**Reviewer's Report**

**Of**

# "Measuring the Economic Benefits of America's Everglades Restoration"

**Reviewed by**

**Stefan C. Norrbin, Ph.D.**
**Professor of Economics, and**
**Director of the Masters Program in Applied Economics**
**Department of Economics**
**Florida State University**
**Tallahassee, Florida**

**January 4, 2011**

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## Executive Summary

The Everglades restoration will result in some indirect positive effects on several parts of the Florida economy. These potential economic effects are quantified in report entitled "*Measuring the Economic Benefits of America's Everglades Restoration; An Economic Evaluation of Ecosystem Services Affiliated with the World's largest Ecosystem Restoration Project,*" by Mather Economics. The report argues that the Everglades restoration project will generate a net present value of $46.5 billion in added economic benefits over the next 50 years. This creates a benefit-cost ratio that exceeds 4 times the cost of the Everglades restoration project of $11.5 billion. The increased economic benefits, estimated in the Everglades report, are distributed as:

Summary of Estimated Economic Benefits from Everglades Restoration
(in billions of dollars)

| | |
|---|---|
| Ground Water Purification | $13.2 |
| Real Estate | $16.1 |
| Wildlife Habitat and Hunting | $12.5 |
| Other benefits | $4.7 |
| Total | $46.5 |

Source: Everglades Report by Mather Economics

This report provides a review of the findings in the Everglades report and provides an objective, un-biased assessment of the methodology, modeling and the assumptions chosen for the study. The report finds that the study, "*Measuring the Economic Benefits of America's Everglades Restoration; An Economic Evaluation of Ecosystem Services Affiliated with the World's largest Ecosystem Restoration Project,*" by Mather Economics, in many instances has chosen assumptions and models that are not appropriate estimates of the expected outcomes of the Everglades restoration. Using more plausible assumptions and economic modeling would lead to substantially lower estimates of the expected gains. In fact, the more realistic estimates would cut the three top categories to just a small fraction of the estimated gains in the study under review.

## I. Introduction

The Everglades restoration will result in some indirect positive effects on several parts of the Florida economy. These potential economic effects are quantified in report entitled "*Measuring the Economic Benefits of America's Everglades Restoration; An Economic Evaluation of Ecosystem Services Affiliated with the World's largest Ecosystem Restoration Project,*" by Mather Economics. The report (hereafter called the Everglades report) argues that the Everglades restoration project will generate a net present value of $46.5 billion in added economic benefits over the next 50 years. This creates a benefit-cost ratio that exceeds 4 times the cost of the Everglades restoration project of $11.5 billion. The increased economic benefits, estimated in the Everglades report, are distributed as:

Table 1: Summary of Estimated Economic Benefits from Everglades Restoration
(in billions of dollars)

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| Ground Water Purification | $13.2 |
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| Other benefits | $4.7 |
| Total | $46.5 |

Source: Everglades Report by Mather Economics

The bulk of my comments will pertain to the overall estimation of the economic impact of three categories of: groundwater purification, real estate and wildlife habitat. These three categories comprise 90% of the estimated $46.5 billion increase in economic expenditures or cost savings. To provide a useful review I will focus my comments on two areas, the **best practice of modeling and methodology** and the **plausibility of the assumptions** used in the computation of the models. The best practice of modeling and methodology will examine whether the report uses sound and appropriate economic theory to model the issue, and the most appropriate empirical framework to compute the effects. The plausibility of the assumptions made is examined to determine whether the authors used the best available assumptions, and that they were made in an unbiased way. In particular, I want to provide some guidance on whether the assumptions are reasonable choices, rather than unusual extreme choices. In as far as possible I will also provide some alternative assumptions or modeling choices that might be considered in estimating the impact of the Everglades restoration.

### II. Groundwater Desalination

The second largest economic impact of the Everglades restoration is the reduced cost of desalinating brackish groundwater. The model has three steps:

1. Infer the change in salinity over the next 50 years without the Everglades restoration
2. Compute the yearly desalination cost
3. Compute the decrease in desalination costs if the Everglades were to be restored and all groundwater returned to its 1970s level and “stay there even as the volume of water withdrawn grows as population and demand grow.” (page v, Mather )

In an effort to assure reasonable and conservative measures of the impact of the Everglades restoration, I would like to focus on the assumptions used in step 1 and step 3.

*2.1 Extrapolating the salinity over the next 50 years*

One of the major arguments in the discussion is that the salinity of the groundwater will increase in the future if the Everglades are not cleaned up. As support for this assertion the report provides the following two graphs:

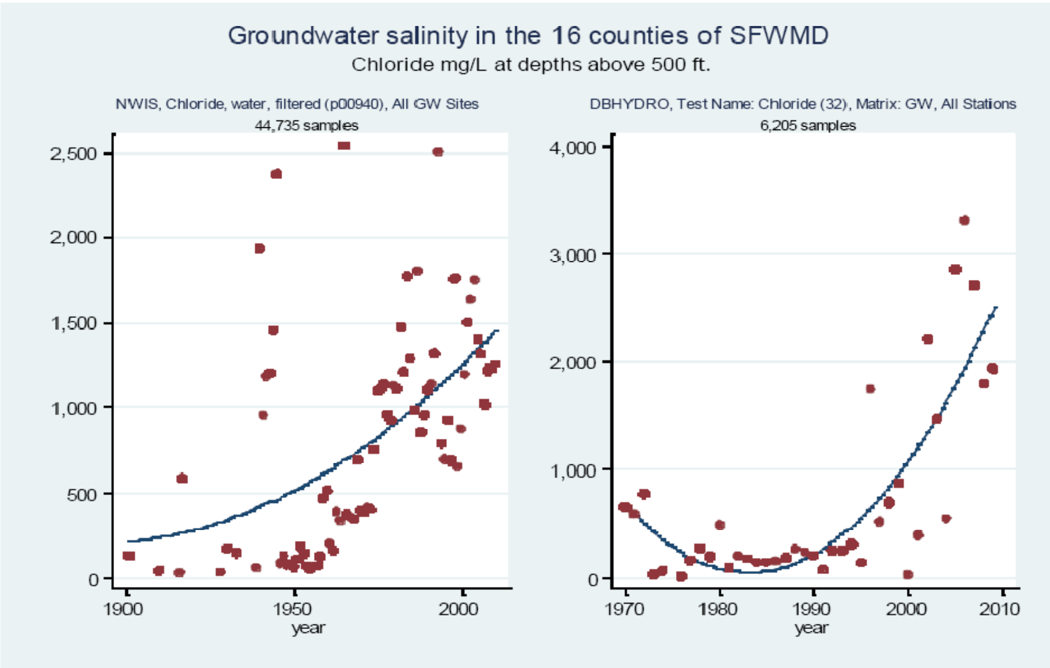
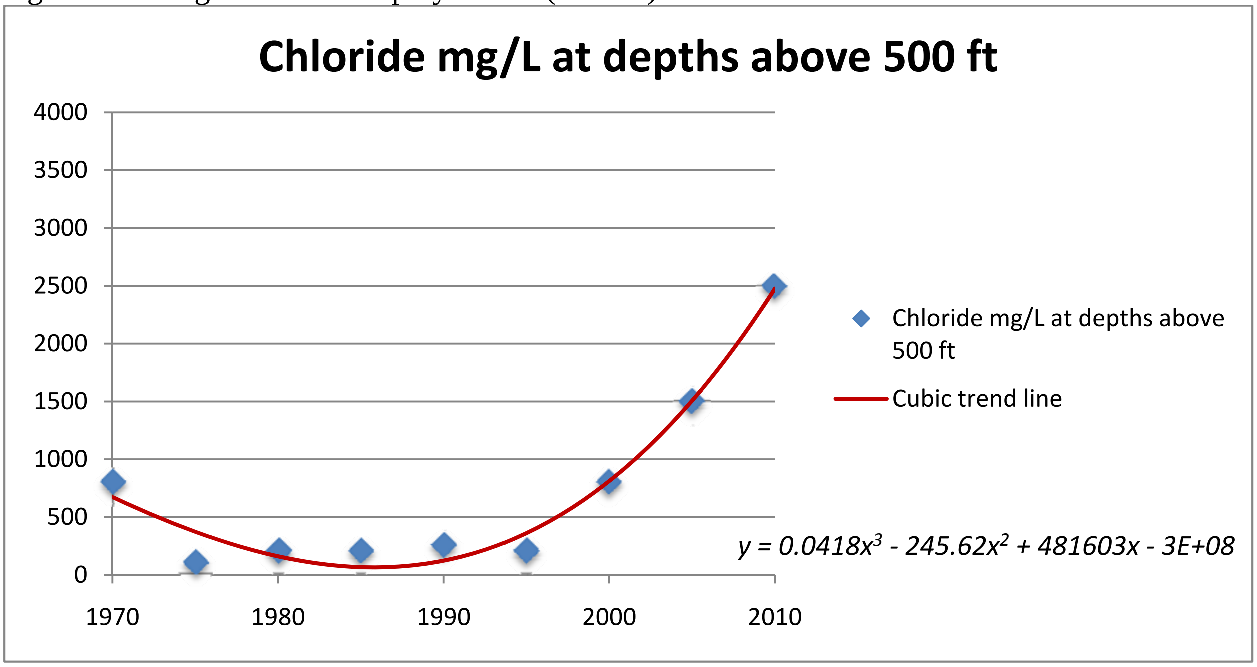



**Figure 1** Groundwater Chloride Levels vi

Another reviewer has evaluated the suitability of the data itself. Since that is not my area of expertise my review is limited to the methods, rather than the actual data, used by Mather. The fitted trend shows that the saline level can be expected to increase in the future according to both samples. The report argues that the increasing saline levels will lead to sharp increases in costs of providing drinking water to South Florida. The above pictures do generate some concerns. First, the two have dramatically different fitted trends! The left one is much slower growing, and covers a longer time period, whereas the picture on the right shows an explosive trend with a fairly short time frame. The authors want to forecast out the fitted trend for a fifty year period, so the natural tendency would be to use the data from the picture on the left. However, the report argues that county coverage is more complete in the right picture, and authors choose to forecast using that data.

Extrapolating using a short time sample can be very misleading. In the following two graphs I illustrate that point by reproducing a fitted trend in data that approximate the right graph in Figure 1. My graph uses only semi-decade data to simplify the exposition.[1] A cubic trend line fits the data best, but a quadratic would work also.

Figure 2: Fitting the data with polynomial (order 3) trend line



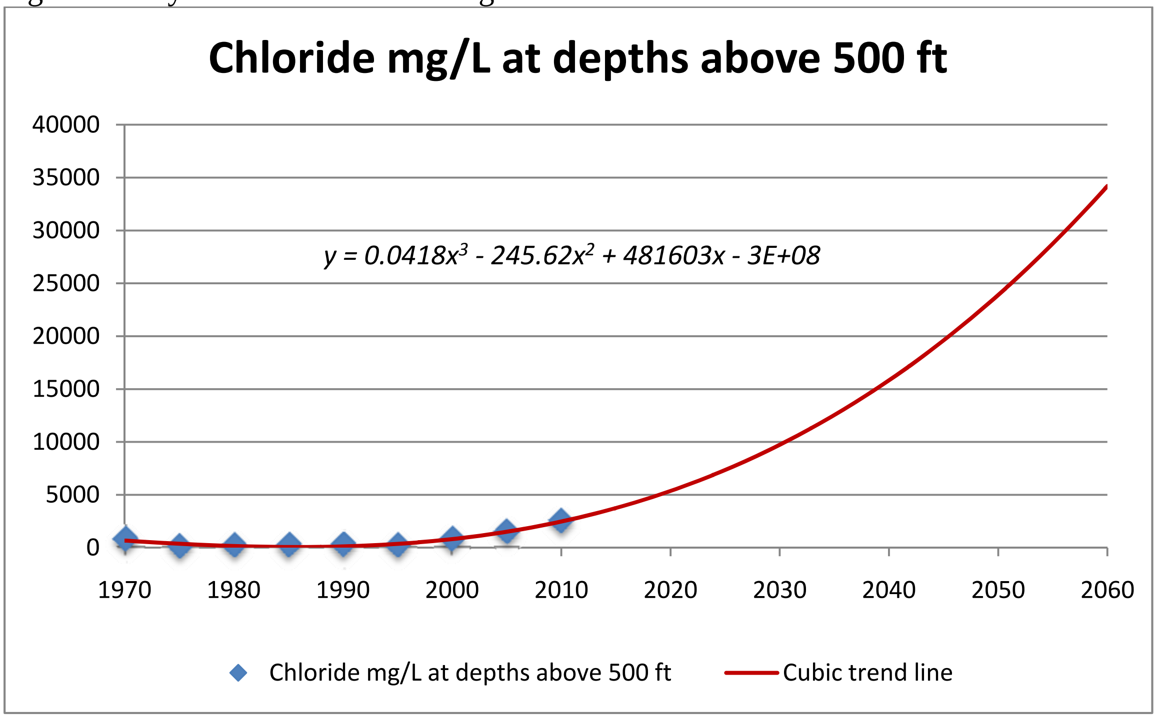

Source: Authors calculation based on data in the Figure 1 from the Everglades report

Using the above fitted relationship I then forecast the saline levels in the future in Figure 3. As can be seen in Figure 3, forecasting out as long as 50 years into the future leads to absurd levels of salinity very quickly. In fact, the brackish water reaches saline levels of 15,000 in 2040 (the level of sea water) and becomes even more saline than most sea water by the end of the sample. Therefore it is very important to use long time periods to make sure that the forecast does not respond to recent phenomena. Note that in addition to being a short time period the right hand

[1] The data used are based on the data used by the Everglades report. However, the full data set is not used here as it was not available in the report. In addition, the actual forecasting model was not available so I have designed a forecast model that mimics the trend reported in the Everglades report.

picture also has a substantial variation in estimates, especially after year 2000. Thus the precision of the estimate is also questionable, and at a minimum the authors should provide a range of forecasts.[2]

Figure 3: 50-year-ahead forecast using the cubic trend line




Source: Author's forecasts

*2.2 Restoring the groundwater salinity levels to that of the 1970's*

The final step in estimating the cost savings of less saline water is to make an assumption about the impact of the Everglades restoration on the salinity level in the sixteen counties that are assumed to be affected. The report assumes that the effect will be to immediately return all groundwater in all sixteen counties to the saline level that existed in 1970. This assumption is questionable. The implicit assumption is that the sole cause of the increase in saline levels is due to the Everglades. However, environmental studies point to several causes of increases in saline levels. For example, increased population and salt water intrusion has been seen as potential sources of saline variations. Malvia and Hopfensperger (2007) argue that "Saline water in the

[2] Examining the data more closely also indicates that many new points of measurements (new stations) were added in the 2000's causing a potential for a discontinuity in the data. These new spots for measuring the degree of salinity would likely to lead a discontinuous time series process. This could seriously affect the potential for forecasting using these data.

shallow confined aquifers of Collier and Lee counties is locally connate water trapped during sea level highstands." (p. 1548)[3]

Instead of assuming that the water quality would return to the 1970's the report could have compared the trends in a comparable area not dependent on the Everglades area with the trend in the counties that are assumed to be affected. The comparable area would act as a control group to capture other factors that could cause saline levels to go up, and the difference would be associated with the Everglades. The Everglades restoration would then remove the difference between the control group trend and the sixteen counties' trend. Such an approach would be much more defensible than the approach that the report adopted that assumes that the entire increase in saline in the groundwater in the sixteen counties is due to the Everglades.

*2.3 Summary of the cost savings of lower chloride levels*

The assumptions made in estimating the impact of the improvement in the chloride level, following the Everglades restoration project, are far from conservative or reasonable. The forecast path is much too aggressive. In addition, the data used exhibits a substantial change in the 2000-2010 decade. This substantial change might be due to a sharp increase in the sampling sites for measuring salinity levels and/or the heavy rainfall that the Everglades report attributes to later in the study as the cause of the increase in wildlife in the Everglades in the last decade. To be conservative the study ought to have used the data provided by NWIS. Furthermore, the study again picks an overly optimistic assumption that chloride levels will return to their 1970's levels across all 16 counties of South Florida. For this to be true, the only cause of the chloride increase from 1970-2010 would be due to the Everglades, and restoring the Everglades would immediately return all aquifers to their 1970s levels. **Therefore it is the reviewer's professional judgment that the assumptions and modeling for the cost savings of lower chloride levels are not plausible. The expected cost savings would be a small fraction of the values reported in the Everglades study.**

[3] Maliva, Robert and Karl Hopfensperger, "impacts of Residential Development on humid subtropical Freshwater Resources: Southwest Florida Experience," Journal of the American Water Resources Association, vol. 43, No. 6, 2007, 1540-1549.

### III. Housing Impact of Improved Water Quality

Clean waterways would have a positive effect on the values of homes. For example a house that is on a clear stream would have a premium as compared to the same house situated on a polluted stream. To compute such an estimate one needs three components:

1. Total value of stock of houses affected
2. The sensitivity of the house price to clean waterways
3. The expected improvement in the quality of waterways

The assumptions made in each of these three components are controversial and will be discussed in this section of the report.

*3.1 The sensitivity of the house price to the clean waterways and the houses affected*

The most difficult part of the analysis is to compute how much of a house price is due to clean water. The report uses the only study that has successfully estimated such a sensitivity to water pollution, namely a study by Poor et al. investigating the water quality effect on “a small watershed in southern Maryland (p. 799)[4]. This study finds that a 1% change in the water quality, measured as total suspended solids mg/L, results in a point estimate of a 0.07% impact on a house price. Thus, a 10% improvement in water quality would have less than one percent effect on the price. The study follows rigorous standards and is very well done.

A drawback with using this study is that it covers a sample that is quite different from the sixteen counties in South Florida. The Maryland study covers a limited set of houses (with 350 annual sales) that are in close proximity to each other and to waterways. All the houses are between the Patuxent river, Potomac river and Chesapeake Bay, with more than 8% of the houses either on the water or adjacent to properties on the water. In contrast, the sixteen counties in the report are the bulk of Florida’s housing market comprising $976 billion in housing value. It is erroneous to believe that the estimated value in the Maryland study can be used without any adjustment.

There are two ways of adjusting the estimated effects to make the results more realistic. The first way is to use the fact that all economic studies have a standard error of the estimated coefficient. In the study the point estimate might be useful, but the effect is very likely lower for the sixteen counties in Florida. Thus, one could adjust the point estimate by subtracting one or two standard deviations to be conservative. Subtracting one standard deviation would lead to an elasticity of 0.0385%, and a total of $8.8 billion effect (using the same potential improvement in water quality as is used in the report). In addition, the area of the effect should be limited to a

[4] Poor, Joan, Keri Pessagno, and Robert Paul, “Exploring the hedonic value of ambient water quality: A local watershed-based study,” *Ecological Economics*, 60, 2007, 797-806.

sample of housing that is in some way affected by water quality (being on the water or close enough). Unfortunately Poor et al. (2007) did not give any guidance to how the water quality valuation dissipates by distance. One would assume that a house that is 1 meter away from water has a large price effect, whereas a house 100 meters away should have less of an effect of water quality, and if the house is 10 kilometers away there should be a negligible effect. Exactly where such a threshold is, where the effect becomes negligible, is difficult to say (but could have been estimated using the Maryland data) so a range of possible values should be used. For example, assume that half of the sixteen counties' real estate is in some vicinity to waterways that are linked to the restoration in the Everglades, then the total effect shrinks to $4.4 billion.

*3.2 The Expected improvement in water quality*

The improvement in water quality is measure of the size of the effect on all waterways in the sixteen counties in South Florida as a result of the Everglades restoration. The report uses the same approach to estimate this improvement in quality as in the first part, by assuming that all waterways would be returned to their quality in 1970's. The estimated 23.4% is the level of dissolved oxygen (in mg/L) in 2009 as a fraction of 1970-1971 level. Clearly this is a strong assumption. In fact the report seems to recognize this because in the full report a spreadsheet exists that allows for some ranges in estimates. Oddly enough the range in the spreadsheet ranges from 1% to 100% (no effect to pure water). To be conservative one would have 23.4% as a high number, as this would imply that all dissolved oxygen added since 1970 is due to the Everglades and a restoration of the Everglades would reverse this completely (i.e. a 100% reversal). A plausible range would then be somewhere between some cleanup (maybe 5%) to the 23.4%. A conservative approach would be somewhere in the middle. Using a 15% effect the total value of the house value increase would be $2.82 billion (given my more conservative assumptions above).

*3.3 Summary of the Effect on House prices by the improved water quality*

The assumptions made by the Everglades report in estimating the effect on house prices are far from conservative or reasonable. Assuming that the full effect estimated for small community surrounded by water applies to all sixteen counties of Florida is not an appropriate choice. In addition, assuming that water quality would immediately improve by 23.4% for the *entire* water-system in sixteen counties, is absurd. Using more conservative assumptions would lead to a much smaller benchmark effect of $2.82 billion with a higher and lower range around that. **Therefore it is the reviewer's professional judgment that the assumptions and modeling for the effect on house prices are not plausible. The conservatively expected change in house prices would be much smaller than the Everglades report suggests.**

## IV. Wildlife Habitat

In the third major section the report estimates the value of an increase in local viewing of wild-life habitat, and the expected decrease in hunting as a consequence of the restoration of the Everglades. To estimate the increased local viewing of the wildlife, the authors go through three steps:

1. Estimate the total value of expenditures on wildlife in the Everglades captured by local viewing.
2. Estimate the increased expenditures as wild-life viewing opportunities increase.

I will focus my discussion on wild-life viewing, as the discussions and estimates surrounding the changes to hunting opportunities to be plausible.

### *4.1 Estimating the value of wildlife expenditures*

In the report the total expenditures on wildlife is cited as "Table 31; page 39; FWS-FHWAR" (page 91, report). The total value is reported as $3.08 billion annually and a remark is added in footnote 94 "We *excluded* for our calculations the 'special equipment expenditure' category because we are attempting to measure habitat-only demand." (p. 91, report, italics added). The following table comes from the same source, the *2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation*[5].

Table 2: Expenditures for Wildlife-Watching Activities for Florida: 2006
(in millions of dollars)

| Trip-related Expenditures | | | Expenditures for Equipment | | | Other | Total |
|---|---|---|---|---|---|---|---|
| Food and lodging | Trans-portation | Other trip | Wildlife Equip | Auxiliary | Special Equipment | | |
| 565 | 264 | 58 | 353 | 24 | 1,353* | 463 | 3,080 |

*Estimate based on sample size of 10-29
Source: *2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, Table 69, p.116*

Note that the amount used in the report *included* the "special equipment category". This is a non-trivial error as the special equipment constitutes 44% of the total expenditure amount. Special equipment is equipment that may be used for wildlife viewing and other activities, and is questionable to include. Especially as this category is very sparsely reported (less than 30 respondents) and varies highly across time. If we exclude the special equipment then the total wildlife expenditures would have been $1.7 billion in 2006.

[5] 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, Table 69, p.116

The Everglades report has a separate section for tourism, so the report makes it clear that they only want to "estimate the habitat impact on resident viewings in and around their homes" (p.22, short report). Fortunately, the 2006 National Survey reports the percentage of the respondents that are tourists. To avoid double-counting the $1.7 billion number should be adjusted by the ratio of respondents in and around their homes. The fraction of the respondents that are in and around their homes is 77% in 2006.[6] Therefore the total amount attributable to local viewing is $1.3 billion. Even this number might be high as some of the categories in Table 1 indicate that the away from home respondents are likely to spend more. For example, transportation of $264 million is likely to be higher for away from home participants then around home. So probably the value is still too high. As we do not have a breakdown of the survey results it is difficult to refine the number more.

Finally, the Everglades report estimates the fraction of the wildlife activity that is going on in the Everglades by using the ratio of hunting in the Everglades to the total in Florida. As we do not know the fraction of wildlife watching as a fraction of the rest of Florida, this seems a plausible and conservative approach. Using the fraction used in the report of 46.4% we obtain a total value of wildlife expenditures by resident viewings in and around their home to be $0.6 billion.

### *4.2 Estimating the increased expenditures as wildlife increases*

The final step in the computation of an increased wildlife habitat value is calculating how much additional expenditures are created as wildlife becomes more abundant. The Everglades report uses the idea that the more wildlife (proxied by the wading bird population) there is, the more expenditures there are. The function is assumed, in the Everglades report, to be linear. Thus, doubling the wildlife would, according to the report, lead to twice as much expenditures on wildlife viewing. This is not a reasonable approach as the more wildlife there are does not mean that one would need to buy more birdfeeders or binoculars to see them. In fact, economists usually assume that a decreasing marginal return exists.[7] The exact shape is hard to find, given that only two data points exist, but it would be extremely unlikely to be linear.

To estimate the multiplier, the Everglades report estimates a ratio of expenditure to wading bird population (assuming that other wildlife grow at the same rate as wading birds), and then forecasts the expenditures by projecting the quantity increase of wading birds. The ratio of expenditures to wading birds is estimated for 2001 and 2006. Unfortunately the 2001 survey coincides with a recession in the U.S. and is likely to affect the numbers greatly. In recessions consumers reduce the amount of expenditures on non-necessities. We can see some support for this argument in Table 3.

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[6] 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, Table 66, p. 113.

[7] In contrast, tourism may be affected and more people may travel to see the wildlife, but that is not what we are measuring here. Therefore one would need a highly nonlinear slope in this case.

Table 3: Trend in Overall Wildlife Watching Expenditures 1991-2006, for Florida Residents
(millions of 2006 dollars)

| 1991 | 1996 | 2001 | 2006 |
|---|---|---|---|
| 1,804 | 1,800 | 1,531 | 1,924 |

Source: National Survey of Fishing, Hunting and Wildlife-Associated Recreation, *Wildlife watching trends: 1991-2006 – A Reference Report*

Table 2 shows a slowdown from 1996 to 2001 and then an uptick following the exit of the recession to the peak of the cycle in 2006.[8] The wildlife expenditures decrease in 2001 and pick up again in 2006. The Everglades report attributes the increase in wildlife expenditures from 2001 to 2006 as coming from the increased availability of wildlife (as proxied by wading birds), but it is likely that a large part of this increase came as consequence of the economy going from the bottom of the business cycle to the peak of a cycle, resulting in more willingness to spend.

Three approaches can be used to give some idea of what the estimated gains from wildlife viewing would be using a more conservative approach. The first would use the identical demand approach to the Everglades report (keeping the linearity assumption and ignoring the business cycle), but would use the method outlined in 4.1 to compute the total value of resident viewings less the special equipment. The total estimated expenditures with 75% restoration of the bird population would be $222 million.[9] That is less than half the amount computed by the Everglades report. Thus, the net present value is also less than half of the $12.5 billion estimated by the Everglades report. The second approach estimates what the 2001 number would have been had there not been a recession. Interpolating the 2001 number using the linear interpolation of the data in Table 2, one reaches a mere $12 million in expected expenditures, using the estimation technique from the Everglades report. Finally, if one allows for a declining marginal impact of additional wildlife on expenditures, assumed in almost all economic models, the total impact for each year is reduced to $9 million.[10]

*4.3 Summary of the Expenditure impact of Wildlife viewing and Hunting*

The assumptions made and functional form of the model, in the Everglades report, to estimate the potential increase in wildlife expenditures are far from conservative or reasonable. The total

[8] Note that these data are not the same as we discussed earlier, because they only pertain to in-state residents in Florida, but are used to illustrate the cyclical effect on wildlife activity.
[9] This adjustment should not be expected to affect the net present value much. The key variables are the forecasted number of wading birds and the relationship between the wading birds and the expenditures. However, because the special equipment is tremendously high in 2006, the calculation is still affected substantially.
[10] In this case we assume a 25% reduction in the marginal impact of additional wildlife.

value of wildlife viewing expenditures is too high. This is even acknowledged by the report, albeit in a footnote. Note that this section only refers to *local viewing or viewing in and around the home*. In addition, the Everglades report ignores two of the most commonly used concepts in Economics, namely: the business cycle and diminishing marginal returns. Accounting for the business cycle and using some plausible assumptions about the degree of diminishing marginal returns results in a dramatic reduction in the wildlife expenditures relative to the Everglades report. Using plausible assumptions the effect decreases to a net present value of $276 million for a fifty year period. Of course taking into account the 17 million a year loss in hunting expenditures that the Everglades report estimates, then the net present value of Wildlife viewing and hunting combined would end up negative. **Therefore it is the reviewer's professional judgment that the assumptions and modeling for the Wildlife viewing expenditure increase are not plausible. The conservatively expected local viewing wildlife expenditure gain, directly attributable to the Everglades restoration, is estimated to be $276 million.**

### V. Choice of discount rate

The discount rate dramatically affects the Everglades report. The costs are paid currently, whereas the benefits are received over a 50-year period. To compare costs and benefits one needs to discount the future benefits on the basis that such benefits would also be received if the funds were used in an alternate manner. For example, if the current expenditure were to be invested in the bond market then one would receive a bond return for 50 years. The discount rate has a substantial effect on benefits received far in the future.

The choice of a discount rate should be made based on alternative uses of the available funds. Thus, the discount rate used differs depending on project. The Mather Economics team decided to use the municipal bond rate in South Florida. "We used the current municipal bond rate in South Florida, minus the current inflation rate to discount the future expected flows of services. This rate as of Spring 2010 was 2.1%."[11] Clearly, recent bond rates have been very low. If one looks at the 10-year Treasury bond in the 1990s, the average yield was 6.01% with an average inflation of 2.88%, resulting in a 3.13% discount rate. National Oceanic and Atmospheric Administration (NOAA) has adopted a 3% discount rate, when discounting restoration and assessment costs, based on the 10-year Treasury bond experience in the 1990s.[12] Federal guidelines use an even higher discount rate of 4.125% for all water and related resource plans.[13] Furthermore the Office of Management and Budget (OMB) uses a 7% discount rate on

[11] Everglades report, p.45
[12] http://www.csc.noaa.gov/coastal/economics/discounting.htm
[13] http://www.federalregister.gov/articles/2010/12/29/2010-32801/change-in-discount-rate-for-water-resources-planning

the basis that this would be the return to private projects that could be done instead of the public investment.[14]

In the Everglades report the 50-year life of the economic benefits make the choice of the discount rate very important. For example, if we examine the wildlife habitat viewing the Everglades report values this at a net present value of $12.5 billion for the 50-year period. Using the NOAA discount rate of 3% this total falls to $10.6 billion. It further shrinks to $8.7 billion if one uses the Federally mandated 4.125% rate, and falls down to $5.8 billion if the OMB discount rate is used.

**In conclusion, the Everglades report used a too low discount rate**. **An appropriate rate of would have substantially reduced the net present value of the benefits.** Using a more appropriate discount rate would reduce the net present value of some categories of benefits by 15% to 50%.

## VI. Summary of Assessment

This report has examined the study, "*Measuring the Economic Benefits of America's Everglades Restoration; An Economic Evaluation of Ecosystem Services Affiliated with the World's largest Ecosystem Restoration Project,*" by Mather Economics. The comments have focused on two areas, the **best practice of modeling and methodology** and the **plausibility of the assumptions** used in the computation of the models. The best practice of modeling and methodology examined whether the report uses sound and appropriate economic theory to model the issue, and the most appropriate empirical framework to compute the effects. The plausibility of the assumptions was also examined to determine whether the authors used the best available assumptions, and that they were reasonable choices, rather than unusual extreme choices.

It is this reviewer's best professional judgment that the study, "*Measuring the Economic Benefits of America's Everglades Restoration; An Economic Evaluation of Ecosystem Services Affiliated with the World's largest Ecosystem Restoration Project,*" has in many instances chosen assumptions and models that are **not** appropriate estimates of the expected outcomes of the Everglades restoration. I have attempted to suggest alternative assumptions and modeling techniques that would be considered more reasonable and conservative. **Using more plausible assumptions about the expected benefits and a more appropriate discount rate would lead substantially lower estimates of the expected gains. In fact, the more appropriate estimates would cut the three top categories to just a small fraction of the estimated gains in the study under review. Note that the expected job gains are also a small fraction of the ones estimated in the Everglades report, as the job creation is linked to the amount of expenditures created.**

[14] http://www.csc.noaa.gov/coastal/economics/discounting.htm

## VII. References


Malvia, Robert and Karl Hopfensberger, Impacts of Residential Development on humid subtropics Freshwater Resources: Southwest Florida Experience," *Journal of American Water Resources Association*, vol. 43, No.6, 2007, 1540-1549.

Poor, Joan, Keri Pessagno and Robert Paul, "Exploting the Hedonic Value of Ambient Water quality: A local watershed-based study," *Ecological Economics*, 60, 2007, 797-806.

National Survey of Fishing, Hunting and Wildlife-associated Recreation, various years

## VIII. Appendix

**Biographic Sketch, Stefan C. Norrbin, Ph.D.**

Stefan is a Professor of Economics and the Director of the Applied Master's program in Economics at Florida State University, Tallahassee, Florida. Stefan's research areas are in Applied Econometrics, International Economics and Applied Macroeconomics. He has a broad research agenda with over 45 journal articles in various areas of Economics and Finance including articles in the leading Economics journals, such as: *Journal of Political Economy*, *Journal of Monetary Economics* and *Journal of International Economics*. He is presently working on his second book, to be published by *Academic Press*.

Stefan's professional experience includes working as consultant for McKinsey & Co., as well as serving as a professor at University of Alabama, University of Hawaii and department chair at Samford University. He has been involved in many research contracts for the State of Florida such as designing new child support guidelines, analysis of property tax proposals, design of an affordability index for local utilities, as well as evaluating the economic benefits of the Team Child program and the legal aid program in Florida. Dr. Norrbin has also served as a consultant to the Swedish Central Bank.

Stefan received his A.B. degree from Brown University and his M.S. and Ph.D. from Arizona State University.