

December 2006

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## Recommended Citation

Courtney, James, "Decision Support Models for Environmental Management: A Pricing Model for Florida Scrub Habitat" (2006).  
*AMCIS 2006 Proceedings*. 192.  
<http://aisel.aisnet.org/amcis2006/192>

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# Decision Support Models for Environmental Management: A Pricing Model for Florida Scrub Habitat

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## ABSTRACT

Environmental ethicists believe it is immoral for human action to result in the extinction of a species. The US Endangered Species Act of 1973 codifies this belief. This paper describes an ongoing case study involving the development of a DSS model to predict the price of Florida scrub habitat. This habitat is crucial to the survival of the Florida scrub-jay, a bird found only in Florida that is listed as threatened on the endangered species list. To develop on lands that are occupied by Florida scrub-jays, the property owner must provide mitigation fees for the impacts. The basic question addressed is whether the mitigation fee is adequate to keep up with land price inflation for the next few years. The case involves the use of software designed to support the visualization of planning models by providing simple mechanisms for visualizing results of “what if” analyses. Engaging visual displays may enhance the ability to convince decision makers and the general public to provide adequate funds to protect this endangered bird.

## Keywords

Scrub habitat, Florida scrub-jay, spreadsheets, visualization, planning models

## INTRODUCTION

Epstein (2002) traces the history of environmental ethics back to Lynn White’s classic paper "The Historical Roots of our Ecologic Crisis" (1967) and Garrett Hardin's "The Tragedy of the Commons" (1968) in the journal *Science*. The Wikipedia, the free, online encyclopedia indicates that:

**Environmental ethics** or environmental philosophy considers the ethical relationship between human beings and the environment in which they live. It exerts influence on a large range of disciplines including law, sociology, theology, economics and geography. There are many ethical decisions that human beings make with respect to the environment. For example:

- Should we continue to clear cut the forests for the sake of human consumption?
- Should we continue to make gasoline powered vehicles, depleting fossil fuel resources while the technology exists to create zero-emission vehicles?
- What environmental obligations do we need to keep for future generations?
- Is it right for humans to knowingly cause the extinction of a species for the (perceived or real) convenience of humanity?

In the US, the Endangered Species Act of 1973 was in part a response to this movement and directly confronts the last question in the list above with a definite “No!” The Act protects not only the species on the endangered or threatened, but also the ecosystems on which they depend. This paper describes a financial planning model that is designed to help protect the habitat of one such threatened specie, the Florida scrub-jay. This threatened bird is described in the next section, then a DSS model designed to help in planning habitat acquisition is described. Finally some conclusions regarding the future of the bird are drawn.



## THE FLORIDA SCRUB-JAY AND ITS HABITAT

The Florida scrub-jay is protected as a threatened bird on the U. S. Endangered Species List. Florida scrub habitat is critical for the continued survival of the Florida scrub-jay as the bird is found only in association with this ecosystem (Banyan and Maletesta, 2000). The birds mate for life and are very territorial, establishing an area of about 25 acres. Offspring stay within this area also, thereby establish a familial territory. This makes it very difficult for them to establish a new territory, especially since Florida scrub habitat is among the most threatened in North America (Banyan and Maletesta, 2000).

The ecosystem itself is very dry and supports limited foliage, with much open, sandy area and trees less than 10 feet tall. The scrub-jay requires patches of bare sand to bury acorns, their favorite food, which is stored for later consumption (Sharpe, 2005). Unfortunately scrub habitat is relatively easy to clear for development or agricultural purposes such as orange groves (Banyan and Maletesta, 2000).

To develop on lands that are occupied by Florida scrub-jays, the property owner and/or developer must develop a Habitat Conservation Plan which includes an element called an Incidental Take Permit. This process, which includes a mitigation element, allows the habitat to be cleared if the conservation plan is approved.

To satisfy the mitigation provision, the developer must set aside 2 acres of scrub habitat for each acre impacted by development or pay a fee of which effectively amounts to \$45,552 per acre impacted. (The fee is actually \$22,776 per acre, but fees must be paid for 2 acres for each acre impacted.) The mitigation fees are collected by the United States Fish and Wildlife Service, the agency with jurisdiction over scrub-jay issues, and are to be used for the purchase of scrub habitat to benefit the long term survival of scrub-jays.



Florida, like many parts of the US, has been experiencing a boom in housing development. This is rapidly driving up the price of land, including scrub habitat. The purpose of this project is to look at the cost of land within scrub habitat to date and project future land prices per acre. This would allow for a comparison of the cost of mitigation fees to the land prices, and an estimation of the rate of development within scrub habitat. The basic research question being addressed is thus: “Can a decision support systems (DSS) model be developed to assist in determining if mitigation fees and the mitigation process are adequate in living up to the legal and ethical obligation to protect the Florida scrub-jay now and in future years?” The model is to be tested on data for a county in central Florida.

## THE SCRUB HABITAT PRICING MODEL

The scrub habitat pricing model is quite simple. The equations are simple trend lines and price projections are based on expected inflation rates in central Florida. Four property types were identified for this project single family, commercial, industrial, and institutional. The model projects total property development in each category based on historical growth rates then estimates the percentage of that growth in scrub habitat, also based on historical data. Preliminary data for the model has been gathered from the tax rolls and a geographic information system of a Central Florida county in which scrub jays are found. The data has turned out to be somewhat “messy” and is going to require considerable cleansing to make it useful.

Assumptions made for the model are as follows:

- Mitigation fees per acre were \$6000 from 1999 to 2003, \$7400 for 2004 and 2005, and will be \$22,726 thereafter (so these numbers must be doubled in the model).
- The average percent increase in price per acre from 2003 to 2005 provides the average annual increase in land prices from 2006 onwards.

- Average acres sold per year are equal to the sum of acres sold between 1999 and 2005 divided by the number of years.
- The percent of development within scrub habitat is derived from the average projected rate of development from 2005 to 2009 in the cities that contain scrub habitat.
- Rate of development in scrub habitat increases by the average percent each year. To estimate the total number of acres developed from 2006 to 2009 the years would need to be added together.

The projections are based on the raw data obtained from the County's database. The projections will be used to compare mitigation fees against the projected costs of land within scrub habitat to determine whether sufficient funds will be available to maintain scrub habitat.

#### **A PLANNER'S LAB APPLICATION OF THE MODEL**

An application of this model has been developed in the Planner's Lab (PL) software developed by GRW Studios of Omaha, Nebraska (GRW Studios, 2005; Wagner, et al., in press). This software integrates seamlessly with Macromedia Flash MX and has excellent facilities for visualizing model results very easily. It is available to universities free of charge for educational and administrative use. A screen shot with some of the equations for the model is shown in Figure 1. Equations for residential parcels are shown in the text below to make them more readable.

The Column statement at the top of Figure 1 indicates that the model is to cover years 1999 – 2009. Also, equations are arranged into hierarchical nodes. Thus, for example, in Figure 1 we have nodes for Residential Land, Commercial Land and Mitigation Fees. The Residential Land equations are currently displayed. Notice that the equations in Planner's Lab models are written in algebraic form rather than in the row-column kind of references that are used in spreadsheets such as Excel. It is easy to view and edit equations in this manner. For instance, the inflation rate for residential land is shown in Line 1 and currently is an astronomical 38%! The rate is automatically extended the columns for each year by the PL software. The price per acre for 1999 through 2005 is shown in Line 2. For 2006 onward, prices increase by the rate of inflation. Line 7 shows the calculation for mitigation fees each year, and Line 8 calculates the number of residential acres that can be purchased with those mitigation fees given the price per acre for each year.

% Residential Inflation Rate = 0.38785

\$ Residential Price Per Acre = 33093.31, 21998.59, 43896.93, 31242.77, 46063.95, 115837.01, 122884.48, PREVIOUS \* (1 + Residential Inflation Rate)

% Residential Development Growth Rate = 0.21

Residential Parcels Developed = 0 FOR 6, 1944.05, PREVIOUS \* (1 + Residential Development Growth Rate)

% Residential In Scrub Habitat = 0.21

Average Residential Parcel Size = 1.2362

\$ Residential Mitigation Revenue = Residential Parcels Developed \* Average Residential Parcel Size \* Residential In Scrub Habitat \* (Mitigation Fees IN Mitigation Fees \* 2)

Residential Purchasable Habitat = Residential Mitigation Revenue / Residential Price Per Acre

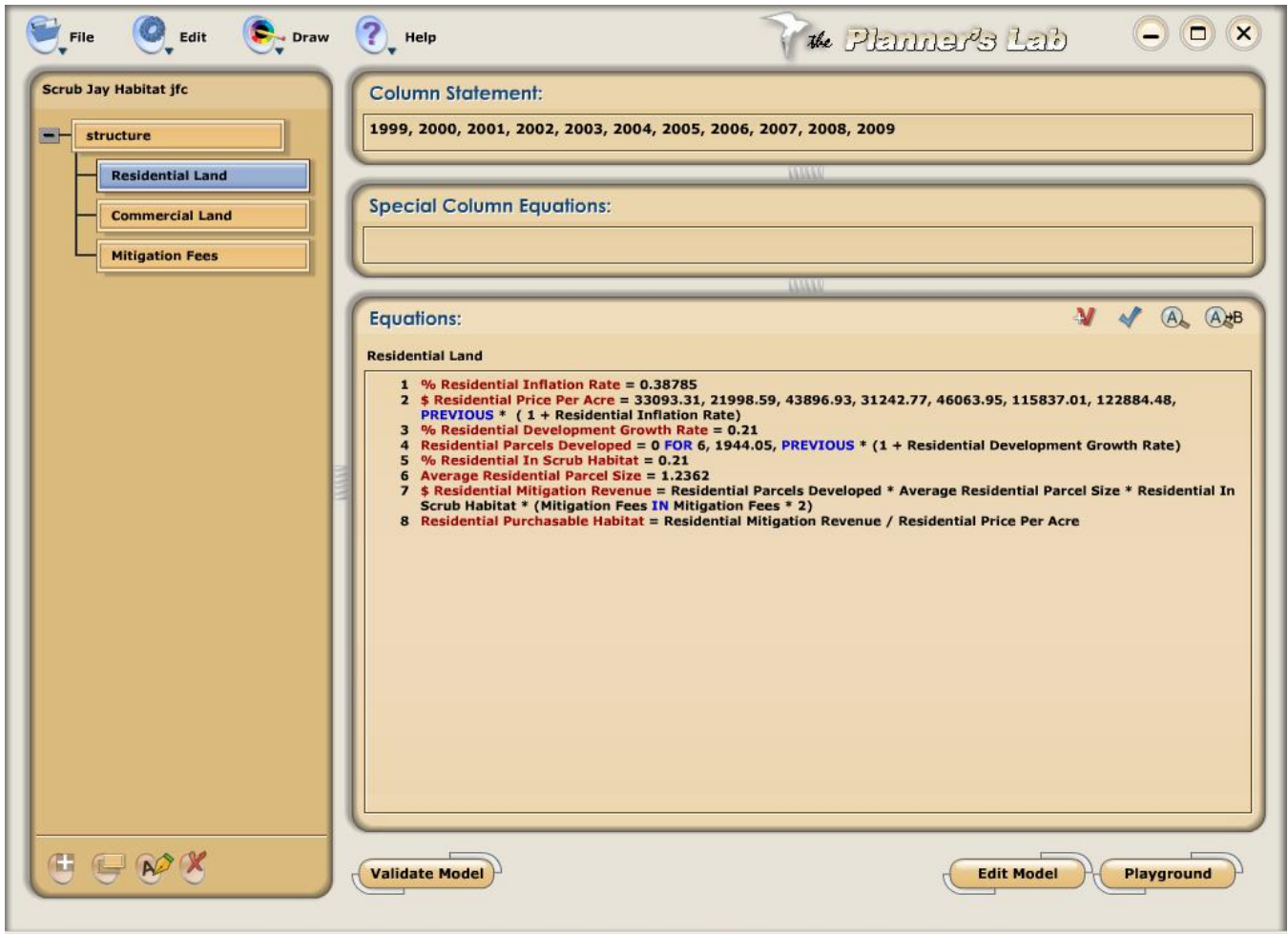


Figure 1. Equations for Residential Parcels in the Scrub Habitat Model in the Planner’s Lab Software

**WHAT IF ANALYSIS**

What if analysis with the PL software is visually engaging and very simple to perform. A screen shot using trend lines for doing what if analysis is shown in Figure 2. The number of acres that can be purchased with the current level of mitigation fees has been chosen as the goal variable. Additional target variables can be chosen, if desired. What if variables are the residential land inflation rate, the rate at which residential parcels are being developed, and the mitigation rate. Data is not yet available for 1999 – 2004, so the line is at 0 for those years. With the current values, it is easy to see how the number of acres purchasable declines as price per acre goes up.

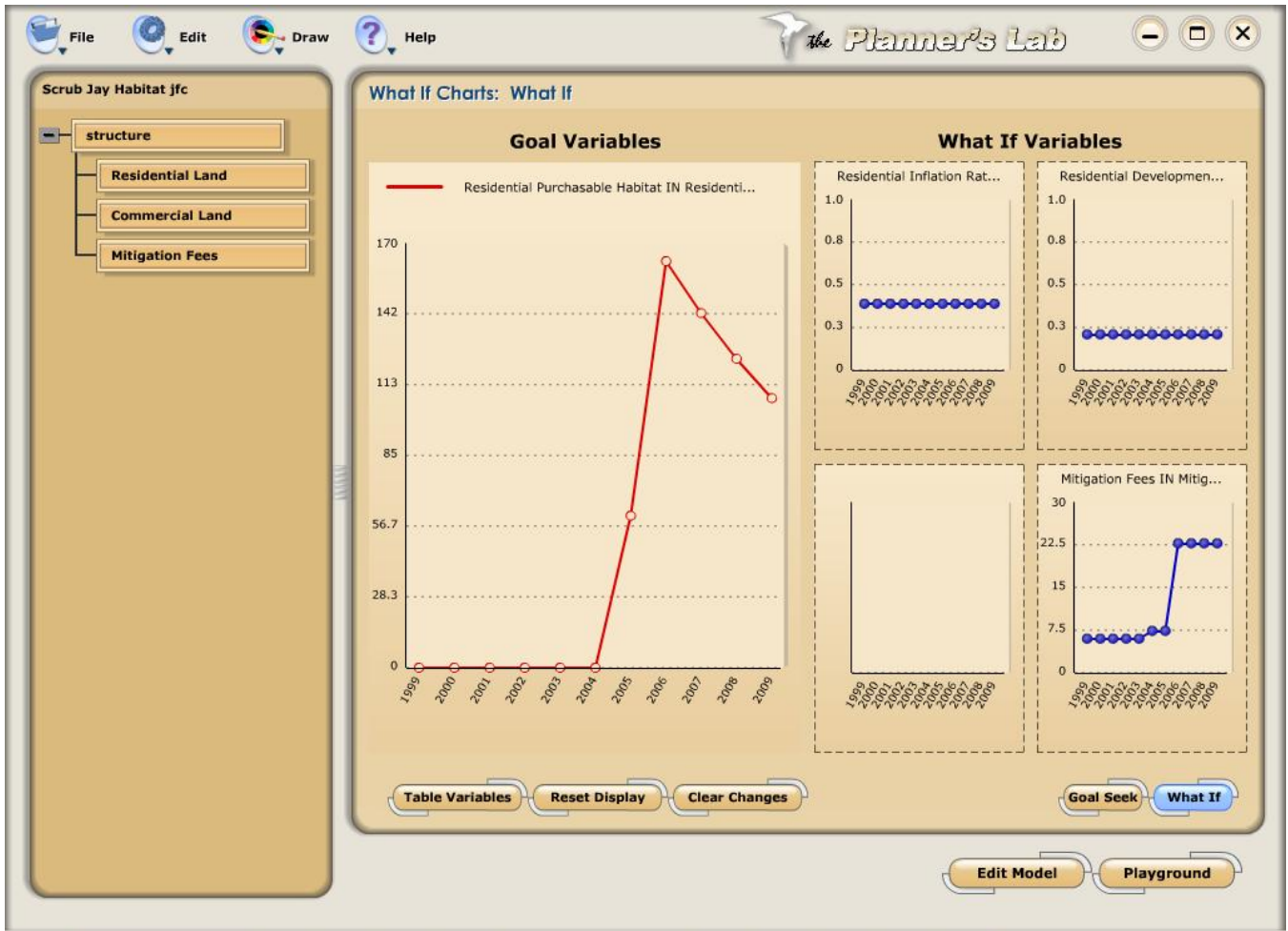


Figure 2. Acres of Residential Land that can be Purchased with the Current Assumptions.

Figure 3 illustrates what happens if the mitigation fee is increased to \$24,960 in 2007. The dashed line for the number of acres that can be purchased is the old value. The solid line indicates that more acres can be purchased.

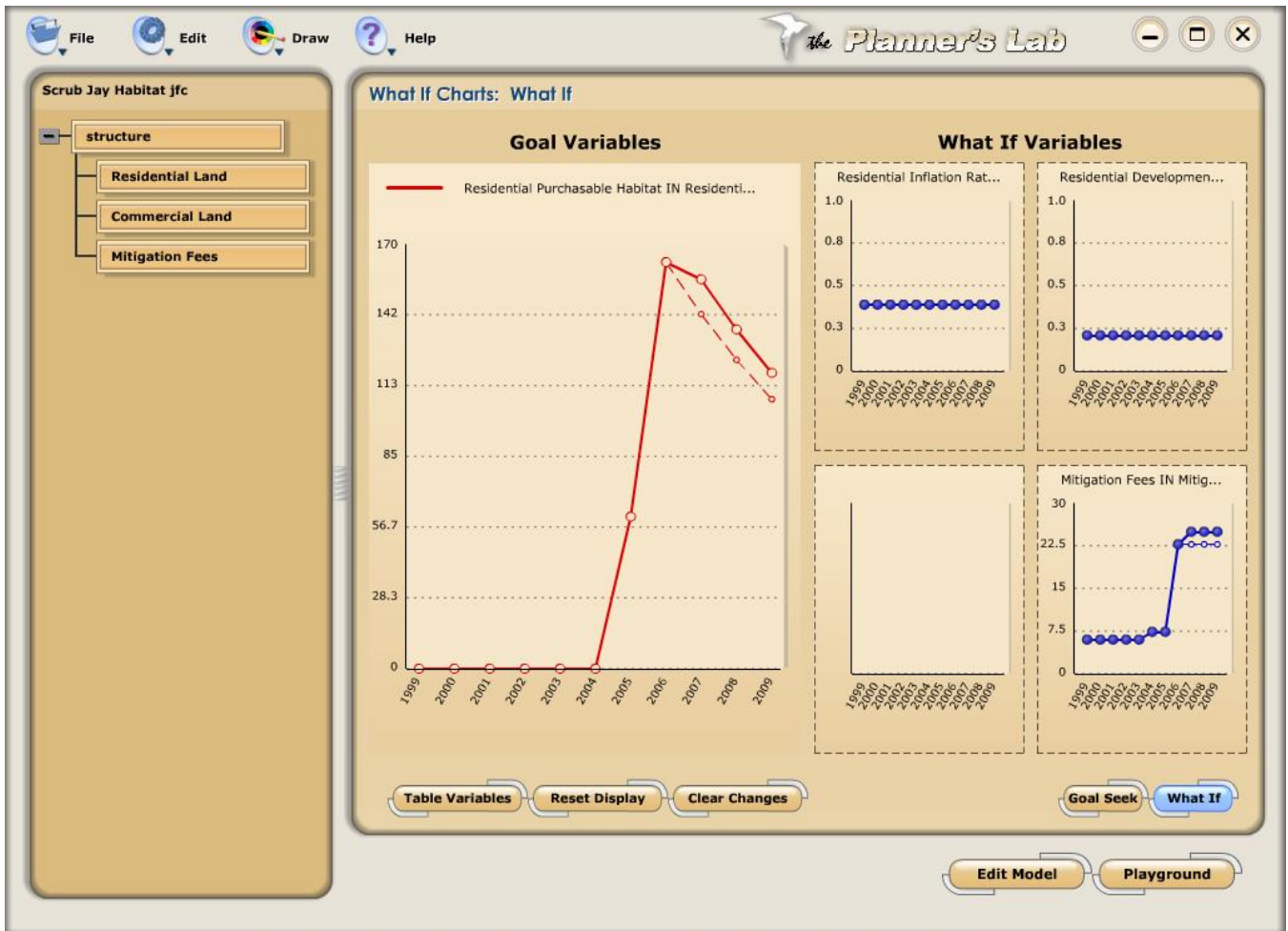


Figure 4. Acres of Residential Land that can be Purchased if Mitigation Fees Increase to \$24,960 in 2007

In Figure 4, we assume that the rapid rate of development and price inflation subsides and that mitigation fees remain constant. Obviously more land can be purchased to protect scrub habitat.

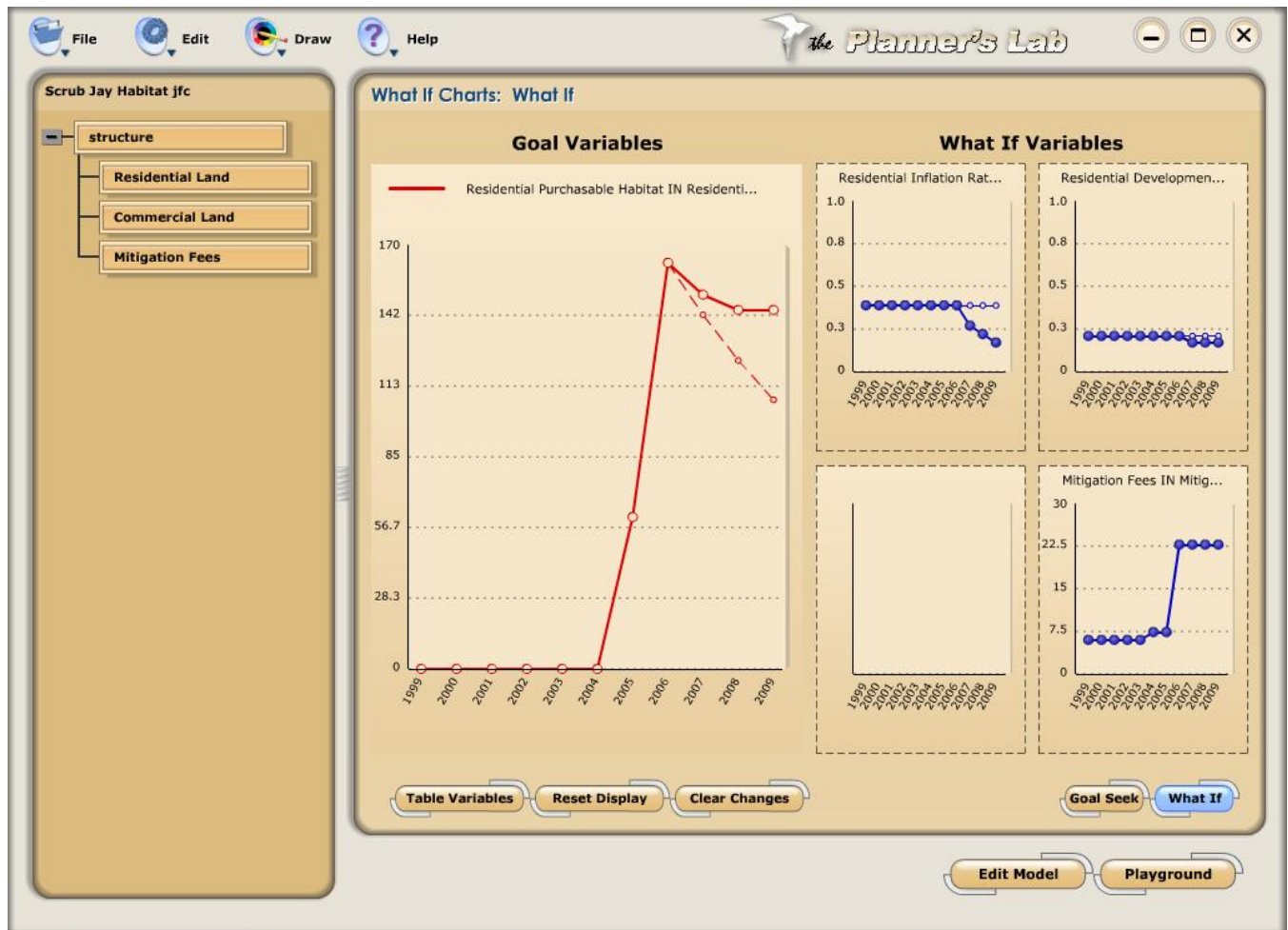


Figure 4. Acres of Land Purchasable if the Rates of Development and Inflation Decrease

**CONCLUSION**

Environmental ethicists believe that humankind has a moral obligation to avoid actions that threaten to render species extinct and the Endangered Species Act codifies that obligation. The Florida scrub-jay is a threatened species and its survival critically depends upon protection of its habitat. Mitigation fees must keep pace with land prices if scrub-jay habitat is to be protected. Preliminary investigation indicates that mitigation fees are not adequate for the task; however, more extensive data analysis is needed.

While the Planner's Lab model is extremely useful, the data requires additional cleansing before the results could be considered valid. Further data collection and analysis is necessary to verify some of the assumptions made by the group in the Planner's Lab model. However, the use of a model like Planner's Lab leaves less room for human error in data input. Also, this method will allow for the creation of "what if" scenarios with regard to decreases, but more likely increases in property prices.

By utilizing the available data up to 2005, possible inaccuracies in the data are being identified. For example, it is unlikely that land prices over the last few years decreased in value from one year to another.

This model could be extremely useful for projections of land price, especially since many different variables can be added to the model. However, a more detailed analysis of the raw data must be executed before a more accurate projection of land



prices can be made. To project the rate of development, further data will need to be collected. Data needed for further studies would include collecting annual numbers of permits issued by the County within the scrub areas of the GIS. This would require many more hours of data collection. The number of parcels sold per year can be compared to the number of parcels the model estimates would have been sold. Further adjustments need to be made to the data that was input into the model. And also, further adjustments to the equations and links between nodes within the model are necessary to ensure that this model works more accurately.

## ACKNOWLEDGMENTS

The author would like to acknowledge the assistance of students in the MBA program at the University of Central Florida, whose term paper provided the impetus for this paper, but who wished to remain anonymous.

## REFERENCES

1. Banyan, R. and Malatesta, A., "Florida Scrub-Jay: Losing Ground," EcoFlorida, Premier Issue, Spring, 2000, available at: [http://www.ecofloridamag.com/archived/scrub\\_jay.htm](http://www.ecofloridamag.com/archived/scrub_jay.htm), accessed April 28, 2005.
2. Epstein, R. (2002) "A very brief history of the history of the origins of environmental ethics for the novice," <http://www.cep.unt.edu/novice.html>, accessed April 12, 2006.
3. GRW Studios (2005) The Planner's Lab User Guide, <http://www.grwstudios.com>, accessed April 12, 2006.
4. Hardin, G., (1968) "The tragedy of the commons," *Science*, Vol. 162, 1243-1248.
5. Sharpe, G. G. (2005) "The Lake Wales Ridge: Florida's Ancient Islands," in *Naturally Central Florida: Fitting the Pieces Together*, Metropolitan Center for Regional Studies, University of Central Florida, L.W. Chapin (Ed).
6. Wagner, G.R., Courtney, J.F. and Paradise, D.B. (in press) "A software laboratory for advancing decision support simulation," in *Intelligent Decision-Making Support Systems: Foundations, Applications and Challenges*, G. A. Forgionne, M. Mora and J. N. D. Gupta (Eds), Springer – Verlag.
7. White, Lynn (1967), "Historical roots of our ecological crisis," *Science*, , Vol. 155: 1203-1207.