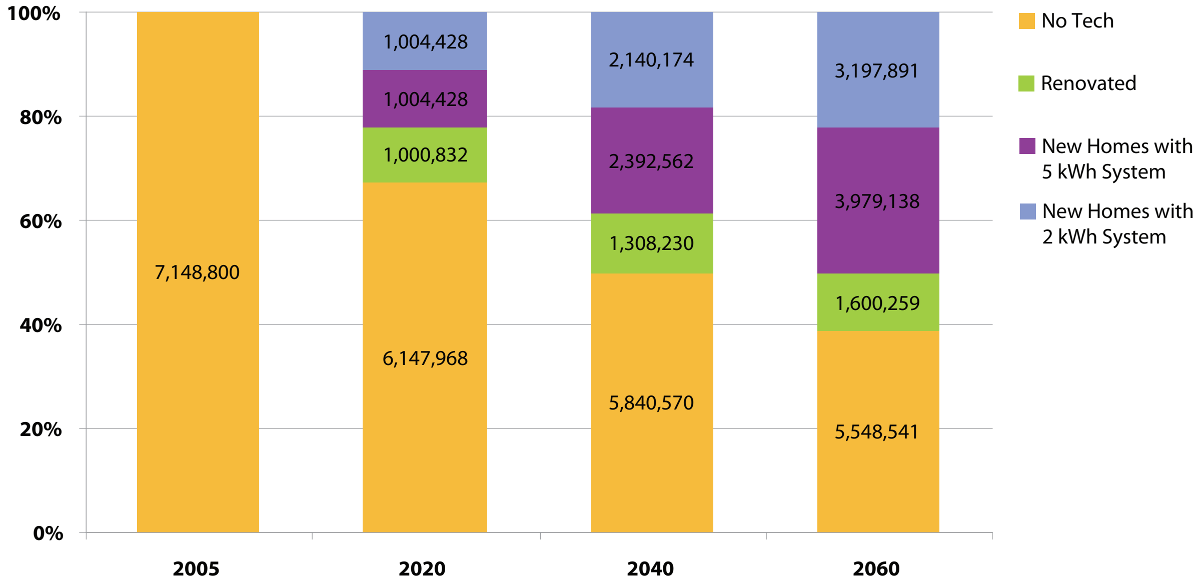
### Type of system and costs

The cost for installation for a 2-kilowatt system is $16,000 to $20,000 and $35,000 to $45,000 for a 5-kilowatt system. With a $16,000 rebate, a new 5-kilowatt system will cost an average of $24,000. If a household monthly electricity bill is $150, it will take about 13 years for the system to pay for itself. The return on investment on an average sized 2-kilowatt residential system is about seven or eight years. But if viewed over the twenty-five to thirty year life span of the solar panels, the cost savings can easily be in the tens of thousands of dollars.[12]

## Total Photovoltaic Systems




## Photovoltaic Systems



### Savings

A typical household in Florida uses 45-50 kilowatt-hours (kWh) of electricity per day. There are solar panels available that each produce 4.5-5 kWh of electricity.  Therefore, a 10 array, 5 kW system will produce 45-50 kWh of electricity, entirely offsetting daily electricity needs of a conventional home.  The more energy efficient a home is, the less electricity it needs. To keep household electricity consumption at the same levels as today, all new homes will need a system made of panels that generate either 2kWh or 5kWh per day.  A small percentage of existing homes will require a 2 kWh system or 5 kWh system.  Refer to the table "Photovoltaic System Calculations" in the appendix for details.

## Financial Incentives

Most major manufacturers offer warranties of 20 or more years on solar systems that maintain a high percentage of initial rated power output. When selecting PV modules, consumers should look for the product listing, qualification testing, and warranty information in the manufacturer's specifications.

As part of the 2006 Florida Energy Act, the Solar Energy Systems Incentives Program provides rebates for purchase and installation of solar energy systems in homes and businesses. Any resident of Florida who purchases and installs a new solar energy system from July 1, 2006, through June 30, 2010 is eligible for a rebate on a portion of the purchase price of that solar energy system.  Please refer to the "Financials Incentive" section of the Appendix for more information.

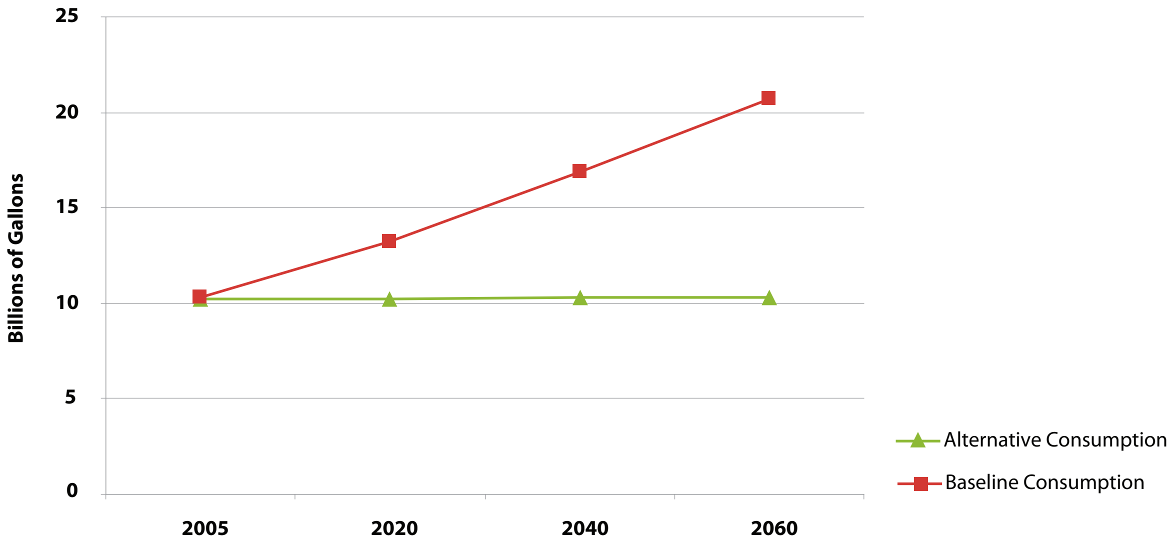
# Petroleum Consumption by Personal and Commercial Vehicles

Personal automobiles account for 30 percent of Florida's energy consumption. This is a key area where policies and incentives to promote existing technology could have a significant impact on maintaining or reducing energy consumption.[1] Florida uses 86 billion gallons of gasoline per year and consumption is growing by 300 million gallons per year. The state along with the country as a whole is dependent on politically unstable countries for this supply. Florida imports essentially all of its crude oil and gasoline, only producing less than one percent of the oil it uses.[2] Oil dependence has many negative effects including threats to national security and reduction in leverage when there are threats from oil-exporting nations[3].

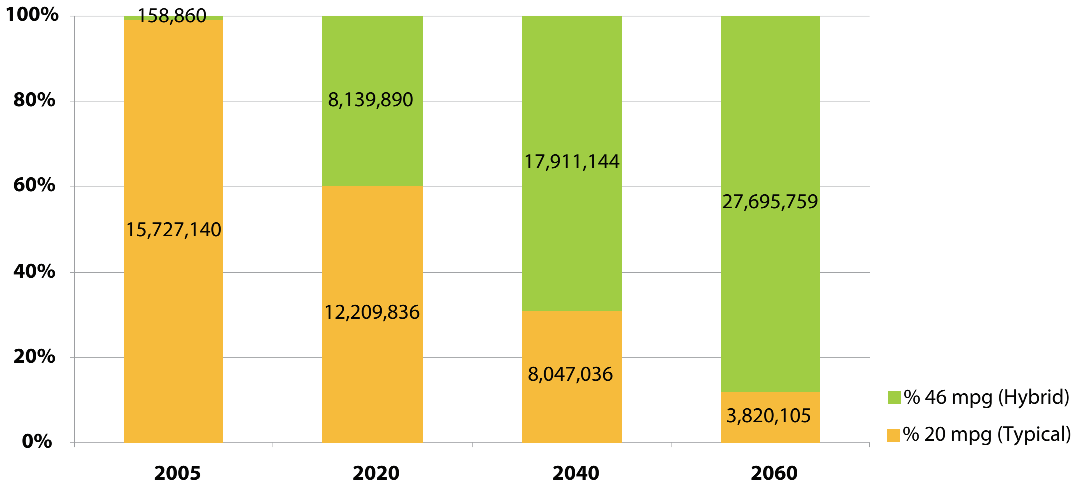
Aside from increasing consumption and reliance on foreign countries, gasoline negatively affects air quality and contributes to global warming. Oil accounts for 42 percent of the world's energy-related carbon dioxide emissions that trap heat in the atmosphere.[4] With Florida's economy so strongly dependent on tourism and transportation fuel, the need for future fuel alternatives and clean air is essential.[5]

Improvements in automobile technology and design such as engine efficiency, aerodynamic shape, and lighter weight materials have led to automobiles consuming less than half as much energy from 1970 to 1990.[6] The Clean Air Act Amendments of 1990, the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, and the Energy Policy

## Petroleum Used With and Without Technology (per year)



## Percent and Total Vehicles Needing Technology




Act of 1992 were essential in the movement to reduce pollution from automobiles. These policies sought to decrease automobile use, enhance alternative fuels, and advance technology to reduce emissions from vehicles.[7] Despite the efforts of these laws, a reduction in automobile use and increase in electric propulsion technology have not been achieved.[8] Currently less than one percent of Floridians own alternative fuel automobiles.[9]

### Future Consumption without Technology

Florida has more registered cars per capita than any other state.[10] In 2005, there were 15.9 million personal and commercial automobiles, motorcycles, buses, and trucks registered in the state.[11] These vehicles consumed 10.4 billion gallons of gasoline, achieving an average of 20 miles per gallon of gasoline if each vehicle traveled 13,000 miles per year .[12] Assuming that the percentage of people who own vehicles will remain constant in the future, the number of miles driven remains constant, and the miles per gallon remains at 20, automobiles will have consumed 13.2 billion gallons in 2020, 16.9 billion gallons in 2040, and 20.7 billion gallons in 2060.

Florida's twelve-month average price for regular unleaded gas is 2.60 dollars per gallon. A household with one automobile would pay approximately 1,600 dollars for gasoline in a year. The cost of gasoline is increasing, which will directly affect Florida's drivers. Between the 2003 and 2006, world oil prices increased roughly 25 dollars per barrel to over 78 dollars per barrel.[13]

### Technology

In order to reduce or maintain consumption of gasoline as Florida's population increases, adoption of technologies for personal vehicles is essential. Most of the technological advances in automobile design and fuel sources are abundant, but their practicality and efficiency are debatable. Please refer to the Section "Personal Vehicle Technology" for more information.

Hybrid vehicles can currently achieve 46 mpg.[14] If the percentage of vehicles in Florida that achieved this mileage either by use of hybrid vehicles or an alternative fuel increased, petroleum consumption could at least remain constant with the growing population. In 2020, 40 percent of vehicles would need to achieve on average 46 mpg, in 2040, 69 percent, and in 2060, 87 percent. This would reduce consumption of petroleum from the baseline projection substantially. It would save 2.9 billion gallons in 2020, 6.6 billion gallons on 2040, and 10.3 billion in 2060. Hybrid vehicles that achieve this mileage also have a high score (8 out of 10) in air pollution and greenhouse gas emission, minimizing harmful affects on the environment.[15]

### Costs

The costs of owning and operating a hybrid or alternative fuel vehicles will not only save on gasoline consumption but also on the direct cost of transportation to vehicle owners. Alternative fuel vehicles cost the same amount to mass-produce as gasoline powered vehicles.[16] Therefore, when alternative fuel vehicles are in higher demand, they should be similar in price to gasoline-powered vehicles. Refer to "Cost of Hybrids" in the Appendix.

Florida is actively starting to address the oil consumption issue. In 2005, 20 percent of the Department of Energy's fleet was alternative fuel or hybrid vehicles.[17] The Florida Legislature established The Century Commission for a Sustainable Florida in 2005 to develop research related to energy. One of their goals is to establish a date when Florida will become independent of foreign oil by reducing its consumption in proportion to the state's share of domestic production. The government is essential in the shift to using clean, efficient fuels because large companies have vested interesto continue using conventional fuel sources. For instance, it costs 2,000 to 3,000 to retrofit a gasoline pump to ethanol.[18] The government must require that the transition to more efficient vehicles occurs soon in order to decrease dependence on foreign countries and to ensure that Florida's environment is not degraded from personal and commercial vehicles.

An increase in the use of hybrid vehicles or vehicles that achieve a doubling in fuel efficiency, along with substituting some personal vehicle trips with public transportation as a is part of the alternative future for Florida, will maintain or improve the air quality and possibly decrease cost of transportation for current and future residents.

## Conclusion

The technologies for water, energy and petroleum conservation are an important step towards making a more sustainable Florida. Significant consumption reductions are also necessary in the hospitality, industrial, and agricultural sectors. Floridians must face the following questions in the near future.

- What needs to be done to ensure that all new homes and a percentage of existing homes have rainwater collection systems, solar water heaters, photovoltaic systems, and hybrid vehicles?
- How much are people willing to pay for a better and cleaner water service and dependable electricity service?
- How much will the state incentizive these technologies?

These questions speak to essential issues about resource efficiency and must be confronted to directly address issues of growth, sustainability, carrying capacity, and quality of life.

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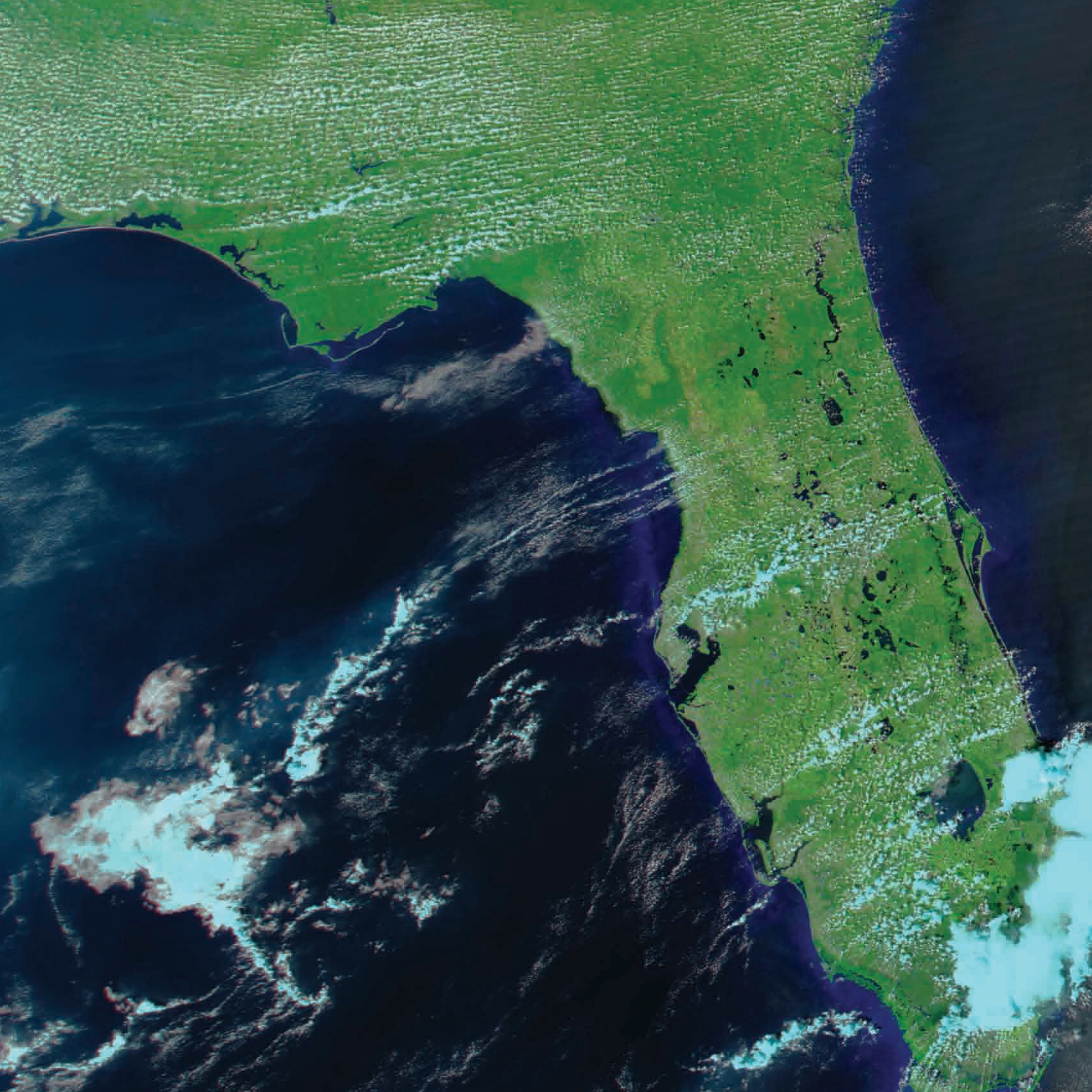

# Next Steps for Florida

This report serves as an illustration of an alternative scenario to the trend projection for urbanization in the state of Florida through the year 2060 with an awareness of the effects that the decisions being made today go far beyond 2060. The scenario incorporates the following 7 principles to plan for an alternative future for the state:

1. Protect Florida's Essential Land

2. Invest in Balanced Transportation

3. Plan for Climate Change

4. Don't Waste Land

5. Design with Nature

6. Encourage Compact Development

7. Rebuild to Create Great Places

| | ~~TREND~~ | ALTERNATIVE ✓ |
|---|---|---|
| Land Development | $700 BILLION | $174 BILLION |
| New Acres Developed | 7 MILLION | 1.6 MILLION |
| Transportation Modes Offered | HIGHWAYS | HIGHWAYS + HIGH SPEED RAIL LOCAL RAIL |
| Highways | $85 BILLION | $21 BILLION |
| Transit | | $61 BILLION |
| Land Acquisition | | $203 BILLION |
| Highest Priority Conservation Land Saved | 0 ACRES | 8.5 MILLION ACRES |

The first step would be for official agencies in Florida to repeat the process outlined in this report with full public participation. Our expectation is that the conclusions will be comparable, although, of course, the actual areas and expenditures will not be the same as the studio's estimates.

Between 2008 and 2020, it is crucial that Florida implements balanced transportation and secures the highest priority conservation land. The studio's estimates are that Florida should be prepared to spend an average of $2 billion a year to purchase the land most at risk of development within the acres most necessary for a state-wide conservation plan, and an additional $2.8 billion a year to build the first phase of the high-speed rail system covering Florida south of Orlando, and to fund local transit systems that connect to the high-speed rail.

It is estimated 2,500,000 acres of the ideal conservation network, prepared by putting together the recommendations of existing reports, are shown by the trend to be at the greatest risk of being developed by 2020. To purchase the development rights for this land the studio estimated an average cost of $10,000 an acre.

The first phase of the high-speed rail is an estimated 556 miles, at an estimated cost of $30,000,000 a mile. The rail is shown as using highway rights of way, or powerline corridors. Approximately 40 percent of the mileage follows power lines, which are especially useful as an alternative where highways are narrow and the areas around them often developed.

| | |
|---|---|
| **By 2020** | Purchase 2.5 million acres of development rights at an average cost of $10,000 an acre<br>Build 556 miles of high speed rail at $30 million a mile<br>Utilizing public/private partnerships and Florida High Rail Authority<br>Build 743 miles of local transit at $20 million a mile<br>Build 171 miles of regional rail at $15 million a mile<br>Expand 1,068 miles of highway<br>*Totaling ~$70 billion or ~$5.3 billion per year* |
| **By 2040** | Purchase 2 million acres of development rights at an average cost of $21,000 an acre<br>Build another 754 miles of high speed rail<br>Build another 214 miles of local transit<br>Build another 32 miles of regional rail<br>Expand 351 miles of highway if needed<br>*Totaling ~$67 billion or ~$3.6 billion per year* |
| **By 2060** | Purchase 4 million acres of development rights at an average cost ~$33,000 an acre<br>Expand 636 miles of highway if needed<br>*Totaling ~$144 billion or $7.2 billion per year* |

The first phase estimates also include 743 miles of light transit lines at an estimated cost of $20 million a mile and 171 miles of regional transit lines at $15 million a mile.

While the average capital expenditure needed over the next 13 years to secure the alternative is estimated at $5.3 billion, it could be less in the initial years and more later.

Looking to the years between 2020 and 2040 it is estimated that the State of Florida will need to spend an average of $3.6 billion a year in capital expenditures to implement the alternative to the trend. These estimates are in 2005 dollars but it was assumed that the cost of development rights will be higher: $21,000 in 2005 dollars.

Between 2020 and 2040 the State of Florida will need to secure the development rights to another 2,000,000 acres of land within the ideal conservation network, build 754 miles of high-speed rail, 214 miles of light transit, and 32 miles of regional transit.

Most of the expenditure between 2040 and 2060 is projected for securing development rights for the remaining 4,000,000 acres of the ideal conservation network, which we are estimating will cost $33,000 an acre in 2005 dollars. The computer model used shows that relatively few of these acres will be at risk for development within the assumptions of our alternative model, but it will be important to secure them for the long-term future of the state. By 2040, some of the effects of sea-level rise will start to be felt, and should be anticipated by state policies

Regardless of the distribution of population on the landscape, the projected population increases will require major efforts to conserve water, reduce power use, secure alternative sources of power, and reduce fuel consumption. These measures need to begin immediately.

# APPENDIX

## A: Conservation

**Table 1: Projected Cost Per Acre for Land Purchased for Conservation, 2007 to 2060**

| Year | Projected dollars per acre | Average cost per acre over period |
|---|---|---|
| 2007 | $6,501 | |
| 2008 | $7,130 | |
| 2009 | $7,759 | |
| 2010 | $8,388 | |
| 2011 | $9,016 | |
| 2012 | $9,645 | |
| 2013 | $10,274 | |
| 2014 | $10,903 | |
| 2015 | $11,532 | |
| 2016 | $12,161 | |
| 2017 | $12,789 | |
| 2018 | $13,418 | |
| 2019 | $14,047 | |
| 2020 | $14,676 | **$10,588** |
| 2021 | $15,305 | |
| 2022 | $15,934 | |
| 2023 | $16,562 | |
| 2024 | $17,191 | |
| 2025 | $17,820 | |
| 2026 | $18,449 | |
| 2027 | $19,078 | |
| 2028 | $19,707 | |
| 2029 | $20,335 | |
| 2030 | $20,964 | |
| 2031 | $21,593 | |
| 2032 | $22,222 | |
| 2033 | $22,851 | |
| 2034 | $23,480 | |
| 2035 | $24,109 | |
| 2036 | $24,737 | |
| 2037 | $25,366 | |
| 2038 | $25,995 | |
| 2039 | $26,624 | |
| 2040 | $27,253 | **$21,279** |
| 2041 | $27,882 | |
| 2042 | $28,510 | |
| 2043 | $29,139 | |
| 2044 | $29,768 | |
| 2045 | $30,397 | |
| 2046 | $31,026 | |
| 2047 | $31,655 | |
| 2048 | $32,283 | |
| 2049 | $32,912 | |
| 2050 | $33,541 | |
| 2051 | $34,170 | |
| 2052 | $34,799 | |
| 2053 | $35,428 | |
| 2054 | $36,056 | |
| 2055 | $36,685 | |
| 2056 | $37,314 | |
| 2057 | $37,943 | |
| 2058 | $38,572 | |
| 2059 | $39,201 | |
| 2060 | $39,830 | **$33,856** |

**Table 2: Land Purchased for Conservation by the State of Florida 1999 to 2006**

| Year | Acres of land purchased for conservation | Total Cost | Dollars per acre |
|---|---|---|---|
| 1999 | 178,051 | $440,076,428 | $2,472 |
| 2000 | 212,233 | $476,742,664 | $2,246 |
| 2001 | 267,277 | $414,256,980 | $1,550 |
| 2002 | 184,462 | $436,275,291 | $2,365 |
| 2003 | 103,588 | $526,107,772 | $5,079 |
| 2004 | 105,499 | $362,435,266 | $3,435 |
| 2005 | 54,138 | $340,303,875 | $6,286 |
| 2006 | 83,663 | $496,675,858 | $5,937 |

# B: Existing Typologies

## Typology lexicons

### Residential Typologies

| RESIDENTIAL (Units/Acre) | |
|---|---|
| Single Family Detached | 1–10 |
| Zero Lot Line Houses | 2–7 |
| Patio/Atrium Houses | 7 |
| Semi-Detached (Duplex, Triplex, and Quadruplex) | 10-15 |
| Semi-Detached/Detached with "Granny Flat" or "Accessory Dwelling Unit | 10–15 |
| Townhouse/Row House, in city | 20 |
| Townhouse/Row House, outside city | 12-16 |
| Multi-family Low Rise/Stacked Flats | 12-20 |
| Mid-rise | 45–75 |
| High-rise | 75–125 |
| **OFFICE (Square Feet)** | |
| Low-rise | 2,500 |
| Mid-rise | 80,000–400,000 |
| High-Rise | 10,000–20,000/floor |
| Office/Business Park | 360,000 |
| **HOTELS AND RESORTS (Rooms)** | |
| Extended Stay Hotel | 80–150 |
| Motel/ Limited Service/ Roadside Hotel | 80–120 |
| Full Service/Business/Conference Hotel | 150–500 |
| Bed and Breakfasts/Country Inn/Guesthouse | 25 |
| Boutique Resort Hotel | 50–100 |
| Resorts | 200–800 |
| Mega resorts | 800–1,200 |

| | |
|---|---|
| **RETAIL (Square Feet)** | |
| Strip Mall (Unanchored) | 10,000–200,000 |
| Strip Mall (Anchored) | 50,000–300,000 |
| Community Retail (Neighborhood Service Retail) | 150,000–350,000 |
| Power Center | 30,000–200,000 (per box) |
| Regional Malls | 100,000–200,000 |
| Urban Department Stores | 200,000–350,000 |
| **INDUSTRIAL (Square Feet)** | |
| Light Assembly/Flex Building | Varies |
| Bulk warehouses | Varies |
| Heavy Manufacturing | 50,000 –1,000,000 |
| **SPORTS AND RECREATION/ENTERTAINMENT** | |
| Stadiums | Varies |
| Marinas | Varies |
| Golf Courses | Varies |
| NASCAR | Varies |
| Theme Parks | Varies |

## Residential Typologies

### *Single Family Detached*

Planning commissions use zoning to establish minimum lot sizes and setbacks for conventional single-family detached subdivisions. Lot size and number of stories vary greatly, but homes are usually set back from the street and located in the middle of the lot with yard space on four sides.

### *Zero Lot Line Houses*

A type of detached house characterized by narrow but deep lots with the house located along a side property line, creating one more usable side yards as opposed to two narrow side yards. This type is used in response to the rising cost of land in suburban areas. Lots typically range from 40 to 50 feet wide and 80 to 100 feet deep. They typically do not have windows or doors on the side facing the street. The number of unit per acre ranges from 2 to 7.

### *Patio/Atrium Houses*

These are single family homes arranged around an open court. Atrium houses use the entire area of the lot, with the building reaching multiple lot lines. This is a common type of house in Florida because it provides space for outdoor activities around an enclosed pool area. They reach up to 7 units per acre.

### *Semi Detached (Duplex, Triplex, and Quadruplex)*

This type consists of two or more units attached by a common wall. Duplexes and triplexes are generally attached in a linear fashion similar to townhouses. Quadruplex units are sometimes attached in rows or more commonly configured with two side-by- side units attached back-to-back with two more side-by-side units, resulting in a square configuration with a unit in each corner. This arrangement indicates there is not one dominant front or back and can make designing circulation difficult. This type of housing is built at ten to fifteen units per acre.

### *Semi Detached/Detached with "Granny Flat", "In-Law Unit" or "Accessory Dwelling Unit"*

A typical single-family unit is provided with a small detached or semi-detached independently accessed apartment unit. A staple of New Urbanism, the "In-law Unit" or "Accessory Dwelling Unit" has been used as a way to provide mixed-income housing within the same block. Alleys are typically associated with this typology. They have a density from 10 to 15 units per acre.

### *Townhouse/Row House - Subsets: Front Loaded Townhouse, Rear Loaded Townhouse*

Attached single family multi-story units with interior circulation, typically situated close to the curb line with units facing the main street. They usually share party walls with the adjoining unit. In rear loaded townhouses, the units are accessed by a back alley. This configuration provides a garage or covered parking off of the main street, reduces the number of curb cuts, and improves the streetscape. The density within cities could reach up to 20 units per acre and the density outside cities could reach up to 12 to 16 units per acre.

### *Multi-family low Rise/stacked flats - subset: Garden Apartments*

Buildings that contain ten or more units on the site to allow for landscaping and surface parking lots. These types can be rental or for-sale units are typically two to three stories with no elevator. The density of this type is 12 to 20 units per acre

### *Mid-rise*

Mid-Rise buildings are generally four to eight stories and are always equipped with elevators. One of the least expensive ways to provide parking for a mid-rise development is to build a multi-story garage in the center of the development with a 20-foot gap around its perimeter to provide natural ventilation. Corridor accessed units should be built around the garage. If the units adjoin the garage, the garage must be mechanically ventilated. Midrise units can accommodate approximately 45 to 75 units per acre.

### *High-rise*

Providing adequate parking is critical in a high-rise residential development. Parking can be provided in a below grade garage, but more commonly the building is built atop a parking podium, and "liner units" or retail is wrapped around the perimeter of the parking. Units are corridor accessed and most individual units are single story. Amenities such as common rooms, exercise rooms, and small retail are frequently part of the building scheme. The density for high-rise structures is 75 to 125 units per acre.

## Retail Typologies

Retail is important to the vibrancy of cities and can be considered a visible indicator of economic health. City center retail development can take many forms. Some of the retail typologies include strip malls, community retail centers, power centers, neighborhood retail and urban entertainment.

### *Strip malls*

Strip centers may be anchored or unanchored. An anchored center has one or more large retail stores such as a "big box" retailer or grocery store that attracts customers to the center.

Unanchored strip centers lack such anchors and are combinations of small stores ranging from 600 to10,000 square feet. Unanchored centers have tenants such as nail salons, restaurants, video rental shops, pet grooming salons, and dentist offices. These centers range from 10,000 square feet to about 200,000 square feet. Strip centers tend to be located on major local arterial roads with good ingress and egress. A center may sometimes appear to be easily accessible, but one may not be able to enter or exit the center easily or can only enter from a single entrance or direction, causing congestion.

Anchored strip centers tend to be larger than unanchored centers because the anchors require a great deal of space and are complemented by smaller tenants. Supermarkets are typical anchors for strip centers. Anchor supermarkets will typically have signage visible near the entrance of the center. Anchored centers are generally 50,000 to 300,000 square feet. Stand-alone centers have a single "big box" store such as Wal-Mart, Target, or K-mart with no other stores. Often strip centers rent out parcels, with tenants such as fast food restaurants or a local bank branch. These out parcels may be managed and/or owned independently from the rest of the anchor.

### *Community Retail Center (Neighborhood Service Retail)*

This type is generally 150,000 to 350,000 square feet. They have several anchors, such as a supermarket and a drugstore, as well as several specialty stores such as a Foot Locker and smaller inline stores. These centers can be laid out as a single center or as two or three contiguous strip centers. Restaurants are generally included in the center. These centers are located on local artery roads with excellent ingress and egress near an interstate highway exit.

### *Power Center*

This type has few inline stores but has three to five major big box retailers such as Wal-Mart, Home Depot, or Staples. These boxes are each generally 30,000 to 200,000 square feet. Power centers may also contain out parcels.

### *Regional Malls*

This type runs 400,000 to 2,000,000 square feet and usually have two to six anchor stores. These anchors are typically department stores such as JCPenney, Nordstrom, and Macy's, as well as big boxes like Barnes & Noble. Mall anchors are generally 60,000 to120,000 square feet and may extend one or more levels. The mall is populated with inline stores between anchors. The strategy is that anchors draw customers to the center, while the complementary inline stores of 600 to 120,000 square feet create a rich retail environment. When comparing malls and downtown shops, individually owned downtown shops are interested in maximizing their own profit, rather than maximizing the profits for the entire retail environment. In contrast, a mall attempts to maximize the entire shopping experience through complementary tenancy, design, shared amenities, and common area maintenance. As a result, they are generally a better organizational form than downtown shops, as they are able to create and internalize positive externalities.

### *Department Stores*

A department store is a retail establishment that specializes in selling a wide range of products without a single predominant merchandise line. Department stores usually sell products including apparel, furniture, appliances, electronics, hardware, toiletries, cosmetics, photography equipment, jewelry, toys, and sporting goods. Certain department stores are further classified as discount department stores.

When department stores are found in center cities, parking space is usually incorporated in the building.

## Office Typologies

Office typologies can be categorized by several classifications including class, location, size and flexibility, use and ownership, and building features and amenities.[1]

### *Categorizing based on class:*

Office spaces can be Class A, B, or C, but there is no definitive 'grading' system.

Class A: Central Business District (CBD) office property is relatively new and well located. They have modern HVAC and electrical systems and quality architecture. A so-called "trophy building" would be among the top two to three percent of the Class A properties and "feature outstanding architecture, building materials, location, and management."[2]

Class B: Space is less well located, smaller, older, has fewer modern amenities, and is not as well designed as Class A space.

Class C: This type of space characterizes the remainder of properties; buildings in this class are substantially older and have not been modernized, may be functionally obsolete, and often contain asbestos or other environmental hazards.

***Categorizing based on location:***

Central business district (CBD): This type of office is usually located in a city's central corridor. Elements that require careful design are street frontages and the transportation network.

Suburban office buildings: This type is relatively unique to the United States. Class A suburban properties tend to be new mid-rise structures of 80,000 to 400,000 square feet, with 8,000 to 14,000 square foot floor plates. Class B and C spaces are older and are less well located. Suburban office parks provide a campus-like assemblage of low to mid-rise office buildings, with the buildings sharing common amenities. Like other suburban building typologies, they offer abundant parking , access to major roadways, and relatively inexpensive rents.

***Categorizing based on size:***

Low-rise structure: This type of office comprises one to three stories and has a typical size of 2,500 square feet. Surface parking surrounds the structure.

Mid-rise structure: Mid-rise structures are usually 4 to15 stories. The size typically varies from 80,000 to 400,000 square feet, with a floor plat of 8,000 to14,000 square foot. Surface parking usually surrounds the structure.

High-rise structure: This type is usually 16 stories and up. The floor plate of a high-rise Class A building can run from 10,000 to 20,000 square feet, with four to eight corner offices per floor. The challenges facing high-rises are efficiency in vertical transportation, efficiency in terms of net to gross area, and safety, particularly in the event of a fire.

Business/industrial park (Office Clusters): [3] This type is usually located near major freeways or beltways. They attract companies and service organizations that do not need to be in the CBD and are seeking high quality office space at lower rents than in downtowns. Offices in this category may range from one to three stories. Types of business parks include:

> Industrial: Large-scale manufacturing and warehouse facilities with limited to no office space;
> Warehouse/Distribution: Large, often low-rise storage facilities with provisions for truck loading and parking and little to no office space. They contain very few on-site amenities for employees;
> Logistics or Commerce: This type focuses on value-added services of logistics and processing rather than warehousing and storage;
> Research**:** Research and Development (R&D) and science parks contain multi-functional facilities and are usually linked to a university;
> Technology: They caters to high-tech companies and are located near related companies rather than a university;

Incubator**:** Designed to meet the needs of small, startup businesses, incubator parks provides flexibly configured and economically priced space;

Corporate**:** Often located on high-profile sites, corporate parks may look like office parks but often the activities and uses housed there go beyond traditional office space to include research laboratories and even light manufacturing.

## Hotel Typologies

### *Extended Stay:*

These hotels are designed for people staying a week or more and attempt to make guests feel like they are home. Thus, extended stay hotels have large rooms, small kitchens, and limited services. They usually consist of 80 to 150 rooms.

### *Limited service:*[4]

These hotels are usually boutique properties in urban areas. The distinguishing feature for these hotels is that they are smaller and do not offer amenities such as room service, restaurants, banquet service, or convention space. This limits overhead and tends to stabilize operating income. They are low-rise structures of one to two stories that usually have 80 to 120 rooms. Guest rooms account for 80 percent of the total building area, and the ratio of parking spaces to rooms is 1:1. Their typical size is approximately 70,000 square feet.

### *Full Service:*

There are two types of full service hotels:

#### CBD full service[5]

This type may be a high price point operator such as a Four Seasons or Mandarin, or a lower price point like a Marriott. Most full service hotels provide room service, restaurants, banquet space, convention services, and food and beverage services. Full service hotels may also provide spas and limited retail. They usually range from 150 to 200 rooms.

#### Resorts

"Resort Hotels are large, often self-sufficient hotel properties that include major on-site amenities such as tennis courts, golf courses, large swimming pools, retail operations, and numerous restaurants."[6]

They have strong emphasis on site planning and environmental concerns, thus lobbies and public spaces encourage guests to visit outdoor areas. They contain reasonably sized and decorated guest rooms with extra storage for long stays. An important feature of resort hotels is their proximity and easy access to natural, scenic, recreational, and/or cultural amenities that make them attractive places to visit.

Resort hotels typically have 200 to 800 rooms. The space allotted to each key ranges from 650 square feet to 1,250 square feet; this includes public and guest room space. Guest rooms range in size from 13 to 15 feet in width to 28 to 32 feet in length. Resort hotels are typically a combination of mid and high-rise buildings.

### *Mega Resort*
These are a larger version of resort hotels. Mega resort hotels usually have 800 to 1,200 rooms. They combine lodging, meeting facilities, and an extensive array of amenities and activities. Many of these typologies are designed in a fantasy theme such as the Walt Disney World Dolphin and Swan Hotels and the Grand Cypress Hotel in Orlando, FL.

## Parking

The following are schedules of car park space requirements, which illustrate the magnitude of dependency on cars because of certain building typologies.

**AMERICAN PLANNING ASSOCIATION NONRESIDENTIAL PARKING STANDARD**

| COMMERCIAL | |
|---|---|
| Bank/Financial Institution | 3.9 per 1,000 SF GFA |
| w/Drive Through | 3.7 per 1,000 SF GFA |
| w/o Drive Through | 3.2 per 1,000 SF GFA |
| Restaurants | .29 per seat |
| Retail Store (free standing) | 4.2 per 1,000 SF GFA |
| Shopping Center | |
| Under 600,000 SF | 4.1 per 1,000 SF GFA |
| Over 600, 000 SF | 5.5 per 1,000 SF GFA |
| Supermarket (Freestanding) | 5 per 1,000 SF GFA |
| Office Uses | |
| General | 3.4 per 1,000 SF GFA |
| Medical | 4.3 per 1,000 SF GFA |
| **INDUSTRIAL** | |
| Industrial - light | 1.6 per 1,000 SF GFA |
| Heavy Manufacturing | .5 per employee |
| Research Lab | 1.4 per employee |
| Warehouse | 1.3 per 1,000 SF GFA |

| RECREATIONAL USES | |
|---|---|
| Bowling Alley | 3.8 per lane |
| Golf Course | 4.6 per hole |
| Health Club | 7 per 1,000 SF GFA |
| Marina | 1.2 per boat slip |
| Miniature Golf | 1.8 per hole |
| Pool Hall | 9.4 per 1,000 SF GFA |
| Arcade | 3.8 per 1,000 SF GFA |
| Skating Ring | 5.2 per 1,000 SF GFA |
| Stadium | .27 per seat |
| Tennis Court | 3.6 per court |
| **INSTITUTIONAL USES** | |
| Church | .3 per seat |
| Convalescent Home | .4 per bed |
| Funeral Home | .3 per seat |
| Hospital | 1.7 per bed |
| Library Museum | 4.3 per 1,000 SF GFA |
| Schools | |
| Nursery/Elem/Intermediate | 2.5 per classroom |
| High School | measured multiple ways |
| College | .4 per student |

| RESIDENTIAL SITE IMPROVEMENT STANDARD (RSIS) | |
|---|---|
| **Housing Unit Type/Size** | **Parking Requirement** |
| *Single-Family detached* | |
| 2 bedroom | 1.5 |
| 3 bedroom | 1.9 |
| 4 bedroom | 2.2 |
| 5 bedroom | 2.4 |
| *Two-Family (duplex)* | |
| 2 bedroom | 1.4 |
| 3 bedroom | 1.5 |
| 4 bedroom | 1.6 |
| *Garden Apartment (and midrise)* | |
| 1 bedroom | 1.2 |
| 2 bedroom | 1.6 |
| 3 bedroom | 1.8 |
| *Townhouse* | |
| 1 bedroom | 1.6 |
| 2 bedroom | 1.9 |
| 3 bedroom | 2.1 |
| *High rise* | |
| 1 bedroom | 0.8 |
| 2 bedroom | 1.3 |
| 3 bedroom | 1.9 |
| *Mobile home* | |
| 1 bedroom | 1.8 |
| 2 bedroom | 2 |

# Endnotes:


**Existing Patterns of Development: Typology Lexicons**

1. J Case, Office Development Handbook, 2nd ed. (Washington, D.C.: Urban Land Institute, 1998), 5.
2. Office Development Handbook, 6-7
3. Office Development Handbook, 6-7
4. Peter Linneman, Real Estate Finance & Investment, Risk and Opportunities, 2nd ed. (Philadelphia, Peter Linneman, 2004), pp 8-13.
5. Linneman
6. Linneman, 8.

**Additional Sources**

Cyril B. Paumier, Creating a Vibrant City Center, Urban Design and Regeneration Principles, (Washington, D.C.: Urban Land Institue, 2004), pp 25- 29.

# C. Climate Change

## Sea Level Rise

Coastal land that is likely to be below sea level by 2060 because of sea level rise was included in the mask layer, meaning that additional population was not added to these lands.

Total sea level rise calculations take into account both tectonic land subsidence and global sea-level rise estimations.

### Assumptions

| | Tectonic land subsidence (0.5 millimeters per year) | Global sea level rise | Total relative sea level rise |
|---|---|---|---|
| **Meters by 2020** | 0.0105 | 0.0875 | 0.0980 |
| **Meters by 2040** | 0.0205 | 0.2000 | 0.2205 |
| **Meters by 2060** | 0.0305 | 0.3875 | 0.4180 |

## Extreme Coastal Hazard Areas

Coastal land that is more likely to experience inundation during severe weather was included in a suitability layer.

In the model, one of the factors weighed in determining the suitability of these lands was a negative desirability due to coastal hazard potential. We assumed that this risk was a function of elevation and distance from the coast. The coastal hazard zones are not intended to reflect exact storm surge zones or include all land affected by very extreme storm events in all areas of the state.

Our first assumption was that land below an elevation of 3.8 meters was more likely than other land to experience inundation during severe weather. 3.8 meters is a calculated average 100-year storm surge for Florida. (D. Max Sheppard and William Miller Jr., *Design Storm Surge Hydrographs For The Florida Coast: Executive Summary)*

However, the threat primarily applies to those lands closest to the coastline, so the coastal hazard zones were limited to areas within 30 kilometers from the coast.

Finally, undesirable suitability rankings were created for the most hazardous fifty percent of these areas.

## Sources:

Tectonic land subsidence: Simon Engelhart, Ph.D. Candidate, University of Pennsylvania

Total global sea level rise: Derived from the Intergovernmental Panel on Climate Change Third Assessment Report high range of sea level rise. This IPCC estimation takes into account all scenarios including land-ice changes, permafrost changes, and sediment deposition, but does not account for ice-dynamical changes in the West Antarctic ice sheet. (IPCC Third Assessment Report - Climate Change 2001, Chapter 11, p. 671, Figure 11.12)

Elevation data: U.S. Geological Survey NED 1/3 arc second data. One arc second data was used in those areas where 1/3 arc second data was not available. For the purposes of running the model, horizontal resolution was down-sampled to 1 acre.

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Florida Emergency Response Team, *Collier County Storm Surge Zones*, October 2, 2006, "Florida's Storm Surge Zones, Evacuation Routes and Evacuation Zones" http://floridadisaster.org/PublicMapping/index.htm

IPCC, 2001: *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T.,Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881pp.

National Elevation Dataset, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD., http://seamless.usgs.gov/

Sheppard, D. Max and Miller, William Jr., (September 2003) *Design Storm Surge Hydrographs for the Florida Coast: Executive Summary,* Florida Department of Transportation, Tallahassee, Florida, University of Florida, Gainesville, Florida

# D: Sustainability

## Water Consumption

### Rainwater Collection System

Collecting rainwater onsite lowers the impact of storm water collection and conveyance systems.  A rainwater collection system consists of the following components:

- Catchment area (roof): For most non-potable water collection systems, any roofing material is sufficient.  For potable use of rainwater, special coating materials are needed such as a layer of "Super-Flex 100% Acrylic Elastomer Roof Coating."
- Conveyance system (guttering, downspouts, and piping): Gutters are used to transport water from the roof to pipes that bring water into the tanks. These mechanisms should use a minimum of 26 gauge galvanized steel or 0.025 inch aluminum.
- Storage system (tanks and cisterns): Storage systems must be sized properly to ensure that the rainwater potential is optimized.  They can be located above or below ground.  The best materials for cisterns include concrete, steel, ferro-cement, and fiberglass.  Storage systems should have a cover to prevent mosquito breeding and algae growth that occurs with contact with sunlight.
- Filtration: The best strategy is to filter and screen out the contaminants before they enter the cistern.
- Distribution: Removing the water from the cistern can be achieved through gravity, if the cistern is sufficiently high enough, or by pumping.

### Filtration Methods

To reuse water for drinking, the following filtration methods can help achieve the desired water quality:

- Absorption: This physical process occurs when liquids, gases, dissolved or suspended matter adhere to the surface or in the pores of an adsorbent medium. Carbon filters use this technology to filter water.
- Softeners: Water softening devices use a caption exchange resin, regenerated with sodium chloride or potassium chloride, to reduce the amount of hardness in the water.
- Ultraviolet Treatment: This treatment style uses ultraviolet light to disinfect water or to reduce the amount of heterotrophic bacteria present in the water.
- Reverse Osmosis: A process that reverses the flow of water in a natural process of osmosis so that water passes from a more concentrated solution to a more dilute solution through a semi-permeable membrane.
- Distillers: These systems heat water to its boiling point and then collect the water vapor as it condenses.

### Additional Methods

#### *Water conservation*

- Desalinization of Seawater: The Tampa Bay facility has a great potential but the solution does not seem to be promising for the state's future due to the fact that it is extremely costly, there are residual problems, and it is not 100 percent reliable.
- Greywater Usage: Greywater is non-industrial wastewater generated from domestic processes such as washing dishes, laundry and bathing. Greywater can be reused for watering lawns or flushing toilets.
- Separation of drinking water from irrigation, cooling, and waste disposal.
- Use of vernacular landscaping materials instead of grass will require less water as well as less maintenance.
- Placing restrictions on water use; (e.g., no lawns can be watered between 8AM and 6PM).
- Installing low-flow showerheads (2.5 gallons per minute) for all new homes and all shower replacements on existing homes.
- Installing 1.6 gallon per flush toilets and 2.5 gallon per minute faucets.
- Using water meters help to regulate and control water usage.
- Public education and accessibility to information.

### Methods of water conservation currently used in Florida

The SFWMD and other agencies have established the following mandatory water conservation methods for residential development:

- Placing restrictions on water use (e.g., no lawns can be watered between 8AM and 6PM).
- Installing low-flow showerheads (2.5 gallons per minute) for all new homes and all shower replacements on existing homes.
- Installing 1.6 gallon per flush toilets and 2.5 gallon per minute faucets.
- Using water meters help to regulate and control water usage.
- Public education and accessibility to information.

## Domestic Energy Initiatives

### Types of Water Heating Systems[1]

#### *Pumped system*

A pumped system has one or more solar energy collectors installed on the roof and a water storage tank at a lower level, usually in the garage or utility room. This system circulates potable water from the storage tank through the collectors and back into the tank. The solar collector is the main component of this system and usually consists of a metal box with insulation and a black absorber plate that collects solar radiation and heats the water. An electronic controller, a simple appliance timer, or a photovoltaic panel regulates the circulating pump.

### *Integral collector storage system (ICS)*

In this unit, the solar water storage system is built into the collector. The heated potable water is delivered by the city or by well water pressure either to an auxiliary tank or directly to the point of use. Cold water flows through the collector where it is heated by the sun. Hot water is drawn from the top where is the hottest and replacement water flows into the bottom. This system requires no pumps and controllers. When hot water is needed, cold water from the house flows into the collector and hot water from the collector flows to a standard hot water auxiliary tank inside the house. A freeze protection valve is installed in the top plumbing near the collector. This valve opens to allow relatively warm water to flow through the collector to prevent freezing.

### *Thermosiphon system*

A thermosiphon solar water heating system has a tank mounted above the collector, normally built on the roof, to provide a natural gravity flow of water. Hot water rises through piping in the collector. Gravity pulls the heavier, cold water down from the tank and into the collector inlet. The cold water pushes the heated water through the collector outlet and into the top of the tank, thus heating the water in the tank. This system features a thermally operated valve that protects the collector from freezing. It also includes isolation valves, which allow the solar system to be manually drained in case of freezing conditions, or to be bypassed completely. Like the ICS system, thermosiphon systems are relatively simple because they use no pumps or controllers and water always flows through the collector. Both ICS and thermosiphon systems require two tanks, the solar heating system tank as well as an auxiliary tank.

## Types of Photovoltaic Systems[2]

### *Grid-connected or utility-interactive photovoltaic system*

A grid-connected system operates in parallel with the electric utility grid. The main component of this system is the power-conditioning unit (PCU) that converts the DC power produced by the PV array into AC power consistent with voltage and power quality requirements of the utility grid. When output is greater than on-site demand, AC power is fed back into the grid. At night and at other times when the electricity demand is greater than electricity produced, the balance of power is received from the connecting utility. Most residential systems require as little as 50 square feet for a small "starter" system up to as 1,000 square feet for larger systems. A typical one kilowatt system would occupy 80 to 360 square feet. A five kilowatt system will require 1500 to 1800 square feet of roof space.[13] The size of the array depends on the total energy efficiency of the home.

### *Stand-alone photovoltaic systems*

Stand-alone PV systems are designed to operate independent of the electric utility grid, and are generally designed and sized to supply certain DC and/or AC electrical loads. These types of systems may be powered by a PV array only or may use an auxiliary power source in what is called a PV-hybrid system. The simplest type of stand-alone PV system is a direct-coupled system, where the DC output of a PV module or array is directly connected to a DC load. Since there is no electrical energy storage (batteries) in direct-coupled systems, the load only operates during sunlight hours, making these designs suitable for common applications such as ventilation fans, water pumps, and small circulation pumps for solar thermal water heating systems.

## Solar Technology Financial Incentives

Systems eligible for a rebate must be one of the following:

- Two kilowatts or larger for a solar photovoltaic system
- A solar energy system that provides at least 50 percent of a building's hot water consumption for a solar thermal system
- A solar thermal pool heater

Commercial solar water heating systems are eligible for a rebate of $15 per 1,000 btu for a maximum of $5000, and PV systems of 2 kilowatts or larger can qualify for a rebate based on the manufacturer's power output rating of the system modules. This amounts to $4.00 per Watt with a residential cap amount of $20,000 and a $100,000 cap for commercial, publicly owned, or private not-for-profit organizations. Solar hot water heater and energy management savings, state and federal tax credits, and rebates up to $2,500 per year are available through December 31, 2008 contingent upon the FDEP fiscal budget.[3] All solar equipment sold in Florida must be certified by the Florida Solar Energy Center (FSEC). Contractors are trained and tested by the FSEC and must obtain their license through the Florida Department of Business and Professional Regulation.[4]

## Petroleum Consumption

### Personal Vehicle Technology

Experts hold divergent opinions about the best future direction of vehicles; opinions vary from fuel-celled vehicles with solar-hydrogen energy farms, to hybrid plug-ins, electrical vehicles, or some combination of alternative fuels.[1] None of the current alternative fuels available today have advantages that clearly out weigh their disadvantages.

Hybrid-electric technology is one area that has been adopted by mainstream consumers and has proven benefits.[2] Florida has the third most hybrid vehicles registered of any state in 2005.[3] This technology uses gasoline engines and electronic motors to decrease fuel consumption and emissions. Fuel consumption is currently 46 mpg. Hybrid vehicles have gasoline engines like conventional engines except they are usually smaller and more efficient. They also have electric motors that provide power when accelerating or passing, and convert energy from the engine or regenerative braking into electricity. The electric engine acts as a generator converting energy into electricity, which is stored in the battery. The engine also shuts off when the vehicle comes to a stop.[4]

### Cost of Hybrids

Achieving 46 mpg will reduce the amount a person will need to spend on gasoline in a year by more than a half, from 1,600 to 735 dollars. An additional cost incentive to hybrid car owners is the current federal income tax credit of up to 3,400 dollars. Unfortunately, purchasing the more popular vehicles does not come with as much of a credit because the incentives phase out after a company sells their 60,000th hybrid vehicle. Florida legislation does not further credit hybrid vehicles but does incentivize electric vehicles and alternative fuel vehicles. Electric vehicle owners are protected from insurance surcharges and alternative fuel vehicles are exempt from emission inspection requirements. State and local government alternative fuel vehicles fleets are exempt from decal fees.

## Solar Water Heating

| Year | Total homes | New homes | Percent renovated | Number renovated | Homes with no technology | New homes with technology | Total homes with technology | Percent all homes with technology |
|---|---|---|---|---|---|---|---|---|
| **2005** | 7,148,800 | 0 | 0 | 0 | 7,148,800 | 0 | 0 | 0 |
| **2020** | 9,157,656 | 2,008,856 | 50% | 3,574,400 | 3,574,400 | 2,008,856 | 5,583,256 | 61% |
| **2040** | 11,681,537 | 2,523,881 | 80% | 2,859,520 | 714,880 | 2,523,881 | 10,966,657 | 94% |
| **2060** | 14,325,830 | 2,644,293 | 69% | 493,267 | 221,613 | 2,644,293 | 14,104,217 | 98% |

* This is for a household size of 2.5 persons per household. This value derived from an average of 3990 kwh/year used to heat water for a 4 person household.
Source: Florida Solar Energy Center Q+A Section for Consumers.
** Solar water heaters were estimated to reduce utility electricity use by 65 percent

## Residential PV Systems

| Year | Total homes | New homes | Percent renovated | Number renovated | Homes with no technology | New homes with 5 kWh system | New homes with 2 kWh system | Total homes with technology |
|---|---|---|---|---|---|---|---|---|
| **2005** | 7,148,800 | 0 | 0 | 0 | 7,148,800 | 0 | 0 | 0 |
| **2020** | 9,157,656 | 2,008,856 | 14% | 1,000,832 | 6,147,968 | 1,004,428 | 1,004,428 | 3,009,688 |
| **2040** | 11,681,537 | 2,523,881 | 5% | 307,398 | 5,840,570 | 1,388,134 | 1,135,746 | 5,840,967 |
| **2060** | 14,325,830 | 2,644,293 | 5% | 292,028 | 5,548,541 | 1,586,576 | 1,057,717 | 8,777,288 |

* A standard house in florida will use 45-50 kWh/day according to researchers at the Florida Solar Energy Center
** A 10 array, 50 kWh system completely offsets a home's electrical energy without reliance on the grid.

| | Electricity use per HH (kWh)* | Electricity used by new homes with heaters** | Electricity used by renovated homes | Electricity used by home with no heater | Total energy use with electricity reduction |
|---|---|---|---|---|---|
| | 49,326,720 | 0 | 0 | 49,326,720 | 49,326,720 |
| | 63,187,826 | 9,009,719 | 16,031,184 | 24,663,360 | 49,704,263 |
| | 80,602,604 | 11,319,605 | 32,857,670 | 4,932,672 | 49,109,947 |
| | 98,848,224 | 11,859,653 | 36,150,268 | 1,529,128 | 49,539,049 |

| | Percent all homes with technology | Electricity use per HH (kWh)* | Electricity used by 2 kWh system | Electricity used by 5 kWh system** | Electricity used by renovated homes with 2 kWh system | Electricity used by homes with no technology | Total energy use with electricity reduction |
|---|---|---|---|---|---|---|---|
| | 0 | 357,440,000 | 0 | 0 | 0 | 357,440,000 | 357,440,000 |
| | 33% | 457,882,800 | 25,110,700 | 0 | 25,020,800 | 307,398,400 | 357,529,900 |
| | 50% | 584,076,840 | 28,393,659 | 0 | 11,447,070 | 292,028,480 | 331,869,209 |
| | 61% | 716,291,480 | 26,442,928 | 0 | 14,601,921 | 277,427,056 | 318,471,905 |

## Alternative-Technology / Fuel for Vehicles

| | Gasoline | Gas-Electric Hybrid Autos | Electricity | Biodiesel |
|---|---|---|---|---|
| **Vehicles in Use in Florida: 2002*** | 15,886,000 | 10,470 | 357 | - |
| **% of Vehicles** | 99% | 0.06591% | 0.00225% | - |
| **Main source** | imported crude oil | petroleum / electricity | battery, generators, fuel cells, electric conductors, domestic coal fired power plants (or nuclear, natural gas, hydroelectirc, renewable resources) | cooking oil (new or recycled waste oil), animal fats, rapeseed oil, soybean oil |
| **Energy Compared to Gasoline** | 100% (20 mpg) | - | - | 90% |
| **Environmental Impact** | harmful emissions | reduction in ozone-forming emissions | emissions only due to power generation | reduced ozone-forming emissions, plants absorb carbon dioxide that is released from buring fuel, nitrogen oxides may increase |
| **Other** | - | - | need special hookups to homes or electrical supply | uses the same infrastructure as diesel fuel |

*State Transportation Statistics. U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics. December 2006. pG-4, G-5
**Florida Solar Energy Center
***Sperling, p26.
****Sperling, p28.

| | Hydrogen / Fuel Cell | Liquefied Petroleum Gases | Natural Gas | Methanol | Ethanol (E85) |
|---|---|---|---|---|---|
| | - | 4,171 | 4,152 | 6 | 7,856 |
| | - | 0.02626% | 0.02614% | 0.00004% | 0.04945% |
| | chemical reaction of hydrogen and oxygen, solar energy, natural gas, methanol, fossil fuels | by-product of petroleum refining or natural gas processing | domestic underground reserves, refineries or natural gas processing plants | natural gas, coal, woody biomass, commercially by catalyzed reaction of hydrogen and carbon monoxide | domestic corn, grains, ag waste - renewable / often combined with gasoline |
| | - | 74% | 25% | 57% | 70% |
| | zero regulated emissions for fuel cell-powered, only nitrogen oxides emissions for internal combustion engines on hydrogen | 60% reduction in ozone-forming emissions | reduced ozone-forming emissions, hydrocarbons may increase | full strength (M100) reduces ozone-forming emissions but unsafe*** | negative water, air and land impacts from ag, 25% reduction in ozone-forming emissions |
| | no commercial vehicles yet, fuel stations in Orlando | 45% derived from oil, most accessible, several stations in Florida | several stations in Florida | not commonly used, transition costs low**** | DOE will issue $17 million to support technologies to improve vehicle efficiency and use of E85 fuel** |

## Endnotes:

Domestic Energy Initiatives

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5: "Florida 2060: A Population Distribution Scenario for the State of Florida" report cover, *www.1000friendsofflorida.org/PUBS/2060/Florida-2060-Report-Final.pdf*

6: Neptune Beach, *http://www.flickr.com/photos/noidiotsplease/155884513/*

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11: "First Five Years Work Program," *Florida Department of Transportation, 2006*

12: Highway 95, *http://www.flickr.com/photos/qivn/230557955/*

16: Hyde Park, *http://www.flickr.com/photos/hyku/134967433/*

19: St. Vincent National Wildlife Refuge Freshwater Lake, *Washington DC Library, U.S. Fish and Wildlife Service (http://images.fws.gov)*

20: Sunrise over Pelican Island NWR, *NCTC Image Library, U.S. Fish and Wildlife Service, http://images.fws.gov*

22: (top) Blue Spring, Orange City, Florida, USA *http://www.flickr.com/photos/wagsdot911/344060446/*

22: (bottom) Blue Spring, Orange City, Florida, USA, *http://www.flickr.com/photos/scott_waterman/340741076/*

24: River of Grass, Shark Valley, National Scenic Byways Program, A. E. Crane, *http://www.byways.org/explore/byways/12130/photos.html*

26: Florida cattle, *http://www.flickr.com/photos/71217725@N00/135985759/*

35: Surface rail, *http://www.flickr.com/photos/lazytom/246238497/*

36: Ybor trolley, *http://www.flickr.com/photos/hyku/134966694/*

37: (top) Miami, *http://www.flickr.com/photos/travischurch/1833724/*

37: (bottom) Japan Rail Shinkansen, Japan Rail Shinkansen, *http://www.flickr.com/photos/squirll/24967321/*

38: (bottom) Highway, *http://www.flickr.com/photos/spotje/32819857/*

46: (top) Storm damage, *www.hydroonenetworks.com*

46: (bottom) Flood, *www.answers.com/topic/key-haven*

47: Sea level, *http://www.lenntech.com/images/sealevelrise.jpg*

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52: Building, Gulf Breeze, up-to-date building techniques, *FEMA Photo, Mark Wolfe, http://www.photolibrary.fema.gov/photolibrary*

53: (top) Storm surge, *www2.sunysuffolk.edu/.../ storm_surge_lutgens.jpg*

53: (bottom) Sea wall, *http://www.beachhunter.net/images/renourishment/boca_seawall2623small.jpg*

54: Everglades, East Everglades Agriculture Area, *Washington DC Library, U.S. Fish and Wildlife Service, http://images.fws.gov*

55: Fort Lauderdale airview, *http://www.flickr.com/photos/travischurch/1833729/in/set-46776/*

56: Crooked River, Lake County, *http://www.lakegovernment.com/media/pictures/*

58: (left) High-rise, Mixed-use multi-tower, Everglades, *http://www.zilbert.com/images/condo_pix/everglades/buildings.jpg*

58: (right) High-rise, Espirito Santo Plaza, Miami, mix of office, hotel and residential uses, *http://www.bestofmiamiproperties.com/DowntownMiami*

59: (top) Mizner Park, *http://www.miznerpark.com/html/index.asp*

59: (bottom) South Beach, Miami, *http://www.flickr.com/photos/kevinbowman/232743734/*

60: Stadium, Denver, *http://www.flickr.com/photos/stefrobb/29771375/*

62: (top) Norris Lake, Florida, kayaking *http://www.lakecountyfl.gov/media/send_postcard/send_postcard.aspx?cardID=16*

62: (bottom) Florida manatee, Washington DC Library, *U.S. Fish and Wildlife Service, http://images.fws.gov*

63: Celebration, *studio photo*

64: Celebration, *studio photo*

65: St. Augustine Lighthouse, National Scenic Byways Program, *http://www.byways.org/explore/byways/2477/photos.html*

67: Celebration, *studio photo*

68: Mizner Park, *http://www.flickr.com/photos/evilkim/341304024/*

71: Ybor trolley stop, *http://www.flickr.com/photos/hyku/134965646/*

73: (top) The Crossings

73: (top) The Courtyards of Delray, Florida

73: (top) Arbutus, Vancouver

73: (center) Addison Circle, Texas

73: (bottom) Portland, Oregon

73: (bottom) The Echelon, West Palm Beach, Florida

76: Casa Monica Hotel, St. Augustine, National Scenic Byways Program, Dennis Adams, *http://www.byways.org/explore/byways/2477/photos.html*

84: Heron, Crooked River, *http://www.lakecountyfl.gov/media/pictures/*

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86: Loggerhead Sea Turtle at Archie Carr National Wildlife Refuge, *NCTC Image Library, U.S. Fish and Wildlife Service, http://images.fws.gov*

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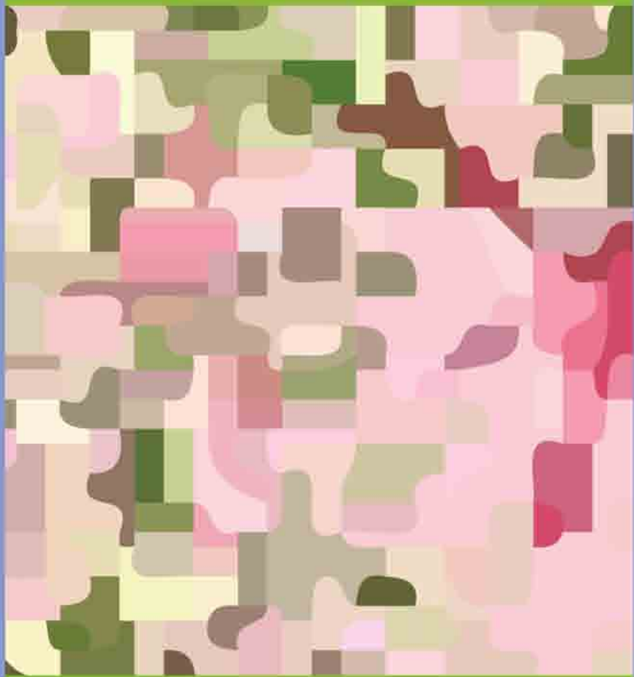
123: Fountain, Hyde Park, *http://www.flickr.com/photos/hyku/134967648/*

168: Hyde Park, *http://www.flickr.com/photos/hyku/134967433/*


storehouse
Old
Hyde
Park
Village



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