

Towards a Sustainable Florida

**A Review of
Environmental, Social and Economic Concepts
for
Sustainable Development in Florida**

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Applied Sustainability – Introduction and Vision

Stephen S. Mulkey

The problem

Florida is experiencing a progressively unfolding dilemma as a consequence of booming population growth and development in a context of limiting natural resources. Florida's population is projected to increase by 72 percent to 27.5 million over the next twenty-five years, and double in fifty years. Urban development, suburban sprawl, transportation pressures, coastal densities, habitat fragmentation, and reduced agricultural lands will be the inevitable result of this population increase unless growth is managed wisely. Existing conservation and preservation lands are under increasingly intense pressure, and lands that should be protected will be lost to development unless they are identified and protected in some form soon. The visionary state programs of Florida Forever and Preservation 2000 have preserved over 2 million acres, but we must act now to finish the job before the opportunity is forever lost. In March 2006, Gov. Bush delivered the keynote address at the Florida Symposium on Strategies for Regional Cooperation in which he emphasized the linkage between Florida's environment and its economy stating, "We are in danger of killing the goose that lays the golden eggs." By this he meant that the currently vibrant economy of the state is critically dependent upon Florida's storied, sun-washed quality of life and its natural environment, now reeling from multiple assaults. The constraints on land use are made ever more critical by the unfolding consequences of climate change, which are predicted to raise sea level 12 inches by 2075. Experts also predict an increasing probability of more intense hurricanes striking the Florida coasts where 80 percent of the population resides. This confluence of constraints makes the identification of statewide growth management priorities critically urgent. To postpone or avoid such planning will result in irretrievable losses of natural resources and significantly amplified costs in the future when the choices will be dire and the trade offs more economically expensive.

The conundrum of sustainable development

The Agenda 21 Program of the United Nations defines sustainable development as development that "meets the needs of the present generation without compromising the ability of future generations to meet their needs." This echoes the seventh generation philosophy of the Iroquois, whereby chiefs were responsible for the effects of their actions on their descendants for seven generations. Sustainability is the result of the flow of energy through natural, social, and economic systems. Thus, the 2002 World Summit on Sustainable Development identified three objectives for sustainable development: (1) protecting natural resources, (2) eradicating poverty, and (3) changing unsustainable production and consumption patterns. Regardless of how the term is defined, the conundrum inherent in sustainable development is that the goals of sustainability are interdependent. Indeed, the complex interdependence of the environmental, social, and economic legs of sustainability is apparent from even a casual consideration of any one of the issues related to growth management in Florida. For example, simple solutions for maximizing the near-term growth of the state's economy would undoubtedly result in

negative consequences for the natural environment and significantly erode the quality of life for its citizens. Ultimately, we must at least maintain the life support system provided by the natural component if we are to have any hope of achieving a sustainable society and economy.

The present situation is not new, and since the early 1800's the history of Florida has been characterized by periodic land speculation. What is different about our unfolding predicament is the high degree of consensus among policy makers, developers, land managers, and conservationists that a limit to development is rapidly being approached, beyond which the state's economy and natural resources will suffer possibly unrecoverable damages. Figure 1 shows the projected residential growth of the state by 2020 in which 2 to 3 million acres of aquifer recharge lands will be developed (estimated by the Florida Chapter of The Nature Conservancy). It is clear that this vision of the future is not consistent with the goals of sustainable development. Most would agree that it is time for a different vision of Florida.

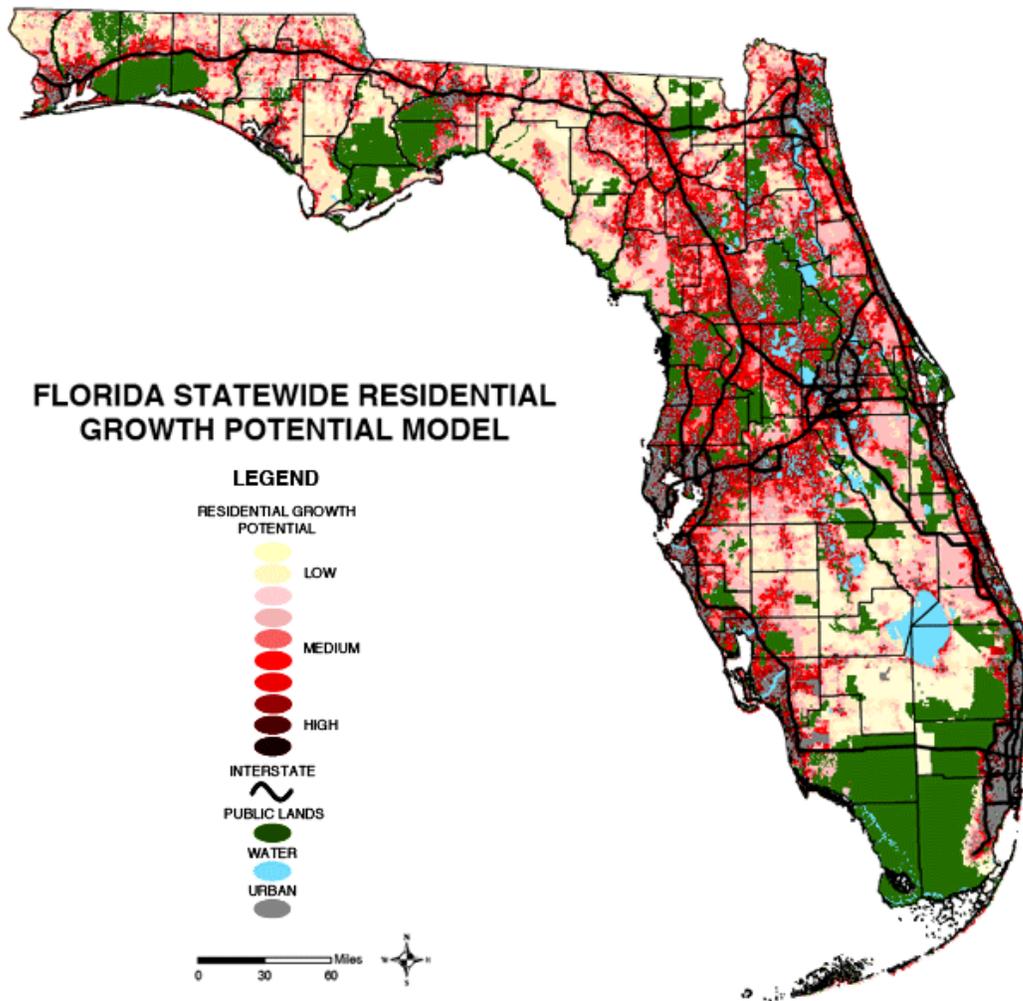


Figure 1. Florida potential residential growth by 2020. Data from J. Teisinger (University of Florida GeoPlan Center, 2002).

A future by design or a future by default?

A near term vision for managing resources over the coming decade might partially mitigate the consequences of past excesses and poor planning, and perhaps define appropriate use for some of the state's lands and natural resources. However, such a limited plan would not provide economic incentives for creation of a future where sustainable resource use and economic development go hand in hand. Far preferable to a limited strategy relying solely on near-term regulation and damage control would be a longer-term vision of Florida's future in which the social, economic, and environmental components of sustainability are mutually reinforcing. Inherent to a comprehensive design strategy is the potential to capture efficiencies that would truly enhance the quality of Florida's environment and the quality of life for its citizens, rather than merely maintain the status quo. An overarching design for long-term use of the state's resources would provide a defined set of economic and conservation objectives, and thus provide business incentive for innovation and entrepreneurial development. In this approach, the solutions for Florida's growth problems can become, in part, the market drivers for economic development projected over a 25 year and 50 year time horizon. Protecting Florida's natural environment is integral to maintaining Florida's economic health and quality of life, and sound planning, including economic incentive, is needed to ensure that our natural environment is effectively protected.

The tools for getting started

As a first step in this visioning process, we must know which tools are available to support the goals of sustainable development. The following reports are a review of the concepts for key areas relevant to the natural, social, and economic legs of sustainability. The authors are individuals with recognized expertise in their respective fields, and who are members of the PLUS (People and Land Use Strategies) faculty work group at the University of Florida. Listed below are the contributors and their topics with respect to the three legs of sustainability.

As a starting point for enhancing sustainability, two features are apparent from these reports. First, given the nature of sustainability, it is not surprising that there is extensive interdependence and overlap among the concepts presented. While each author emphasizes the importance of a particular aspect, it is impossible to talk about any one recommendation for a sustainable future without extensive linkage to all the natural, social and economic factors that might affect that factor. Accordingly, the distinction among the three legs of sustainability is somewhat artificial, and this points to the need for a comprehensive planning strategy in which these interrelationships can be addressed by experts and stakeholders with different skills and expertise. Similarly, certain topics are integrated into multiple articles. For example, mitigating greenhouse gas emissions is a common theme in the articles on community design, transportation, and energy. Additionally, training students to have an integrative, systems approach to problems is not the exclusive purview of education, but is also central to building a sustainable economy.

Secondly, it is important to realize that the authors are recounting existing tools for moving towards a sustainable future. Futuristic ideas and untested concepts are not presented. Outside the context of these articles are many innovative and exciting concepts requiring research and testing. This, again, points to the need for a means to facilitate the development of new concepts for sustainability so that we may move beyond short-term mitigation of our problems and towards the vision of a better future.

Tools for Applied Sustainability

Topic	Authors	Expertise
<i>I. Environmental</i>		
Protecting Ecosystem Services	Alan Hodges	Environmental Economics
Water Resource Sustainability	James W. Jawitz	Hydrologic Ecosystems
Bioenergy	Janaki Alavalapati	Resource Policy & Economics
Energy Technology	Eric Wachsman	Materials Science & Engineering
Land Use	Margaret Carr Paul Zwick	Land Use Planning
<i>II. Social</i>		
Community Design	Martin Gold Mark Hostetler	Community Design Urban Wildlife & Natural Resource Conservation
Transportation	Ruth Steiner	Land Use and Transportation
Housing	Kristin Larsen	Housing, Preservation & Planning
Population Health	Barbara Lutz Andrea Gregg	Health Policy & Public Health
Public Safety	Richard Schneider	Crime Prevention & Planning
Disaster Mitigation	Carol Lehtola Charles M. Brown	Agricultural Safety
Culture & Sustainability	Mark Brennan	Community Development
Adaptive Governance	Christine Overdeest Alyson Flournoy	Environmental Governance Environmental & Land Use Law
<i>III. Economic</i>		
Education	Martha Monroe	Environmental Education
Economic Development	David Denslow Jim Dewey Babak Lotfinia	Economics Analysis & Business Research

A suggested process for moving forward

The process of visioning a sustainable future at 25 and 50 years hence requires a concerted interdisciplinary and iterative exchange among experts, stakeholders and citizens. Central to the development of a comprehensive strategy in which multiple futures can be assessed for their impact on various sectors is that the planning be accessible, transparent, and subject to continual refinement. It is essential that the visioning process not be controlled by one or even a few vested interests. All stakeholders should at some point be engaged in the process of refining the vision of the

future, and more than one future should be part of the visioning process. In PLUS, it is our founding principle and experience that the best solutions emerge as a robust synthesis from the exchange of ideas among experts in often contrasting fields. Design efficiencies and economies of scale emerge when ecosystems scientists sit down at the same table with regional planners and economists. Moreover, we have learned that the best ideas sometimes come from stakeholders who are actively engaged with the problems in question because they have experience with crafting solutions in the field. This is where the competing constraints common to creating sustainable solutions are often painfully experienced by those charged with finding solutions.

Because of the overlapping nature of the three legs of sustainability, we suggest a resource-based approach to the crafting of solutions. Logistically this simplifies the task because research groups are presently organized around key resources. Although ultimately interdependent, the critically important resources of land, water, and energy are appropriate separate starting points in this process. This would be a three-stage process where expert “think tanks” or keystone independent agencies for each of these resource areas proceed as follows: (1) Experts from multiple disciplines assemble the fundamental science and data associated with a particular resource. (2) The data and concepts are synthesized into a limited number of possible futures at 25 and 50 years hence. (3) These visions are iteratively refined with input from stakeholders and citizens. This last step should engage elements of all three research groups, and synthesis of concepts could occur at formal, working meetings among the three groups. Such meetings might be conducted on a regional basis to incorporate the unique characteristics of each of Florida’s distinct regions.

In this process, the separate interdisciplinary teams of experts would develop concepts for sustainable use of each of these resources. Each team would contain a mix of experts in natural systems, social systems, and economics, thus including the traditional perspective of sustainability. There should be open exchange between the three resource “think tanks” engaged in the visioning process, and experts in policy and institutional process should be part of the process at all stages. Within each resource area, competing scenarios must be considered and reconciled. For example, land use planning must consider the competing needs of conservation, preservation of agriculture, and urban needs to support Florida’s growing population. Experts from disciplines associated with each of these concerns could be assembled by the keystone agency responsible for the land use visioning process.

The outcome of this process would move Florida towards a future by design rather than a future by default. Ideally this process would provide economic incentive for innovation, and engage industry and business in the visioning process. A comprehensive plan for a better future for Florida would emerge from this process that would maximize the incentive for change and minimize the need for regulation.

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Editor's Note

The opinions expressed in these essays are those of the individual authors, who have contracted to write these pieces under the auspices of academic freedom. Recommendations expressed here do not necessarily represent the views of the University of Florida or the Century Commission.

Protecting Ecosystem Services in Florida

Alan W. Hodges

What are ecosystem services?

The natural environment provides an array of ecosystem goods and services that are critical to the welfare of the human population and to the support of life generally. Following are some of the important ecosystem services that have been widely recognized (Daily, 1997):

- Production of agricultural food and fiber products
- Forestry and fisheries production
- Setting for outdoor recreational activity
- Purification of air and water
- Mitigation of droughts and floods
- Generation and preservation of soils and renewal of their fertility
- Detoxification and decomposition of wastes
- Pollination of crops and natural vegetation
- Dispersal of seeds
- Cycling and movement of nutrients
- Control of potential agricultural pests
- Maintenance of biodiversity
- Protection of coastal shores from erosion by waves
- Protection from the sun's harmful ultraviolet rays
- Partial stabilization of climate
- Moderation of weather extremes and their impacts

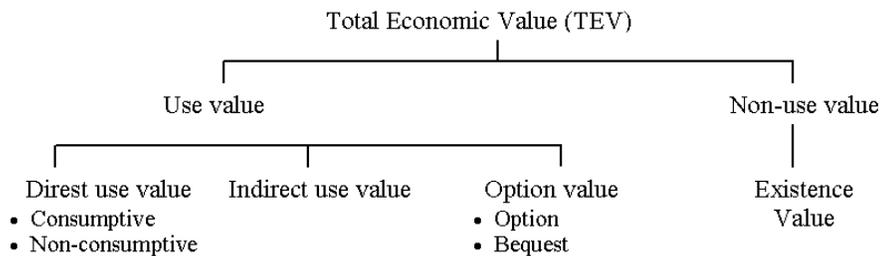
Nature furnishes these services to human society as an outcome of the normal functioning of healthy ecosystems. Flows of materials, energy and information arise from the natural capital stocks of plants, animals, minerals, and atmospheric gases, which may be periodically accumulated or depleted by both natural cycles and human activities. Ecosystems have evolved over billions of years to be highly efficient and robust. Some of these ecosystem services provided by nature are critical and irreplaceable. Others may be accomplished by engineered human systems only at great expense and effort. For example, humans traveling in the space shuttle require sophisticated special equipment for basic life support functions of gas exchange, waste recycling and energy collection.

Ecosystems differ widely in their services provided based on geography, climate, soils, and composition of the biological community. The state of Florida is particularly blessed with a diverse mix of highly productive terrestrial, freshwater and marine ecosystems by virtue of its position as a long peninsula surrounded by warm ocean waters, with abundant rainfall that is fairly evenly distributed throughout the year. The moderate subtropical environment supports year-round growing conditions for plants, and allows many cold-sensitive species to thrive. Florida is recognized as one of North America's leading reservoirs of biological diversity, with a total of 668 vertebrate animal groups, of

which 115 are endemic to the state, and 57 federally listed threatened and endangered species.

A basic classification of economic values associated with the environment includes direct uses, indirect uses, option values and non-use values (Figure 1). Direct use values, as the term suggests, refer to goods and services that are used directly by human beings and includes those consumptive uses such as food products, materials for construction or clothing and medicinal items, as well as non-consumptive uses such as recreation and aesthetic enjoyment that do not require actual harvest of products. Indirect use values are the benefits derived from ecosystem functions like nutrient retention, watershed protection, groundwater recharge, carbon sequestration, micro-climatic stabilization, shoreline stabilization, etc. Option values are derived from preserving the option to use resources in the future that may not be used at present, either by oneself, by others, or by one's heirs. Non-use values, also known as existence or passive use values, refer to the satisfaction that people may derive simply by knowing that a resource exists even if they never expect to use it themselves.

Figure-1: Classification of economic values of the environment.



Threats to ecosystem services

The sustainability of ecosystem services in a region depends upon having a substantial area maintained in natural or semi-natural land uses such as wilderness areas, public parks, forests, grasslands, crop lands and other open spaces. Loss of ecosystem services due to urbanization and land use conversion of rural and natural areas is a major concern in Florida, as it is throughout the world. As a result of development, nearly 5 million acres of agricultural and rural lands in Florida were converted to urban use between 1964 and 1997, and an additional 1.3 million acres are expected to be lost in the next ten years. Florida's population is projected to double by 2030, and the burden on environmental systems can be expected to increase similarly.

Because ecosystem services are not generally traded in the marketplace, their full value is not captured in the conventional economic statistics. The market value of goods and services derived from ecosystems typically reflects only the human labor, technological and managerial inputs used for their extraction, processing, transportation and distribution. A consequence of this is that the underlying natural resources may be unsustainably exploited or improperly managed. The nature and amount of services produced can be compromised depending on how the resource is managed. For example,

a forest ecosystem that is intensively managed for timber may have diminished capacity to provide other services such as wildlife habitat and water quality.

Efforts towards ecosystem protection

Because of their valuable and often irreplaceable services, ecosystem protection has come to be seen as a least cost social welfare policy. Increasing concerns about the accelerated loss of natural areas, farm lands and other open spaces have led to the initiation of a number of conservation programs in the U.S. For example, American voters approved \$24 billion in support for conservation in 801 ballot initiatives in 2003. Public acquisition of environmentally sensitive lands in Florida started with a \$20 million bond issue in 1964. Eventually, under the Conservation and Recreation Lands (CARL) Program, habitat for wildlife, unique natural areas and geologic features, wetlands, and historical sites were acquired for conservation and protection of open spaces. "Preservation 2000" was an ambitious land acquisition program initiated in 1990, and was later extended as "Florida Forever" for 2001 to 2010. With about \$3.7 billion paid to acquire 3.8 million acres so far, Florida's public land acquisition program is among the most aggressive in the country. Land preservation programs can contribute to growth control as well as helping to maintain the provision of ecosystem services. However, acquisition of lands for open space preservation requires huge amounts of public money, often in competition with other public projects. Also, the ongoing management of these public lands may be an issue that public agencies are ill-equipped to handle. More recently, the transfer of development rights to qualified conservation organizations through conservation easements has become an attractive lower cost option for limiting development while maintaining rural lands in economic use. Ideally, program administrators should choose areas for protection that offer the highest level of social benefits given the cost, in order to maximize social welfare.

Valuation of ecosystem services and conservation

A rational public policy for protection of ecosystem services should be based on scientifically sound and transparent procedures for their valuation, in order to determine tradeoffs and to monitor values over time. Economic valuation of ecosystem services should consider both market values such as commodity production, and non-market benefits and amenities. Usually, the need is to estimate the net benefits of marginal changes in ecosystem function due to interventions that alter existing conditions, and to determine whether the benefits of a conservation investment, regulation, or incentive will justify its costs. It can be expected that a change in management may increase the value of some services and decrease the value of others, so the important finding is the net difference in value. Valuation of ecosystems involves first estimating the quantities of the goods and services being provided (e.g. the amount of wood being harvested, the supply of clean water to downstream users), then multiplying by an estimate of their respective economic values. Net benefits are obtained by subtracting any costs involved in producing or using the service (for example, the timber harvesting costs).

There are many challenges in estimating the economic value of ecosystem services. Consumptive use values are relatively easy to measure since prices for commodities can

be obtained from markets. Valuing non-consumptive uses, however, is often difficult since there may be no measurable commodity flow. For indirect uses such as water purification, the replacement cost method is often used to estimate the value by assessing the cost of providing an engineered system to accomplish the same function. Non-use values are the most difficult to estimate because they are not observable in people's behavior. Surveys are commonly employed to estimate values for uses which the respondents themselves may not use or experience directly.

Empirical studies to evaluate ecosystem services or environmental amenities typically fall in two broad approaches: stated preference and revealed preference. Stated preference approaches are usually based on surveys in which individuals are directly questioned about their willingness to pay for certain hypothetical changes in environmental services or amenities, or are asked to choose among sets with different levels of attributes. Under revealed preference approaches, values that people place on environmental services are inferred from their behavior in markets for related goods and services.

A common method reported in the literature is known as contingent valuation, in which people are asked what they would be willing to pay (WTP) for a good or service or their willingness to accept (WTA) compensation for its loss. In other words, the measure of value is what people would trade or sacrifice to improve or restore ecosystem services. WTP and WTA techniques typically seek values in monetary units that enable comparison with other welfare-contributing activities such as spending on education or health. The validity of contingent valuation results depends upon having realistic and meaningful scenarios, and having subjects that clearly understand and conscientiously participate in their task.

Another important approach to valuation of ecosystem services is the hedonic pricing method, whereby the value of various environmental attributes may be assessed based on their contribution to the price of a good or service in the market place. For example, in housing markets, the price paid for a particular house will reflect not only the attributes of the house and property itself, but also the neighborhood, local schools, access to shopping and the general environment. By analyzing data on previous market transactions, the analyst can infer values for these attributes. Many studies have used the hedonic pricing approach to evaluate environmental amenities or quality of life attributes. In Florida, these environmental amenities contribute a huge value to the real estate and residential development industries.

Representative estimates of ecosystem values

Numerous studies have attempted to determine the total economic value of ecosystem goods and services at scales from local to global. One of the most ambitious undertakings in ecosystem valuation was that by Costanza and colleagues, who attempted to develop global estimates using a variety of market and non-market data for 17 categories of services in 13 different types of ecosystems. Their estimate of the global value of ecosystem services in 1994 ranged from US\$16 to \$54 trillion (Tr), with a most likely value of \$33 trillion. The largest share of values were for the ecosystem functions of nutrient cycling (\$17 Tr), gas regulation (\$1.3 Tr), waste treatment (\$2.3 Tr), and

disturbance regulation (\$1.8 Tr). A majority of value was contributed by marine ecosystems (\$20.9 Tr), forests (\$4.7 Tr), and wetlands (\$4.9 Tr). On a unit area basis (per hectare), the total ecosystem values were \$92 for cropland, \$232 for grasslands, \$302 for temperate/boreal forest, \$19,580 for swamps/floodplains, and \$22,832 for estuaries.

Specifically with regard to Florida, several recent studies have attempted to value the environmental services of rural or natural lands using contingent valuation methods. For example, one study reported that the average willingness to pay for the restoration of the Florida Everglades ranged from \$59 to \$79 per household per year. In another study, it was found that residents of four counties in northeast Florida would pay an average of about \$44 per household, for a 250,000-acre conservation program that would use a combination of fee-simple land purchases and conservation easements to maintain water quality and quantity. Yet another study reported a mean willingness to pay value as high as \$138 per household for moderate levels of improvement in water quality, biodiversity, and carbon sequestration through silvopasture (forestry and livestock integration) systems in the Lake Okeechobee watershed. Thus, these studies have dealt with the provision of some selected set of ecosystem services, such as clean drinking water or wildlife habitat, or the benefits of a component of a particular habitat.

Environmental accounting

In the United States, the system of national income and product accounts measures the market value of goods and services, but as already mentioned, does not capture the non-market values associated with many ecosystem services. Some progressive countries and regions, such as the European Union, have attempted to develop more systematic accounting systems for tracking of environmental goods and services, in order to provide a more complete assessment of costs and benefits of environmental protection. These systems explicitly recognize ecosystem inputs to the economy, stocks and flows of natural capital, and residual waste products discharged to the environment (Hecht). Other accounting systems have been developed to evaluate the total life-cycle impacts of economic activity on the environment (Hendrickson, Lave and Matthews). When institutionalized, these accounting systems enable policy makers to evaluate more clearly the environmental consequences of alternative policy scenarios. It is recommended that such a system be established for Florida that incorporates environmental indicators.

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Water Resource Sustainability in Florida

James W. Jawitz

The sustainable water resource management challenge is to provide sufficient water resources for human needs while at the same time maintaining the valuable ecosystem services provided by water in natural systems. As Florida's population grows, demands on freshwater resources to provide drinking water for cities and irrigation water for agriculture continue to expand. Simultaneously, there is increasing awareness of the importance of preventing pollution and leaving enough water for natural ecosystem functions. These combined pressures define the need for sustainable water resource management.

Florida's water resources

Florida is relatively rich in fresh water resources, especially groundwater. Florida has more available groundwater in aquifers than any other state. The Floridan aquifer, which underlies much of the state and is used for drinking water in North and Central Florida, is among the world's most productive aquifers. The principal aquifers of Florida combine to supply drinking water to greater than 90% of the State's population. The abundant groundwater emerges as spring water in parts of Florida. Of the 84 largest springs in the United States, 33 are in Florida—more than in any other state.

While the rivers in Florida do not rank among the nation's mightiest (even Florida's largest rivers—the Apalachicola, the Suwannee and the St. Johns—have only a fraction of the flow of the continent's and the world's largest rivers), Florida has thousands of lakes, large and small. The largest of these is Lake Okeechobee, which is the second largest lake wholly within the United States.

Florida water resource concerns

Each day in Florida, 2.7 billion gallons of water are extracted by humans from groundwater and surface water systems, while an average of 150 billion gallons of rain falls on the State. Thus, on a state-wide scale the amount of water extracted by humans is small compared to the daily renewal from rainfall, and on a state-wide scale it is apparent that water in Florida is abundant.

However, water resource allocation is a problem of spatial and temporal variability. While the State has abundant water on aggregate, certain parts of the State do not have enough water locally to support the large-scale development that has arisen. Examples of places in Florida that rely on importing water from neighboring counties or regions include the Florida Keys, St. Petersburg, Charlotte County, and Sarasota County.

In several counties in the Florida panhandle, increased pumping of groundwater following decades of population growth has resulted in a decline in groundwater levels

by as much as 100 ft. In many parts of Florida, notably the Tampa Bay area, increased groundwater pumping has resulted in widespread drying of surface water bodies, such as lakes and wetlands that are inter-connected with groundwater systems.

Florida is famed for its Everglades, and wetlands today cover about one-quarter of the State. However, wetlands formerly covered half of Florida, but over one-half of these wetlands have been drained for agriculture, flood control and residential development.

The above discussion has emphasized water quantity, but water quality is a growing concern for both groundwater and surface water resources in the State. The water quality in Lake Okeechobee has suffered from excessive inputs of nutrients due to human activities within its watershed. The purity of many of Florida's spring waters is threatened by the encroachment of human activities within their surrounding springsheds. The large-scale Everglades restoration currently underway was catalyzed in part by human-induced degradation of the water quality in this sensitive ecosystem.

Projected population growth in the coming decades is expected to exacerbate these problems as well as add other parts of the State to the list of areas with water resource concerns.

Users of Florida water resources

Florida's water resources provide many services, both to ecosystems and humans. Humans receive direct benefits from water that is withdrawn from ecosystems by using it for drinking water or other residential, industrial, or municipal services. Water also provides many benefits to humans when used to support agriculture, primarily through irrigation of crops for food and fiber.

Humans also receive other direct benefits from water when it is not withdrawn from ecosystems, but rather left to allow those ecosystems to function. Ecosystem-related recreation, conservation, and tourism have been shown to be extremely important to State and local economies.

In 2000, agricultural uses (mostly irrigation) accounted for 53% of fresh water withdrawals in Florida, according to data collected by the United States Geological Survey. An additional 14% of fresh water withdrawals were used for industry, mining, and thermoelectric power generation. The remainder (roughly 30%) of fresh water withdrawals was for public water supply. Overall, in the United States public water supplies accounted for approximately 10% of all fresh water withdrawals, while irrigation accounted for nearly 40%. The strong dominance of agriculture over municipal consumption of fresh water is also consistent with world-wide statistics.

Moving towards water resource sustainability in Florida

The historic definition of resource sustainability has meant resource consumption at a rate that will leave enough for future generations. For water resources, a sustainable rate of

consumption is commonly considered to be at or below the renewable supply. In most of Florida, this would imply that water consumption rates should be consistent with the supply available from rainfall—rather than depleting groundwater tables, or importing water. Moreover, more modern interpretations of water resource sustainability have imposed the dual constraints of consumption at or below renewable supplies while also leaving enough water for natural ecosystems to function. The most current application of sustainability ideals further introduces the goal of also ensuring social and economic sustainability.

In Florida, as in many parts of the world, it is apparent that water resource sustainability problems are not caused by running out of water. Crises that are being encountered are related to how humans have used and managed water. In most cases, the problems are not related to water supply, but rather water demand. However, policy makers have historically applied supply-side solutions. Here, demand-side solutions are emphasized, rather than more and bigger engineering schemes to supply more water or to shift water from one region to another.

Two different scales of water demand sustainability problems can be identified. At a global, national, or even state scale, municipal water use is a minor factor (less than 15% of fresh water use) and significant savings are best optimized in the agricultural and industrial sectors (which combine for more than 60% of fresh water use). For example, USGS data for Florida shows that water-intensive flood irrigation was used on 41% of the 2 million total irrigated acres in 2000, a decrease from 57% in 1985. Water-efficient micro-irrigation practices were used on 31% of irrigated land in Florida in 2000. On a state-wide scale, there is room for vast improvement in agricultural water use efficiency.

At a municipal or even regional scale, the household water use habits of millions of consumers can be quite significant locally—despite their relative insignificance at larger scales. Long-term sustainability of water resources at the municipal scale will require adjustments in the water use habits of consumers. Low-flow toilets and showers and similar water-saving techniques are indeed important, but savings obtained are relatively small compared to those available from landscape irrigation, where Florida households still use one-half of their water. In most cases, especially at the household-scale, pristine drinking-quality water is used for this purpose. Methods to reduce this water resource demand include changes in landscaping practices (such as xeriscaping or using drought resistant plants), and expansion of the practice of using reclaimed water for irrigation.

It is important to also note that the use habits of consumers are often dictated by the pricing of water. Historically, water has been treated as a virtually free resource with the fees charged by municipal distribution systems related only to the treatment and transmission costs. Modification of the pricing structure for water is an important tool that has been underutilized for the preservation of these resources.

The ultimate solution for sustainability of Florida's water resources is for policy makers, water resources managers, and consumers to embrace the wise use of water resources.

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Bioenergy

Janaki R.R. Alavalapati

Environmental concerns over the use of fossil fuels, national security concerns over the dependence on foreign oil, geopolitical conflicts in major oil exporting countries, and growing public preferences for a cleaner environment are stimulating the demand for renewable fuel sources such as bioenergy. Bioenergy resources, including forests and agriculture crops, cropping and processing residuals, and municipal, animal, and industrial wastes, provide about 14% of the world's and 4% of the United States' primary energy supplies. Bioenergy not only provides process heat and power, but with the many technological advances now in progress, it can also provide new and novel fuels (e.g., alcohols, hydrogen, etc.) which have relevance in power generation as well as in the transportation sector (see Figure 1). Regardless of its end use, bioenergy generates income directly from sales and through emerging markets (e.g. renewable energy credits), employment, and rural community stability while mitigating global warming concerns. In spite of numerous environmental and social benefits of bioenergy, it is not being produced and/or consumed at a socially desirable level. One of the main reasons is the price differential. The price of bioenergy is ~7.5 cents per kilowatt-hour while the price of conventional energy is ~5.0 cents per kilowatt-hour. However, if environmental and social benefits of bioenergy production are considered, bioenergy can be competitive. As such, efforts to promote bioenergy at both national and international levels are increasing.

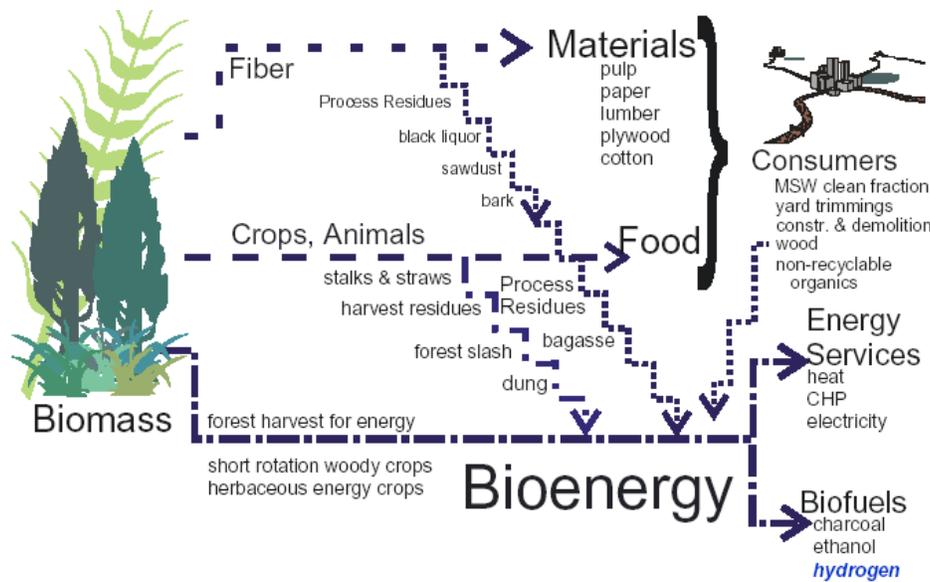


Figure 1: Biomass sources and bioenergy types (Source: Bob Schleser)

Florida currently uses over 8.6 billion gallons of fossil fuel a year, which constitutes 97% of its total energy use, and demand for fossil fuels is growing by 300 million gallons a year. The major problem with fossil fuels is that these are neither sustainable nor environmentally benign resources for the state of Florida. While there is currently no energy source to compare with the potency of fossil fuels, there is an assortment of renewable energy sources available to Floridians that can avoid many problems

associated with the use of fossil fuels. Out of them, biomass from sugar cane, citrus molasses, animal waste, and forests, has major potential to produce liquid fuels, biogas, and electricity.

Bioethanol

Ethanol can be produced in different ways, using a variety of bio feedstocks. Crops with higher yields of energy such as sugarcane and switch grass are more effective in producing ethanol than corn. However, a recent study (USDA 2006) suggests that ethanol from sugarcane costs about \$2.40 per gallon, which is two times more expensive than ethanol produced from corn. The United States EviroFuels LLC will soon be constructing an ethanol production plant at Port Sutton in Tampa to produce up to 50 million gallons of ethanol annually with a plan of importing corn feedstock from the Mississippi delta. In Florida, cellulosic biomass (derived from the cellulose in sources such as sugarcane fiber, sawdust, paper pulp, small diameter trees, and dedicated energy crops such as poplar and eucalyptus) holds greater promise as a feedstock for ethanol production due to its widespread availability and potential for high fuel yields. As with producing ethanol from grain, processing cellulosic sources requires extraction of fermentable sugars from the feedstock for distillation into alcohol. Unlike grain, the sugars in cellulose are locked in complex carbohydrates called polysaccharides, or long chains of simple sugars. Separating these complex structures into fermentable sugars is essential to the efficient and economical production of cellulosic ethanol. Dr. Ingram, a University of Florida researcher, has developed a biotech “bug” that is capable of converting cellulosic biomass to ethanol. Although this technology has promise, it might take a few more years before it functions on a commercial scale.

Biodiesel

Biodiesel refers to a diesel-equivalent processed fuel derived from biological sources. Though derived from biological sources, it's a processed fuel that can be readily used in diesel-engine vehicles, which distinguishes biodiesel from the straight vegetable oils or waste vegetable oils used as fuels in some modified diesel vehicles. A variety of oils can be used to produce biodiesel. These include virgin oil feedstock (rapeseed and soybean oils, for example); waste vegetable oil; and animal fats. Breeding and functional genomics of peanut for biodiesel production has a potential in Florida and the University of Florida is exploring this issue further.

Biogasification

Direct combustion is the most common way of converting biomass to energy in the form of both heat and electricity. Direct combustion is well understood, relatively straightforward, commercially available, and can be regarded as a proven technology. Compared to gasification and pyrolysis, it is the simplest and most well-developed method, and biomass combustion systems can easily be integrated with existing infrastructure.

Gasification is a high-temperature thermochemical conversion of biomass into a combustible gas instead of into heat. This is achieved through the partial combustion of the biomass material in a restricted supply of air or oxygen, usually in a high-temperature environment of around 1200-1400°C. The product of gasification - producer gas – can be used for cooking or heat supply, or it can be used in secondary conversion technologies such as gas turbines and engines for producing electricity or mechanical work. This option is very attractive since it can co-fire with natural gas or with the newly evolving coal gasification fueled power plants. In thermal gasification, it is possible to use mixed feedstocks to produce a consistent stream of gases that can be catalytically converted to alcohol, biodiesel or methane. Some believe it to be the best path to use mixed cellulosic biomass for producing liquid fuels.

Pyrolysis is a thermal decomposition process occurring in the absence of oxygen, and it is also the first step in combustion and gasification processes where it is followed by total or partial oxidation of the primary products. The goal of pyrolysis is to produce a liquid fuel, termed bio-oil or pyrolysis oil, which can be used as a fuel for heating or power generation. The produced oil is composed of a very complex mixture of oxygenated hydrocarbons, and like crude fossil oil can be used in refining to produce a range of chemicals, fuels and fertilizers. The main benefit of the pyrolysis process, when compared to combustion and gasification, is that a liquid fuel is easier to transport than either solid or gaseous fuels.

Methane, the main content of biogas, is a flexible form of bioenergy that can produce heat and electricity and also serve as a vehicle fuel. It is produced through anaerobic digestion of organic residues (citrus waste, animal residues, and culled vegetables and fruits, for example) and energy crops that are abundant in Florida. In fact, any biodegradable waste materials such as waste paper, grass clippings, leftover food, sewage and animal waste can be processed. It is a fairly simple process that can greatly reduce the amount of organic matter which might otherwise end up in landfills or waste incinerators. Increasing environmental pressures on waste disposal will provide stimulus for reducing waste volumes and generating useful bioenergy. Researchers at the University of Florida are exploring biogas technologies to utilize Florida feedstocks.

Biomass co-firing for electricity

In recent years, the Common Purpose Institute and the University of Florida have partnered with the U.S. Department of Energy and electric utilities in central Florida in collaborative biomass co-firing research at three coal-fired power plants that have 900 megawatts of generation capacity. At a biomass co-firing rate of 3 percent (by heat input), this would be a Renewable Energy equivalent of installing 54,000 large solar panels. There is a huge potential in Florida to expand co-firing because of an abundant supply of forest biomass in north central Florida. A recent study indicates that in Green Cove Springs, Florida, at a price of \$3 per million BTU, 40 trillion BTU of biomass (logging debris, urban wood waste, and stumps) can be supplied. For comparison, the delivered cost of competing fossil fuels is about \$1.26 per million BTU for coal, and \$6.40 per MBTU for natural gas. Furthermore, a study in Gainesville, Florida indicated

that a 200 megawatt conventional coal-fired boiler would generate 13,192 jobs in 30 years while a 70 megawatt biomass plant would generate 18,288 jobs for the same period.

Policy environment

Several policy incentives are in place to stimulate production and consumption of bioenergy. For example, a tax credit of \$0.51 per gallon of ethanol is set until 2010 to promote the consumption of ethanol. The Cellulosic Biomass Program under the Energy Policy Act (2005) counts a gallon of ethanol produced from crop residues and tree crops as 2.5 gallons to satisfy the Renewable Fuel Standard (RFS). The American Jobs Creation Act of 2004 offers a tax credit of \$1.00 per gallon of biodiesel from oil crops and animal fats and \$0.50 per gallon tax credit for production from recycled fats and oils. The US agricultural policy is allowing landowners to harvest biomass grown under the Conservation Reserve Program for bioenergy. The Healthy Forest Restoration Act authorized funds to establish small-scale business enterprises to make use of biomass and small-diameter material for bioenergy. In addition to these federal policies, state support for bioenergy research and extension and incentives for entrepreneurs to set pilot projects would provide further stimulus for bioenergy.

In summary, Florida has various biomass resources that can be used to produce bioenergy in a sustainable manner. New market opportunities for biomass would improve the profitability of agriculture and forestry. In particular, with the advancement of cellulosic ethanol technology, a market for woody biomass to produce ethanol would stimulate rural economies and community stability. This would not only slow the conversion of rural ecosystems to urban sprawl but help sustain economic growth in Florida.

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Sustainable Energy Technologies and Resources

Eric Wachsman

Societal Need

Whether it is the numerous reports in the evening news, the President's State of the Union Address, the Governor's Executive Order, the numerous bills going forward in the House and Senate (at both State and Federal levels), or just the rising cost of gasoline observed every day by consumers at the pumps, the availability of a sustainable energy supply will play an increasingly important role in our future and may be the defining issue of this century. Our quality of life, standard of living, and national security depend on energy. The limited supply of fossil energy, its accelerated consumption, its impact on global warming, and the dependence on its supply from unstable countries in the Middle East and elsewhere are major U.S. economic and security issues. To address these issues we must have a strong, balanced energy research program based on the best and most efficient use of our indigenous natural resources, while minimizing our dependence on imported energy forms.

Abundant, reliable, clean, and affordable energy is essential for a healthy State of Florida economy. The development of environmentally friendly, renewable, and cost-effective energy options to power automobiles, homes, and businesses is critical to our state's future. These facts have already been recognized by the Governor and the State Legislature. The State has invested in nuclear power and advanced fossil fuel power plants. Florida is a leader in advanced clean coal technology with the current Polk Power Station in Tampa and the Stanton Energy Center under construction in Orlando. Further, Florida is actively working towards the deployment of hydrogen vehicle fueling stations. It is crucial to the success of these initiatives that Florida provides demonstration sites and also actively participates in the development of these technologies and educates its citizens in these technologies so that the state can derive the greatest benefit out of the resultant job creation. Clean energy technology is expected to be the greatest growth sector in the US economy and we need to bring that economic growth to the State of Florida.

Fossil fuels (oil, gas, and coal) are a finite resource and we are approaching the point where available resources of oil and gas cannot meet the world's demand. While there are differences of opinion as to when exactly we reach the point where we consume more than we can produce, one of the most respected sources calculates that this peaking point for oil occurs as soon as 2016 to 2037 (Fig. 1). Therefore, in as little as 10 years we could reach the point when demand for our most crucial transportation fuel outstrips supply and the resulting consequences are felt in all sectors of the economy.

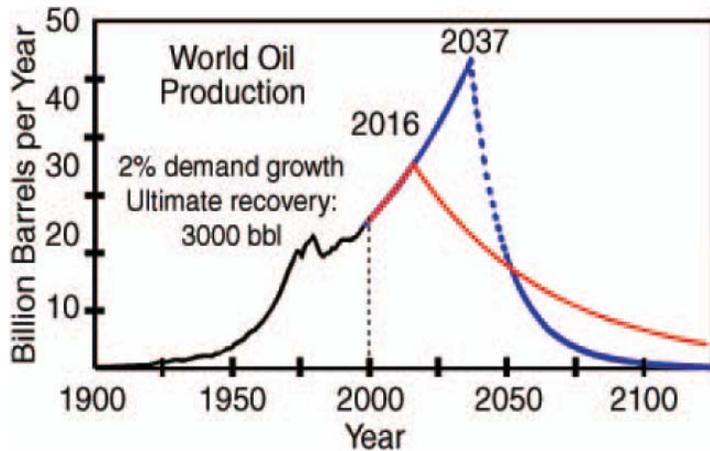


Figure 1: The challenge of dwindling world oil supply represented in two scenarios of oil production and consumption. The red curve assumes that production grows at 2% per year and then declines at the same rate, producing a peak in 2016. The blue curve assumes that production grows at 2% per year until it reaches 10% of the reserves, and then declines while

maintaining the same ratio. The area under both curves is the same, equal to total estimated reserves. - *M.S. Dresselhaus, G.W. Crabtree and M.V. Buchanan, MRS Bulletin, vol. 30, pp. 518-524, July 2005.*

Much has been made of the transition to a “Hydrogen Economy” to address this issue. The President highlighted this in two of his State of the Union speeches and the Governor and numerous Florida Legislators have called for Florida to be a leader in hydrogen energy technology. However, this is a long-term solution that will require tens of billions of dollars in research and development on hydrogen production and storage and fuel cell technology, as well as trillions of dollars to convert our fueling infrastructure from a liquid hydrocarbon to a gaseous hydrogen distribution system.

We can’t wait for the Hydrogen Economy to become a reality; we need to find near term solutions. For transportation, the most promising near term solution are biofuels (e.g., ethanol). This also was highlighted in the President’s State of the Union speech, and supported by the Governor and numerous Florida Legislators.

The likely scenario for our transition to a Hydrogen Economy is shown in Figure 2. As oil production decreases and the cost of gasoline increases, the fraction of alternative transportation fuels increases. Due to the much greater investment in time and money needed to transition to a Hydrogen Economy, its fractional contribution becomes significant at a later date, and in the interim biofuels contribute a major share.

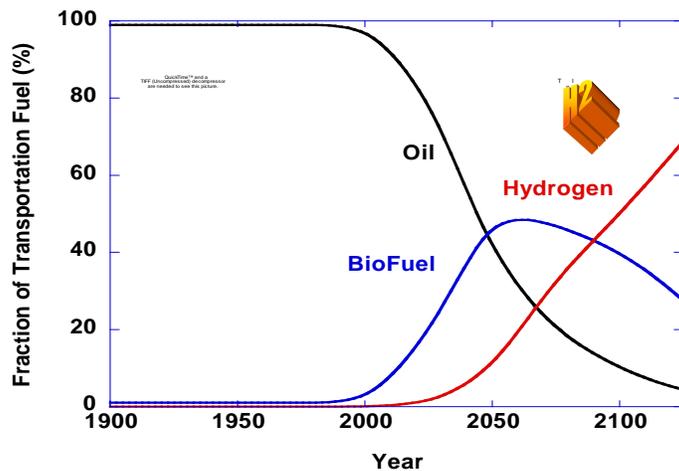


Figure 2: Likely transportation fuel scenario showing effect of dwindling world oil supply and transition to Hydrogen Economy mediated in the midterm by Biofuels.

What is important to take away from this figure is first, the urgency of dealing with this issue, and second, that for a long period of time our transportation fuels will be a mixture of fuels. The fact that there will be a mixture of fuel technologies means that a higher order system-wide approach to energy is critical. The same can be said for stationary electric power generation, which is currently a mix of natural gas, coal, and nuclear. Due to the decreasing availability and rising cost of natural gas, electric power generation will transition to a coal, nuclear, biomass and solar mix.

These energy resources, in terms of their relevant technologies, are summarized below. However, bioenergy is described in more detail in a separate document.

Gasification

Coal is an abundant US resource and is one of the primary sources of electric power generation in the State of Florida. However, conventional coal combustion power plants are an inherently dirty process, creating numerous pollutants, particulate emissions, and one of the greatest sources of global warming: carbon dioxide.

In contrast, coal power plants that rely on gasification of coal, prior to combustion, are dramatically cleaner and have the potential to sequester carbon dioxide, thereby minimizing environmental impact. This clean coal technology is called Integrated Gasification Coal Combined Cycle (IGCC) and Florida is the US leader in IGCC deployment. One of the first operational IGCC power plants in the US is the TECO Polk

Power Station in Tampa and a second IGCC is under construction in Orlando at the Stanton Energy Center.

Not only is IGCC a cleaner technology, but it also has higher efficiency so that more electricity is produced for each unit of coal consumed. IGCC is a newer technology and typically has a ~10% higher capital cost than conventional combustion technologies, but as more IGCC plants are built, the cost will come down. Further, the environmental benefits can be considered to outweigh the higher initial cost since if future regulations limit green house gas emissions, IGCC will ultimately become the lower cost technology due to its higher efficiency and greater ability to sequester carbon dioxide.

In addition to coal, IGCC technology can also be used to cleanly and efficiently produce electricity from Florida's available biomass resources as well as from various waste streams. The development of gasification technology in Florida to utilize these energy feedstocks would go a long way to enhance our energy independence and security.

Nuclear

Nuclear energy will always play a role in the US energy portfolio. Florida already has nuclear power plants and after a long hiatus in the construction of new US nuclear power plants, Florida Power & Light is planning to build one in Florida in the very near future. The advantage of nuclear is that it does not contribute to air pollution or global warming. The major disadvantage is that there still is no solution to storage of radioactive waste products. The US Department of Energy has been planning for some time to store spent nuclear fuel at Yucca Mountain, Nevada. However, this continues to be delayed with current estimates indicating the site won't be ready until 2040 at the earliest. Once operational, there still remains the issue of transporting spent nuclear fuel from Florida to Nevada. Moreover, the public still fears nuclear energy and locating sites for nuclear plants is problematic.

Solar Cells

Solar cells are viewed as the ultimate energy resource harnessing the sun's energy to create electricity through photovoltaic technology. Solar cells remain expensive relative to competing technologies. Significant research and development is necessary to improve performance and reduce cost for solar cell technology to be competitive. In addition, while Florida is the "Sunshine State," the fact remains that due to our humidity and cloud cover the actual available solar energy is less in Florida than in states like Arizona.

In contrast, solar thermal technology is cost competitive and should be deployed as rapidly as possible through out the state. This technology harnesses solar energy for hot

water heating and in so doing can reduce our electricity and natural gas demand for this application.

Hydrogen

The Hydrogen Economy is viewed as the ultimate energy solution with, in an ideal world, hydrogen produced by solar energy powered electrolysis. The hydrogen would then be used in fuel cells to produce electricity with zero emissions. However, it must be emphasized that hydrogen is not an energy resource. We can't drill for hydrogen or pull it out of the air. Rather, hydrogen is the energy carrier in this cycle between production and utilization.

In order for the Hydrogen Economy to ever be a reality, technology needs to be developed to cost effectively produce hydrogen from available resources. Solar electrolysis of water is still too far in the future. Currently, hydrogen is produced by steam reforming (a catalytic process) natural gas followed by gas separation technology to produce high purity hydrogen gas. In the near future, the federal government's vision is to co-produce hydrogen gas and electricity in a clean coal plant called "FutureGen". The crucial components of FutureGen are gas separation technology combined with gasification in an IGCC power plant.

As stated above, Florida is the US leader in IGCC due to the Polk Power Station in Tampa and the IGCC under construction in Orlando. Florida is also actively working towards the deployment of hydrogen vehicle fueling stations. If the combination of IGCC power plants and the appropriate hydrogen separation technology were available, Florida could then be the national leader in both hydrogen production (from coal) and hydrogen fuel distribution. Hydrogen separation membrane technology developed at UF has the potential to make this vision a reality.

Having said this, it will be decades before hydrogen is a major component of our energy mix. Besides production issues, there is no currently satisfactory technology to store hydrogen for automotive applications, the hydrogen distribution infrastructure is essentially non-existent, and major breakthroughs are necessary in fuel cell technology to make hydrogen-powered engines cost competitive with the internal combustion engine.

Fuel Cells

Fuel cells are the future of energy production in America. They offer great promise as a clean and efficient process for directly converting chemical energy to electricity while providing significant environmental benefits. They have three times the efficiency of an internal combustion engine. They produce negligible carbon monoxide, hydrocarbons, or

nitrous oxides, and, as a result of their high efficiency, produce about one-third less carbon dioxide per kilowatt hour than internal combustion engines.

Advances in performance and cost of fuel cells are crucial to the Hydrogen Economy. Research at UF has led to the development of the world record highest conductivity oxide electrolyte. This new material creates the opportunity for dramatic improvements in fuel cell performance and cost. Further, in recognition of our extensive contributions to fuel cell research, the U.S. Department of Energy (DOE) has created a DOE High Temperature Electrochemistry Center at UF to advance the fundamental knowledge and performance of fuel cell materials.

In addition to performance and cost, fuel flexibility is crucial to adoption of fuel cell technology. Most fuel cells reported in the news require pure hydrogen as a fuel. This has resulted in the current dispute as to whether fuel cell vehicles should be developed with satisfactory performance and cost first, or whether the fueling infrastructure should be deployed first. In contrast, the Solid Oxide Fuel Cells (SOFCs) being developed at UF will not only operate on hydrogen, but can also directly operate on a variety of hydrocarbon fuels ranging from gasoline to biofuels. Thus, SOFCs provide the bridging technology from our current fossil fuel infrastructure, through the biofuel transition, to the ultimate Hydrogen Economy (Fig. 2).

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Dr. Wachsman is Editor of *Ionics* and Associate Editor of the *Journal of The American Ceramic Society*. He is Chair of the High Temperature Materials Division and a member of the Board of Directors and the Fuel Cell Organizing Committee of The Electrochemical Society. He is also Councilor of the Florida Section of the American Ceramic Society, and a member of the American Chemical Society and the International Society for Solid State Ionics. He has more than 100 publications and 8 patents on ionic and electronic transport in ceramics, their catalytic properties, and device performance.

In addition, Dr. Wachsman is a frequent invited panelist on fuel cell and hydrogen energy research, ranging from the US Department of Energy "Fuel Cell Report to Congress" and "Basic Research Needs Related to High Temperature Electrochemical Devices for Hydrogen Production, Storage and Use," to the National Science Foundation "Workshop on Fundamental Research Needs in Ceramics," NATO "Mixed Ionic-Electronic Conducting (MIEC) Perovskites for Advanced Energy Systems," and the National Academies "Global Dialogues on Emerging Science and Technologies."

Resources

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Land Use in Florida

Margaret H. Carr and Paul D. Zwick

To understand the complex issue of land use in Florida, five important questions come to mind.

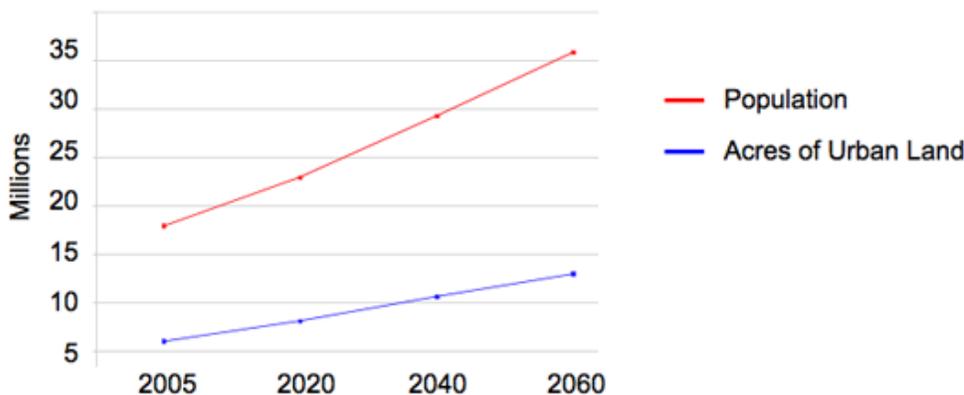
1. What do the numbers tell us about existing and future land use?
2. What will shape our collective vision for future land use?
3. Will our existing land use decision making process successfully get us where we want to go?
4. What are the social and cultural impacts of land use change?, and
5. To what degree do we account for unknowns like global climate change, when considering future land use?

In this report, these questions are briefly addressed and each analysis concludes with a summary statement.

The Numbers

The numbers tell us Florida is in the midst of rapid change. The engine of change is population growth, largely attributable to a combination of continued domestic and international immigration. The 2030 population projection developed by the Bureau of Economic and Business Research at the University of Florida quantifies this trend as a statewide population increase of 900 people per day.¹ To put this in more tangible terms, just imagine that for each of the 365 days of the year, between the time you wake in the morning and drink that cup of coffee and the time you turn out your light at night, 900 additional people call Florida home. This is more new people in one day than the population of many of our small historic communities.

The physical manifestation of this population growth is land use change, and the more rapidly population increases, the more rapidly land use changes occur. If the current growth trend continues, between now and 2060 the population will more than double and without change in our land use policies, the additional land devoted to urban use will also more than double.²

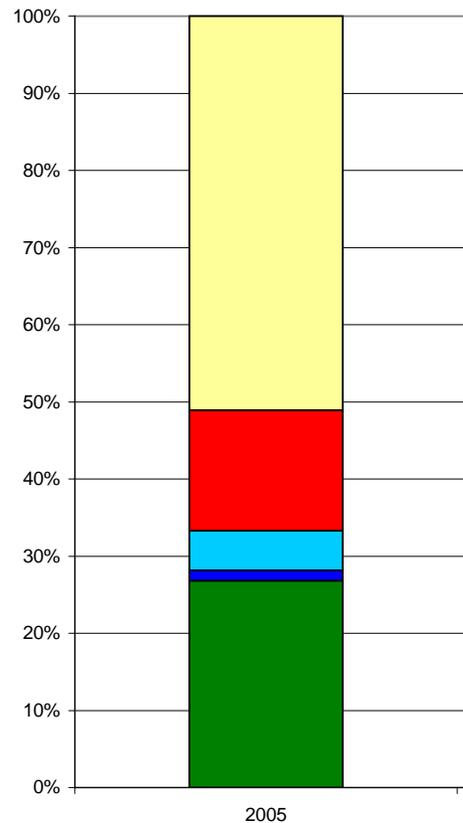


Period	Starting Population	Ending Population	Additional Population to be Accommodated	Additional Acres Required for New Population (without a change in land use policies)
2005 - 2060	17,872,295	35,814,574	17,942,279	6,953,264

An analysis of the existing distribution of lands into five simple use categories reveals that approximately 26 percent of the State is under conservation protection, 2 percent is open water under conservation protection, another 5 percent is open water not included within the boundaries of existing conservation areas, and 15 percent is in urban use. The balance, 52 percent, is in other uses including cropland, mining, timberland, citrus, aquaculture and other undeveloped lands including the remaining pristine lands to be found in the State.

The graph represents Florida's 2005 land use allocation, where yellow is agriculture, pristine areas (including proposed conservation lands) and other undeveloped lands, red is urban development, light blue is open water not within conservation areas, dark blue is open water within conservation areas and green is existing conservation lands.³

1. *The numbers tell us that significant population growth over the next 50 years is highly probable and if current land use policies remain in place, as much as an additional 7 million acres of land will be converted to urban use. The next fifty years will largely determine what the final allocation of Florida lands will be: what will remain in agriculture and conservation and what will be converted to urban use. There will be great pressure to convert a sizable amount to urban use to accommodate new Floridians.*



The Vision

It seems quite important for citizens of the State to participate in a discussion of the ultimate pattern of land use we wish to see in Florida. One of our counties, Pinellas, has already reached virtual build-out and it is highly likely that others like Seminole, Orange

and Hillsborough will soon follow.⁴ This does not mean these counties will be entirely dedicated to urban use, but for conservation and agricultural lands to remain within them they will require some formal protective status. Keeping this in mind, the following questions are posed to suggest the kinds of issues that might be addressed in a set of statewide land use goals.

The overarching questions:

- Is there an optimal distribution of our lands among the broad categories of agriculture, conservation and urban?
- If so, what is that optimal distribution?

Key questions related to agricultural lands

- Can our State survive without agriculture and if so, what might be the impacts of the loss of an agricultural economy in Florida to the state and to the nation?
- How can agriculture be sustained with rising land values, changing climate patterns and increasing competition from international agricultural producers?
- Do agricultural lands provide benefits other than the agricultural economy they support and the commodities they produce? If so, what are those other benefits?
- To what degree, if any, should government assist with the safeguarding of agricultural lands, whether through land use regulation or government subsidies?

Key questions related to urban lands

- What should the character of our urban environments be?
- Do we need to provide quarter acre lots and a single family home for every Floridian?
- To what degree should walkable cities comprised of mixed use neighborhoods with ample, accessible open space be a goal?
- Can we preserve housing and lifestyle choices for our citizens or will the press of additional people preclude choice?
- Will Floridians of the future remain dependent on the automobile or are there feasible and acceptable transportation alternatives?
- If energy costs continue to increase, how can patterns of urban development help reduce individual energy costs?

Key questions related to conservation lands

- Do we want to continue to set aside our valuable natural resource areas for the good of the plants and animals native to our State?
- How important is it to safeguard natural areas for the ecosystems services human beings depend on like clean water, flood storage, fisheries and outdoor recreation opportunities?
- Is sufficient land already under protective status?

2. *There will be a spectrum of answers to the many questions worth asking on the way to adopting land use goals. A dialogue is needed to answer those*

questions, shape our goals and develop a collective vision for the ideal physical character of the future Florida.

The Process

The great majority of land use decision making in Florida remains in the hands of locally elected officials. In and of itself this is not so problematic, but coupled with the incremental nature of land use decision making and the size of many land development projects, it makes for an unsatisfactory process. The passage of the Environmental Land and Water Management Act of 1972, the Growth Management Act of 1985 and subsequent tweakings by legislatures and governors have all attempted to provide some coordination among land use decisions but with only limited success. All one has to do is look around and ask, is this what we want Florida to look like in the future? We think for the great majority the answer is no. So, assuming we can agree upon a set of land use goals and a collective vision, what land use policies and process adjustments are needed to help us meet those goals?

It is tempting to look to Great Britain as a model for land use decision making as it seems the patterns of land use in this nation preserves considerably more cultural and natural heritage than we have been able to preserve, and the resulting urban areas are compact with adequate open space and good transportation alternatives. A different history of land ownership, a different set of laws governing land use decisions and a different public attitude about the role of government in land use choice makes the comparison interesting, but probably not very useful. We are bound to accept our constitutional law that private property cannot be taken without just compensation, and so it appears only public hazards that might result from the development of wetlands or floodplains are easily restricted through land use regulation. The result is most of our land is developable under law.⁵

So how shall we proceed in refining our policies in order to accomplish a collective set of land use goals? Several evolving trends hold promise, 1) the rise of regionalism, 2) transfer of development rights in one form or another, 3) form-based codes and 4) public land acquisition.

Regionalism

Since so many of Florida's urban areas have grown beyond the bounds of their counties, much less their cities, there is an obvious need to address land use decision making at a broad scale. This also applies when considering agriculture and conservation lands, as the importance of context is increasingly well understood for optimal function of all of these systems. Two regions of the state are clearly embracing the idea of regionalism in order to discuss and direct their futures: the seven counties around Orlando and seven counties in southwest Florida. These are largely grassroots initiatives that have mostly evolved outside the existing regional planning council (RPC) structure. This combined with the mixed reviews RPCs receive around the state and their history as targets for legislative elimination, suggest the RPCs and their role in land use decision making

should be evaluated and either eliminated or recreated. Regardless of this issue's outcome, facilitation of regional oversight of land use decision making is needed.⁶

Transfer of Development Rights

We see some experimentation with development rights transfer at the local and state levels. At the local level, several counties have adopted outright transfer of development rights ordinances. These ordinances establish sending and receiving zones designed to create incentives to encourage free market trade in development rights between the two zones. We have also seen the adoption of conservation subdivision ordinances that allow for the clustering of development on a portion of a land-holding in exchange for some measure of permanent protection for the balance of the land-holding. The latter represents a transfer of development rights within the boundaries of a single land-holding. Similarly, the State's Rural Lands Stewardship Act supports concentrated development of portions of large land holdings in return for some degree of protection for the remaining lands. The old adage, "the devil lies in the details" applies to all of these programs as there is some concern that the ratio of protected land to developed land will be inadequate or that the protected lands may be only set aside temporarily rather than in perpetuity. It appears, however, that these programs hold promise for directing the pattern of settlement of greenfields (previously undeveloped land), as they harness market forces to pay for permanent land set asides. It is suggested that more time and effort be spent on refining these techniques.

Form-based Codes

There is also a need to enhance the policies and processes that shape the character and quality of our urban form. This includes the development of entirely new communities and the redevelopment of existing urban areas. It would be ideal if the quality of life in our cities was so satisfactory that every new Floridian and many existing Floridians would choose our cities rather than suburbia. But for this to happen, our cities must be safe, beautiful, easy to navigate and full of unique cultural features that clearly distinguish one from another. Many policies are in place that are positively shaping our future urban areas like enterprise zones and tax increment financing, but new strategies are also needed. Form-based codes are an evolving strategy that hold potential to positively shape future urban form.⁷

Purchase of Development Rights

Straight out conservation acquisition using public funds generated from a variety of sources has proven a very popular and successful program at the local and state levels. Florida Forever followed on the heels of Preservation2000 that succeeded the Conservation and Recreation Lands program, and Save our Rivers. Over twenty county governments have chosen to raise their own funds for public land acquisition. The lands being protected under these programs are a mixture of pristine lands, silvicultural lands and lands important for water resource protection. Many areas are purchased in fee simple, but increasingly less than fee acquisitions are being negotiated. Since one approach does not meet all acquisition objectives, both strategies, with adequate funding,⁸ must be included in the toolbox available for public acquisitions.

A program that has not yet directly received public funding but must be considered in the future is the purchase of development rights on agricultural lands. There are numerous examples in the state where this has in fact occurred but the protection for the agricultural activity has always been ancillary to some other purpose, especially the protection of water resources. It is increasingly clear that if agricultural activity is to continue within the state some permanent protection for the land will be necessary. Market forces are so strong that safeguarding agricultural land through tax incentives has proven unsuccessful. It appears that mutually agreed upon taxation to generate funds to protect agricultural land will be essential.

3. *New policies and processes are needed to improve our land use decision making so we may meet our collective land use goals. Strategies recommended for use are continued use of public funds for conservation acquisitions and the development of new revenue sources for protection of agricultural land; increased reliance on transfer of development rights to create incentives for achieving agreed upon patterns of land use, application of form-based codes to ensure desired quality and pattern in our urban form, and increased emphasis on regionalism.*

The Cultural and Social Impacts

There is an unending list of cultural and social impacts associated with changing patterns of land use. Here are but a few:

- possible loss of landscapes and sites of cultural and historic importance;
- change in local and regional economies including shifts in business and job opportunities;
- transportation change including increased commuting times and/or availability of new transit options;
- increased cost of living resulting from higher taxes and/or longer commutes;
- increased access to health care, educational, recreational and cultural opportunities; and
- change in neighborhood composition and stability.

In addition to these factors, the rate of land use change is also worth consideration. Explosive land use change creates stress at almost every turn. Government agencies charged with oversight become taxed, the infrastructure needed to support growth becomes taxed, and community members who must adjust to a rapidly changing environment can become overwhelmed. Even when the economy has the potential to fuel rapidly changing land use, it is worth considering how to place a governor on the rate of change. The concurrency requirements of the Growth Management Act have not adequately addressed this issue.

4. *Land use change can be advantageous or disadvantageous to the individual and community. It is important that the consequences of change are identified and considered as part of the land use decision-making process. The pace of land use change should match the community's ability to absorb and adjust.*

The Unknowns

There are a series of known unknowns and unknown unknowns that will affect land use in Florida. To the degree possible, land use decision-making should address the known unknowns. (It is, of course, impossible to address the unknown.) Two important known unknowns are global climate change, and the diminishing reserves of non-renewable energy sources. So how might these unknowns be addressed when considering land use change? The primary recommendation is: do not preclude future flexibility by land use decisions made today. For example, if sea level rise becomes a reality, hindsight will tell us that further development of low lying and coastal areas was imprudent. In the future, if sea level rise does not come to pass, the opportunity to develop low lying and coastal areas will still remain. Similarly, approval of development patterns highly dependent on consumption of non-renewable fossil fuels is inappropriate if alternative patterns of land use less dependent on this resource are known to exist. Again, in the future, if alternative fuels become available, the opportunity will still remain for energy dependent development to occur. On the other hand, once this development has taken place, redevelopment to more energy efficient patterns is expensive and complicated.

The future is full of many imponderables including global climate change and diminishing non-renewable energy sources. To the degree possible, current land use decision-making should take into consideration potential scenarios resulting from these and other potentialities in order to preserve future land use options.

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Sustainable Community Design & Management Strategies for Florida

Martin Gold and Mark Hostetler

Florida's population, projected to double between 2000 and 2050, will grow to approximately 30 million residents by the year 2030, elevating it to the third largest state in the nation. Patterns of urbanity that will be required to support this dramatic growth will substantially impact ecosystems, public health, natural resources, transportation, economic efficiency (how resources are utilized toward productivity), economic engines (e.g., tourism), and livability. At present land use density, Florida will not be able to accommodate the projected population without considerable environmental degradation. Environmental degradations will include reduced agricultural lands, loss of natural habitat, loss of aquifer recharge areas, storm flooding, reductions in air quality and subsequent loss of revenue that relies on Florida's environmental quality.

The "Factor Four" principle proposes that if resource productivity can be quadrupled through design and technology, wealth could be doubled and resource use could be halved. This should be the goal for the State of Florida. If, as a community organism, we can do more with less, we can make substantial macro-economic gains. Opportunities to approach Factor Four efficiencies lie in three key domains: land use, transportation and civic policy. Land use strategies must simultaneously promote increased density (urban ecology) while protecting agricultural (rural ecology) lands and enhancing livability. Transportation must become a multi-modal and layered transit infrastructure that is more reliable, more efficient and less costly while promoting public health. Strategic policy initiatives from municipalities, state agencies, and the legislature are needed to promote sustainable community designs. This paper suggests community design and management strategies that advance resource conservation, promote healthy lifestyles and facilitate socially connected, livable neighborhoods.

Transportation Ecology

Transportation ecology is an emergent field covering the relationships between transportation, ecology and community considering traffic congestion, land use, multiple means (transit, auto, bicycle, and pedestrian), CO₂-emissions, noise, safety, infrastructure costs, implementation timelines, storm water management, site contamination and public outreach. A small group of innovative professionals have attempted to address real transportation difficulties that have been, in large part, unsolvable for over two decades as the established transportation sector has been unable to throttle growth to match infrastructure improvements, perhaps as a consequence of land use. Transportation must be addressed as a designed community infrastructure, integrated with land use and planning from which a community can grow and prosper, rather than as a reactive treatment to resolve the symptom of automobile congestion.

What is a green transportation system?

Driving a car is a significant source of material and energy consumption that accounts for 30% of the energy expenditures in the U.S., whereas buildings account for 40% and industry accounts for 30%. In automobiles, 95% of the fuel is used to move only the vehicle, while 5% moves the person. This is not only a squandering of critically limited fuel resources resulting in a wide range of geo-political consequences, but the excessive energy conversion emits vast amounts of pollutants into the air locally. Studies published in the August 2004 issue of the *Journal of American Public Health* suggest that pedestrians and cyclists traveling adjacent to congested automobile routes are exposed to toxin levels that exceed heavy cigarette smoking. Automobile exhaust plume modeling, a relatively new field, is shedding light on this little studied immediate air quality health concern. In 1996, the Surgeon General, responding to the heart disease epidemic — the second leading cause of death in the US as a result of sedentary lifestyle — stated that “More walking and cycling for practical daily travel is an ideal approach to raising physical activity levels.” Other studies by the Centers for Disease Control have directly correlated urban sprawl and time spent in an automobile to excessive body weight, diabetes and obesity resulting in a substantial burden to health care costs, reductions in overall productivity and premature deaths in the US.

Anything that discourages the use of a car and diminishes the surface area of roads will also minimize the consumption of other natural resources and related negative environmental impacts. People-powered transportation and transit infrastructure are critical elements of efficient community design for the future. Examples include:

- Minimal width streets, with calming devices such as speed humps, roundabouts, curved roads, and speed limit signs;
- Street-integrated light rail and bus transit systems that allow flexibility in power sources (electric, natural gas, biodiesel);
- Streets built of recycled materials;
- Grid connectivity in community streets and neighborhoods to diffuse peak traffic;
- Pedestrian paths and cycle paths with the most direct routes between destinations such as other nearby neighborhoods and retail areas to reduce the time expenditure when using these modes;
- Trees planted along paths, roads and in parking areas. This shades the asphalt and reduces the urban heat island effect;
- Roads and parking areas made of light-colored material to reduce absorption of heat from the sun; and
- Sidewalks, driveways, paths and roads made from pervious material to allow water to seep directly into the ground reducing storm water infrastructure and flooding.

Why should trails, sidewalks and open and shared spaces be integrated with transportation?

Trails, sidewalks, and open spaces encourage residents to interact with each other and their environment, and to both engage with the space and nurture it through sensitive occupation. Too many people tracking through a natural area can disturb wildlife and destroy plant communities. Conversely, non-occupation can promote unsavory activities such as the dumping of potentially hazardous materials, poaching, archeological thefts, and squatting. Furthermore, these important natural areas promote a strong sense of community by facilitating interactions among neighbors through shared use and responsibility. A sense of community is vitally important to creating and fostering sustainability because communications and interactions among residents help spread and accelerate sustainable behaviors. Other strategies to promote a sense of community include:

- Front porches located near the sidewalks with garages in the back. This type of arrangement can encourage residents to talk with their neighbors.
- Common areas where people can gather are an important feature, such as a community pool, shelter, or playground. A community pool is especially “green”, as it not only provides a common gathering place, but also decreases the incentive for families to build their own individual pools.
- Open spaces can be civic attractors, recreational areas and storm water management facilities if carefully designed to gain efficiencies in use, budget allocations and more compact urban space — which is inherently more walkable and sustainable.

Commerce efficiency relies heavily on community transportation infrastructure. In the 50's and 60's, parking difficulties hindered trade in the urban core, triggering the parking requirements in land use zoning and, ultimately, the ubiquitous strip mall and suburban office plaza. Today, parking is typically plentiful at these enterprises, but now traffic congestion impedes access and reduces commercial activity as many motorists avoid these locations when possible.

Community efficiency as a whole is greatly reduced by traffic congestion and was estimated to cost Floridians \$5.63 billion from unnecessary fuel consumption and time loss in eight major metropolitan areas in a single year (*Tough Choices: Shaping Florida's Future*, Denslow & Weissert, 2005). Robert Putnam of Harvard University published a study that suggests that for every 10 minutes spent commuting, there is a reduction of 10% in civic education, such as scouting, involvement in clubs, and community work (National Wildlife Federation, “Unbearable Traffic Congestion”). Congestion also provides fertile ground for stress, road rage and traffic accidents which are difficult to qualify or quantify in terms of community quality and efficiency. California has clearly demonstrated that more roads and more travel lanes cannot solve the problem of traffic congestion. Interdisciplinary research, stakeholder collaboration and innovations are needed to develop layered and multifaceted strategies to elicit solutions for the critical and difficult land use/transportation issues we face.

Community Morphology

Land use and zoning as applied today is woefully inadequate to accommodate the growth projected for Florida in the next 50 years. Zoning, originally developed in conjunction with public health concerns regarding the squalor and land values of unregulated dense urban areas at the turn of the 20th Century, has produced a host of problems unforeseen at its inception. Most notable is the proliferation of automobile use and the subsequent impact on the post WW II landscape, which comprises almost all of Florida as we know it today. Although the separation of incompatible uses generally protects residential land values, it parses destinations into zones, with low densities that require automobiles for citizens to move between them, institutionalizing automobile dependence. In this circumstance, community design is reduced to the application of zoning as land use policy, which establishes the lowest common denominator as the expectation. The result is the decentralized suburban and exurban sprawl with endless strip plaza development along clogged transportation arteries between once distinguishable urban places. Planned Use Development (PUD) seems to be the only way to implement innovative community designs; however, this process is substantially more cumbersome than traditional suburban development. Thus, developers are reluctant to pursue innovative community designs.

The call for a response to this condition has generated a resurgence of community design advocates and strategic proposals such as Smart Growth, New Urbanism, Traditional Neighborhood Design (TND) and Transit Oriented Design (TOD). Many of the new strategies are based on historic precedents that were pre-automobile. In Europe, transportation ecology issues have been more acute as the car has been leveraged into previously existing pedestrian systems. As a result of these constraints, European developments typically are more compact, often referred to as high density – low rise. The multitude of questions regarding the best strategies for accommodating automobiles, bicycles, people and mass transit in the US are still being raised, debated and tested. To this end, Community Design Centers have been established in Arkansas, Ohio, Michigan, Georgia and Florida in partnership with major universities to proactively engage community designers in the identification and application of strategies for better communities. In Florida, the linear nature of coastal development, the diverse climate, the agricultural potential, the distinctive ecology and the seasonal nature of a large segment of the population suggests unique requirements for improving our communities through design.

Community design must begin to engage the form of our cities, develop strategies for the distribution of residents and services, address population density, promote civic quality and, as noted earlier, explore alternatives for transportation networks that promote efficient and sustainable living.

The most sustainable strategy a community can adopt is to locate large portions of the population in close proximity to workplaces, commerce and recreation. This alone will

eliminate substantial automobile trips resulting in less congestion on existing road infrastructure, regular physical activity for residents, better air quality, and social capital, which is defined as the collective value of interpersonal networks. Most current zoning and land use designations do not promote such mixed use and ultimately discourage this through bureaucratic requirements that require special review, additional application approvals or comprehensive land use changes that occur only bi-yearly in most municipalities. The correct mix of residential density, open space, services, commerce and varied demographic groups is yet to be established. Much more study with interdisciplinary teams including academics, municipal agencies, developers and citizens is needed to find locally specific strategies to address these larger sustainability issues. Other benefits of designed communities include increased social capital through increased human interaction, which has been closely related to neighborhoods with civic space where people within walking distance naturally get to know each other. Social capital is often related to reductions in crime and an improvement in quality of life. New Urbanist and Smart Growth advocates suggest strategies to promote this through residential density in new development and redevelopment and the inclusion of destinations such as parks and commercial enterprises.

Community design for disaster mitigation is a newly developing policy area. In the recent past, policy limited coastal population when possible. Detailed coastal construction guidelines are available for individual projects, such as FEMA's guidelines on coastal construction. Larger community land use or design strategies for existing and new development need to be examined and refined in terms of the higher population densities that can be expected in the future as well as potential sea level rise.

How should Covenants, Codes, and Restrictions (CCRs) address environmental issues?

Most master planned communities have Covenants, Codes, and Restrictions (CCRs), which act as guidelines to how the community is managed. These help set the flavor and tone of the neighborhood. If the community has a homeowner association (HOA), it usually has the power to enforce the CCRs. In creating a sustainable community, first and foremost, the language within the document should not prohibit sustainable practices. For example, a CCR document might stipulate that the front yard must consist of 80% lawn. With this language, a homeowner could not convert a lawn to more native landscaping. A CCR should include language about land stewardship and conservation of natural resources. It should explain the sustainable design features of the home, yard, and neighborhood and how to maintain these features, and also prohibit certain actions that could compromise the sustainable features of a neighborhood. Some possibilities include:

- prohibitions against planting invasive exotic plants, including definitions of what "invasive exotic" means;
- language about upkeep of sustainable features within a home; and
- environmentally friendly landscaping and lawn maintenance recommendations.

Urban Landscapes

Urban areas harbor diverse boundary ecosystems ranging from semi-natural habitats and parks to wastelands, brownfields and other highly human-influenced ecosystems. Nurturing urban biodiversity requires integration of ecological and environmental knowledge into urban planning and design. Analysis of the complex information about human influence on urban ecosystems and interdisciplinary research involving natural and social sciences requires unique expertise, typically not found solely within planning, landscape or ecology fields. Integrating ecology, landscape, social structures and urban form into the process of urban planning and design is necessary.

Water and power is generally abundant in Florida but only sparsely captured in the forms most readily available. Resource capture and cycling to close the loop between resource inflows and outflows will require policy and strategies for rainwater and solar harvesting through decentralized but integrated residential systems.

Can irrigation and storm water systems improve water quality and conservation?

Water quality and quantity are significant growth management issues, and residential developments present many challenges. Irrigation and home water use consumes vast amounts of water. Moreover, the sheer number of impervious surfaces such as roofs and pavement means that less rainfall percolates naturally into the ground, replenishing the water table. Instead, the water runs off the property, creating a potential for flooding. This water may carry chemicals and silt into natural water bodies such as streams and ponds.

Typically, curbs and gutters are used to shunt storm water to built retention ponds. A more sustainable method, which requires fewer materials and less energy to build, is to use the natural features and soil conditions already present on the property. The sandiest, lowest-lying portions of the property can be set aside and left in their current state. These low-lying areas within yards are called “rain gardens.” Swales located throughout the site direct water to the natural retention areas, and because the swales are not made of cement, water will percolate into the ground as it travels to them. A more diffuse system is much better for the hydrology of the area and can reduce impact on surrounding wetlands.

Sixty percent of residential water consumption is used for irrigation and 40% is used within the home. An efficient irrigation system, such as drip or micro-irrigation, is recommended (<http://www.floridaswater.com/irmethods.html>). A micro-irrigation system that uses soil moisture sensors is more efficient because it only waters when the soil is dry. A central watering system would be the most efficient system because it eliminates management error by individual homeowners. Within the home, one can save water by using water-efficient appliances and fixtures such as front-load washing machines and low-flow toilets.

What is a sustainable community landscape?

Using native plants — naturally adapted to local climate and soil conditions — and minimizing lawns saves water and energy and reduces fertilizer, pesticide, and herbicide regimes that are harmful to the larger ecosystem. Yards and neighborhoods can become habitat for wildlife (see <http://www.wec.ufl.edu/extension>) which, through design and management, could increase biodiversity. Landscaping around homes, business and in civic spaces such as medians and parks should promote habitat, reduce the severity of storm run-off and be naturally resistant to local pests. Native plants generally provide these benefits. Additionally, plants can be used strategically to remove petroleum hydrocarbons from storm water as part of wetland garden systems as an alternative approach to storm water retention. In extreme cases, plants can be used to remove contamination on sites such as rail-trail conversions in a process known as phytoremediation. Overall, choosing the type of plants, where they are planted, and how they are installed is critical to increase the likelihood of plant survival and to minimize maintenance (see <http://hort.ufl.edu/fyn/>).

What kinds of tree protection and native area preservation strategies should be employed?

How trees and whole natural areas are designated and managed during the construction process is critical for their long-term health. Trees should be protected with fencing that protects the roots out to the drip line, the outer edge of the leafy canopy. Otherwise, the tree may die after several years due to soil compaction or fill dirt smothering the roots. Houses, roads, and other impervious surfaces could be minimized to enhance tree and natural area preservation. For example, reducing road widths and laying utilities underneath a road will minimize the amount of trenching. Proper management of construction debris and chemicals will prevent leaching of toxins into the ground. With regard to protected natural areas, appropriate management strategies should be implemented, both during the construction and post-construction phases. Designated natural areas should not be dominated by invasive exotics (e.g., Chinese Tallow). A restoration plan may be needed to remove exotic vegetation, accompanied with a long-term strategy to prevent re-invasion. Further, the health of these natural areas is intricately tied to the behaviors of nearby residents, and a community should have some sort of visible educational program.

Sustainable Architecture

Doubling the area of the built environment over the next 50 years to accommodate the expected population growth will require architecture to be substantially less resource-consumptive and more resource-producing. Architecture must not only become more energy effective, more protective of public health and more environmentally equitable, but must also begin to transfer the resources at a given site such as rain, nutrients, solar radiant energy, breezes and consumer waste. Eventually, the buildings would turn themselves into (re)usable resources. The College of Design Construction and Planning at the University of Florida has just established a certificate in interdisciplinary sustainability in recognition of this critical need.

What are the structural materials used to build a sustainable home?

Many construction techniques can benefit (or hinder) the energy efficiency, indoor air quality, and resilience of the house to weather conditions over its lifetime. We list a few important issues below:

- *Indoor air quality* - A leaky home can bring humidity, pollen, dust, and mold from outside, from crawl spaces, and from attics into the conditioned space. The home should have an effective air barrier to prevent this kind of leakage. During construction, all leaks between conditioned and unconditioned spaces should be sealed with durable materials and the home should be built in such a way as to prevent wicking of water from the ground into the house. Many paints, varnishes, and carpets emit volatile organic compounds (VOCs) that can affect indoor air quality. This can be controlled by using the low-VOC paints, glues, varnishes, and carpet.
- *Termites* - For new homes, a fine wire mesh could be installed with the foundation as a physical barrier against termites (e.g., The Termimesh System™), resulting in savings in pesticide costs.
- *Insulation* – Proper insulation in the walls and attic serves as a protective barrier, keeping out excessive heat and cold and maintaining even temperatures within the home. Insulation is rated in terms of thermal resistance, called R-value, which indicates the resistance to heat flow. The higher the R-value, the more effective the insulation.
- *Green materials* – Overall, green construction materials consume less energy from harvesting to installation. They produce fewer greenhouse gases, and they produce fewer toxins and waste. Examples include: 1) Materials from renewable resources such as fast-growing bamboo rather than slow-growing tropical hardwoods; 2) Recycled materials such as concrete that can be made (in part) of fly-ash waste from coal-fired plants; 3) Non-toxic materials such as non-CCA-treated wood; and 4) Durable, low maintenance materials. Steel, for example, is much more durable than wood.

How can the HVAC systems affect energy conservation?

The heating, ventilation, and air conditioning (HVAC) system consumes a significant portion of a home's energy budget, generally 30% to 50% for commercial buildings and 70% for a residential home. Communities could consider a centralized cooling system rather than a multitude of individual units, which are usually noisy and add to urban heat island effects. These centralized units could also be coupled with high efficiency chillers and ice storage systems, allowing operation at night, when electricity is cheap, rather than during the daytime when power providers are struggling to meet demand.

Homes and small commercial buildings could be designed to provide comfort passively through much of the year to reduce the reliance on HVAC systems. Homes could be raised up off the ground, have cross ventilation, be shaded by trees, and have sensibly-placed fans and windows to provide comfort for a large portion of the year. Small HVAC systems must be efficiently designed and properly installed, as their combined

operation comprises a substantial portion of cooling consumption across the State. Other HVAC considerations include:

- Bigger is not better. An air conditioner is not only designed to cool a building but also to remove moisture. The Sensible Heat Ratio (SHR) is a measure of how much humidity an air conditioner removes. An oversized unit cools the building too quickly and doesn't run long enough to reduce the humidity level. The SHR should be 0.75 or lower.
- The Seasonal Energy Efficient Rating (SEER) indicates how energy efficient the unit is in terms of removing heat per kilowatt of power used. A high efficiency unit is rated SEER 13 or higher.
- The air handler and all duct work should be in conditioned space. This helps prevent loss of heated or cooled air to the outside.
- Leaks in the ducts not only results in loss of conditioned air, but can also create air pressure imbalances in the house. If the amount of air delivered through the supply ducts is not equal to the air drawn through the return ducts, the resulting imbalance can cause outside air to be drawn into the house.

Are our communities ENERGY STAR[®] compliant?

Started in 1992, ENERGY STAR is a voluntary labeling program administered by the federal Environmental Protection Agency (EPA), which identifies and labels products that are energy-efficient. Many people are familiar with the ENERGY STAR labeling for consumer products such as light bulbs, but there is also an ENERGY STAR certification process for buildings. ENERGY STAR homes are certified by an independent party, and generally are 30% more energy-efficient than typical homes. An ENERGY STAR home can have building envelope upgrades, high-performance windows, controlled air infiltration, upgraded heating and air conditioning systems, tight duct systems, and upgraded water-heating equipment. After the home has been built, a third-party tester inspects it and issues the certificate. To make the entire community more energy efficient, a developer should mandate that every home within a new community be ENERGY STAR certified. To find out more about energy-efficient features within a home, visit the ENERGY STAR web site <http://www.energystar.com>.

Landscaping and orientation of the house can also make a home more energy efficient. The home should be oriented north-south to minimize sun exposure, and trees should be planted on the east and west sides of the house to provide shade in the summer.

Community Understanding and Acceptance

Understanding and acceptance are *essential* if a sustainable community is to function as originally intended. Although it is a developer or planner who originally implements a green design, it is up to the community residents to manage and maintain many of the sustainable features. As an example, consider compact fluorescent lights (CFL). When a replacement must eventually be purchased, an uninformed homebuyer may see the lower price of a halogen or incandescent bulb and buy it instead of a CFL. But if the homeowner clearly understands how much money and energy has been saved over the

lifespan of the bulb, the replacement will be another CFL. Similarly, new residents must be educated. Houses are sold, experienced owners leave, and new owners arrive, unfamiliar with the community's green culture. All residents must be on board in terms of understanding the conservation goals and practices of a community in order for sustainability to be maintained.

On a broad scale, a municipality needs to implement an effective marketing and education campaign to create a culture of sustainability. These campaigns need to identify barriers to sustainable behaviors and offer meaningful solutions to overcome these barriers. On a neighborhood level, where a green development has been planned, one way to get the word out is for the developer to implement an educational program that consists of a brochure, a web site, and informative kiosks situated along a sidewalk or path. For large, master-planned communities, it is also useful to have a full-time conservation manager that works for the neighborhood. This manager can serve as a local source for information and help implement or facilitate newsletters, local conservation committees, and environmental activities such as bird walks and clean-ups.

For a Florida example of a community that has both an environmental education package and a conservation manager, visit <http://www.wec.ufl.edu/extension/gc/Harmony/index.htm>.

Conclusions

Municipal agencies, policymakers, developers, corporations and homeowners need economic incentives and education to advance innovation and integration of sustainable strategies in our communities. Successful European and domestic land use models exist that could be recalibrated to excel in Florida. In Florida, examples exist of residential communities and municipalities that are implementing many of the sustainable practices mentioned above. The Town of Harmony (www.harmonyfl.com) is a working residential model and at the county level, Sarasota County (www.sustainable Sarasota.com/) is taking steps to create a culture of sustainability. Decisions made by homeowners, building professionals, and policymakers interact in dynamic ways to either enhance or inhibit sustainable practices. Barriers to adopting sustainable practices usually fall into the categories of 1) lack of understanding and acceptance by both the public and private sector, or 2) lack of appropriate policy to support adoption of sustainable practices. The solution to overcoming these barriers is within the educational and policy realms. Policy typically enhances or constrains decisions by design and building professionals and homeowners; decisions by design and building professionals constrain or enhance homeowner decisions; and homeowners can sometimes constrain or enhance decisions of both policymakers and building professionals through collective economic and voting power.

As a starting point, we recommend a statewide policy that would promote sustainability workshops involving stakeholders in each county. The goal of these workshops is to provide a venue where local citizens, developers, and policymakers can craft incentive-

based policies (e.g., permit breaks for builders that adopt ENERGY STAR homes) and/or regulations that promote the implementation of the practices mentioned in this paper. The following steps could create successful, sustainable development policies. First, introduce a new voluntary ordinance using stakeholder input. Voluntary ordinances should include some significant economic incentives, such as fast tracking permits, permit fee reductions, and density bonuses. A voluntary ordinance will give developers the opportunity to try out the ordinance and help set up a culture of acceptance for these new design/build practices. Through the voluntary step, opportunities exist to work out kinks in the ordinance. Second, after substantial marketing and education of the new standards or building practices, a voluntary ordinance can evolve into a mandatory ordinance once a particular practice becomes mainstreamed. For mandatory ordinances, a baseline standard could be used for all developments to follow; however, additional incentives might be included so that developers can go above and beyond the baseline standard.

In addition, certification entities could be used to help municipalities and developers to implement sustainable practices. Such certification gives counties and developers marketing advantages, which are incentives to adopt sustainable practices. Examples of certification programs include United States Green Building Coalition's LEED standards (www.usgbc.org), Audubon International (<http://www.auduboninternational.org>) and Florida Green Building Coalition (<http://floridagreenbuilding.org>).

Overall, good marketing plans and education initiatives will help increase public awareness about new policies and ensure compliance with new ordinances. In addition, continuing education courses, summits, and workshops would disseminate knowledge about policies along with the tools to implement those policies. Counties could make use of statewide programs, such as University of Florida's Program for Resource Efficient Communities (<http://www.energy.ufl.edu>) and local community design centers, such as the Florida Community Design Center (<http://www.floridacommunitydesign.org/>), offering continuing education courses and practical, informational workshops geared for municipalities and the design/build community.

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Transportation and Sustainability

Ruth L. Steiner

A sustainable transportation network in Florida needs to be designed to support the needs of Florida residents. Such a network can be understood from a habitat approach. All residents should be able to participate in all of the activities of daily living – food, clothing, shelter, social interaction, and work – in places that encourage efficient mobility. To accomplish this, the community must provide land uses and activities that allow people to be self-sufficient. Children, disabled persons, and the elderly should be able to get around for daily activities. Residents, whether they can or can not drive, need the transportation network to provide convenient and safe access to these daily activities. Residents need roadways, sidewalks, bicycle paths and transit to go to a variety of destinations within their own neighborhood.

The transportation network also serves a diverse set of other needs and users. Residents need to travel to other communities in the state for business and recreation. This travel can be accomplished on highways, using automobiles or buses, or through air travel. Florida's transportation network needs to support the economic vitality of the State. The importance of transportation can be seen in two major economic sectors in the state: tourism and agriculture. In 2005, almost 84 million visitors came to Florida and contributed \$87 billion dollars to Florida's economy.¹ Another major contributor to the state's economy, the agricultural sector, produced \$6.84 billion worth of goods for markets throughout the United States and the world.² Tourists depend upon roadways and airports to travel to, and between, destinations in Florida. Businesses need trucks, trains, ships and planes to move their goods to destinations throughout Florida, the United States and the world.

Florida faces a diverse set of challenges in developing that transportation network. First and foremost, we have underinvested in transportation facilities. The state has taken actions to develop an interregional and regional transportation network with the Strategic Intermodal System (SIS) and the Transportation Regional Incentive Program (TRIP). The SIS is a statewide network of high-priority transportation facilities, including the state's largest and most significant commercial service airports, spaceport, deepwater seaports, freight rail terminals, passenger rail and intercity bus terminals, rail corridors, waterways and highways. TRIP was created to improve regionally significant transportation facilities that benefit regional travel and commerce. However, the SIS is not fully funded and local governments need to get involved to ensure that the state system is not overloaded with local trips. Similarly, local governments need to

¹ Visit Florida. 2006. "About Visit Florida." Available at:

[http://media.visitflorida.org/about/research/](http://media.visitflorida.org/about/research/http://media.visitflorida.org/about/research/)

² Florida Agricultural Statistics Service. 2006. "Florida Agricultural Facts, 2006." Available at: http://www.nass.usda.gov/Statistics_by_State/Florida/Publications/Annual_Statistical_Bulletin/faf06/A1thru8.pdf

collaborate with adjacent jurisdictions to ensure that while they benefit from new development, they should not simply export the transportation impacts downstream.

Throughout the state there is a lack of good and affordable transportation access between major urban areas using modes other than the automobile. Increasing housing costs are placing burdens on low-income homeowners to drive long distances to get to their employment. Transportation is the second largest component of household budgets with US households spending an average of 19% of their budget on it.³ Households, on average, only spend more for housing.

Congestion remains an issue in many areas of the state. For example, in Miami, travelers face 147 million hours of delay and 87 million gallons of excess fuel consumption due to congestion.⁴ Congestion near schools is making it less safe for all modes of transportation to school. Florida's fatality rate has been declining for many years to a rate of 1.66 fatalities per 100 million miles of travel in 2004.⁵ However, it is still above the national average of 1.51 fatalities per 100 million vehicle miles.⁶ Florida consistently ranks among the states with the highest rates of bicycle and pedestrian crashes and fatalities.⁷

The transportation system also has significant impacts on the environment. Currently 96.4% of the energy consumed in the transportation system is derived from petroleum sources. Energy consumption in the transportation sector has increase from 24.6% of all energy consumed in 1973 to 28.1% in 2005.⁸ The transportation system also affects the environment through degradation of air quality, greenhouse gas emissions and global

³ Center for Transit-Oriented Development and Center for Neighborhood Technology. (2006). "The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice," Washington, DC: Brookings Institution Urban Markets Initiative. Available at: http://www.brookings.edu/metro/umi/20060127_affindex.htm

⁴ Schrank, David and Tim Lomax. 2005. "The 2005 Urban Mobility Report," College Station, TX: Texas Transportation Institute. Available at: http://tti.tamu.edu/documents/mobility_report_2005_wappx.pdf

⁵ Florida Department of Highway Safety and Motor Vehicles. 2005. "2004 Traffic Crash Statistics Report." Tallahassee, FL: Office of Management Research and Development, Florida Department of Highway Safety and Motor Vehicles. Available at: <http://www.hsmv.state.fl.us/hsmvdocs/cf2004.pdf>

⁶ Florida Department of Transportation (FDOT) State Safety Office. 2003. *Strategic Highway Safety Plan*, Tallahassee, FL: Florida Department of Transportation Safety Office and National Highway Safety Administration (NHTSA) 2005. Traffic Safety Facts. Available at:

⁷ National Highway Traffic Safety Administration. 2005. "Traffic Safety Facts: Pedestrians." Available at: <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2004/809913.pdf> and "Traffic Safety Facts: Pedacyclists." Available at: <http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.5928da45f99592381601031046108a0c/>

⁸ Center for Transportation Analysis (CTA) Engineering Science & Technology Division. 2006. "Transportation Energy Data Book: Edition 25." Oak Ridge, TN: Oak Ridge National Laboratory. Available at: <http://cta.ornl.gov/data/download25.shtml>

climate change, reduced impervious surfaces, habitat loss and fragmentation, changes in hydrology, increased acidity of water and increased water pollution and nutrients.⁹

Over the next several decades, the transportation system will face additional challenges due to growth in activity. The population of Florida is projected to grow to 26.4 million by 2030. This will lead to further increases in traffic and congestion throughout the state. Of that population, an estimated 26% are expected to be over the age of 65. This aging population represents a higher number of residents who are not able to drive and who will live in places that are not well served by public transportation. The increase in population will place a larger number of people in coastal areas and create continuing challenges for evacuation during hurricanes and other disasters. As the passage of the Central American Free Trade Agreement (CAFTA) the Free Trade Area of the Americas (FTAA) are likely to lead to increases in imports and exports through Florida's ports, this will likely lead to increases in freight movement by trucks, trains and air.

To develop a sustainable transportation network, it is necessary to balance the issues of equity, economy, and environment. Housing affordability, community design and land use need to be considered. If affordable housing is not available near where people, especially people with low incomes, work or want to live, these families will face an undue burden with respect to transportation costs. If the only location for affordable housing is at the fringe of the urban area, the residents will have few choices of transportation. If our communities are designed with overly wide roads, some residents will be limited in their ability to participate in the economic activities of the community. Transit users, bicyclist and pedestrian will be placed a great risk in crossing these road. If, on the other hand, the state does not have adequate capacity for regional and interregional travel, there could be an adverse impact on the state and local economies.

How we choose to develop will influence the ability of residents, tourists and businesses to get around our communities. Traffic congestion should not be the sole factor in decisions about where to invest in transportation as is the current practice in the concurrency management systems of some local governments. Congestion can be a sign of vital economic activity, or it can be a sign of a poorly designed transportation system. The state and local government need to balance the needs for the transportation system with the visions and goals of the community.

Thus, transportation investments need to be coordinated with land use investments. Three scales of development need to be considered in coordinating these two systems: the site scale, the neighborhood scale, and the regional scale. At the site scale, connections between the various modes of transportation need to be made. Pedestrians should be able to walk safely from a building to parking lots or transit stops. Automobile and truck

⁹ United States Environmental Protection Agency (USEPA). 2001. *Our Built and Natural Environments: A Technical Review of Interactions between Land Use, Transportation, and Environmental Quality*. Washington, DC: United States Environmental Protection Agency (January). Available at: <http://www.smartgrowth.org/library/built.html>

drivers should be able to access a site safely from the adjacent roadway. Easy access should be provided between adjacent developments.

At the neighborhood scale, pedestrians and bicyclists should have safe, continuous and predictable access between residences and other land uses. Investments in transit need to be coordinated with a land use pattern that supports the transit. This includes land use at a density high enough to support transit, mixed land uses to provide a diversity of destinations for transit users and other pedestrians. The network should be designed to allow residents to get to the activities of daily living without contributing to congestion on major arterials or placing themselves in an unsafe travel environment.

At the regional scale, jobs should be balanced with housing so that residents of one community don't need to drive long distances to get to employment. Low income households need to have access to employment near to where they live. People who can't drive due to cognitive, physical or other disability should have access to activities for their daily living so that they can contribute to the community. In summary, the regional network should support movements between cities, but also support local accessibility. Similarly, tourist destinations need to be coordinated with the local transportation system. At the regional level, activity centers need to be established that support the movement of people and goods using the most efficient mode possible.

Additionally, the following considerations are central to balancing issues of equity, economics and environment to address the needs for a safe, continuous and well-designed transportation system.

- Florida needs a true multi-modal planning and transportation system that is designed to match its context. In urban areas, no amount of funding will be adequate to eliminate congestion. Emphasis needs to be placed on providing a diversity of land use destinations that are located on a connected grid street network with high density. The land use mix should include retail, office and other destinations that are used on a routine basis. The grid street network should be developed with small blocks to support walking and bicycling and good connectivity to transit. High density provides a critical mass for the retail and the transit that in the area. In suburban areas, a similar land use mix, street connectivity, and density should be coordinated with the transportation network. Although the density may be lower than in urban environments, it should be high enough to support frequent transit service. The node of mixed land uses and connected streets should be organized to decrease the trip length, allow capture of trips internal to the development, and produce mode shifts to transit for trips outside of the development and to walking and bicycling within the development. Such a development pattern can leverage public investment in transit and reduce the level of congestion on adjacent arteries.
- Transportation is essential to economic vitality. Access to airports, train stations, tourist destinations, and other major activity centers needs to be provided in an efficient manner. Technology should be deployed to increase the throughput on

the transportation system, to increase system reliability, and reduce congestion delays due to accidents.

- Regional mobility needs to be balanced with community livability. Efforts to maximize vehicular mobility often conflict with the needs for the safe movement of bicyclists, pedestrians and transit users. Regional mobility is necessary for our economic vitality. However, regional mobility should not prevent the development of a safe, continuous and predictable movement of pedestrians and bicyclists. The transportation-land use system needs to be designed in a manner that supports these diverse needs; this is where community design becomes important. New and creative designs for the diverse scale and speed of movement in urban areas need to be considered. Freight movement must be supported with new modes of movement that are compatible with community livability. For example, freight transit, in smaller more flexible vehicles, may be more compatible with urban environments than large trucks on already congested urban streets.
- State and local governments need to focus on the development of transportation network connectivity and the reservation of new corridors for regional movement in advance of the land development. In doing so, government will ensure that the land will be more affordable and community resistance to roadway projects will not prevent the building of a connected regional and local transportation network.
- Redundancy should be built into the transportation network to allow residents and visitors to have alternative paths and modes for movement. Redundancy offers greater transportation choice on a daily basis and provides choices when roads are closed for construction or during emergencies.
- Innovative technologies need to be developed to reduce the environmental impacts of the transportation system. Alternative materials and methods of reducing water runoff from parking lots and roadways need to be developed and deployed. Research needs to be conducted on alternative transportation fuels, such as biodiesel and solar fuel cells that use resources readily available in Florida.

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Brookings Institution – a series of research studies on urban policy including reform of the transportation system, (<http://www.brookings.edu/es/urban/issues/transportation/transportation.htm>)

Transportation Research Board (www.trb.org) – provides an overview of transportation-related research from this organization that is a part of the National Academy of Science and National Academy of Engineering.

Affordable Housing and Sustainability

Kristin Larsen

In order to have a sustainable Florida, adequate housing needs to be available for all residents at a cost of no more than 30% of household income.¹⁰ Over the past few decades, the federal government has reduced housing assistance for lower income households. State and local governments have increasingly taken on this responsibility.

Florida faces a multitude of diverse housing issues. These range from insufficient farm worker housing in rural areas to rapid acceleration of property values in some urban neighborhoods. Understanding demographic changes is also essential to addressing housing needs in the state. Projected population increases are likely to intensify current challenges.

Meeting these challenges will require balancing equity, economic, and environmental values to address housing needs for current and future residents. In 1988, the Florida legislature recognized these issues and set a goal of meeting the state's housing needs by 2010, a goal that certainly will remain unfulfilled by that date.¹¹ Still, this goal acknowledges that the state's economic health is tied to how well it meets the housing needs of poor and working-class people.

With housing condition no longer a major concern, the more widespread issue is affordability and availability of housing, reflecting the relation between income, housing cost, and location. Among low-income households (those earning 80% or less of area median income), 769,977 renter households are cost-burdened, and an additional 711,048 of owner households pays too much for housing.¹² In addition, the 2004 hurricanes hit lower income households particularly hard with one in ten primary residences impacted.

¹⁰ This is a standard definition of affordability and applies to all households from the lowest to the highest incomes. The essential difference between these households is that once housing costs are subtracted from a low-income household's earnings, the remaining funds available for necessities such as food, transportation, and health care are significantly lower.

¹¹ Section 420.0003(2), Florida Statutes states "[b]y the year 2010, this state shall ensure that decent and affordable housing is available for all of its residents." According to the 1999 Florida Affordable Housing Study Commission, very little progress was being made toward this goal with only two-thirds of the new need in 1998 met, leaving a "backlog of 1.35 million cost burdened households" ("Final Report – 1999", Tallahassee, FL: p. 13).

¹² Florida Department of Community Affairs (2004) *State of Florida Consolidated Plan, Federal Fiscal Years 2005-2010*, Tallahassee, FL: p. 23. These numbers are based solely on cost burden – defined as devoting more than 30% of income to housing. They do not reflect overcrowded or substandard conditions.

Over half of these damaged units (57%), provided shelter for households earning 60% or less of the area median income.¹³

While the need is more critical among the lowest income households, even working class households (those earning up to 120% of area median income) are struggling with housing payments. In some parts of the state, the median value of a home is rising ten times as fast as the area's median income. Recent reports have ranked several of the state's metropolitan areas as some of the most price-inflated housing markets in the country, among them Naples, Port St. Lucie, Miami, West Palm Beach, Sarasota, and Fort Lauderdale.¹⁴

The situation is worse for low-income renters. In Florida, the fair market rent (FMR) for a one-bedroom unit is \$687, meaning that a wage earner would have to earn \$13.21 per hour – much more than the minimum wage – in order to afford a standard rental unit in Florida.¹⁵ Over 60% of extremely low income households (those earning 0-30% of area median income) lack affordable rental housing.¹⁶ Further, the state is losing affordable rental units. During the next 15 years, over 17% of Florida's assisted rental units are expected to be lost.¹⁷

What solutions are available to address these challenges? Adequate, affordable housing should be considered essential to accommodate Florida's growing population, just like adequate roads, sewer, water, and schools. This approach “makes provision of affordable housing an explicit responsibility of local governments, with such responsibility tied to a local comprehensive plan prepared under a set of rules and regulations established by the state.”¹⁸ Thus the state maintains oversight, but the local government designs the specifics of the program and implements it so that sufficient affordable housing is in place as new residents arrive.

¹³ Florida Hurricane Housing Work Group (2005) *Recommendations to Assist in Florida's Long Term Housing Recovery Efforts*. Accessed 15 August 2005, <http://www.floridahousing.org/Home/Newsroom/Publications/Hurricane+Housing+Work+Group.htm>, pp. 9, 12.

¹⁴ R. J. DeKaser and J. G. Charamonde (2005) *House Prices in America: Valuation Methodology and Findings*, Cleveland, OH, National City Corporation.

¹⁵ National Low Income Housing Coalition (2005) *Out of Reach 2005*. Accessed on 16 August 2006, <http://www.nlihc.org/oor2005/data.php?getstate=on&state%5B%5D=FL>. As defined by the U.S. Department of Housing and Urban Development (HUD) for purposes of its rental programs, FMR reflects rent and utilities for a modest unit based on local conditions.

¹⁶ Florida Department of Community Affairs (2004) *State of Florida Consolidated Plan, Federal Fiscal Years 2005-2010*, Tallahassee, FL: p. 23.

¹⁷ Florida Affordable Housing Study Commission (2005) *Final Report – 2005*. Tallahassee, FL: FHFC.

¹⁸ Marc Smith and Ruth Steiner. 2002. Affordable Housing as an Adequate Public Facility. *Valparaiso University Law Review* 36(2): 443-459, pg. 444.

Additionally, the following considerations are central to balancing issues of equity, economics and environment to address affordable housing needs in the state.

- Address the increasing hardships associated with maintaining affordable property insurance. The 2006 Property Insurance and Reform Committee was created on June 27th by executive order. The committee's goal is to seek solutions that address the financial hardships associated with the devastating impacts of the past two hurricane seasons. Due to reduced availability and increased cost of insurance, housing expenses are rising in Florida, making this a critical affordability issue.
- Ensure hurricane education and mitigation strategies integrate housing policy and program initiatives. Currently there is very little coordination among agencies and within agencies to comprehensively plan for hurricanes. These strategies should include short-term evacuation and emergency housing responses, mid-term issues such as ongoing home maintenance, and long-term decisions involving residential land use.
- Encourage more effective coordination between federal, state, and local housing programs so that the expenditure of relatively scarce funds more fully meets housing needs.
- Develop housing solutions that are responsive to distinctive local characteristics. The urban-rural dichotomy is particularly significant – there are 35 urban and 32 rural counties in the state – as is the difference between coastal and non-coastal areas. Socio-demographic characteristics of the residents are equally important. Addressing housing issues for the elderly, the homeless, farm workers, and extremely low income populations and work force housing for moderate income households may require diverse strategies and approaches attuned to the particular characteristics of these groups. During its most recent session, the Florida legislature enacted a work force housing pilot program.
- Require better coordination between housing plans and with other planning documents. Since 1985, the State of Florida has required that all local governments maintain a Housing Element as part of a broader growth management plan. These documents should more clearly articulate local goals, objectives, and policies, which would assist in directing the expenditure of housing program funds and prioritization of housing goals relative to other goals such as economic development. The Housing Element is the key housing planning document and should function as such.
- Understand that transportation issues are housing issues. Increasingly, housing experts are including transportation costs as a key housing consideration. Households often weigh the typically higher costs of living proximate to work with commute time and travel costs. A recent study found that at every income

level, those who spent less on housing spent relatively more on commuting.¹⁹ In Florida, a total of 10 counties have a majority of residents who do not work in their home county.²⁰ More research is needed to determine whether this is due to decisions to live in less expensive areas in return for longer commutes to work.

- Proactively identify unnecessary regulatory barriers and remove them. Regulatory barriers continue to increase housing costs. These include overly restrictive and prohibitively expensive subdivision regulations, land use requirements, and building codes that do more to segregate income groups than to protect the public interest. As part of receiving State Housing Initiatives Partnership funding, larger cities and all counties are required to examine regulatory barriers. The identification and removal of such barriers is essential to lowering unnecessary housing costs.

- Recognize the value of older neighborhoods in contributing to sustainability, and safeguard the existing affordable housing stock. Among the benefits associated with preserving older and historic neighborhoods are the higher percentage of affordable units as compared to new developments and the proximity to work, school, shopping, and public transit.²¹ Affordable housing programs, housing codes and regulations tend to accommodate new construction, creating barriers for rehabilitation. Gentrification is another critical issue in these neighborhoods. Gentrification is the displacement of long-term residents, forced to move because of increasing housing costs. Innovative strategies such as Community Land Trusts do not necessarily work in every circumstance but should be considered a potential tool to safeguard land value and ensure affordability over the long-term, especially in neighborhoods with specific indicators that gentrification is occurring or likely to occur.

- Build the capacity of non-profit partners to better meet local affordable housing needs. While Florida has some significant housing programs in place, such as the nation's largest state housing trust fund, it does not have the depth of non-profit housing providers and specialists that other states do. Further, those local non-profits that do provide housing support often do not have the capacity to partner on larger or more complex projects. Programs that strengthen the capacity of these agencies are essential.

¹⁹ Joint Center for Housing Studies of Harvard University (2006) *The State of the Nation's Housing 2006*. Accessed on 16 August 2006, <http://www.jchs.harvard.edu/publications/markets/son2006/son2006.pdf>.

²⁰ Shimberg Center for Affordable Housing (2004) *The State of Florida's Housing, 2004*, Gainesville, FL: Shimberg Center for Affordable Housing.

²¹ Rypkema, Donovan (2002) *Historic Preservation and Affordable Housing: The Missed Connection*. Washington, DC: National Trust for Historic Preservation. Accessed on 24 October 2005, http://www.nationaltrust.org/issues/housing/Missed_Connection.pdf.

- Adopt inclusive housing policies that proactively integrate fair housing initiatives in all land use decisions. Though illegal, housing discrimination continues, and local governments are not immune to adopting and implementing discriminatory practices, often in response to pressure from residents resistant to affordable housing.

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Resources

Knowledgeplex – a search engine that provides access to extensive resources on affordable housing and community development from academic studies to newspaper reports, <http://www.knowledgeplex.org/?UserID=2&>.

Harvard Joint Center for Housing Studies – among other studies, issues the annual State of the Nation's Housing report that provides an overview of the previous year's housing activities and issues, <http://www.jchs.harvard.edu/>.

National Low Income Housing Coalition – includes resources on current housing issues across the country and the annually updated “Out of Reach” calculator of housing rents as compared to income, <http://www.nlihc.org/oor2005/data.php?getstate=on&state%5B%5D=FL>

Florida Housing Finance Corporation – includes information on state housing programs and reports addressing current housing issues including the annual Affordable Housing Study Commission reports, <http://www.floridahousing.org/Home/>.

Shimberg Center for Affordable Housing – collects and updates a wealth of housing data for the State of Florida and conducts research studies such as the annual State of Florida's Housing, <http://www.shimberg.ufl.edu/>.

Population Health: A Marker of Sustainability

Andrea C. Gregg and Barbara J. Lutz

Current concepts of our nation's health involve much more than the mere absence of disease. Ideally, *health* encompasses a state of complete physical, emotional, and social well-being, balanced with intellectual, environmental, and spiritual fitness.¹ Healthy people feel safe, are actively engaged in their community, and have opportunities to grow and be productive. Population health, a marker of sustainability,² is an approach to health care planning that focuses on a total population and its continued ability to thrive. State infrastructures, like fire/rescue, police protection, public schools, housing, and recreational services, contribute broadly to this goal, while public health infrastructures provide a continuum of services that directly serve the population's health care needs. Several states have taken the lead in addressing health sustainability by developing plans that reflect their unique populations and health care resources.^{3, 4, 5} This movement parallels reviews and recommendations made by some of the most visionary minds in the nation,⁶⁻¹⁰ and thus can serve as a guide for Florida. To initiate planning for sustainability, the health status of Florida's population, its healthcare infrastructure, and priorities for sustainability are considered in this paper.

Florida's Population

Florida, currently the 4th most populous state in the nation, is projected to be 3rd by 2025, with the highest proportion of elderly citizens (65+ years). This growing proportion of elders has been measured in terms of what the U.S. Census Bureau calls a dependency rate, which depicts the proportion of youth and elders compared to working adults. Florida ranks 4th in this category as well, showing a disproportionately high dependent population (almost 40%).^{11, 12} In 2002, annual Florida health care expenditures were \$4,967 per capita, exceeding the national mean of \$4,654. As a percentage of personal income, health care expenditures also exceeded that of the nation (16.8% versus 15.1%).¹³ Yet with respect to the *Healthy People 2010* indicators,⁸ Florida has one of the worst state profiles, ranking above the 50th percentile among all states for: Acquired Immunodeficiency Syndrome (AIDS) cases in people ≥ 13 years, adult diabetes, heart disease-related deaths, homicide, low birth weight, motor vehicle-related deaths, and smoking among adults.¹⁴ Compounding these medical and social problems are escalating geographic threats: hurricanes, illegal immigration, and importation of illegal drugs.

Elders represent 18.1% of Florida's population, but their health care expenditures, including prescription drugs, are almost five times that of people under the age of 65.¹³ Florida's elders have multiple health problems, often chronic conditions, which require frequent medical management and hospitalization (46.5% of hospital admissions).¹² Given Florida's large elder population and their high care costs, solutions need to focus on preventing the need for hospitalizations (the most expensive care) through alternative outpatient and home care support systems.

In 2002, 19.4% of Florida Medicaid enrollees were children under the age of 18. This population however, consumed 57.5% of Medicaid expenditures. Infant mortality rates in Florida persistently exceed that of the rest of the nation (7.5/1,000 versus 6.9/1,000 live births in 2002).¹⁵ In other areas, such as teenage birth and high school drop out rates, Florida ranks far above the 50th percentile in the U.S., creating a socioeconomic environment that contributes to poor health outcomes.¹⁶ Studies reveal that high school dropouts are more likely to be unemployed, earn lower wages, and experience worse health than high school graduates.¹⁷ Given the longevity of children and their future potential, sustainability plans must focus on promoting healthy lifestyles and preventing disease. One systematic approach for sustainability is a school health program, with a registered nurse at every public school. Regular access to a health provider with adequate preparation to provide population-based school health care would enable timely health risk screenings, early referral for care, and much needed health education.

Persons from racial and ethnic minority groups comprise 41.1% of Florida's population (versus an average of 30.6% per state in the U.S.). Another estimated 200,000 migrant/seasonal farm workers and their families travel to and work in Florida annually.^{12, 18, 19} This highly diverse group experiences cultural, language, and economic barriers that impact health and hinder or block access to health care services. Marked health disparities are characteristic, with infant mortality and cardiovascular disease mortality rates more than twice that of whites, and death rates from HIV *10 times higher*.¹⁵ Accessible, culturally sensitive care in ethnic and minority communities, as well as socioeconomic support (e.g., Florida's *Closing the Gap* program), are needed to improve the sustained health of this population.²

Poverty rates of almost half of Florida's 67 counties exceed the overall U.S. rate of 12.7%; in seven counties, more than one-fifth of the population is below poverty level.²¹ Florida has the sixth highest proportion of people without health insurance in the U.S, which translates to approximately 2.8 million (19.2% non-elderly and 12.1% children) with no coverage.^{12, 22} Such poverty must be addressed in Florida's sustainability plans, including a plan for health care coverage for all Floridians. Massachusetts' plan for universal health coverage, initiated this year, is a model worth consideration.

Florida's Health Care Infrastructure

Every county in Florida has been designated by the U.S. Department of Health and Human Services as Medically Underserved Area or as containing a Medically Underserved Population. Florida's public health system, once a leader in population health, has declined over time, although there has been some resurgence in the area of disaster planning, brought on by the recent hurricane crises. To date, however, the Department of Health cannot effectively address the challenges it faces due to a shortage of workforce and funding resources. As a result, most of Florida's health care is delivered through an amalgam of public, non-profit, investor-owned, military and veteran organizations, each operating independently of the others. Clearly, the current health care delivery system is ill equipped to meet the state's population health problems.

Establishing and maintaining a continuum of basic health care services through the Public Health Department should be considered a state government priority.

The public health infrastructure in Florida, consisting of one health department per county, currently provides minimal primary care services for the poor, some health education, and disease surveillance programs. Depending on county size and location of the health department, access to care can be a challenge, particularly for the poor. Inaccessibility, whether geographic or financial, causes many Floridians to delay seeking care until problems are so acute they require high-cost, hospital-based services. Plans for sustainability need to include a significantly strengthened public health infrastructure that is both financially and geographically accessible, and more importantly, one that moves care away from acute care centers, such as hospitals, into the communities where people live.

Health care services aimed at maintaining health (health promotion), and preventing disease (risk screening and counseling) must be increased in order to reduce hospitalization rates and corresponding health care expenditures. Primary care (treatment for uncomplicated, acute disorders), preventive dentistry and vision services are essential if health disparities among Florida's population are to be minimized. Improving access to such basic health care services in communities where citizens reside might be achieved more economically through public health department partnerships with existing non-governmental health provider systems and in collaboration with key stakeholders in each community. Partnerships could increase accessibility to other health-related services, including pharmacies and social services.

Confounding the problems with public health care infrastructure, The U.S. Department of Health and Human Services has also designated every county in Florida as a Health Professional Shortage Area. Although there are large numbers of health providers practicing in Florida, they are poorly distributed for population health. Programs such as the Area Health Education Consortium (AHEC) have focused on attracting professionals into medically underserved area with some success. More is needed. Public health content needs to be emphasized in all state-funded health professional programs, including clinical rotations to public health sites. Scholarships, grants, and loans could provide support for emerging health professionals to choose public health as a career, and public health department salaries need to be market-competitive.

Consideration should also be given to restructuring the organization of health professionals within Florida's public health infrastructure. An approach similar to that of the military, where cost-effective care is delivered efficiently through a tiered-system of specialized providers, should be considered. Patients would be initially triaged by registered nurses, receive primary care from nurse practitioners and physician assistants, or be referred to acute care by internists or medical specialists. Barriers to such reorganization in the public health sector, however, will need to be addressed. Professional regulations in Florida have prevented advanced nurse practitioners and physician assistants from practicing to the full extent of their knowledge and ability. For

example, Florida is now one of only four states in the nation that prohibits nurse practitioners from prescribing a full scope of medications for their patients. There is no evidence this prohibition enhances public safety, but clearly, it does limit access to care and does add cost. Florida also is experiencing a protracted shortage of registered nurses, as well as a nursing faculty shortage. Aggressive interventions begun by state government must be sustained, as the shortage in Florida and the nation is projected to be long-term.

Priority Goals for Sustainability

While a variety of alternatives for sustainable population health in Florida have been described, several emerge as priorities:

- Ensuring basic-level health care coverage for ALL Floridians.
- Implementing a school health program provided by a qualified registered nurse in every school.
- Providing a continuum of public health services from preventive screening, to early treatment of uncomplicated, acute disorders, to timely referral for specialty care— delivered in communities where people live.
- Ensuring a well-educated public health workforce by requiring public health content and clinical rotations to public health sites in all state-funded health professional programs.

In order to accomplish these goals, Florida leaders must expand their thinking about population health. According to the Commonwealth Fund, to achieve sustainability we will need to provide high quality care that is efficient, equitable, and accessible to ALL citizens.⁹ Public health care services must be integrated and coordinated, with the understanding that sustainability can only be achieved if we systematically address the multiple determinants and “intractable disparities” in health among Floridians.²³

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Safety, Sustainability, Urban Design and Land Use Planning

Richard H. Schneider

Introduction

Communities cannot be sustained over time when citizens are afraid to use their own streets or where ‘no go’ zones proliferate that even police are reluctant to enter. While the creation of unsafe places and associated feelings of insecurity are related to factors that are long term and national in scope (such as economic forces, income inequality and the widespread availability of guns and drugs), short and mid term community level design and planning strategies can help reduce threats to security and the fears that result. In Florida, a variety of safe community design strategies can be incorporated into comprehensive plans developed pursuant to the Local Government Comprehensive Planning and Land Development Regulation Act (Chapter 163, Part II, Florida Statutes) as well as into the zoning, building regulation and design ordinances that help implement those plans. This paper considers some of those strategies and argues for a coordinated crime prevention planning approach that involves both governmental and informal organizations.

Place-based Crime Prevention

Safe community design strategies are grounded in theories of place-based crime prevention, which include defensible space, environmental criminology, situational crime prevention, and crime prevention through environmental design (CPTED). Evidence supporting these interconnected concepts has grown significantly in recent years and communities throughout the world have begun to implement the crime prevention approaches that they suggest. These strategies are unlike traditional approaches to crime that focus on offenders’ psychological or sociological dispositions, on the deployment of police, or on judicial and correctional processes. Rather they concentrate on reducing crime *opportunities* through better planning, design and management of the physical settings in which offenses occur or are likely to occur. The essence of this notion is that since behavior is influenced by the environment, we can plan, design and manage places so as to reduce or mitigate criminal behavior.

Strategies

Planning, zoning and building regulations can be crafted to thoughtfully actualize the key principles advanced by the above theories using four basic approaches: *territorial reinforcement*, *natural surveillance*, *access control*, and *property maintenance*.

The first approach, *Territorial reinforcement*, involves physical planning and design that clearly delineates public and private spaces and that helps foster the sense of responsibility and control for such spaces among their legitimate users, whether they legally own the space or not. Territorial reinforcement can be achieved through many means, including the use of paving materials, signs, fencing, or landscape definition, to

name but a few. An example of territorial reinforcement includes the encouragement of community gardens in what would otherwise be urban waste spaces. One overall goal of territorial reinforcement is to minimize ambiguous spaces (where ownership is difficult to understand) since these tend to be problematic areas, especially in distressed communities. Sustainable community design achieves this outcome through governmental outputs such as subdivision regulations, zoning requirements, site plan guidelines and plan review processes that are administered by both planners and police. Local civic, religious and non-profit organizations can have major roles in helping design these regulations so that they comport with social contexts. A caveat is that territorial reinforcement may be challenging to implement in some places such as transit stops or along transportation corridors.

A second broad strategy of the place-based crime prevention theories noted above is *natural surveillance*. This involves the design and planning of buildings and sites and the consideration of land use adjacencies so that opportunities to observe problematic areas by legitimate users are maximized. These areas may include places where money is collected or areas where people are especially vulnerable, such as parking lots. Particular design and planning attention must be paid to nighttime activities and to at-risk populations, such as children and the elderly. Natural surveillance can be augmented by CCTV or by guards, but these add-ons are inherently less sustainable than surveillance that is incorporated into the initial design of the structure or site. To facilitate natural surveillance, lighting, fencing and landscape design standards can be woven into existing building and zoning regulations or, optimally, can be integrated into new regulations. Community design guidelines can also prescribe fenestration dimensions on building facades and the placement of building entrances to maximize surveillance. Such regulations are presently found in a growing number of Florida communities as part of New Urbanist design guidelines which aim at better connecting buildings and their streets. Fundamental assumptions of natural surveillance are that observation increases risk to offenders, thereby decreasing crime opportunity, and that observers will either intervene to help victims or report offenses to authorities, neither of which is entirely true in practice. In general, however, from a crime prevention standpoint it is better for potential offenders to be observed than to be unobserved.

Access control is a third place-based crime prevention strategy that refers to the ability to constrain entrance to structures and sites in ways that maximize the flow of legitimate users while minimizing opportunities for offenders. At the individual dwelling level, access control is one of the most fundamental crime prevention approaches and is implemented by a range of target hardening systems, including strengthened doors, window systems and the addition of locking and alarm devices. At the community level, access control is easily the most controversial element of place-based crime prevention. Aspects of access control have been seen as restricting the permeability of communities by encouraging gated neighborhoods, traditional subdivision cul-de-sac street layouts, and closed public streets. These in turn are associated with a fragmented urban fabric, economic segregation, and increased reliance on personal automobiles as distinct from pedestrianism, all less sustainable options for long term community development. Nevertheless, the preponderance of evidence shows that more permeable street networks

tend to be associated with higher crime rates and many crime prevention experts and police support decisions to close streets in certain circumstances. Thoughtful design and careful attention to adjacent land uses makes it possible to reconcile some of the issues involved in these conflicting approaches, but in the ultimate analysis the community needs to be advised of positive and negative implications of street layout decisions and be part of the planning process.

Property maintenance is a fourth place-based crime prevention strategy that has design and planning implications. It is related to the “broken windows” theory which suggests that poorly maintained property sends out environmental cues as to whether anyone takes responsibility for a place and will act to defend it. The basic concept is that small acts of incivility (such as litter on the street, graffiti, or a broken window) will lead to larger and more serious acts, including criminal behavior. While some research has supported this thinking, there are other studies that suggest that the perception of environmental cues is a very complex phenomena which involves many factors and that offenders evaluate a range of cues – some environmental and some social – in selecting targets. One of these is the reputation of the area for illicit activity, something that may be independent of its physical condition. Nevertheless, property maintenance is an important planning and quality of life issue with implications for sustaining neighborhoods. Property maintenance can be addressed through code enforcement that is sensitive to local housing needs and to other local social-economic issues. These needs are often best articulated by community groups and civic organizations.

Conclusion

There are other place-based crime prevention strategies that are not discussed here because of time and space limitation. The ones presented are clearly based on institutional (formal governmental) roles and actions but civil society (including churches, NGO’s and civic organizations) plays a crucial role in crime prevention and in so doing, influences planning outcomes. As noted at the outset of this paper, safe community planning and design strategies can be built into Florida’s comprehensive plans, the basic laws that guide and govern local development, and into zoning and other codes that help implement comprehensive plans. Jurisdictions such as Broward County, Sarasota and Tampa have done this through special guidelines, ordinances and overlay zoning districts. The City of Tempe, Arizona has seamlessly woven crime prevention design within its zoning code and attributes crime reductions in many formerly problematic areas to the implementation of these strategies. Evidence from Britain, where “Secure by Design” plan review is provided by every police agency acting in concert with local planning authorities, supports the use of place-based crime prevention approaches. Nevertheless, it should be clear that none of approaches presented here is a magic bullet and that successful implementation of any or all of these strategies must be tailored to local circumstances, must be based on meticulous risk and victimization assessments, and must involve local social and civic organizations.

While many US jurisdictions have incorporated these strategies piecemeal into various housing, transportation, land use and urban design ordinances there are few coordinated

(police, planning and citizen) or comprehensive approaches to this issue. This is important because despite generally falling crime rates in the US and Florida, safety and security remain high on most citizens' list of priorities and are particularly significant issues for residents of distressed and failing neighborhoods. If Florida's cities and towns are to be sustainable, they can and should be planned and designed so that citizens are safer than they are presently from crime and from the fear of crime.

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Disaster Mitigation and Sustainability

Carol J. Lehtola and Charles M. Brown

Preparing Florida for disaster is a tall order. Because of its location and climate, Florida is highly susceptible to a wide variety of natural and man-made disasters. As we begin the 21st century and look forward to another century of prosperity in the land of sunshine, we must recognize that Florida is also a land of hurricanes, wildfires, lightning, tropical pest infestations, the occasional drought and periodic freezes.

We often view these events as unavoidable evils that damage or destroy our communities, but the experiences of the last hundreds years and a growing body of science show that these “disasters” are often essential to the health of our state. Many of Florida’s ecosystems depend on the occasional deluge provided by a hurricane and by the recycling and cleansing provided by wildfire. As our population and development crowd the coasts and encroach on inland habitats, more and more people and their property are exposed to these recurrent natural hazards.

We must learn to live with these occurrences and plan communities so as to minimize our exposure to their destructive force and to allow these events to perform their essential functions in our environments. This is how we will pass on to future generations the Florida we know and love.

As we ask how to proceed into the 21st century, we should look back to the 20th century for the important lessons it teaches about Florida, sustainability and disaster. When the 20th century began, the population of Florida was just over one half million. Florida was still a frontier, and the model for living here was one of conquering and reshaping the landscape. Now, at the beginning of the 21st century, the population is over 17 million and climbing fast. There may be 30 million Floridians by mid century. Our model for living in Florida must become one of preserving and restoring the land and living in harmony with it.

A Lesson from History

The history of the 20th century regarding Florida disasters holds many lessons, from the Miami hurricane of 1926 that cemented the collapse of the Florida Land Boom to Hurricane Andrew in 1992 that caused the near-collapse of the state’s insurance system. A quick comparison of these two storms shows change, progress, as well as continuing issues of concern.

	1926 Miami Hurricane	Hurricane Andrew (1992)
Miami-Dade population	200,000	2.2 million
Fatalities	200	15
Homes damaged or destroyed	13,000	100,000
Persons displaced	25,000–50,000	250,000–300,000
Damage estimate	\$2 billion (1990 dollars)	\$25 billion

The comparison is not exact, because Hurricane Andrew struck south of the city of Miami. If Andrew had followed the same path as the 1926 hurricane, it has been estimated that the damage would have been nearly \$100 billion.

One lesson that came out of both storms — 75 years apart — was that building codes were inadequate. An improperly built building is a disaster waiting to happen.

Yet obviously there was progress. Considering the populations that were exposed to the disaster, the death toll in 1992 should have been much higher. Advances in storm tracking and prediction, better warning systems, and a public responsive to the call for evacuation combined to reduce the loss of life from Andrew to a very low level. That is a success story.

A major outcome of Andrew was a housing boom in Broward County— directly north of Miami-Dade — as many residents of south Miami-Dade used the destruction of their homes as an opportunity to move. The demand for homes caused housing prices in Broward County to soar. Relocating may give people a sense of security, but the question remains whether their communities, housing developments, and houses are well designed for hurricanes.

Each of Florida’s major disasters – hurricanes, wildfires, pest infestations, and urban fires – have lessons to teach us, lessons that are easy to forget.

Designing for Disaster

In 1999, the National Academy of Sciences published “Disasters by Design: A Reassessment of Natural Hazards in the United States.” That publication was the result of a multi-year study involving several federal agencies. The study had the goal of bringing together and summarizing everything that science, social science and engineering could bring to bear on disaster and then making recommendations for research and policy.

In the study, it was observed that short-range thinking often causes us to apply solutions to a problem that in turn causes other problems. For example, if a hurricane causes a limb to fall on a house, the residents of that home may cut down many or all the trees in their yard. The result is that the house is now more directly exposed to destructive wind damage. In spite of the potential danger of trees in high winds, trees are often protective and their shade valuable. Similarly, a builder may choose a lower grade of shingle to save money, but if a storm rips off the roof and destroys the house, what has really been saved?

Better decisions at all levels will result from adopting a perspective that comes from:

- viewing our communities holistically — as integrated technological, economic, and social systems,
- viewing our communities in their environmental context, and
- considering solutions from a long-term point of view.

Based on considerations like these, “Disasters by Design” offered the following guidelines for sustainable mitigation planning:

1. Maintain and, if possible, enhance environmental quality.
2. Maintain and, if possible, enhance people’s quality of life.
3. Foster local resiliency to and responsibility for disasters.
4. Recognize that sustainable, vital local economies are essential.
5. Identify and ensure inter- and intragenerational equity.
6. Adopt a consensus-building approach, starting at the local level.

These guidelines promote a balanced approach. For example, we often hear environmental considerations pitted against economic considerations. It is our task to stop posing false alternatives and find ways that these interests can work together. We must promote and support measures such as:

- Community designs that do not increase vulnerability to disaster or impede disaster response or recovery,
- Community designs that do not sacrifice the quality of life of one segment of society in favor of another,
- Building codes that will make people’s homes safe places in all but the most extreme conditions.

A Typology of Impacts

Despite the wide variety of disasters that can occur, these events confront us with a combination of specific impacts. For example, a hurricane and a terrorist attack can both cause significant destruction of property and loss of life. A wildfire and a hazardous materials incident can both displace people and cause injuries. A list of impacts could include:

- Destruction of property
- Displacement of persons
- Extensive death and/or injury
- Impacts on specific economic sectors (i.e., agriculture, insurance, tourism)
- Collapse of infrastructure response (i.e., emergency services and medical facilities)
- Decontamination and disposal (i.e., biological or radiological)

Thinking about the impacts can focus our planning for resources, infrastructure, and education that will make our communities and our citizens more resilient.

Communication, Cooperation, and Coordination

Hurricane Katrina is fresh in all our minds. A year later, the aftermath is still playing out and real recovery has hardly begun. Hurricane Katrina’s impact on the New Orleans and

the Gulf Coast provided an opportunity to observe the response to disaster at an unprecedented scale. The operation of local, state, and national government was challenged and ultimately fell short in critical ways.

The network of rules, regulations and restrictions that control how governments at different levels can interact are not well designed for situations when tens or hundreds of thousands of people are suddenly in jeopardy. The incidents surrounding Katrina are unforgettable: the stranding of tens of thousands of people; the evacuation and displacement of hundreds of thousands; the destruction of thousands of homes and businesses; and the persistent flooding of a city situated below sea level and protected by inadequate structures.

We suggest three key areas that authorities and agencies should continually examine:

- Communication
- Cooperation
- Coordination

Communication implies that we need a continual dialogue about sustainable planning as it regards disaster resiliency. It now appears that the intensity of hurricane seasons varies in cycles of 10-20 years. During a period of less intense seasons, we should not slacken our planning efforts or relax our building codes — the hurricanes will be back. Communication is also about bringing all the players into the discussion. Everyone in the community has a role to play.

Cooperation is about the need for agencies and authorities to resolve internal conflicts and jurisdictional issues before a community is confronted with a wall of water, a disease outbreak or some other incident that demands that agencies and governmental entities work together.

Coordination means that not only must our agencies and government entities have an attitude of cooperation, they must also be able to work together under the most demanding conditions smoothly and effectively. Happily, interagency cooperation has become more common, but a true disaster like Katrina quickly shows how authentic and effective those efforts are. Planning, rehearsing and debriefing must become common activities if we are to be as prepared as possible when disaster strikes.

In summary, designing for disaster can help the governments and citizens of Florida prepare to meet hazardous occurrences with resiliency and to mitigate the negative impacts of those occurrences.

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The Importance of Local Culture and Community in Achieving Sustainable Development

M.A. Brennan

Introduction

A need exists for local, state, and federal policy makers to understand the important role that local culture, history, and community can play in achieving sustainable development. Sustainability and the developmental paths of communities are usually explained by reference to economics, human capital deficits, or the structure of local labor markets. Rarely, however, are the local community, its culture, and its history seen as important in achieving sustainability. Sustainability in a general sense can be seen as meeting the needs of the present without compromising the ability of future generations to meet their own needs. These needs not only apply to the environmental context, but also to our social, economic, and cultural lives. The local culture and history is central in shaping the definition and responses to community needs. Local culture and community also can provide possible solutions for addressing needs. By paying attention to and incorporating cultural values, traditions, and histories, sustainable development efforts can be achieved.

The need for such recognition is particularly important in Florida which has an incredibly rich history and wide range of cultures and communities. These cultures have dealt with Florida life in the best of times and in the most challenging of times. Their experiences are particularly relevant to sustainability. Throughout the state, we have cultures, families and communities that have existed for generations. All have developed unique histories, skills, experiences, economies, and traditions that have allowed for their continued survival and that directly shape options for sustainability. To retain their cultures, they have needed to remain somewhat self-sufficient and live in a sustainable manner within their geographic area. As a result, they clearly understand what sustainability is and how to achieve it.

However, throughout Florida many of our communities are threatened as population growth, land use pressure, and other conditions force out long-time residents or significantly alter ways of life for others. Similarly, many of our communities have become increasingly tied to outside corporate and development decisions. Such ties limit local autonomy and decision-making capacities.

The potential of local culture as a tool for achieving sustainability speaks to the need for community-based responses. Local people are in a far better position than are outside entities to understand their needs, natural resource bases, and the limits to which development can extend. However, many of our communities often need assistance in retaining or regaining their autonomy. This assistance can take the form of Extension and other trainings programs to encourage locally based community capacity building, entrepreneurial efforts, sustainable resource usage, and growth management.

Culture, Community, and Sustainability

Culture is a living thing, consisting of elements of the past and outside influences in the present. Local culture provides a basis for common understandings, traditions, and values, which are all central to residents taking action to improve local life. Culture is a motivating factor in the creation of solidarity and reflects shared identity, expected conduct, and commitment to the community. Local culture can also reflect the extent to which communities come together to address common needs. Their ability to act is vital to the success of future locally-based development efforts.

Providing a cultural and community basis for development results in several implications. People are likely to take part in, and remain committed to, development efforts to which they feel directly connected. Similarly, they are more likely to support sustainability if its impacts are ever present to them. Development efforts that consider or focus on culture provide a mechanism for linking local residents to the development process. Through such efforts, local residents can encourage development that preserves or promotes their culture and way of life. This is particularly important in those efforts that seek to elicit local participation, volunteerism, and community action. All of these directly contribute to the emergence of community and to possibilities for sustainable development.

Community, like culture, directly shapes sustainability. Community is more than a simple geographic entity. It is a social and psychological entity that represents a place, its people, its history, and the relationships that exist there. Community development is a dynamic process involving all of the diverse groups with a locality. Through these groups, people act to achieve various interests and goals. Identifying common needs and connecting these diverse individual groups is central to community and to sustainable development. Meeting these general needs contributes to the greater well-being of the entire locality, while significantly enhancing local structures or institutions. Such actions also enhance the environment for small business, entrepreneurial efforts, and other locally based economic development efforts. Furthermore, each of these groups presents an enormous range of skills, experiences, and methods for addressing local needs and problems. Bringing together these local assets allows for sustainable development efforts to be maximized. Community is important in that it contributes to individual and social well-being by establishing and maintaining channels of communication, organizing resources to meet local needs, and providing a framework where the collective is more than the sum of its parts.

When diverse individuals and their organizations interact with one another, they begin to mutually understand needs and wants that are common to all residents. Community action is the foundation of the community development process because it encompasses deliberate and positive efforts designed to meet the general needs of all local residents. Such action provides local residents with the ability to retain community identities, maintain local control over decision-making, and address their own development needs. The existence of community action directs attention to the fact that local people acting together have the power to transform and change their communities. This adaptive capacity is reflected in the ability of people to manage, utilize, and enhance those

resources available to them. As long as people care about each other and the place they live, every community has the potential for such collective action.

Extension professionals and policy-makers are frequently faced with the task of establishing programs in settings characterized by conflict among different groups of stakeholders with very different needs, values, and policy preferences. This is particularly true in Florida, where demands for various resources drive many decisions. In many communities, these conflicts are often rooted in differences between groups that seek to protect community quality and those which seek to exploit local resources (typically the local workforce and natural resource base) as a means of achieving economic development. It is important to emphasize that coordinating actions across community groups and reaching compromises do not necessarily harmonize diverse interests or completely bridge different perspectives and viewpoints. Instead, the development of community brings into focus common interests in local aspects of local life. And, of equal importance, as the linkages between residents that comprise the community proliferate, a more inclusive decision-making process ensues. The end result of this is more sustainable communities.

From Sustainable Development to Sustainable Communities

It is at the community level where the consequences of environmental degradation are most keenly felt and where successful intervention is most noticeable. There also often tends to be greater confidence in government and other local action at this level. The combination of these factors creates a climate that is conducive to the kind of long-term local coordination implicit in the term, "sustainable development." Equally important, sustainable development rooted in local communities has the advantage of flexibility. Communities differ in terms of environmental problems, natural and human resource endowments, physical and climatic conditions, and levels of economic and social development. Adopting a "one size fits all" approach is simply not possible in achieving sustainability. A community-level approach allows for the design of policies and practices that are sensitive to the opportunities, constraints, and uniqueness inherent to particular places. In more specific terms, the ideal sustainable community can be achieved along five dimensions (Bridger, Luloff, and Brennan, 2006):

1. There is an emphasis on *increasing local economic diversity*. Included is a move away from the often standard interest in bringing in national "box stores" in order to encouraging locally owned businesses. Support for entrepreneurial efforts and small business development/retention is key here. Similarly, efforts to encourage local buying and patronage also facilitates this diversity. Both may seem like an idealistic vision for economic diversity, but in reality, recent trends toward and demands for organic farming, specialty businesses, and unique tourism ventures speak to the significant impact locally based businesses can have.
2. *Self reliance*, the second dimension, is closely related to economic diversity. Self-reliance entails the development of local markets, local production, local processing of previously imported goods, and greater cooperation among local

economic entities. Self-reliant communities would still be linked to the larger economic system, but would have vibrant locally administered economies that would better protect them from the whims of global markets and corporations. Again, efforts to promote entrepreneurial efforts and locally owned small businesses would contribute to sustainability in this area.

3. A third dimension involves a *reduction in the use of energy* coupled to the *careful management and recycling of waste products*. Ideally, this means that the use of energy and materials should be in balance with the locality's ability to absorb waste. However it also reflects an efficient use of available resources, as well as planning for long term resource needs. The presence of local culture and familiarity with resources make local decision making imperative for sustainable usage of these resources.
4. The fourth dimension focuses on the *protection and enhancement of biological diversity and careful stewardship of natural resources*. Sustainable communities recognize the local resources that historically have contributed to their survival. These resources, be they forests, coastal areas, or farmlands, are part of local culture and significant to local social and economic life. Careful management and extensive deliberation on their uses is essential to sustainable development. Usage should also be in accordance with long held techniques for sustainable use.
5. Sustainable communities are committed to *social justice*, and provide for the housing needs, social needs, and living needs of all residents, without the class and race-based spatial separation of households and neighborhoods that is typical of many localities. In Florida the issues of affordable and workforce housing are becoming increasingly important and effect both our natural resource bases and community diversity. The need for such social justice also ensures equality of access to public services, and contributes to an overall greater community well-being in both the short and long term.

Perhaps most important to all of the above, sustainable communities should strive to create an empowered citizenry that can effectively participate in the decision-making process. Without locally controlled development, the chances of achieving sustainability are dim. To achieve such local empowerment, several conditions are vital:

- *Increased community capacity building*. Through Extension and other change agents, local capacity and broad based civic engagement must be encouraged. This can take the form of community organizing and advanced training and support for nonprofits and grassroots organizations (organizing, grant writing, management) to help achieve an active citizenry. Also included is the development of structures where the young and others can learn skills and achieve ownership of sustainability building efforts. Such approaches should motivate and transfer skills to people who are involved.

- *Broad based local representation* inclusive of the diversity in the local population. For all local planning efforts to be effective and sustainable, it should be mandated that local committees and planning efforts be reflective of the local population. This includes long time residents, but also newcomers. Without such local representation, the potential for select groups to be excluded, ignored, and eliminated from decision-making exists. Broad based representation is essential in that it maximizes local resources and skills for action, helps guard against local action being dominated by local elites, and ensures that the needs of *all* local groups are met. Furthermore, it ensures that the past experiences, traditions, and cultural behaviors that contribute to sustainability are not lost or ignored. Community input can be solicited through traditional methods as well as email, fax, or other avenues of communication.
- Stronger promotion, input, and *recognition of the uniqueness of local communities* and their potential for unique locally based development and sustainability. Social, economic, and other development should build on the uniqueness of local culture, history, and community identity. All of our communities have uniqueness; focusing on these characteristics allows for local control over development rather than the common dependence on outside developers and corporations.

Conclusion

Sustainability is not contradictory to growth, profit, and development. Sustainability means that we plan accordingly to our limits and that we develop based on our local strengths and uniqueness. If such efforts are undertaken, local development can be sustainable and therefore socially and economically beneficial in both the short term and the long term. Local culture and community play a central role in efforts to achieve sustainability. Ignoring the critical role of culture hampers sustainable development efforts and may render such efforts as little more than short-term solutions for long term needs.

In the absence of efforts to enhance local capacities, control, and decision-making involving residents, narrow economic interests are likely to dominate the development process. Similarly without significant local input, many measures justified under the rubric of sustainability will be little more than symbolic gestures designed to pacify opposition. The community approach to achieving sustainability presented here provides a conceptual framework for development strategies that avoid such pitfalls. Without a careful consideration and steps toward sustainability, Florida will certainly lose many of the resources, amenities, and, most importantly, the cultures that have given the state its character and history.

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Governance for Sustainability: Towards Adaptive Governance

Alyson C. Flournoy and Christine Overdevest

In the realm of governance, sustainability means decision-making that permits society to meet the needs of the present generation without compromising those of future generations. Frequent criticisms of existing governance structures from the perspective of sustainability include lack of responsiveness to the changing needs and values of the public, inability to account for and adapt to changing circumstances, inadequate responses to uncertainty and complexity, an inadequate information base, and absence of a long-term perspective.

The Century Commission has a central role to play in ensuring that Florida develops and maintains governance structures that promote and support sustainability. To promote sustainability, governance must be:

- Designed for Uncertainty and Complexity
- Responsive
- Adaptive
- Informed
- Guided by a Long-term Perspective.

This section outlines why these attributes are important and then discusses some techniques that can promote governance with these essential characteristics.

The Need for Sustainable Governance

Growth, Uncertainty, and Complexity

Florida has one of the fastest growing populations in the United States and is expected to overtake New York as the third most populous state in 2015 (Campbell 1996). As population grows, consumption, waste, and pollution will increase. Technology will change. Impacts of today will bring unanticipated impacts tomorrow. The future population's values and needs may change. As the Century Commission's mandate recognizes, this reality makes it essential that Florida develop governance that is responsive to the needs and values of this changing population. The prospect of substantial growth also necessitates governance that can adapt as changing circumstances warrant. The complexity and uncertainty created by the interaction of a larger population and the environment demands that we design governance systems that function effectively notwithstanding the limits of our knowledge. The inevitability of substantial change over time coupled with the delay between conduct and its effects makes it imperative that planning efforts employ an adequately long time horizon.

Beyond population growth, Florida faces a changing and complex environment in other ways. Governance structures must be designed to deal with potentially catastrophic events about which our information and understanding will always be limited. Weather systems, human-induced climate change, diminishing fresh water supplies, and the effects of non-native invasive species occur with natural variability and unpredictability.

Obtaining and using available information effectively is an important first step. However, in the absence of complete information and understanding, governance for sustainability requires flexible and adaptive institutions that are designed consciously to deal with uncertainty and rapid change at a variety of scales.

Responding to and taking advantage of promising developments such as environmental technology innovations similarly demands responsiveness and adaptation. New technologies can improve our quality of life and help us collectively to make sustainable choices. Governance structures must be designed to permit us to identify, carefully evaluate, and capitalize on these opportunities. Institutional changes that set general goals for growth management, increase information pooling and feedback, and encourage identification and sharing of best practices, along with on-going revision of public policy, can improve government and industry's adaptive capacity. The Century Commission's mandate to envision the future for the state will be well served by an approach that seeks to promote sustainable governance.

Techniques for Sustainable Governance

Setting General Goals, Information Pooling, Sharing, and Feedback

To promote sustainable governance, the State of Florida should consider setting general goals for the levels of environmental quality it hopes to maintain as population and economic growth occur. Setting goals, preferably through a process of broad public participation, can help communities and regions orient their policy toward the future.

In order to stimulate progress toward these shared goals, the State can adopt policies favoring efficient and effective use of information, such as increased monitoring, pooling, sharing and feedback. Adaptive governance demands that we monitor and take account of realities like population growth and other changes that affect our ecosystems and resource base. Creating greater capacity to describe and characterize changes in the landscape due to human population and economic growth is important to creating more informed public debate, analysis, and policy making.

Government at all levels, private economic actors, and civil society have important roles to play in pooling and sharing on-the-ground monitoring data and helping to analyze emerging trends in environmental quality. Greater access to baseline and trend data on key ecological indicators can help to define emerging and changing problems, create understanding of emerging hotspots, and highlight areas of relative success. Encouraging greater monitoring and feedback of baseline ecological and resource conditions is essential if we are to create a more responsive and robust governance for sustainability in Florida.

Pooling information and monitoring achievement of general goals can help Florida policymakers and industry decision-makers understand how population growth, consumption patterns, and technology changes are impacting the environment in Florida, ideally, in real time, as they occur and unfold. Richer information—and the public debate it can provoke—can stimulate and guide policy making as industry actors can gain

a better understanding of salient problems and how their actions contribute to these problems.

One way to promote the most effective and efficient use of the information would be to hold annual or biennial sustainable governance conferences, inviting government officials from around Florida as well as industry leaders and civil society to report on the status and trends of environmental quality in their area or sectors, using their access to this richer monitoring data. Regulation by information can help guide growth in Florida by empowering stakeholders including policy makers, civil society, and industry with better monitoring information. This will enable them to characterize and act on—or hold public or private actors to account for—growth-related problems.

Defining and Publicizing Best Growth Management Practices

The Century Commission's mandate includes serving as "a repository for our best 'community-building' ideas and as a resource for all Floridians." This mandate comports with the goal of governance that is responsive, adaptive, and informed.

It would be advisable for the State to create a "Best Practices Clearinghouse" to recognize and spotlight the best ideas that promote sustainability. The annual or biennial conference described above could provide a forum for collecting information on best practices as well as status and trends data. Asking community, business, and government leaders both to address trends and to think harder about which strategies work best to achieve our goals will help stimulate innovative thinking.

One possible output of such meetings could be official publications and a website seeking to identify and document best practices in Florida communities and industries. By creating and releasing an annual follow-up publication that can be shared with the legislature, communities and major industries, best practices can be more widely shared. Showcasing examples of success will help leaders facing similar situations learn how peers are approaching similar problems. Inviting environmental organizations and community and citizen groups to present their own analyses of problems and solutions should help broaden and deepen debate, and create more urgency and peer pressure for change. These sorts of multi-actor, multiple issue conferences can spur ground-up issue identification, analysis, and social learning among participants. Moreover, where regulation may be needed, best practice approaches are widely recognized to be effective and efficient (Wagner 2000). Thus the clearinghouse could also serve to support sound regulation.

Promoting Broad Participation

Sustainable governance must be responsive to the changing values and needs of the public. It requires wide participation of civil society—business groups, environmental advocacy groups, and local community and citizen's organizations—to help leaders understand how social values and desires for quality of life change over time. The State of Florida can encourage the participation of civil society, of business groups, and of citizen coalitions in assessing the conditions and responses to environmental problems. Poorer communities often find participation more difficult than their richer peers and may

need financial and technical support to understand trends affecting their neighborhoods and communities. Public commitment to facilitating meaningful input and involvement can go a long way towards validating the right to participate, on which a vibrant, responsive Florida democracy depends.

Employing a Long-Term Perspective

A central challenge inherent in dealing with environmental change is the fact that our actions today may create impacts that become manifest over a time scale that exceeds traditional one- to five- year planning horizons. Sustainable governance seeks to take better account of how today's conduct may affect future generations. This can be a particular challenge when the effects of our conduct today may not become manifest for decades. The recent recognition that current degradation of Florida's springs may have been caused by conduct decades ago and that anthropogenic emissions of the past decades are producing effects on climate today are strong indicators of the need to incorporate a long term perspective in evaluating policy options. Selecting the appropriate time scale for policy analysis is a critical challenge. The mandate of the Century Commission to develop a strategic action plan using 25 and 50 year planning time frames is an important step in addressing this challenge. Tools like carrying capacity analysis may be helpful in incorporating a long-term perspective into policy evaluation processes.

A related challenge is developing long-term funding mechanisms for government programs, so that long-term planning is grounded in a commitment of the resources necessary to meet our common goals. Without stable sources of funding, short-term politics are likely to overwhelm sustained efforts to consider anything but short-term needs and effects.

Revising Policies over Time

Planning with a long-term perspective does not mean developing rigid plans for the long-term future. Central to an adaptive approach is the ability to *adjust policies* to take account of changed conditions and new learning, always informed by a long-term perspective. Commitment to adaptation entails a commitment to responsively change rules and policies as conditions on the ground change. The formation of the Century Commission and its mandate to continually consider laws and regulations and make recommendations on how best to accommodate population growth while maintaining quality of life reflects a step towards the on-going revision necessary to adaptive governance. Building on this, the Commission may wish to study and promote statutory and regulatory approaches that facilitate incorporation of new understandings or experience, rather than those that resist adaptation.

Conclusion

In sum, sustainable governance is governance that is responsive (able to respond to the changing needs and values of the people), adaptive (able to adapt to changing circumstances), designed for uncertainty and complexity (able to function effectively in

the face of uncertainty and complexity), informed (supported by adequate information and techniques to share and pool information) and guided by a long-term perspective.

Change and uncertainty about future conditions is an inevitable state of affairs. A key to sustainable governance is accounting for change and uncertainty. In its role reviewing laws and policies and making recommendations, the Commission should remain vigilant about whether our laws and policies are designed to function effectively in the face of the inevitable change and uncertainty regarding our future.

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Education for Sustainability in Florida

Martha C. Monroe

Education systems will play an important role in the creation of a more sustainable Florida. Perhaps the most obvious examples are our public school systems, and our college and university systems. A less obvious but equally important dimension is the non-formal education sector where youth and adults learn outside of a classroom. These pages will highlight some common elements of the concept of sustainability that can be applied to all forms of education.

Education, of course, is a prerequisite for sustainability in all three components: economics, equity, and environment. Education for sustainability will help citizens ask and answer the questions that will guide them to more sustainable lifestyles, more sustainable purchases, and more sustainable careers. Unfortunately, there is no magic list of sustainable choices. We can make more sustainable decisions, however, when we critically question how materials are produced, where resources come from, where waste goes, who benefits, and who pays. Education about sustainability is not only helping people understand how to ask and answer these questions, but also about how we go about making decisions. The processes we use to create a more sustainable Florida, such as citizen participation and stakeholder groups, are just as important as the solutions they generate. Education must prepare citizens to understand and tolerate solutions as they engage in the process. Therefore, education for sustainability also enables citizens to gain the skills that will allow them to participate in planning and creating a more sustainable Florida.

Experts in all disciplines and industries, as well as residents and leaders, will be involved in moving us toward sustainability. The breadth of possibilities makes public education a critical foundation in this movement. This is not a program for specialists or for only those who express an interest, but for everyone. The design of a sustainable community means not only the design, infrastructure, governance, and materials are more appropriate (greenways, energy saving transportation and buildings, conservation areas, etc.) but also that inhabitants are able to create a sustainable lifestyle and build close relationships with neighbors, wildlife, and food and energy production, and where education, health, and diversity create full, meaningful lives for all.

President Clinton's Council for Sustainable Development outlined an agenda for action for education for sustainability (PSCD 1997) with six core themes:

- Lifelong learning in formal and non-formal education systems
- Interdisciplinary approaches
- Systems thinking
- Partnerships
- Multicultural perspectives
- Empowerment

All six themes are important to implement across all types of education: K-12, college and university, and non-formal. They are integrated into the guidelines below (Monroe 2005).

Education for sustainability is grounded in a sense of place or a home territory, and rooted in understanding the world around us.

A sense of place should incorporate both the natural environment (e.g., local plants and animals, watersheds, weather patterns, and topography) and the social environment (e.g., systems of governance, culture, community organizations, decision making, and local economy). Rather than memorizing their place, youth should come to know it by experiencing it, using it, and enhancing it. Developing a sense of place is hard to do from textbooks. It requires exploration of the world around us and development of a deep understanding of our community (Sobel 1996). While many elementary schools help youngsters explore their place, it is the rare high school and university class that does so. New residents have little idea where their water comes from, where their garbage goes, or how Florida's climate should affect home design and how Florida's ecosystems should affect landscaping.

Florida Gulf Coast University's Colloquium is a notable exception and an excellent example of how education can foster sustainability. This course is required of all students in all majors and covers three themes: building a sense of place, developing an ecological perspective, and sustainability. Field trips, readings, journal entries, and community projects engage students in learning through experiencing these key concepts.

Learning about place is not limited to formal education, however. Florida currently operates an extensive state-wide non-formal education system, the Cooperative Extension Service. With agents and advisory boards in every county, extension programs help meet the needs of local citizens. Current efforts at sustainability are limited to individual sectors, such as clam production, energy efficiency, forestry, or subdivision design, but there is a potential to orchestrate a more comprehensive program to serve communities as they identify the challenges and opportunities for becoming more sustainable. Michigan Extension operates a ten-week course to help citizens serve on local planning boards. Connecticut Extension coordinates a regional approach to water quality that engages citizens in planning for development, conservation, and agriculture.

As we learn more about the world around us, we find there is more to learn. Providing for lifelong learning in formal and non-formal systems about the place we live in is an important strategy to achieving sustainability.

One result of formal education is that students graduate without knowing how to think in whole systems, how to find connections, how to ask big questions, and how to separate the trivial from the important. Now more than ever, however, we need people who think broadly and who understand systems, connections, patterns, and root causes.

David Orr, Oberlin College

Education for sustainability helps learners see connections.

Connections can be drawn by looking forward in time and asking: What will happen if? Or what are the consequences of that? Connections may also be revealed between formerly distinct disciplines, as in the ecology, economics, and social benefits of urban forests. If we do not see connections, we are less likely to realize how economic development, social equity, and environment are intertwined. These connections are less likely to be apparent to learners who spend their day in 50-minute periods of mathematics, science, language arts, and history. They are more likely to evolve in schools that have teams of teachers working on cross-cutting themes, community projects, or systems thinking. Using our own communities to study water quality, affordable housing, migrant farm labor, public transportation, emergency response, or sources of food can help learners see these existing connections (Capra 2000). It is important to remember that sustainability is neither a target nor a showcase. It is a perspective that encourages us to make decisions that are more environmentally sound, socially just, and economically viable.

Outside of the formal education system, institutions such as museums, zoos, faith-based organizations, and community centers provide newsletters, programs, workshops, and opportunities for youth groups, families, and adults to learn more about the world around them. While coordinating a state initiative in sustainability may be difficult among these independent entities, they all respond creatively to the needs in their community. As citizens ask questions about sustainability, these non-formal organizations may be the first to be able to respond with helpful educational programs. Brooker Creek Environmental Education Center in Pinellas County has award-winning exhibits that introduce visitors to their watershed and focus on the importance of conserving and managing our limited natural resources. In collaboration with the Southwest Florida Water Management District, the Center raises awareness about nonpoint water pollution such as fertilizer run-off. The voluntary Brooker Creek Watershed Pledge gives families a chance to prevent water pollution by making simple changes around the house. The program encourages watershed residents to stand together to protect the water quality in Brooker Creek and to see the connections between their actions, water quality, wildlife enhancement, and ecosystem restoration.

The best way to ensure that education for sustainability reaches all citizens may be to link non-formal programs with schools and universities, through after-school enrichment, field trips, class projects, and partnerships. Greg Ira, Florida DEP

Education for sustainability prepares all students to contribute to the work force.

Community colleges and universities prepare students for careers, often in partnership with local businesses and industries. Education for sustainability means that every program should consider what will change as we reconsider the economic, equity, and environmental consequences of each career. Many initiatives to identify, admit, and mentor students from low-income communities are helping to bring positive changes to

families who might have been left out of the economic boom. Every institution should see these efforts as enhancing sustainability.

The Leadership Development Academy, a signature program of the Belafonte Tacolcy Center in Miami, promotes leadership and civic responsibility through four strands. Each strand exposes participants to careers through practical experience and interaction. The strands are entrepreneurial literacy, environment, technology, and health. In addition to choosing strands that are interesting to their audience, the Center has also woven themes of sustainability into this non-formal, multicultural program.

The Educational Alliance for a Sustainable Florida worked with business schools to develop a set of teaching case studies on sustainability in Florida businesses. While sustainability is often popular in environmental and architecture fields, it has been less so in business schools. These cases make it possible for future business leaders to understand sustainability and the Triple Bottom Line (economic, environmental and social valuation) through the voices of people who have made those decisions.

Education for sustainability empowers learners.

Enabling learners to contribute to a sustainable future involves enhancing critical thinking and decision making skills. Leaders will be needed in every possible sector to move society in new directions. Skills for participation and action, based on thoughtful investigation and data analysis, should be practiced in school (Hammond 1996/97). Lee County Schools has been a national leader in using local community issues to engage high school students in problem solving. The local power plant asked the students to help resolve a conflict with manatees and water temperature. Students have developed initiatives that have been approved by taxpayers to purchase conservation lands (Hammond 1992). By focusing on real problems and taking the time to learn the many aspects of an issue, students gain skills in research, analysis, public speaking, and problem solving. They become better thinkers and are more motivated learners (Ernst and Monroe 2004).

Investigating local issues provides an excellent opportunity to blend information from various disciplines, and apply it in the community, such as the Coastal Scrub education project at Pelican Island Elementary School. In partnership with thirteen agencies and conservation organizations, elementary teachers and students developed a magazine for fourth graders, field guides, and a video to increase public understanding of the importance of coastal scrub habitats. The school also acquired and began to manage a parcel of coastal scrubland during this project. The children's efforts created a strong, interested, and supportive community in Indian River County, which eventually resulted in the acquisition of another small parcel of scrub. In addition to learning about the environment, these youth learned about county government, civic participation, and public relations. They gained skills that will last a lifetime and learned that they can make a difference to enhance the sustainability of their community.

The only way of having any confidence that students will later succeed is to be sure to provide them not just with information, theories, and skill-building activities, but also with opportunities to gain experience in applying knowledge and skill to appropriate, real community action projects under expert adult mentorship.

William Hammond, Florida Gulf Coast University

Educational institutions should model sustainability.

K-12 schools can not only establish a framework for seeing connections and practicing skills but also implement sustainable practices with school lunch recycling and composting programs, school gardens, and student councils. These Green Schools are becoming community symbols of new ways of thinking about resources, economics, and equity. Education for sustainability also places a responsibility for modeling sustainability with our colleges and universities. These venues should be leading edge examples of building design, transportation systems, food and materials procurement, and waste disposal. Research on new methods of converting waste to resources, using resources more efficiently, and creating new processes that use sustainable resources is essential. Courses that envision a sustainable future could be built into the curriculum; existing courses can use case studies and community projects to highlight sustainable practices and projects. The University of Florida, for example, currently offers more than 100 courses that emphasize a thread of sustainability, some of which are organized into graduate or undergraduate concentrations, such as those in Building Construction, Environmental Engineering, and Architecture. By understanding and resolving real community problems, students can see themselves as leaders in a sustainable future. Efforts in workforce development should link the business community with educators in productive, effective partnerships. These university and college campuses will become living laboratories for sustainability. Our students can apply and practice what they are learning in the classroom to their daily lives. Through this practical application, students develop habits that reflect principles necessary for a sustainable future. They will take these principles and sustainable practices with them into their lives as citizens, parents, civic leaders, and business professionals.

Florida Gulf Coast University, for example, not only has an Environmental Stewardship Plan and an Environmental Stewardship Advisory Council that reports to President Merwin, but the President's annual performance measures include working with the Council and establishing a structure to advocate and evaluate strategies for environmental safety and management. This level of commitment helps to build a culture that supports sustainability.

Conclusion

Education is a key aspect of moving Florida toward sustainability. There are a variety of strategies that can be employed; all of which will likely help but none of which will be successful alone. Educators, administrators, community organizations, faculty, local government, and the business community must all be empowered with the responsibility to improve our educational systems and practices. Education for sustainability does not

mean a new course or a visit to a special house. A perspective on sustainability must become part of every discipline (but perhaps most clearly social studies, science, and business) to allow citizens to understand options and make good decisions.

Fortunately, strategies for education for sustainability are being explored, developed, and implemented by educators in Florida and around the world. Despite the challenges, these educators in formal and non-formal systems are able to help learners develop lifelong skills and perspectives that will enable them to function in a sustainable world. The experiences and wisdom from their examples can be harnessed to help guide the development of new educational systems for Florida.

Specific near-term actions that could move us in the right direction:

- Include sustainability in Sunshine State Standards for social science and science.
- Include facilitating community-based projects in all teacher education programs.
- Create a small grants program to promote sustainability in non-formal community programs that link to K-12 schools.
- Promote sustainability perspectives in all grade levels, all disciplines, all departments, and all universities and colleges, especially education, business, architecture, engineering, and law.
- Provide awards to educators who teach students to have a sustainability perspective.
- Build community action projects into high school graduate requirements.
- Sponsor the development of stories, plays, songs, TV shows, and videos that promote a sustainability perspective. Include the stories in the reading curriculum.
- Develop a state-wide extension program to promote community sustainability and sustainable living.
- Change the financing for new construction of campus buildings that model sustainable practices so that the investment in the construction can come out of cost savings in operations over time.

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Sustainable Economic Development in Florida

David Denslow, Jim Dewey, and Babak Lotfinia

Floridians are lucky as a people to have a home graced with pleasant weather, beautiful beaches, relatively low prices, numerous venues for entertainment and recreation, vibrant and diverse cultures, and proximity to rapidly developing nations and major trade routes. Yet the benefits deriving from these advantages will be fleeting if we do not leverage and protect them. To best serve its citizens, the state must strive to make full, responsible and sustainable use of these endowments. In this section we discuss what economics has to say on ensuring the long-term welfare of the state's environment and economy. But before that, we pause to consider how complementary the two are: the first term, environment, derives from an old French or Spanish term meaning *neighborhood*, while the latter term, economics, comes to us from the Greek term for *steward*. Prosperous, educated Floridians are apt to care for each other and Florida's natural bounties, and a clean, well governed state will be a pleasure to live in and be a fine example of the American Dream.

Accounting for the environment

As a sign of how public environmental concerns have changed over the past century, the major environmental concern of the early twentieth century in major American urban areas was the large accumulation of horse manure. Though the automobile solved that problem, it introduced others, notably smog. As the century progressed, other issues arose, including soil erosion, the harmful effects of pesticides, lead, asbestos and toxic wastes, air and water quality, and the survival of endangered species.²² Issues of particular concern to Florida included the health of the Everglades and our beaches and the extent and nature of urban growth.²³

As the 20th century closed, the weight of the evidence supported the contention that perhaps the major problem for the 21st century will be global warming.²⁴ It has also

²² Chapter 7 of the *2000 Economic Report of the President* (available at http://www.gpoaccess.gov/usbudget/fy01/pdf/2000_erp.pdf), "Making Markets Work for the Environment," acknowledges the turn of the century by taking a long view of the economics of the environment. In *Collapse: How Societies Choose to Succeed*, Viking, 2004, Jared Diamond describes how several societies collapsed by failing to take a long view of their natural resource settings. For a partially contrarian review of *Collapse*, see "Of porpoises and plantations," *The Economist*, January 13, 2005.

²³ See the Florida Department of State's description of the Everglades Restoration Act (<http://www.dep.state.fl.us/evergladesforever/restoration/default.htm>) and the National Park Service's description of the uniqueness of the Everglades (<http://www.nps.gov/archive/ever/home.htm>).

²⁴ The Environmental Protection Agency's website contains useful information about global warming (<http://yosemite.epa.gov/oar/globalwarming.nsf/content/climate.html>). Another perspective is provided by the National Research Council of the National

become clear that the rising temperatures will affect different parts of the planet in varying and complex ways. Though dealing with warming requires cooperation among the nations of the world, Floridians would be most prudent to formalize an ongoing process for applying the world's rapidly-advancing understanding of global warming to our state: what will global warming imply for our coastal areas, for the Everglades, for local endangered species, for hurricanes, and for building codes. The only safe prediction is that ten years from now, models of global warming will be far more advanced than they are at present, and the sooner we grasp the implications for Florida, the better.

Though the methodology has yet to settle definitively, the state should investigate "environmental accounts," which are similar to the environmental satellite accounts that in the past have been considered for adding to national income accounts. Whereas Gross Domestic Product and the corresponding Gross State Product focus primarily on market transactions as a measure of economic activity, the state satellite accounts would independently track how current environmental changes affect the quality of life both now and in the future. In the words of the U.S. Bureau of Economic Analysis,

Environmental variables affect economic well-being in three major ways: direct effects on consumption or income of households, industry, and government; accumulation in the environment of stocks of residuals that then affect economic activities or economic assets; and effects on the service flows of economic assets, including capital stock, natural resources, and human resources.²⁵

Environmental accounts would provide a measure of whether current activities are sustainable in the sense that the next generation will be able to enjoy the same environmental and economic quality of life as the present one, while devoting an equal percentage of its resources to following the same golden rule with respect to those who will follow them.

Sustainable growth in the state is too large and too important a task to be attempted inefficiently. For that reason, whenever feasible we must join growth to the power of the market, providing incentives for individuals and firms to maintain our natural resources to the point at which the marginal social benefit of doing so equals the marginal social cost. Some rationalizing and environmentally-conscious steps in that direction might include:

- Allocating water by willingness to pay, not by grandfathered privilege. Although not without problems, Australia has developed a sophisticated water pricing and

Academies of Science, *Climate Change Science An Analysis of Some Key Questions*, 2001. On the impacts global warming see Pew Center, *Observed Impacts of Global Climate Change in the U.S.*, November 2004, or see <http://www.pewclimate.org/global-warming-basics/>, the Pew web site.

²⁵ See "Accounting for Renewable and Environmental Resources," *March 2000 Survey of Current Business*. Available at <http://www.bea.gov/bea/an/0300are/maintext.htm>; accessed 29 August 2006.

- trading system that it uses to combat depleting rivers and the general dryness of the continent.²⁶
- Likewise for electricity, end-user prices should perhaps vary with demand by time of day, encouraging firms and households to make more use of the electrical grid during off-peak hours. Crucial to the success of such a plan would be the adoption of computerized “real-time” meters, which would allow electricity firms and households to monitor usage and exposure to swings in the market price of electricity.²⁷
 - Congestion fees, perhaps with similarities to those employed successfully in London, could be used to reduce pollution, noise and fatalities caused by overuse of cars during peak hours. Currently, motorists are able to crowd roads as if extra rush hour capacity were free, when there is in fact significant external cost.²⁸
 - Whenever the net social costs of new development exceed the taxes such development will generate, impact fees should close the difference. While dense coastal development can enhance thousands and perhaps millions of lives, it should not be subsidized by the rest of the state.²⁹
 - Florida should continue to purchase and preserve land and tracts of reefs and sea-beds with unusual or important environmental characteristics. The state, taking a cue from Brazilian efforts to protect the Amazon, might also encourage the formation of large, private nature reserves.

Though the use of economic incentives often has the advantage of providing public revenue that allows other taxes to be reduced, as a practical matter, not every situation allows the power of the market to be harnessed efficiently. In such cases regulation might be a solution, but such regulations should be based on the best scientific knowledge available and, to the extent possible, match marginal social benefits to marginal social costs.³⁰ While the state must not allow individuals and firms free rein to waste Florida’s natural resources, it must carefully and periodically weigh the costs and benefits of each regulation.

²⁶ “Drizabone,” *The Economist*, May 5, 2005.

²⁷ “Beyond the pool,” *The Economist*, March 1, 2001.

²⁸ “Bigger and dearer,” *The Economist*, July 07, 2005.

²⁹ Development directed towards retirees are especially undeserving of subsidy, since retirees as a class 1) are net-beneficiaries of and federal and state entitlement programs, 2) a fiscal wash from the state’s perspective, and 3) are able obtain significant tax advantages by relocating from northern states to Florida. See *Tough Choices: Shaping Florida’s Future*, David Denslow and Carol Weissert eds., available at http://www.bebr.ufl.edu/Publications/Tough_Choices.pdf. See especially, David Denslow, “Empty nesters and retirees,” *Tough Choices*.

³⁰ The indirect costs of regulation, however, can be substantial, so the benefit to be reaped from state intervention should be significant before regulations can be imposed.

Education and enterprises

The suggestions outlined above, and others as determined by more rigorous analysis, will go a long way to making Florida a good, healthful place to live, but the state needs also to work on being a good place to start and run a business. The two biggest obstacles to the state's long-term plans for economic development are the condition of its education system and its exceptional reliance on the corporate income and property taxes. Florida now trails not just the United States as a whole but also the other states of the South in per-student funding and in teacher salaries. This matters because Florida's quality of education has a direct effect on the quality of our labor market. Florida's metropolitan labor markets, with few exceptions, consistently under-perform the nation in average occupational wages and in the proportion of high-wage occupations. Much of this difference stems from the relative dearth of college graduates and the large presence of retirees who demand goods and services typically provided by low-wage occupations.³¹

This contrasts sharply with the fact Florida ranked sixth nationwide in fiscal year 2002-2003 for total revenue derived from the corporate income tax.³² In sum, Florida taxes its low value-added firms as if they were high value-added. Taxes on firms' capital are damaging to the broader economy in their own right: firms pass those taxes on to workers and consumers, in the form of lower capital accumulation (leading to lower productivity and wages) or higher prices, or both.³³ Capital and personal income taxes are also shown to significantly reduce entrepreneurial activity, which is precisely what we do not want if we are to create a dynamic, enterprising population.³⁴

Attracting and preferably generating high-tech businesses in Florida is of special importance for creating a sustainable Florida. Such firms are sources and incubators of managerial talent that can spread to and spark innovation in the public and voluntary sectors. The children of their workers will grow to love and stay in a state that can provide them opportunities for remunerative careers, a pleasant climate and natural beauty. Moreover, the affluent population that follows innovative and productive firms is more likely to proactively care for education and the environment and support policies towards those ends. Here we offer some thoughts that might be of use in preparing a sustainable, prosperous citizenry:

- Make Florida's per-student funding and teacher salaries for primary and secondary education competitive with other states. Florida can knock many states

³¹ See Jim Dewey and David Denslow, "The Quality of Florida's Job Structure," a report commissioned by Enterprise Florida, Inc., the state's public-private partnership for responsible for economic development. Available at [http://www.behr.ufl.edu/Publications/Job Structure Summary.pdf](http://www.behr.ufl.edu/Publications/Job%20Structure%20Summary.pdf).

³² Table 439, *2006 Statistical Abstract of the United States*.

³³ "Capital Taxes are Passed on to Workers and Consumers." NBER Website. Tuesday, August 29, 2006. <<http://www.nber.org/digest/oct04/w10262.html>>.

³⁴ "Taxes and Entrepreneurial Activity." NBER Website. Tuesday, August 29, 2006. <<http://www.nber.org/digest/nov02/w9015.html>>.

out of the water in terms of climate and amenities, but other Southern states offer fierce competition. It will require substantial increases—roughly 7 percent annually—in funding to simply maintain our relative position over the coming years. If our objective is to match the nation, as it ought to be, we should budget for annual increases of more than 10 percent.³⁵

- Florida’s school districts (and perhaps counties) are likely too large for optimal funding over the long-term. By 2030, persons aged 55 and above will account for at least half the electorate,³⁶ and the evidence is clear that seniors prefer lower spending on education than do younger households.³⁷ One way to accommodate both would be to allow geographically and demographically smaller, but more fiscally autonomous districts.³⁸ Large state grants to targeted districts would help ensure the equity of such a system.
- Increase funding to state colleges and universities. Firms employing college graduates tend to locate in states that generously fund higher education, and those workers move to states where firms demand their labor.³⁹ Florida’s systems of higher education have currently undergone significant administrative changes, but funding is perhaps the largest hurdle they face. The average tuition charged by Florida’s community colleges and state universities is dramatically lower than most other states, even in the South.⁴⁰
- Although the state government forecasts trends in revenue through the Consensus Estimating Conference, Florida currently has no way of making long term projections of its expenditures. Considering the state’s ambitions and desires, and the long-term budgetary uncertainties surrounding federal entitlements, this lack of expenditure forecasting is an oversight. Executives and legislators, as well as the general citizenry, must have at least a loose idea of the state’s overall long-term fiscal health.
- While high taxes levied on firms are a natural consequence of some popular policies, they pose a severe threat to the state’s abilities to reach its potential. For the reasons discussed above, we feel that Florida’s situation and the detrimental effects of these taxes warrant serious, reasoned reevaluation and debate of costs and benefits of the state’s fiscal structure.

³⁵ See Jim Dewey, “Funding Florida’s education standards,” *Tough Choices*.

³⁶ “Florida Population Studies,” vol. 39, bulletin 145, p. 74; June 2006. Bureau of Economic and Business Research at the University of Florida.

³⁷ James Poterba, “Demographic Structure and the Political Economy of Public Education,” July 1997, National Bureau of Economic Research, Working Paper 5677.

³⁸ Blair R. Zanzig, “Measuring the Impact of a Competition in Local Government Education Markets on the Cognitive Achievement of Students,” *Economics of Education Review*, Vol. 16, No. 4, pp. 431-441, 1997.

³⁹ Arthur O’Sullivan, *Urban Economics*, 5th edition, McGraw-Hill Irwin, Boston, 2003, p. 81.

⁴⁰ College Board. “Trends in College Pricing 2005.” Accessed 16 January 2006; available at: http://www.collegeboard.com/prod_downloads/press/cost05/trends_college_pricing_05.pdf.

Conclusion:

Many environmental and economic issues are neither easily understood nor cheaply solved, and many may require tough political decisions and trade-offs to address. The better the understanding held by Floridians of basic science, economic incentives, and the complexity of the environment and economy, the brighter and more sustainable their policies will be.

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