

Landscape Conservation and Climate Change Scenarios for the State of Florida

A Decision Support System for Strategic Conservation

Summary for Decision Makers | April 2014



The Project Team would like to acknowledge the support of our partners at the Peninsular Florida Landscape Conservation Cooperative, and funding from the US Fish & Wildlife Services and US Geological Survey. We must also thank the staff of the Regional Planning Councils (RPCs) that helped inform us about projected changes in northern Florida and the Panhandle, including West Florida RPC, Apalachee RPC, North Central Florida RPC, and Northeast Florida RPC. Several Transportation Planning Organizations throughout the state also aided in this analysis by providing Long Range Transportation Plan data.

We are grateful to the many individuals who provided feedback on this analysis, particularly Ernie Cox of Family Lands Remembered and Doria Gordon of The Nature Conservancy. We also acknowledge the guidance of the PFLCC Steering Committee, and special thanks is due to Steve Traxler of USFWS and Tim Breault, PFLCC Coordinator, for their ongoing support and enthusiasm for scenario development in the State of Florida.

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Preface

The science focus of the Peninsular Florida LCC is to enhance conservation planning in Florida by investigating a number of possible trajectories of future landscape transformation. Conservation science is prospective in nature because it examines changing assumptions, vulnerability to stressors, uncertainty and risk. These factors can be expressed as models or combined into alternate future scenarios. Based on initial efforts started with Everglades restoration, we have developed scenarios for the entire state of Florida.

Through a systematic exploration at the landscape-scale, scenarios can be utilized to predict conservation opportunities or areas of conservation conflict. Scenarios are not conceived as blueprints for the future, but rather as learning tools for management of uncertainty. The scenarios inherently contain assumptions with a number of dimensions including future time horizons.

The scenarios that are presented here will have the best utility at large scales as is true with most landscape level models. It is also true is that uncertainty grows as the forecasted timeline is extended. The scenarios will need to be updated and adjusted through learning about their utility and constraints and the need for new input variables.

These scenarios should be valuable resource for anyone engaged in land use planning. They, in and of themselves, cannot make decisions. They can be very useful, transparent tools for informing decisions, particularly in an adaptive context. I would like to thank all of the members of the Peninsular Florida Landscape Conservation Cooperative Steering Committee and our adaptive science team for their support of this project.

Tim Breault, Coordinator
Steve Traxler, Science Coordinator
Peninsular Florida Landscape Conservation Cooperative

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Florida Statewide Scenarios

Peninsular Florida Landscape Conservation Cooperative

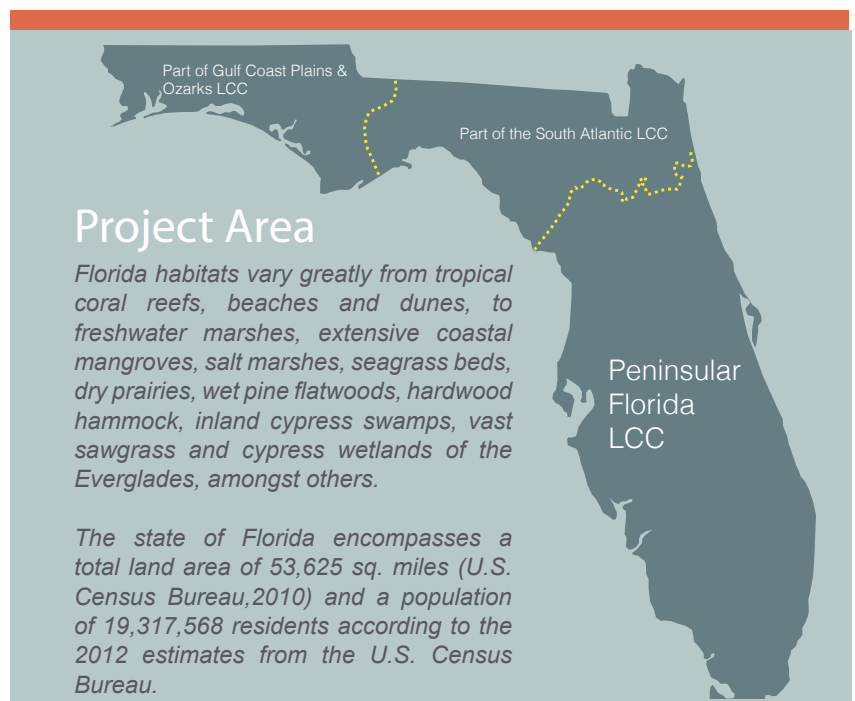
The PFLCC Statewide Conservation Scenarios Project generate visualizations of land cover conditions of three alternative futures for the state of Florida in 2020, 2040 & 2060. The scenarios illustrate interactions between climate change, human population change, and conservation strategies and resources. Particular attention was paid to the potential role of large increases in private voluntary conservation, such as conservation easements. These simulations were integrated into a spatial decision support system which allow interested stakeholders to evaluate conservation strategies at landscape to regional scales.

The Department of Interior has organized 22 Landscape Conservation Cooperatives (LCCs) across the country. These function as applied conservation science partnerships, bridging efforts across agencies, organizations and political boundaries. LCCs provide a platform for collaborative work defining shared landscape conservation goals, and identifying appropriate strategies to support conservation efforts (USFWS 2012). Conservation planning at landscape scale requires both new science and the integration of existing knowledge. This project brought together six science partners representing two federal agencies, one university, one NGO and two private companies.

Florida is a socially complex and biologically diverse state, which is under considerable pressure from both human population increases and climate change. Conservation resources are limited and geographically-variable, both in terms of economics and social will. This study is the one of the first in Florida and nationally to simulate in spatial detail both fee-simple acquisition and conservation easements. We have mapped conservation opportunities across both social and biophysical dimensions, finding very considerable differences. Our results indicate that under expected levels of funding, non-fee-simple conservation will be necessary, but will require a level of institutional support and coordination never before seen in Florida. The result is both a challenge and an opportunity for Florida's LCC.

Statewide PFLCC Steering Committee Members:

US Fish & Wildlife Service
US Geological Survey
National Park Service
National Oceanic and Atmospheric Administration
Department of Defense
USDA/Forest Service
Natural Resources Conservation Service
Florida Fish & Wildlife Conservation Commission
Florida Department of Agriculture and Consumer Services
Florida Department of Transportation
Southwest Florida Water Management District
The Nature Conservancy
Florida Wildlife Federation
Florida Forestry Association
Florida Farm Bureau Federation
Wildlands Conservation
Plum Creek
Breedlove, Dennis & Associates, Inc. (Florida Land Council)
Ken Passarella, and Associates, Inc.
Family Lands Remembered, LLC
Florida State University, Florida Natural Areas Inventory
University of Florida, Center for Landscape Conservation
Private Landowners



Project Framework

The statewide scenarios build upon existing initiatives and prior scenario simulations developed in 2012 by GeoAdaptive and Geodesign Technologies for the Peninsular Florida LCC, and extend the geographic boundary to encompass the whole state of Florida. The geographical extension of the project was necessary to comprehensively explore ecological issues such as habitat connectivity and the impacts of urbanization and population growth. Funding allocations and policy decisions occur at the statewide level and involve a broader group of partners and interested stakeholders. By increasing the project boundaries these factors and interested parties were engaged in a process whose spatial boundaries aligned with existing funding sources and institutional mechanisms.

What are the challenges faced?

The State of Florida faces complex conservation challenges with far-reaching implications. Urbanization and rapid population growth create development pressures on natural systems which cause habitat fragmentation, degradation or destruction. Climate change interjects a series of additional, yet uncertain, variables such as changes in precipitation and temperature (causing conditions such as drought), and the increase of mean sea level, amongst others. In addition, many of the fragile ecosystems of the region reside at low elevations, making them vulnerable to climate change related effects such as sea level rise and salt water intrusion.

Conservation planning requires careful consideration of at least two types of uncertainty. (1) The scientific uncertainties of threatened and endangered species and their associated habitats when faced with climate change and urban growth. (2) The uncertainty behind human behavioral responses and political policy in the context of which conservation planning must function. The challenge of the statewide PFLCC project is to organize effective conservation strategies and actions in light of these types of uncertainties and complex challenges.

Florida's challenging and changing conditions

Florida is not only among the states at the highest risk for climate change impacts - it is one of the nation's largest contributors to global warming. A recent Environment Florida report indicates that global warming pollution in Florida increased by 37% between 1990 and 2004. Florida ranked fifth nationwide for the highest total carbon dioxide emissions in 2004 and second nationwide for the largest increase in that period (Environment Florida Research & Policy Center 2007). The source of these increases is related to the increase in population, urbanization patterns, in combination with highly auto-dependent land use patterns. This growth has also challenged efforts on the conservation arena, where fragmentation and connectivity have become important challenges.

Florida's current growth patterns are unsustainable, both in economic and environmental terms. Fortunately, in an ecosystem services context, the hugely inefficient nature of recent growth provides significant opportunities for conservation funding.

What are the goals for the project?

The statewide scenarios project has four primary goals:

1. Develop, and integrate core science and harmonize datasets, geographic extents, categorical classifications, that will support the development of a comprehensive set of scenarios.
2. Develop a set of "alternative futures" to identify a series of climate-aware conservation scenarios that incorporate a variety of conditions generated by projected population growth, climate change, financial resources and land use and water policies.
3. Evaluate potential impacts of the various scenarios based on a selected set of conservation strategies and mechanisms.
4. Plan for future uses and conditions based on adaptation strategies and modeling outcomes.

Previous Efforts

The Peninsular Florida LCC Climate Scenarios and Species Vulnerability Assessment was completed in 2012 by GeoAdaptive and included the full peninsular Florida LCC geography (40 counties). The project built upon a set of scenarios and simulation methods used for the Greater Everglades region and developed by the principal investigators at the Massachusetts Institute of Technology (MIT) in 2008-2010. A participatory planning process was introduced to consider issues such as private conservation planning, including both public and fee-simple purchase and voluntary conservation methods, while the scenarios were used to test various potential conservation strategies. Projected growth of the region was simulated as a set of "alternative futures" which highlight the encroachment of development and agriculture into prime habitat areas, while simultaneously modeling the impact of inundation due to sea level rise for each projected time horizon: 2020, 2040 and 2060.

Key Concepts

Terminology

Alternative Futures

The rendering of scenarios into the form of maps or 3D models representing a particular future time horizon.

The Critical Lands and Waters Identification Project (University of Florida) (CLIP (v3))-

A Geographic Information Systems (GIS) database and analysis of statewide natural resource conservation priorities in Florida. CLIP was originally designed as a tool for identifying the state's most important conservation priorities to support the efforts of the Century Commission for a Sustainable Florida, and the Florida Fish and Wildlife Conservation Commission's Cooperative Conservation Blueprint (CCB). It was updated and revised to support the scenario planning done in this study.

Conservation Easement

A legally binding agreement that limits certain land uses or prevents development in order to protect the ecological or open-space values for future generations. Ownership and access are maintained and tax benefits are typically provided to the owners (The Nature Conservancy 2014).

Drivers of Change

A scenario planning concept recognizing a primary or highly-significant relationship between a causal factor and resultant changes. For example, population growth can be a "driver" or urban growth.

Fee Simple Land Acquisition

Land purchase transferring full ownership of the property to another party, if the transaction is the result of a donation, there are potential tax benefits for the seller when the land is sold for conservation purposes.

Florida Forever

Land acquisition program managed by the Florida Department of Environmental Protection (FL-DEP) to protect Florida's natural resources for conservation and recreation purposes, which take the form of parks, trails, forests, wildlife management areas, etc. All land acquired is managed in a trust for the benefit of all Florida residents (FL-DEP 2013).

Greenfield Development

The construction of buildings or other permanent structures or infrastructure on previously undeveloped land.

Green Infrastructure

"A strategically planned and managed network of natural lands, working landscapes, and other open spaces that conserves ecosystem values and functions and provides associated benefits to human populations" (Benedict & McMahon 2006).

Prioritization

The act of specifying preferences, usually in the form of numeric or categorical ranks.

Resilience Planning

A technique which uses alternative futures to develop conservation or development plans which are robust relative to a variety of potential changes.

Scenario

An internally consistent bundle of biophysical variables and socioeconomic and regulatory planning assumptions.

Stakeholder

An individual or representative of a group with a legitimate interest in the outcomes of planning or decision-making for a particular topic or area.

Trends

"A general direction of change; a way of behaving, proceeding, etc., that is developing and becoming more common" or recognizable (Merriam-Webster 2014).

Uncertainty

A lack of certainty or knowledge; a condition caused by having limited knowledge where it is impossible to exactly predict the existing state, future outcome, or impact of a change, such as climate change.

Key Processes



Participatory Stakeholder Assessment

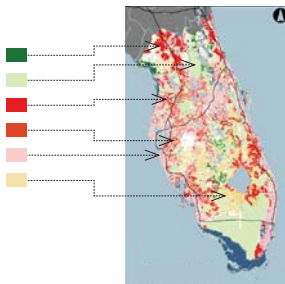
Stakeholders, who are responsible for decision and policy making, are involved in the development of the scenarios and can provide overall validation of the assumptions used in the process. Active, participatory forums allow for creative discussions of the complex social and ecological systems of the region and uncertainties that are part of conservation planning. Groups of local experts such as the Regional Planning Councils, PFLCC Steering Committee, South Florida Climate Compact, and other local and federal organizations are consulted in these processes.



Selection of Drivers of Change

Drivers of change are organized into “dimensions” or a group of bundled assumptions and variables. Each dimension has a series of ranges or thresholds of quantitative variables that represent a group of policies that logically fit together. The Statewide PFLCC project considered the following as the primary drivers of change:

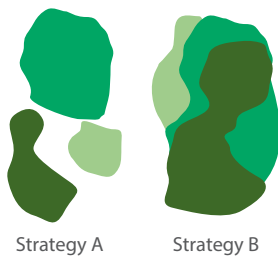
- Change in population
- Financial resources for conservation
- Climate change (sea level rise)
- Planning assumptions and regulations
- Conservations strategies



Scenario-based Simulation Modeling

Multiple variables are packaged into distinct scenarios to test different approaches and model possible “alternative futures”. The scenarios are guided by a set of demands and suitability factors that are used in the modeling process, along with a set of realistic restrictions in the form of policies, laws or regulations. As part of the process the following factors were used as inputs for the model:

- Population growth projections
- Residential density calculations (low, middle and high income)
- Suitability factors for each land use type
- Land use demand projections



Evaluation of Conservation Strategies

The evaluation of different conservation strategies in scale and with realistic parameters (such as financial constraints/budgets) can serve as a means to evaluate the “resiliency” of the resulting patterns (plans which work across a range of conditions).

Scenario Development

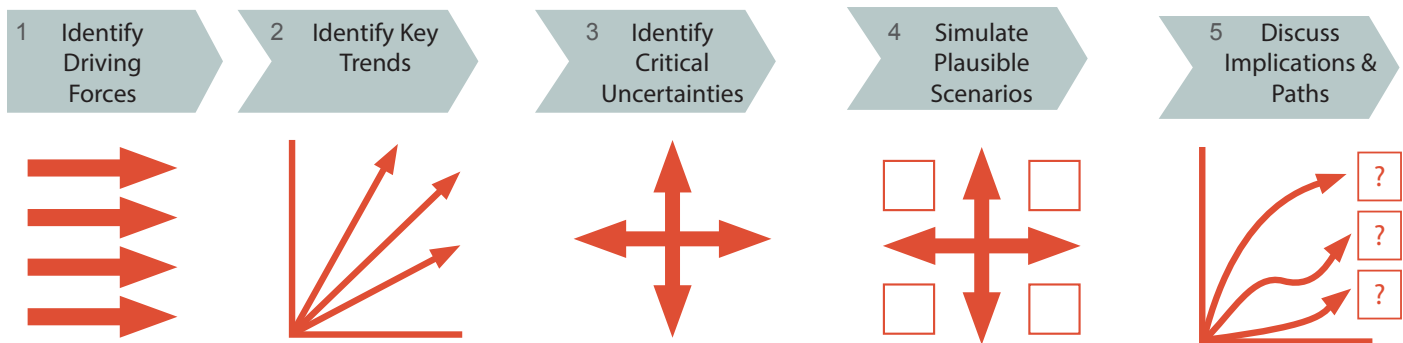
Scenarios allow the simultaneous consideration of multiple possible futures and the exploration of their consequences. They are a critical tool in long-range planning, particularly when compounding uncertainties limit the utility of conventional statistical forecasting techniques.

Scenario Design and Simulation

Spatial scenario assessments are a strategic instrument that allows the exploration of future conditions and helps organizations make more informed choices in uncertain times. Scenarios allow for the visualization of potential changes, both geographically and through time, to deal with the uncertainty caused by human interventions, as well as other larger scale threats such as climate change. Anticipating future patterns enables organizations to make critical immediate decisions with higher confidence, knowing that they have carefully considered a range of future conditions rather than a single low-confidence prediction. Conservation planning involves long term and often irreversible decisions, in particular with decisions concerning the purchase of land. Although biologically-derived conservation priorities are necessary, they are not sufficient and sometimes conflict with new development. Moreover, climate change is altering conservation priorities and must be taken into consideration in making long-term irreversible decisions. Scenario assessments allow the exploration of potential changes in the urban and natural environment and how these will interact with conservation priorities and goals.

Which factors were considered?

- Change in urbanization
- Conservation Priorities (CLIP 3.0 & Florida Forever)
- Land Use (Agriculture, ranching, forestry, commercial)
- Climate Change/Sea Level Rise
- Urbanization



Key Scenario Development Steps. (Source: GeoAdaptive, 2014)

About the Scenarios

The scenarios present possible future land cover and sea level rise for the region for 2020, 2040 and 2060. The scenarios considered in this analysis represent a “wide but plausible” range of parameter values organized in five dimensions: sea level rise, human population growth, land use planning policies and constraints, financial resources for conservation (and conservation strategies and mechanisms). The refinement of the scenario modeling parameters was discussed with the stakeholders and validated with the steering committee to select a set of scenarios of high management interest.

Scenario Development Process

The scenario development process has 5 main steps. The first step involves the identification of the driving forces that will influence the variables and assumptions used in the scenario, while the second step focuses on the identification of uncertainties that can become challenging variables. The third step involves the identification of key trends that will drive the scenarios. The fourth step is the simulation of alternative futures based on based on conceptual scenarios. Once the modeling is completed, the fifth step is quantifying and comparing the outcomes of each scenario. This information can be used by stakeholders and decision makers to test different plausible scenarios and make more informed decisions.

Scenario Architecture

Key Drivers of Change

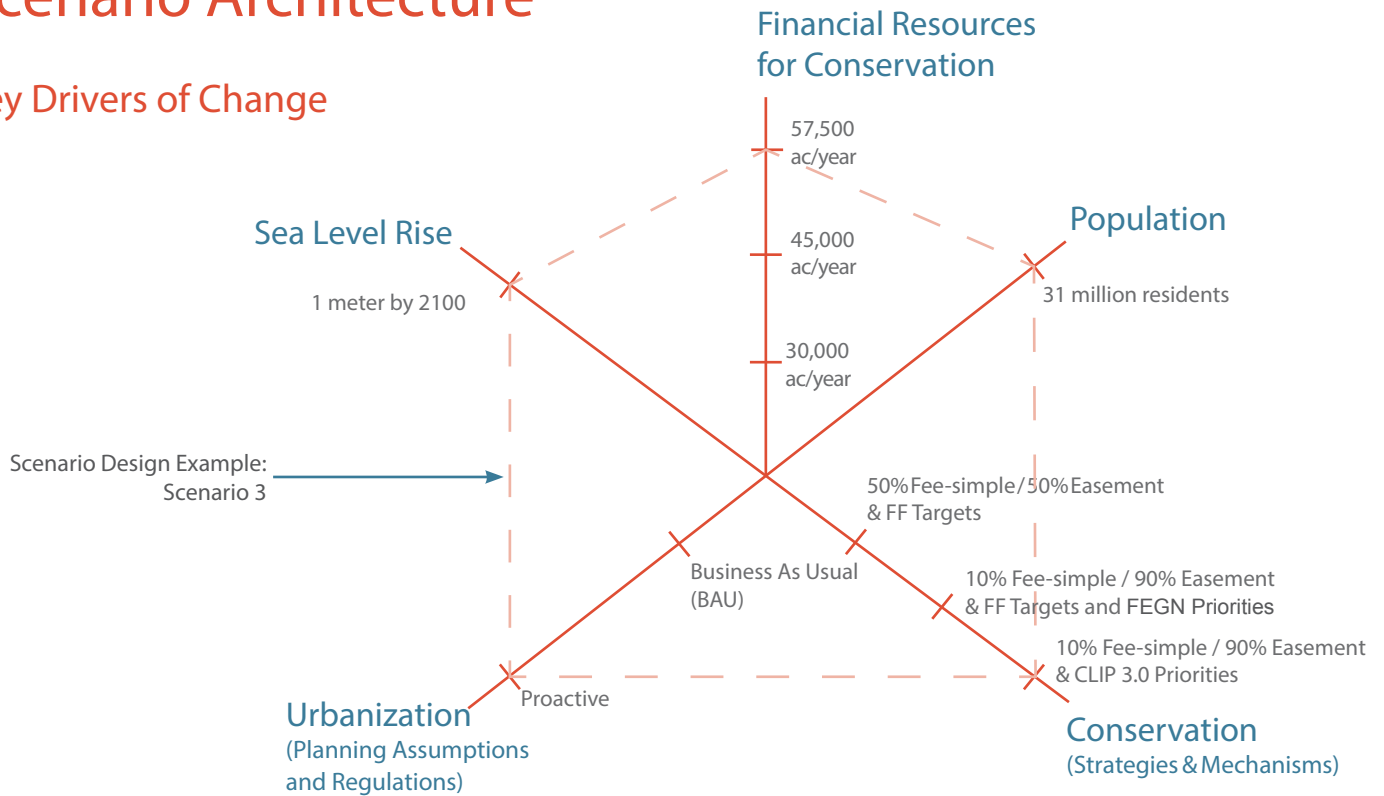


Table: Key Driving Forces

	SCENARIO 1	SCENARIO 2	SCENARIO 3	
Acquisition Rate for Conservation	30,000 acres/year	45,000 acres/year	57,500 acres/year	3 acquisition rates identified to achieve conservation priorities set forth by each scenario, defined by the number of acres of conservation land per year.
Conservation Strategy + prioritization	50% Fee Simple 50% Easement + Florida Forever (FF) Targets	10% Fee Simple 90% Easement + Florida Forever (FF) Targets & Ecological Greenways Network (FEGN) Priorities	10% Fee Simple 90% Easement + CLIP 3.0 (Highest priority)	2 primary conservation strategies which identify the breakdown of acquisition strategies between fee-simple purchases and conservation easements. The prioritization of conservation purchases was based on existing programs such as Florida Forever, Florida Ecological Greenways Network and CLIP (Version 3.0).
Minimum Lot Size for Conservation	none	none	5 acres - Fee Simple 100 acres-Easements	The minimum size of the lots was not considered for two scenarios, however it was limited to 5 acres (Fee-simple purchases) and 100 acres (easement acquisitions).
Population	Trend Population 31 million by 2060	Trend Population 31 million by 2060	Trend Population 31 million by 2060	The projected 2060 population of 31 million remains constant throughout all scenarios.
Urbanization (Planning Strategy)	Business As Usual Low density greenfield development Existing distribution of density	Proactive Green infrastructure + Redevelopment + Densification	Proactive Green infrastructure + Redevelopment + Densification	2 primary planning strategies are explored, the first follows existing distribution of housing densities and is given priority over conservation needs, while the second strategy focuses on redevelopment and redensification and shifts priority to conservation needs.
Sea Level Rise	1 meter by 2100 (IPCC AR5 8500 projection) Development & conservation acquisition allowed in inundation areas	1 meter by 2100 (IPCC AR5 8500 projection) Development & conservation acquisition allowed in inundation areas	1 meter by 2100 (IPCC AR5 8500 projection) Development & conservation acquisition NOT allowed in inundation areas	Sea level projection of 1 m remains constant throughout all scenarios. The allocation of development is either allowed in areas affected by sea level rise or not, depending on the scenario.

Drivers of Change

Human Population Growth

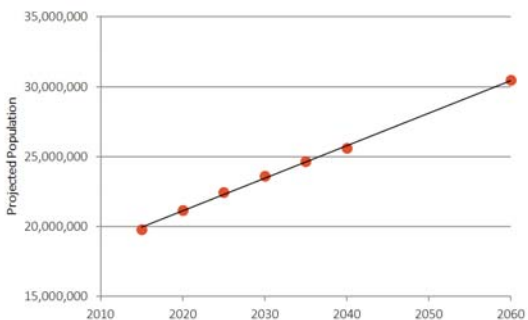
Effects of population on urban growth

The same population growth projection was used for all scenarios. The estimated total of 31 million residents by the year 2060 was derived from BEBR county-level projections. Housing demand based on these population projections was divided into three categories based on development density and income, (high, medium and low) in order to assess the geographic distribution of development in multiple residential land cover classes.

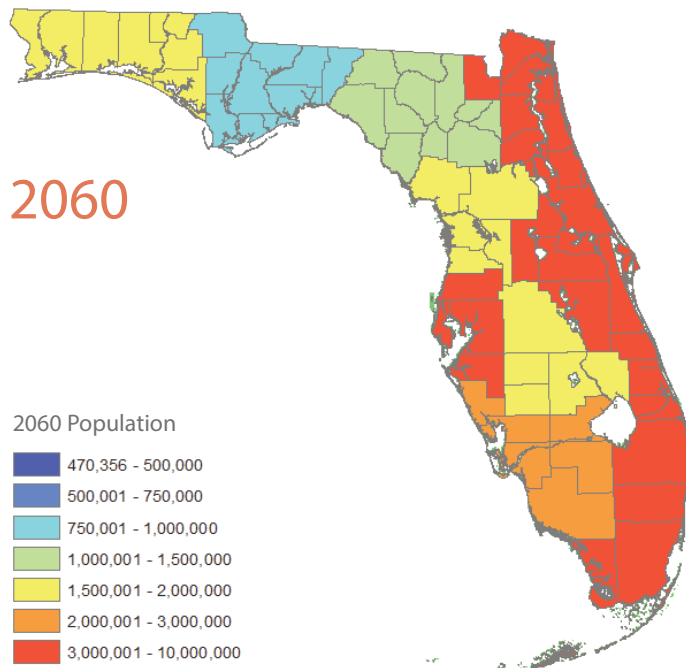
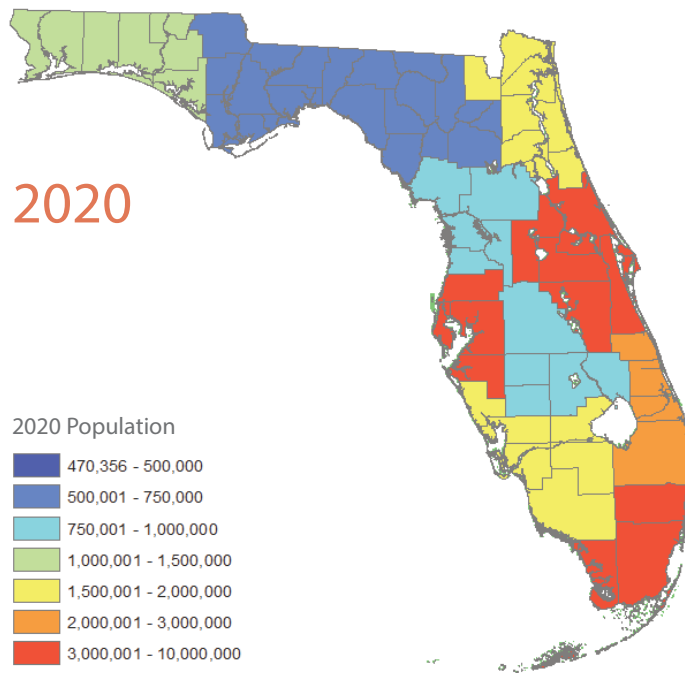
As reflected in the adjoining maps, the eastern coast of the state will contain the largest portion of future population, along with the Tampa Bay area. Significant increases in population are concentrated mostly in northeast Florida near Jacksonville, central Florida, the Treasure coast near Port Saint Lucie and southwest Florida near Cape Coral.

This sets up a basic dynamic which all future Florida conservation must address: not only is the population of the state to nearly double in 50 years, but most future growth will not be near historic urban areas. Conservation must anticipate this growth, particular in areas with limited local resources for conservation planning.

>Human Population >Urbanization



Medium-growth population projections for Florida through 2060. (Source: Bureau of Economic and Business Research, 2013)



Urbanization / Development

Planning assumptions and regulations (land use and water)

As part of the analysis, growth was considered in two general land use categories: conservation and development. Within the development category, 6 different real estate markets were simulated. These considered both density and income, since both affect suitability and location. In an extension of prior Florida scenario efforts, both nonresidential urban development and redevelopment were explicitly simulated.

Two primary sets of land use planning assumptions were used as guides in the development of the land use projections for the statewide scenarios. Combinations of “alternative future” parameters were modeled in order to assess development and conservation patterns under each set of assumptions. The first set of assumptions were developed as the “Business as Usual” policy set. Under this planning regime, the approach by state and local agencies is based on perpetuating current development and land use planning policies, and prioritizing residential growth and low density greenfield development.

The second set of assumptions were developed as the “Proactive” policy set, where conservation allocation takes precedence, and urbanization is focused on policies of redevelopment in existing transit-oriented development (TOD) zones, in addition to policies that are geared towards promoting higher urban densities (redensification) and stricter environmental constraints, where more restrictions would be put into place to limit development in sensitive or hazardous areas. We conducted a detailed analysis of the residential density changes which have occurred across the state over the last 50 years. Contrary to conventional wisdom and our own expectations, we found a number of circumstances in which overall densification of 30% has occurred during this time period. We reasoned that under a proactive set of policies, government might stop legally-restricting moderate densities in particular areas. Where market conditions are strong, one could reasonably expect a similar increase over the next 50 years. In particular, we considered areas previously nominated by counties for “Transit-oriented development”, underutilized commercial strips, areas with single story immediate post-war building stock, and parcels with very low economic value to be likely candidates for redevelopment.



Low density development outside of the city consumes land at a higher rate.
(Source: South Florida Water Management District)

Types of Development

We conducted an analysis of historic rates of conservation in Florida over the last 50 years. We found no consistent trend, and decadal variations of 5-10x average. In the 1990s, over a million acres of land were conserved under the Florida Forever program alone. More recently, this program was targeted for elimination. In reviewing prior easement purchases, we found that on average these cost 40% less per acre than fee-simple acquisition. Given the lack of a clear trend, we surveyed the PFLCC steering committee, and consulted in particular with its members most involved in current conservation deal making. The SC members felt that a rate of 30,000 acres a year of conservation was the most likely future rate. This was validated by review the last 5 years of conservation activity. They also felt that 50% fee-simple and 50% easement was the most likely future ratio of conservation types. We took the numbers as a basis for our “Scenario 1.” SC members were also interested in seeing two alternative scenarios in which the ratio of private voluntary conservation was increased to 90%, allowing for increased efficiency in such deals. We estimated future easement deals as have an efficiency gain over fee simple purchase of 25% in “Scenario 2” and 50% in “Scenario 3.” While some efficiency is likely to be gained by experience and institutional setup, considerable uncertainty remains because there is potential for “diminishing returns” function as conservation easements are massively scaled up. The challenge is that smaller and smaller parcels must be considered, and less-willing easement sellers must be satisfied - both of which are inherently less efficient.

Certain urbanization patterns can cause the fragmentation of landscapes and other unintended consequences such as a high resource consumption rate. The future demand for land was based on two primary types of residential land use patterns: sprawl and redevelopment. Following is a brief description of each.

Land use patterns that refer to the increase of low-density development away from the urban center towards suburban and rural areas is known as sprawl. As development within the urban center decreases, demand for resources increases as new developments appear outside of city limits, such as demands for land and basic services (i.e. water, waste collection, etc.). Additionally, as development continues to grow on the outskirts, commuting time and traffic congestion increase, as individual travel becomes the only available option.

Redevelopment focuses on the development or improvement of areas that are already served by infrastructure and supported by urban services (APA 2002). Frequently incentivized by public agencies, redevelopment efforts take advantage of underutilized properties as a means to respond to new market demands and population growth.

Financial Resources for Conservation



Land purchased as a conservation easement
(Source: Florida Environments)

Conservation funding waxes and wanes over time, but the availability of funding was also taken into consideration for the scenarios. Based on data available for the Florida Forever project (source: FNAI), conservation had not exceeded 30k acres/year in the last 5 years. This figure was validated by the Steering Committee and was used for scenario 1. A larger value was used for the 2nd scenario of 45k acres/year, while the highest value of 57.5k acres/year was used for scenario 3. The allocation of conservation funds considers fee-simple purchases along with conservation easements or private conservation efforts.

Conservation Strategies

Based on the recommendations received from the science team, and consultation with the PFLCC Steering Committee, three conservation approaches were developed for the scenarios. These were selected to represent a representative range of acquisition rates and potential conservation strategies.

Scenario 1: Acquisition occurs at a rate of 30,000 acres per year (based on an average of historical land acquisitions). Prioritization of acquisitions is based on the list developed by the Florida Forever Board of Trustees, as approved by the Acquisition and Restoration Council. The conservation strategy identified for this scenario is an equal mix of fee-simple purchases and conservation easements.

Scenario 2: The selected rate of land acquisition for this scenario is 45,000 acres per year. Acquisitions are prioritized based on the Florida Forever list, with additional conservation in high priority areas from the Florida Ecological Greenways Network (FEGN) analysis. Funding is allocated such that only 10% of conservation is through fee-simple purchases, while the remaining 90% is in conservation easements.

Scenario 3: Reflecting the most proactive conservation policies, this scenario projects acquisition to occur at a rate of 57,500 acres per year. Acquisitions were prioritized based on a tiered ranking of the top priorities in version 3 of the Critical Lands and Waters Identification Project (CLIP), which accounts for a wide range of factors related to ecological habitat, connectivity, and water resource conservation. The same 10% fee-simple/90% conservation easement split was used in this scenario.

Scenario	SHARE		ACRES PER YEAR			TIME STEP			
	Fee-Simple	Easement	Fee-Simple	Easement	Total	2010 –2020	2020 – 2040	2040 – 2060	50 Year Total
1	50%	50%	15,000	22,500	37,500	375,000	750,000	750,000	1,875,000
2	10%	90%	4,500	40,500	45,000	450,000	900,000	900,000	2,250,000
3	10%	90%	6,000	54,000	60,000	600,000	1,200,000	1,200,000	3,000,000

Conservation Allocation (PFLCC Scenarios)

Climate Change | Sea Level Rise

Sea level rise (SLR) was modeled by Jon Oetting (FNAI) and Michael Volk (University of Florida) using LIDAR data processed and tidally-corrected using NOAA methods. Our steering committee elected to use a single level of SLR across the conservation scenarios in order to simulate conservation performance across a severe-but-plausible rate of climate change. One meter of SLR by 2100 is consistent with IPCCs 2014 RCP8500 scenario. The second consideration is the precautionary principal. Conservation strategies and acquisitions are often done “in perpetuity” using scarce public resources. There is currently no global scenario in which SLR is expected to stop by 2100. Therefore, some advocate for using high SLR values for planning, simply as a precaution. Finally, South Florida drainage canals have approximately 1 m of “head” from headwaters to tide. As canals fill up, their effectiveness decreases nonlinearly. Therefore, a challenge in considering SLR values above 1 m is that it is not clear what would happen in South Florida without significant changes in infrastructure.



Projected one-meter sea level rise through 2100 for the state of Florida.

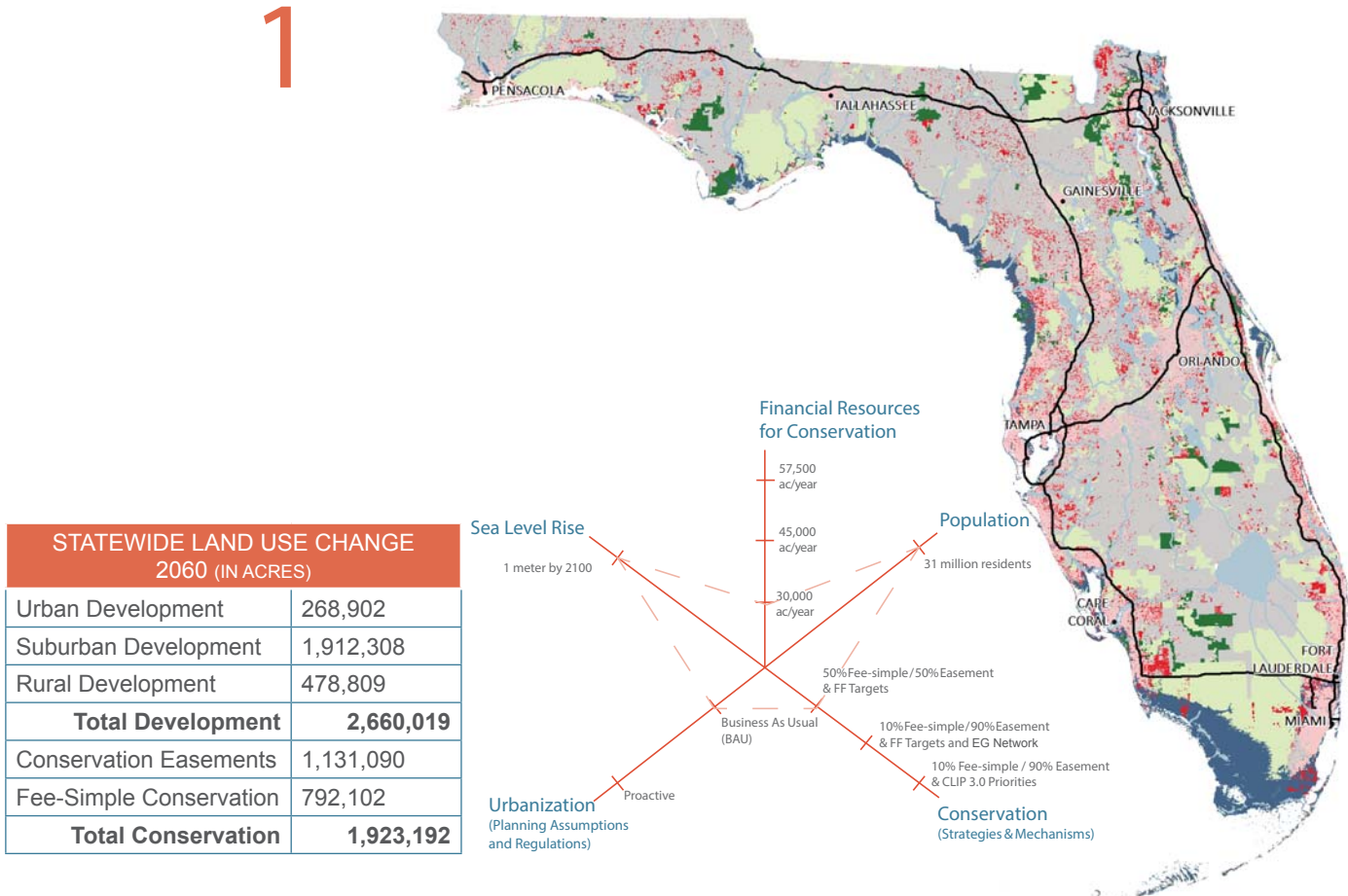


Miami Beach tidal flooding
(Source: Harold Wanless, University of Miami)

Results

Alternative Futures for Florida 2060

1



Overall, our “alternative futures” simulations showed major variation between Scenario 1 and Scenarios 2 & 3. The differences between Scenarios 2 and 3 were considerably more nuanced. This is not unexpected, since Scenario 1 represents significantly different assumptions about future development and conservation strategies, whereas Scenarios 2 and 3 represent incremental refinements of current conservation strategies.

In conservation terms, the switch to an easement-based strategy clearly yields some significant benefits given a fixed budget scaled to recent spending. In non-spatial terms, this supports a gain of approximately 1/3 more conservation acreage. In spatial terms, it supports the development of a much more connected network of areas, with potentially important benefits in terms of climate change adaptation and area-sensitive wildlife.

In development terms, the major difference is in the character of future urban areas. Under Scenarios 2 and 3, there is substantial redevelopment across the state. This is most notable and most successful in the Southeast, where limited land supply, high demand, and over-zoning of commercial strip development provide significant opportunities for commercially-viable infill and mixed use projects.

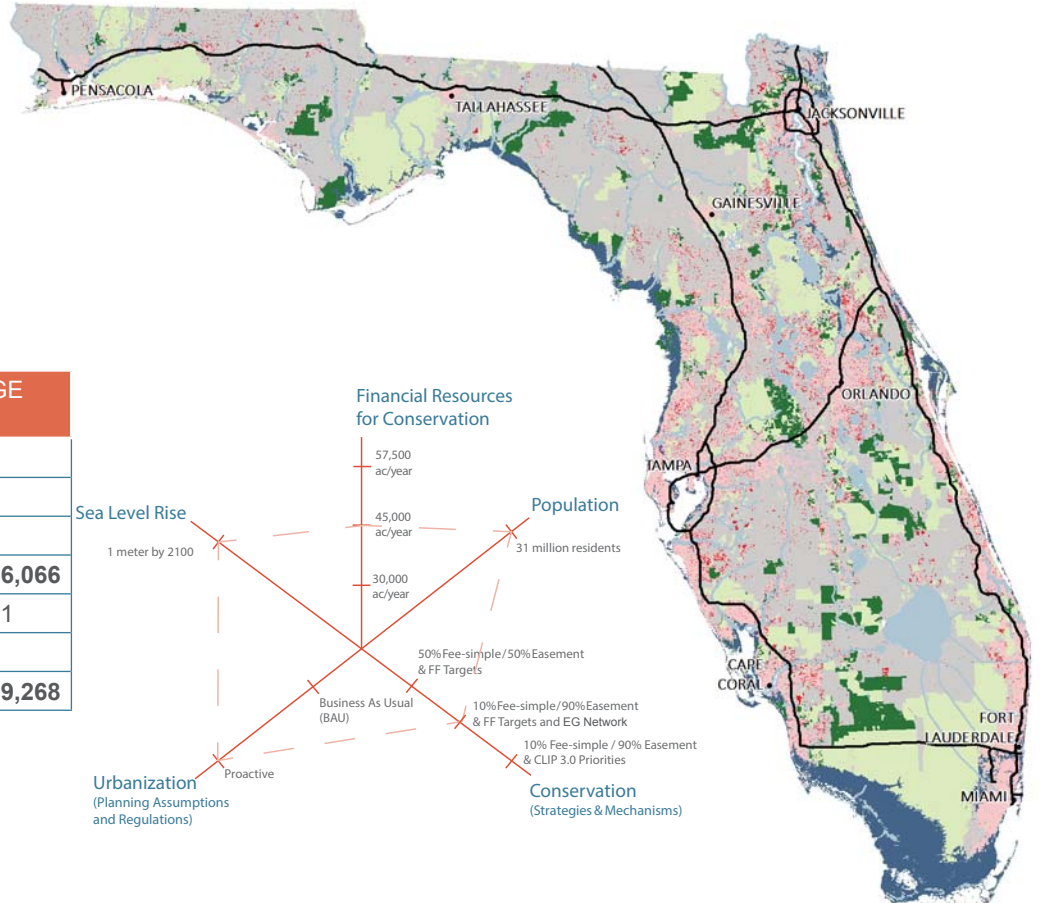
Legend

- Interstate Highway
- Major Rivers
- Major Lakes
- 1m Sea Level Rise
- Conservation
- Urban Areas

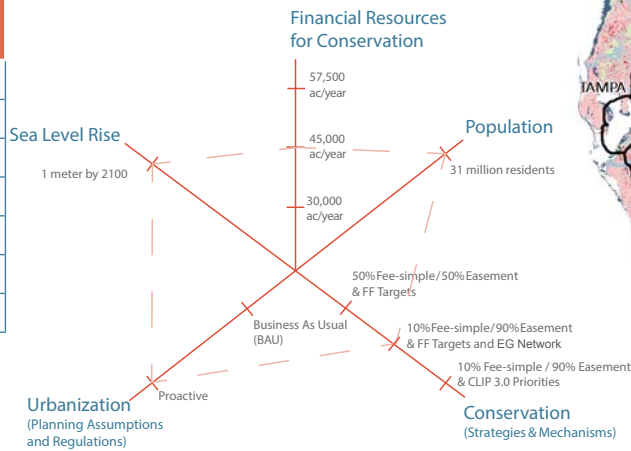
Current Land Cover

- Developed Areas
- Public Land

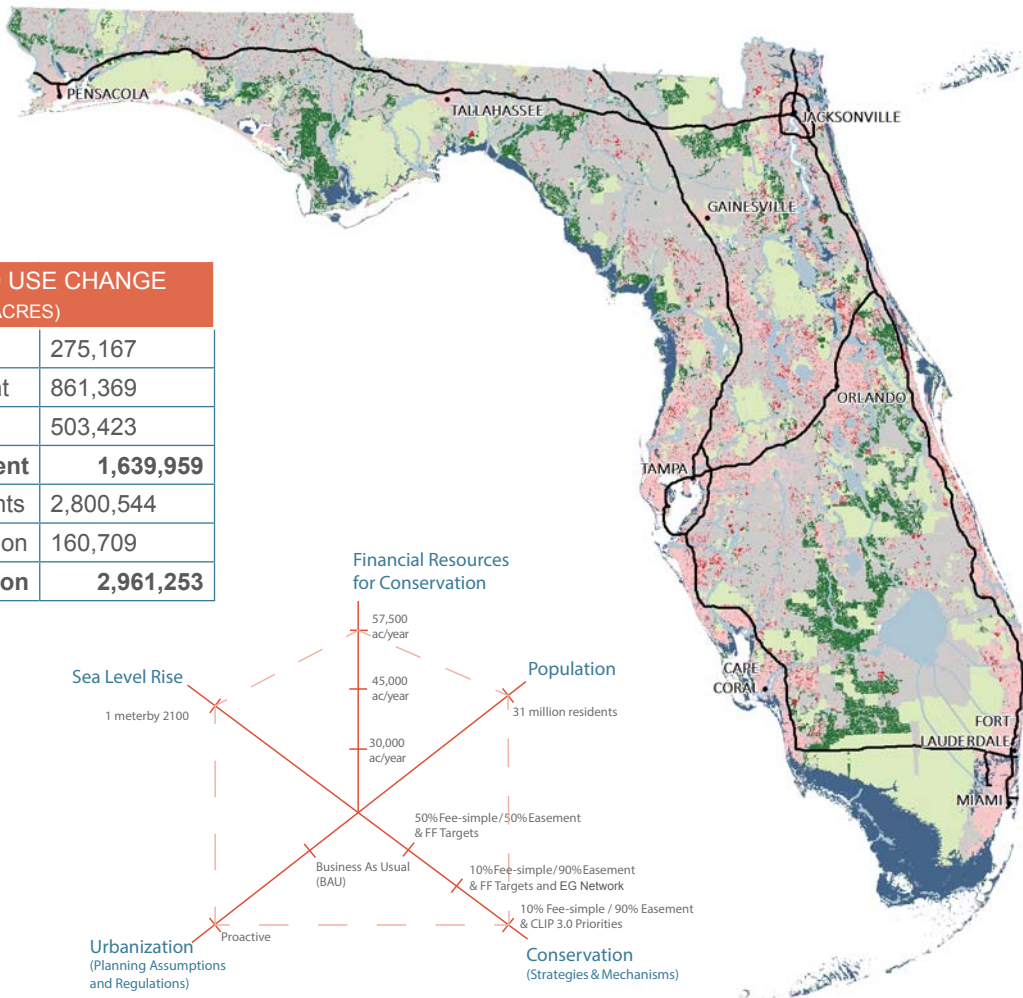
2



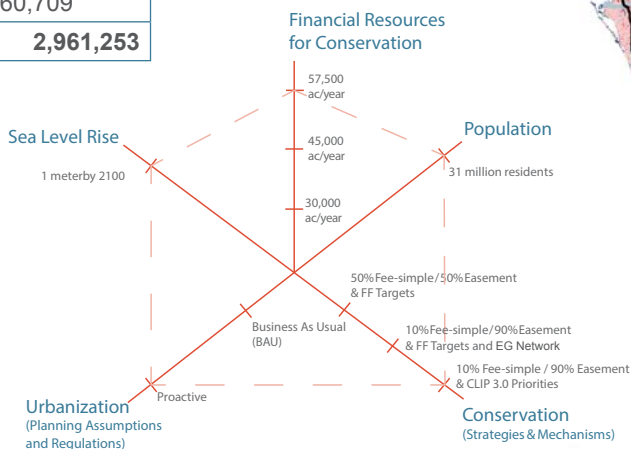
STATEWIDE LAND USE CHANGE 2060 (IN ACRES)	
Urban Development	332,279
Suburban Development	921,544
Rural Development	522,242
Total Development	1,776,066
Conservation Easements	1,938,871
Fee-Simple Conservation	280,396
Total Conservation	2,219,268



3



STATEWIDE LAND USE CHANGE 2060 (IN ACRES)	
Urban Development	275,167
Suburban Development	861,369
Rural Development	503,423
Total Development	1,639,959
Conservation Easements	2,800,544
Fee-Simple Conservation	160,709
Total Conservation	2,961,253



Results: Focal Zones

Our simulation process for future conservation and development took into account both supply and demand. Land is an exhaustible resource, particularly when constrained by ownership and policies. For this reason, not all demand is met under all scenarios. However, our simulation model does attempt to allocate as much of demand as policy and land use allows.

In the allocation process, development is described using 7 categories, and conservation using two. For cartographic clarity, at the RPC scale, we aggregate these into 3 groups: urban, suburban and rural. In simulation, we take into account both income and density, recognizing that markets provide a variety of housing types which attract – or are affordable to – different groups of people. Under Scenario 3, the simulated policy is to support increased development, where the market requests it. In our simulations, this has much more effect in urban areas with existing higher densities, higher incomes, and public transit availability. Even though the same policies were applied across the state, they were markedly less effective in Central Florida and the Panhandle.

Apalachee

In a statewide context, the Panhandle region remains significantly less developed than the rest of the state. In Scenario 1, there is one very large fee-simple conservation acquisition (the 100k acre “Bear Creek Forest”). There are also approximately 5 medium to large conservation easements, the largest of which is the 38,000 acre St. Joe Timberland. In Scenario 3, conservation easements are extensive, with one reaching through the St. Joe Timberland all the way up to the state border.

The difference in development pattern is less dramatic than in central and southern parts of the state, due to lower overall demand. However, the difference between more-compact development and sprawl is still very evident. Under Scenario 3, where such policies are encouraged by rule, the town of Marianna sees extensive growth. Under Scenario 1, where it is not, there is extensive very large lot development in the region to its West.

East Central

In Scenario 1, this detail shows what can only be described as a continued pattern of low-density auto-oriented sprawl development extending from Orlando to Tampa. Interestingly, in Scenario 3, these two metro regions remain separate, and the intervening land use remains largely unchanged from today. In all scenarios, there is very little development in Polk County, which remains much as today.

In Scenario 1, there is a significant amount of fee-simple conservation along the Lake Wales ridge and to its West. This begins to form a continuous network between large blocks of existing public land. There are also three very large conservation easements, also forming continuous open space connections. In Scenario 3, there is a much larger amount of conservation easements, forming a contiguous North-South band nearly 40 miles wide in places. Conversely, there are numerous, but very small, fee-simple acquisitions.

Southwest

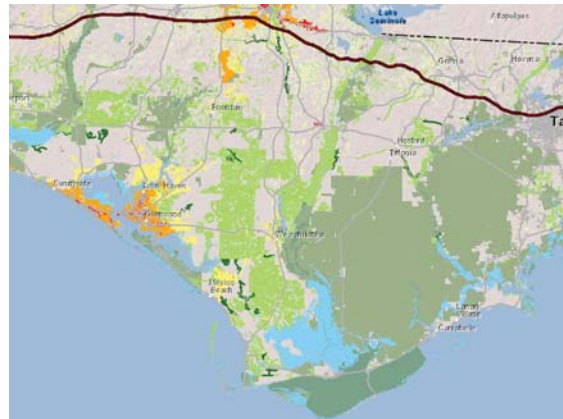
In Scenario 1, this detail view shows the coastal development pattern of the Southwest remaining similar to its current state, although with denser mixed use communities scattered throughout. Because of the recentness of most existing development, our model found few opportunities for infill development in this area. The interior pattern shows a large change relative to current conditions, and this varies across scenarios. In Scenario 1, there are two distinct conservation corridors: an interior one composed of fee-simple ownership linking existing large blocks and extending up to the Caloosahatchee; and a second western corridor composed of easements only. In Scenario 3, there are no distinct corridors and little fee-simple acquisition. Most of the intervening land forms a single massive conservation easement corridor connection through and above the Caloosahatchee. The difference between these scenarios is likely of high significance to the Florida Panther, although further work would be needed to quantify this observation.

Apalachee

Scenario 1

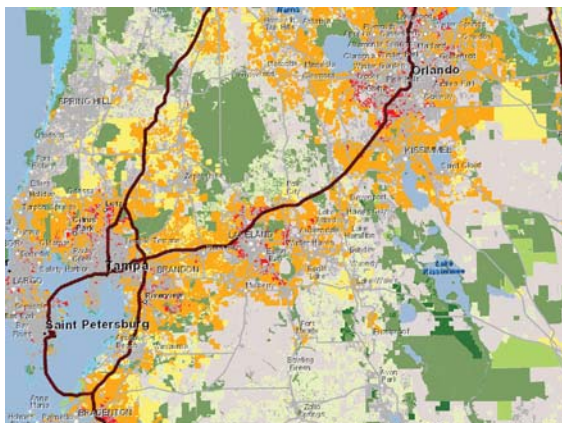


Scenario 3

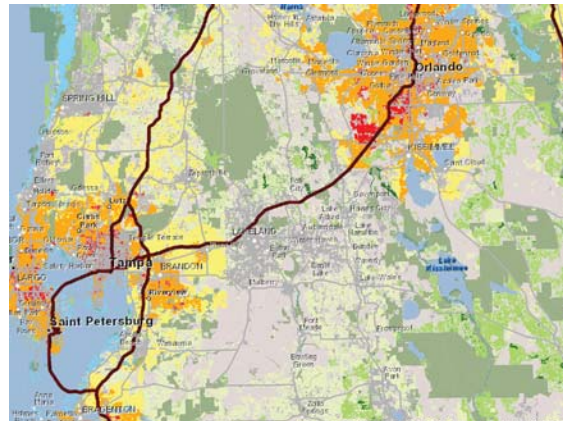


East Central

Scenario 1

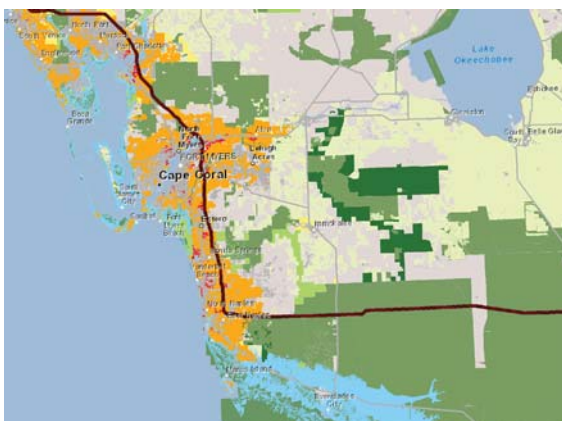


Scenario 3

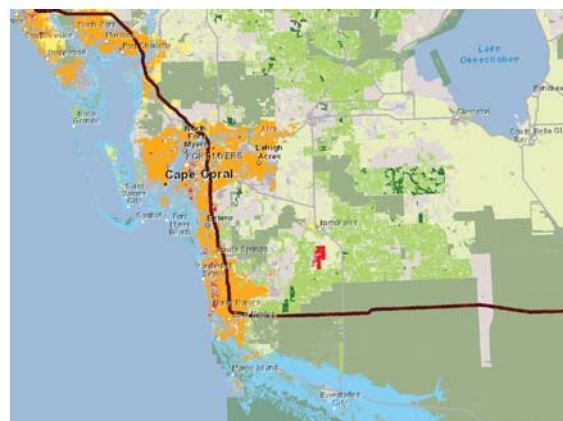


Southwest

Scenario 1



Scenario 3



Legend

Interstate Highway

Major Rivers

Major Lakes

1m Sea Level Rise

Future Fee-Simple Conservation (804)

Future Conservation Easements (6,610)

Scenario 1 Development (2060)

Future Urban & Mixed Use (42,135)

Future Suburban Residential (179,456)

Future Rural Residential (7,944)

Existing

Developed Areas

Public Land

Agriculture

Implications



Benefit of conservation easement is protection of wildlife habitats and natural lands for future generations.

The simulated alternative futures were designed to stress the differences which conservation and planning policies might make in a future Florida with significant sea level rise and human population growth. In general, all three scenarios show that with a historically-reasonable level of financial commitment, the long term conservation strategies envisioned for the state could form a cohesive statewide network protecting much of the state's most valued resources.

The scenarios represent very different visions of how that conservation might be accomplished, but the differences are mostly in social mechanism and not so much in location. The broad strokes of Florida conservation and development patterns have already been set, particularly along both coasts. What remains a fundamental choice is the role of working lands in conservation, particularly ranch lands.

In Scenario 1, we simulate a future in which current planning and development policies are largely unchanged. This leads to a development pattern familiar to all Florida residents: large arterial roads lined with strip development backed with relatively low density suburban housing. Conservation under this scenario follows the existing "Florida Forever" prioritization scheme, using both fee simple purchases and conservation easements in equal measure. Notably, Scenario 1 largely achieves current Florida Forever goals by 2040. In the two decades which follow, focus shifts towards connecting existing conservation lands, using the Florida Greenways strategy. Some significant progress is made, for example in SW Florida, but large gaps remain.

In both Scenarios 2 and 3, by contrast, there is a strong shift in conservation mechanism, and this leads to significant increases in conservation. The difference between these later two scenarios is in which prioritization scheme is implemented: the existing Florida Forever system, or a refined version of the CLIP system (CLIP3) which starts to adjust

rankings based on projected climate change.

All scenarios responded to an identical population demand, as estimated by BEBR demographic forecasts. These forecasts show considerable growth in areas of Florida which have not previously experienced high growth pressure. In particular, Central Florida experiences dramatic growth in all scenarios. The policies which were simulated to encourage densification and infill do show some neighborhoods are gaining mixed use pedestrian areas. However in large part, these measures were ineffective in the central and Northern parts of the state, and the result is what could only be described as very widespread sprawl.

The second major issue to note is the sheer number of conservation easements required under all scenarios, but particularly under Scenario 2 and 3, which obtain 90% of their effect based on easements.

Current databases of Florida Conservation Easements are known to be incomplete. Nonetheless, major easements are recorded by FNAI. As a point of comparison, the FNAI Managed Areas database as of December 2013 listed a total of 342 less-than-fee areas, with a total acreage of just over 750,000 acres.

In Scenario 2, 6,351 easements are required and 151 fee-simple purchases. The total acreage of the easements is just under 2 million. While we purposefully gave preference to larger potential conservation units, the mean size of easements was just over 300 acres. Scenario 3 is twice as challenging, requiring 11,337 easements and 606 fee simple purchases. This is because Scenario 3 goes after more biologically-driven conservation targets, which include more small units.

The switch to a conservation regime based largely on easements brings new challenges, some of which become clear in the details of these scenarios. The amount of land to be managed in easements is about 2.5x current levels, which is arguably a reasonable level of increase when spread over 50 years. However in both Scenarios 2 and 3, this reliance on easements requires an approximately 20x scale-up in terms of deal count relative to current practices.

The cultural and institutional changes required to actually achieve the conservation results shown in these scenarios are significant. Thanks to many years of scientific research, GIS analysis and planning, the broad outlines of what is needed for Florida conservation are largely agreed. Climate change and major urban growth will have impacts on this strategy, as shown by the differences between Scenarios 2 and 3. However the main lesson we derive from this work is the need to develop institutions strong enough and coordinated-enough to manage a major transformation across rural Florida, while there is still a rural Florida left to consider.

How to use the scenarios

Spatial scenario assessments create a decision support framework to scientifically determine and support basic conservation assessments. The allocations of projected growth, while subject to some limitations, provide a glimpse into a range of “alternative futures” which highlight the encroachment of development into prime habitat areas, while simultaneously modeling the impact of inundation due to sea level rise. The pattern and type of land use change at each time horizon (2020, 2040, and 2060) can be leveraged as a tool for prioritizing spending of conservation funds, as well as evaluating policy decisions.

EverVIEW

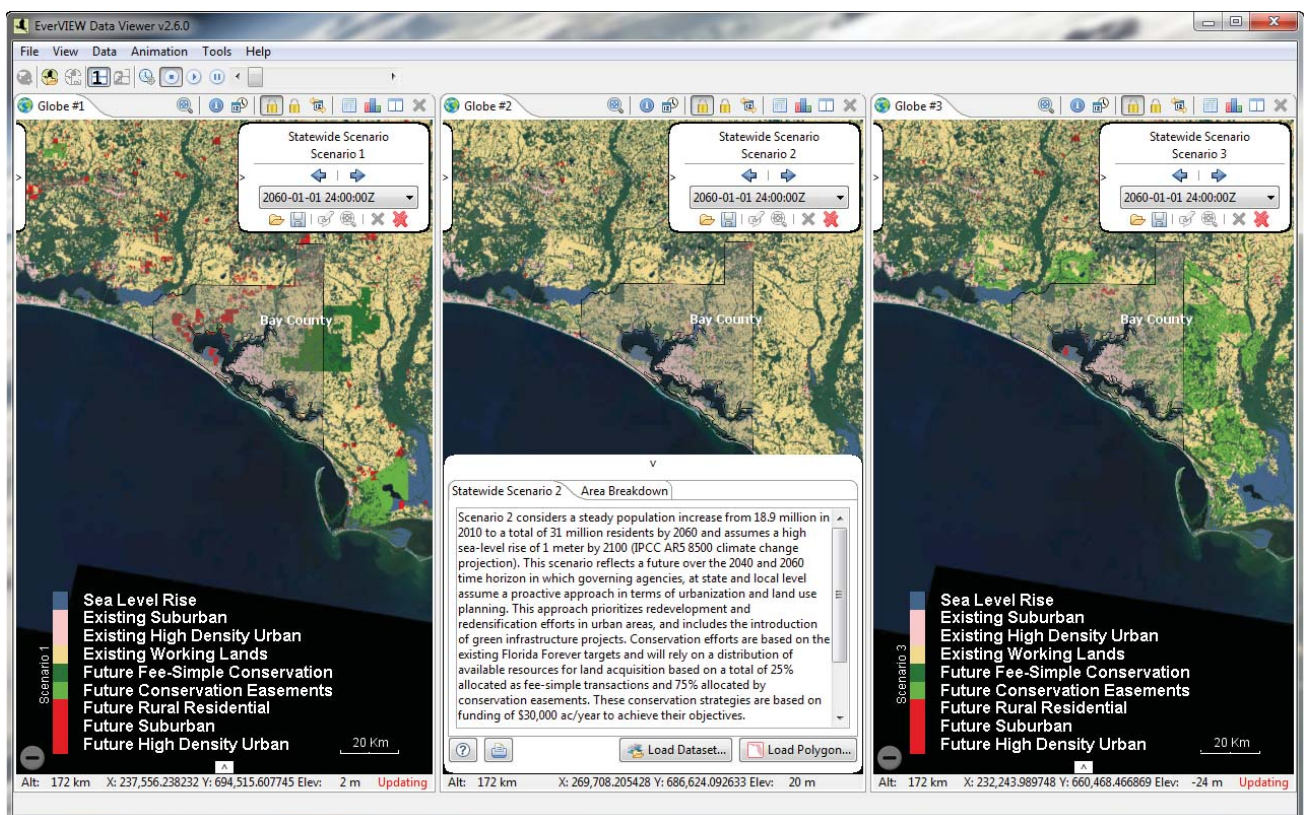
As a means to visualize the scenario results USGS scientists working under the Joint Ecosystem Modeling (JEM) collaborative umbrella have developed an extension for the EverVIEW visualization tool that allows users to view and interact with some of the datasets and results of the land use change analysis. Examples of the datasets used by the PFLCC scenario process include: inundation modeling of a 100-year event with and without sea level rise on 3 select counties; an update to the Critical Lands and Waters Identification Project (CLIP) database; and niche models for Florida’s threatened and endangered vertebrates under future climate conditions.

The PFLCC Scenarios Viewer extension was designed to make the process of locating and loading data, along with configuring EverVIEW to visualize the predictive scenarios, easy for the end user. The extension sets up the EverVIEW environment and automatically retrieves and loads the three statewide scenarios. Users can easily swap out one of the statewide scenarios for one of the county-level 100-year inundation datasets, or compare results against any of the other modeled datasets. Polygons for state counties and conservation areas are also bundled with the tool to allow comparison of specific regions under different conditions.

Additional information about the PFLCC EverVIEW extension can be obtained at the following website:

<http://www.jem.gov/Modeling/EverVIEW>

Example of the EverVIEW extension:



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