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Restoring the Florida Everglades through a sugar land buyout: benefits, costs, and legal challenges

Abstract

After decades of struggle to accommodate both agricultural needs and the environment as part of the plan to save the Everglades, in 2008, Governor of Florida Charlie Crist proposed the acquisition of 187,000 acres of land from the United States Sugar Corporation (U.S. Sugar) for this purpose. After months of negotiations, the final purchase in August 2010 totaled 26,800 acres. This paper presents the history behind these alternatives and the attempts to improve Florida's water quality and the health of the Everglades. A spatial price equilibrium model of the U.S. sugar market is developed to determine the benefits and costs of several of the U.S. Sugar land buyout proposals. Within this framework, all the benefit-cost ratios calculated show that benefits are less than costs. Our analysis employs the concept of an Environmental Equivalent which is the dollar amount of environmental benefits needed from the "Save the Everglades" project to generate benefits that are as great or greater than the costs.

Keywords: Everglades, United States Sugar Corporation, benefits, costs, buyouts.
JEL Classification: Q15, Q25, Q51.

Introduction

Numerous alternatives to acquire agricultural land as part of a plan to "Save the Everglades" were considered by the State of Florida prior to arriving at a final agreement for purchase of land from a large sugarcane producer – the U.S. Sugar Corporation (U.S. Sugar). This land is needed to restore the Everglades[1].

When Governor Charlie Crist announced Florida's $1.75 billion plan to help restore the Everglades by buying out a major landowner, United States Sugar Corporation, he declared that the deal would be remembered as a public acquisition "as monumental as the creation of the nation's first national park, Yellowstone." Standing amid the marshes at the Arthur R. Marshall Loxahatchee National Wildlife Refuge in June 2008, Governor Crist said, "I can envision no better gift to the Everglades, the people of Florida, and the people of America – as well as our planet – than to place in public ownership this missing link that represents the key to true restoration" (Van Natta and Cave, 2010).

However, Governor Crist's original proposal in June 2008 to purchase 187,000 acres of land from U.S. Sugar did not materialize. The proposal was scaled down to 180,000 acres in December 2008, and later, in August 2010, the actual purchase totaled 26,800 acres. The Everglades is a subtropical wetland in southern Florida, encompassing a watershed area of over 18,000 square miles that reaches from the Kissimmee Chain of Lakes to Lake Okeechobee in the north and to the Gulf of Mexico and Florida Bay in the south. At the southernmost end of peninsular Florida, over 1.5 million acres have been designated as the Everglades National Park, and over 729,000 acres have been designated as the Big Cypress National Preserve. The mix of the slow moving water from Lake Okeechobee and the mild subtropical climate has resulted in a completely unique habitat that is conducive to a wealth of wildlife, including birds, alligators, snakes, and turtles.

Over time, the development of various industrial and agricultural enterprises has reduced the flow of clean water to the extent where the Everglades is now half of its historic size, which has endangered the lives of the wildlife that make the remaining Everglades their home. While most would argue that something needs to be done to guarantee the continued health of the Everglades, achieving full consensus as to the course of action to be taken has been elusive.

Environmentalists have long sought to restore the historic flow of water from Lake Okeechobee south through the Everglades and into Florida Bay, a dream hampered by more than a century of piping, dredging, and development. Recreating the flow would require acquisition of sugar land in the 700,000-acre Everglades Agricultural Area (EAA), part of which is owned by U.S. Sugar.

In June 2008, advocates and supporters of Everglades restoration joined together for the announcement of a monumental land acquisition in the EAA. The EAA, which was originally drained for flood

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[1] While the availability of land is an important factor in restoring the Everglades to its natural state because less than half of the historic Everglades remains, there are other factors that negatively influence the Everglades ecosystem. One example is the intrusion of non-native plant and animal species, such as the Burmese python, which has become a predator of native Everglades species.

control, sits directly between Lake Okeechobee and the greater Everglades, right in the middle of where fresh water naturally flowed in what is known as the *River of Grass*. To enable farming in the EAA, water levels on these lands are maintained through the use of pumps and canals that either remove or supply water depending on the needs of the crops.

This paper presents a benefit-cost analysis of (1) the proposed December 2008 land acquisition of 180,000 acres owned by U.S. Sugar that did not materialize and (2) the actual August 2010 land purchase of 26,800 acres. In addition, we discuss the history behind the various alternatives and attempts to improve the quality and storage of water and, in turn, to improve the health of the Everglades, as well as the many legal challenges involved[1]. We conduct our analysis from both the State of Florida and the national perspective. In either case, the environmental benefits would have to be significant to justify the project on economic grounds. We also discuss, but do not analyze, the connection of this project and the EAA A-1 Reservoir and other water quality-focused court proceedings[2].

While our benefit-cost analysis focuses specifically on the impact of the land buyout with reference to the U.S. sugar market in which U.S. Sugar is a major player, we do not take into account the positive environmental externalities that the land buyout generates. The sugar market includes sugar producers and consumers, and is impacted by the U.S. sugar policy which restricts sugar imports through a tariff rate quota (TRQ). The use of the purchased land generated positive externalities such as improved water quality and the improved health of the Everglades. Without taking these externalities into account, the benefit-cost ratio from the U.S. Sugar land purchase is less than one, implying that costs exceed benefits. In order to take account of the net positive benefits generated by the land purchase, we employ the concept of an Environmental Equivalent – the dollar environmental benefits needed from the land buyout to at least generate a benefit-cost ratio equal to one.

1. Historical perspective and legal issues

When restoration of the Everglades became a national priority, culminating in passage of the Comprehensive Everglades Restoration Plan (CERP)[3], all those involved knew that one of the biggest challenges would be to accommodate sugarcane and other farming interests in the EAA while obtaining the ecological benefits of restoration. Restoration plans developed to provide for water storage, treatment, and conveyance[4], were dependent on acquiring sugar land in the EAA. The potential for acquiring land from U.S. Sugar increased when the company began experiencing financial difficulties in 2007.

Governor Crist helped negotiate a deal between U.S. Sugar and South Florida Water Management District (SFWMD), the state agency responsible for the Everglades restoration, to purchase 187,000 acres of land in the EAA and other assets from U.S. Sugar for a purchase price of $1.75 billion (Table 1, see Appendix). The land was purchased to create above-ground water storage, Stormwater Treatment Areas (STAs), and other beneficial projects to help improve the quality, quantity, timing, and distribution of fresh water flowing into the Everglades. The proposed land purchase was heralded as one of the nation's great forward-thinking land acquisitions. In *Time Magazine*, author Michael Grunwald noted in response to the June 2008 announcement of this purchase, "[t]he Everglades, some say, is a test; if we pass, we may get to keep the planet. June 24 may have been the day we stopped flunking that test" (Grunwald, 2008).

As the negotiations proceeded, it became clear that financing would be very challenging. In addition to the $1.75 billion cost of the land deal, the SFWMD was required to continue its statutory obligations for water management and other restoration goals. Despite the united voice of the environmental community of Everglades activists about the importance of this acquisition, the national economic downturn necessitated a number of reductions in its scope. In December 2008, the land deal was reduced to 180,000 acres of land for $1.34 billion and did not include the sugar mill or other U.S. Sugar assets that were part of the original deal. In April 2009, the deal was further reduced to include about 73,000 acres, with a legal option to purchase the remaining U.S. Sugar lands. Finally, in August 2010, the SFWMD Governing Board approved a deal to purchase 26,800

[1] While the initial June 2008 proposal involved the purchase of 187,000 acres of land and all assets of U.S. Sugar, the proposal was revised in December 2008, as described further below.

[2] We define environmental benefits to include activities such as fishing and bird watching. Many of the items included in the environmental benefits can be found in Mather Economics (2010).

[3] Section 601 of the Water Resources Development Act of 2000, Pub. L. No. 106-541, 114 Stat. 2572 (2000).

[4] Much of the storage outlined in early restoration plans relied in great part on aquifer storage and recovery wells (ASR), where water is pumped underground during the wet season and then pumped back up when needed in the dry season. While this technology has been used elsewhere, it has never before been used on the scale that would be needed for Everglades restoration. Additional uncertainties surround the use of these large wells in porous limestone and the need for additional water quality treatment after the water is pulled from the well. The ultimate construction, operation, and maintenance costs would be very high because of the energy-intensive nature of ASR. Due to these factors, CERP required an ASR contingency plan, which to-date has not been formally identified or finalized.

acres of land located near existing STAs for $197 million. The reduction of cost enabled the SFWMD to make the $197 million payment in cash rather than relying on certificate of participation bonds to raise funds. This final purchase also included a legal option to acquire the remaining U.S. Sugar lands under specific terms. This transaction officially closed on October 12, 2010 (Table 1)[1].

Before the advent of the U.S. Sugar land buyout proposal, there were several ongoing initiatives to improve water storage and treatment to benefit the Everglades. One example was building a large reservoir, covering more than 16,000 acres (holding enough water to fill 100,000 Olympic-size swimming pools). The reservoir was once thought to be a vital piece of the CERP signed by President William Clinton in 2000 because of the lack of available land in the EAA. This reservoir was originally planned as part of a larger set of reservoirs and marshes, and hundreds of wells that would be needed to collect, clean, and deliver rainwater to the Everglades. Rather than re-creating more natural flow to restore the Everglades, this reservoir was planned because of the lack of other storage options.

Other initiatives have also focused on the area in and around Lake Okeechobee and the need for improving water storage and treatment in this area to benefit Florida's water supply and tourism industry. One example is the Fisheating Creek watershed because it drains into Lake Okeechobee which, in turn, flows into the Everglades. State and federal governments working with willing landowners seek to form a conservation corridor stretching from Central Florida down to the Everglades National Park in South Florida, improving the water quality in Lake Okeechobee and the Everglades. In early 2011, Secretary of the Interior Ken Salazar announced an initiative to work with ranchers in three study areas: north of Lake Okeechobee in the Kissimmee Basin, in the Fisheating Creek Watershed, and near the Florida Panther National Wildlife Refuge[2]. Called the Greater Everglades Partnership Initiative, this process began with a focus on 150,000 acres near Orlando, referred to as the Everglades Headwaters National Wildlife Refuge and Conservation Area[3]. This program seeks only willing sellers who will benefit from participating in conservation. It has long been known that land acquisition and water quality improvements are needed both north and south of Lake Okeechobee, so along with the U.S. Sugar purchase, this watershed protection will help achieve the goals of conservation and restoration while working with the agricultural community in those important locations.

Many environmental cleanup projects are confronted by legal challenges that are often costly both in terms of legal costs and the delay and/or downscale in conservation efforts. Delayed environmental projects can dampen future environmental benefits. Legal challenges to the U.S. Sugar land acquisition and its proposed funding mechanism were filed by the Miccosukee Tribe of Indians of Florida, and the New Hope and Okeelanta Corporations, subsidiaries of rival sugar grower Florida Crystals Corporation[4]. These and other critics often focused on the costs and the use of bonding authority to pay for the purchase, arguing that negotiations should have resulted in a better windfall for the State of Florida. The Miccosukee Tribe claimed that the purchase would delay the original Everglades restoration proposals. "This is a death warrant for the Everglades … it sucks away all the money devoted to projects now in the pipeline," said Dexter Lehtinen, a lawyer for the tribe.

By spring of 2008, separate litigation had been ongoing involving the 16,000-acre storage reservoir project. The project, known as the EAA A-1 Reservoir, was originally planned as part of a larger 50/50 cost-share agreement between the state and federal governments under the CERP project. In order to make progress on the project sooner, the SFWMD began construction on its own outside of the CERP framework. Environmental groups filed suit against the SFWMD, arguing, among other things, that this project should not be completed by the State alone without following the procedural requirements and protections carefully outlined in CERP. The SFWMD Governing Board voted to suspend construction of the reservoir pending the outcome of this litigation. With the advent of the U.S. Sugar

[1] One obstacle to bond financing for the U.S. Sugar purchase was a decline in the SFWMD's share of property-tax revenue in the 16 counties it manages based on decreased budget funding and falling property values in Florida (Baribeau, 2010).

[2] Additionally, in 2010 and 2011, the United States Department of Agriculture (USDA) allotted $189 million to preserve almost 50,000 acres of ranch land north of Lake Okeechobee in what is known as the Northern Everglades. The federal government acquired the right to protect wetlands and uplands in Glades, Hendry, Highlands, and Okeechobee Counties. This outlay represents the largest contiguous easement purchase in the history of the USDA Wetlands Reserve Program.

[3] The Everglades Headwaters National Wildlife Refuge and Conservation Area was formally established on January 18, 2012.

[4] Florida Crystals opposed the buyout. One of the reasons may be that U.S. Sugar was in serious financial trouble and Florida Crystals was interested in buying out U.S. Sugar while the U.S. economy was in a depressed state. Some accounts are that Florida Crystals Corporation made two written offers to join in the sales deal but U.S. Sugar refused. Fortunately for U.S. Sugar, although the Florida buyout of the original magnitude did not occur, its financial woes were greatly reduced due to the strengthening sugar market. Between January 2007 and January 2010, domestic U.S. sugar prices increased by 30% to 35%.

deal, and new opportunities for examining the best locations for storing water closer to Lake Okeechobee and treating water closer to its point of discharge to the Everglades, the SFWMD voted to cancel construction of the A-1 Reservoir.

There were financial consequences because of SFWMD's decision to suspend the reservoir project. The courts held that SFWMD had to pay the reservoir's contractor a $2-million-a-month penalty for suspending the work. It eventually paid $25 million in penalties and fines for canceling the contract, on top of the $282 million it had already spent on construction. However, as discussed below, this decision would fall in line with further court orders directing the SFWMD to focus on water quality improvement projects.

There were additional ongoing legal challenges and proceedings involving efforts to clean up the Everglades. In its natural state, the Everglades ecosystem thrived with extremely low levels of nutrients. As a result, the addition of nutrients like phosphorus can change the oligotrophic nature of the ecosystem that supports the characteristic abundance of life that makes the Everglades unique and diverse. Every day, some of the River of Grass is impacted by the negative effects of excessive phosphorus. As technical and science experts began to study the potential for using land acquired from U.S. Sugar for restoration projects, the vast majority agreed on one thing: the land slated for use as the A-1 Reservoir is situated at a place in the landscape that could be highly beneficial to water quality treatment and the Everglades would receive a greater benefit if treatment projects, such as an STA, were constructed on the A-1 land rather than on the enormous reservoir. The decision to cancel the contract was criticized by many of the same critics of the U.S. Sugar land purchase because $282 million had already been spent on construction.

In a separate court proceeding that set a 10 parts per billion phosphorus standard for water entering the Everglades[1], the Miccosukee Tribe and Friends of the Everglades asked that the SFWMD be required to reinitiate and complete construction of the A-1 Reservoir. Citing a lack of patience waiting for the U.S. Sugar land purchase to be finalized and any subsequent planning for use of the land purchased, U.S. District Judge Moreno entered an Order compelling construction of the A-1 Reservoir. The SFWMD sought to be relieved of this requirement to construct the reservoir, citing changed circumstances, including new science. This issue was referred to a Special Master. On August 30, 2010, Special Master John Barkett issued a Report, which agreed that the circumstances had changed to an extent that the SFWMD should not be required to construct the reservoir and that water quality improvements might best be served by building an STA or other treatment projects rather than the Reservoir on the A-1 land. On March 22, 2011, Judge Moreno ratified this decision, allowing the project to be targeted at water quality improvements.

In yet another lawsuit concerning water quality in the Everglades, U.S. District Court Judge Gold found that the State of Florida was violating its requirements under the Clean Water Act by extending the deadline for compliance with the 10 parts per billion phosphorus standard, and held that the United States Environmental Protection Agency (EPA) had not fulfilled its own Clean Water Act duty to require Florida to comply with water quality standards. As directed by Judge Gold, on September 3, 2010, the EPA issued an Amended Determination, setting forth specific steps, under a specific enforceable schedule that the EPA and the Florida Department of Environmental Protection (FDEP) must meet to achieve water quality standards in the Everglades. In order to fulfill these requirements, the Amended Determination directs the SFWMD, the State agency responsible for construction, to build new water treatment projects before the deadline dates.

The EPA specifically directed that the SFWMD construct 42,000 acres of STAs. EPA then outlined the steps to reach this goal: (1) complete the purchase of land from U.S. Sugar and begin seeking additional land acquisition in the EAA; (2) either construct STAs on land acquired from U.S. Sugar or initiate a trade for other land on which STAs will be built; and (3) utilize the 16,000 acres of formerly A-1 Reservoir land to construct a large STA. In April 2011, Judge Gold entered an order giving the EPA authority to take over control of Florida's water quality permitting program if Florida continues to delay implementing needed improvements.

In the fall of 2011, the State of Florida through the FDEP and SFWMD developed an alternative plan to meet the water quality goals that is purportedly less costly than the plan developed by the EPA. The plan was unveiled after Florida Governor Rick Scott met

[1] U.S.A, SFWMD et al., Case No. 88-1886 (S. Dist. Fla.). Some describe this lawsuit and the accompanying Settlement Agreement as the event that prompted Everglades restoration. The Settlement Agreement recognized the impact of nutrients in water flowing from sugar farms that make up the vast majority of land in the EAA. "At the present time, the ecological integrity and ultimately the survival of the [Everglades National] Park and [Arthur R. Marshall Loxahatchee National Wildlife] Refuge are threatened by the inflow of EAA drainage water containing excess nutrients. Indeed, the high levels of phosphorus in EAA discharges constitute the most immediate water quality concern facing the Everglades system. EAA drainage that flows directly into the Refuge contains average phosphorus concentrations ten to twenty times higher than background concentrations."

with EPA Administrator Lisa Jackson and other federal officials to discuss the technical merit of Florida's plan and the potential for it to meet the water quality goals. The state plan also identifies the A-1 land for use in improving water quality and considers projects on the land purchased from U.S. Sugar. Discussions are still ongoing between state and federal officials as to whether a compromise plan can be developed and presented to the federal judges.

While interrelated, these proceedings are in fact separate. Therefore, if not for the pending purchase of the U.S. Sugar lands, the EPA and federal court requirements for additional STAs would likely have required land acquisition through means such as eminent domain, without the benefit of willing sellers and without the flexibility to negotiate the price or current usage of the land. Both parties would likely be in much less favorable conditions without willing seller negotiations.

Table 1 gives a summary of the chronology of events and legal issues impacting the buyout of U.S. Sugar land. These events should be kept firmly in mind in the cost-benefit analysis that follows. Later in the paper we discuss conceptually how the incorporation of legal costs would influence the benefit-cost ratios and, in turn, affect the environmental benefits that would be necessary to generate a benefit-cost ratio greater than one from the sugar buyout.

2. Theoretical considerations

The federal sugar program supports the price of sugar in the United States through the operation of a tariff-rate quota (TRQ). The TRQ on sugar in the United States is set to guarantee a domestic sugar price of 18 cents per pound on raw sugar and 22.9 cents per pound on sugar refined from sugar beets[1].

For the purposes of our benefit-cost analysis, a spatial price equilibrium framework, similar to that of Kennedy and Schmitz (2009), that incorporates economic welfare measures (Just, Hueth, and Schmitz, 2004) is developed to determine the market-clearing domestic price given a specified import-quota level[2]. The model incorporates the key policy component of the U.S. sugar policy which is the TRQ. In our model, the United States is assumed to be a small country in that changes in U.S. sugar production do not affect world sugar prices.

Three sectors are utilized within this framework: domestic production, imports, and domestic consumption. Domestic consumption Q_C is comprised of products produced domestically Q_S and/or imported Q_M, such that

$$Q_C = Q_S + Q_M, \quad (1)$$

where Q_M is determined exogenously by the domestic government through its choice of the TRQ level. Given the initial domestic supply and demand functions, the domestic price will adjust to changes in Q_M, which will result in producers adjusting Q_S based on their supply function, and consumers adjusting Q_C based on their demand. A market-clearing price will be achieved when Q_S and Q_C, resulting from the new Q_M, meet the conditions in equation (1).

As shown in Figure 1 (see Appendix), total sugar demand in the U.S. is represented by D_T, with U.S. demand for domestically produced sugar shown by D_{US1}. The supply curve for sugar from the U.S. is represented by S_{US1}[3]. Under free trade, given the world price p_w, the U.S. imports $q_1^* q_4^*$. However, given an import quota of $q_1 q_3$, the U.S. sugar price is p_1. The buyout of sugar-producing land by Florida results in a leftward shift in the supply curve to S_{US2}, which causes the price of land to rise (a major element of the purchase of U.S. Sugar lands is the price of land that is directly related to the price of sugar). This causes the domestic price of sugar to increase to p_2. Under a fixed import quota of $q_2 q_4$, domestic consumption falls to q_2 and domestic production falls to q_4. The increase in the domestic sugar price causes consumers to be worse off by $p_1 ebp_2$ while producers remaining in the industry gain $p_1 p_2 ca$.

Suppose now that because of the acreage buyout, the federal government expands the amount of sugar entering the United States to an amount ec. This causes U.S. domestic consumption to increase to q_1 and U.S. domestic production to fall to q_5. In this case, the U.S. domestic sugar producers who remain after the land buyout do not gain from the buyout, nor do the U.S. producers who have exited. The only gainers in this case are the consumers who gain $p_2 p_1 eb$ from the expanded import quota.

2.1. The Florida perspective. The welfare implications of a reduction in sugar production from the sugar acreage buyout are different at the state level. In Figure 2, aggregate domestic demand is given by D_{US} while the demand for sugar by Florida residents is D_F. The aggregate U.S. supply is S_{US}. Total

[1] The TRQ is another issue that is politically controversial and we do not address the merits of this program.

[2] For recent work using this framework, see Schmitz and Schmitz (2010) and Schmitz and Schmitz (2011).

[3] For convenience, the private marginal cost curve is identical to the social marginal cost curve. However, some contend that the U.S. sugar industry is partly responsible for polluting the Everglades (Swihart 2011, p. 192; see also footnote 1, p. 78). In this case, the social marginal cost curves would lie to the left of the private cost schedule. As a result, part of the environmental benefits from the buyout of the U.S. Sugar land would come about directly through curtailing the supply of pollutants.

supply in the absence of U.S. Sugar is S_1. The supply of sugar from firms outside of Florida is given by *S*.

With the buyout of U.S. Sugar land, the impact on Florida's remaining sugar producers is *cdef*, which is a net gain due to the buyout. However, consumers lose by an amount p_1p_0ab. As a result, the net impact on Florida from the sugar land buyout is very different than it is for the entire United States, where the consumer cost from the buyout is p_0p_1gh while the producer gain is p_1p_0ef.

2.2. Impact on land values. Consider the impact of the U.S. Sugar land buyout on land values. Prior to the buyout, imports totaled $(q_1 - q_2)$ at a price of p_0 (Figure 3). Consider two cases. In the first case, the sugar land buyout causes supply to shift from S_0 to S_1. In the second case, the buyout causes supply to shift to S_2. Assume that imports are regulated by a fixed import quota. In the first case, the domestic price increases to p_1 and the value of the land increases by *abcd*. In the second case, the domestic price increases to p_2 and the value of the land increases by *fgce*. Hence the price of the land in the buyout increases as the total acres purchased in the buyout increases. Note that with S_1, the net cost of the buyout is *dchi*. With S_2, the net cost increases to *ech*. As a result, the net cost of the buyout is a direct function of the total acres of land purchased. Also, since the price of sugar land increases as sugar acreage is reduced, it is not clear cut the value that should be placed on the land that is no longer used for sugar production but instead for Everglades restoration. Willing sellers might well take into account this phenomenon.

3. Empirical analysis and results

In conducting our analysis we recognize the following:

- There are very few comparable land deals to encompass such large tracts of lands as was initially proposed in the U.S. Sugar land buyout, therefore making the circumstances fairly unique, and the fact that U.S. Sugar originally insisted on an "all or nothing" deal. While disputable, it was reported in the New York Times that initial negotiations favored U.S. Sugar (Van Natta and Cave, 2010). The original proposed purchase of 187,000 acres took place before the deflation in property values in Florida that began in late 2008. Therefore, the initial appraisals and negotiations, from which the various scaled-down deals stemmed, were partially based on land value figures from a real estate market that was generally higher valued. By the time the proposed scaled down purchase of 180,000 acres came before the SFWMD Governing Board for approval, some argued that the U.S. Sugar land values were overvalued by as much as $400 million. However, appraisals relied on by the SFWMD represented that the price paid was firmly in the center of the appraised values[1].
- The land sale presented U.S. Sugar with an opportunity to raise needed cash in light of sinking profit margins, and stiff foreign competition.
- The growing financial crisis in the summer of 2008 rapidly changed the scope of the land purchase proposal. In November of that year, Governor Crist announced a smaller, $1.34 billion purchase of just over 180,000 acres of U.S. Sugar's land that did not include any other assets. Because land prices in Florida had already started to fall, the argument arose that if actual market land value figures for late 2008 were used instead of appraised values as the basis for this new purchase, Florida could be paying far less for the company's land. For example, at the same time SFWMD was still working to finalize the land purchase transaction that would pay U.S. Sugar about $7,000 per acre, citrus grove land parcels were being sold for $4,000 per acre[2]. In its fairness opinion, the law firm of Duff and Phelps estimated that U.S. Sugar's property was worth $930 million, which is $400 million less than what SFWMD would have paid for the land if the 180,000-acre purchase had been completed. The value of individual land parcels that were part of the original proposal vary greatly (i.e., land with development or mining potential is valued much higher than sugarcane land, which in turn is valued much higher than citrus land), making the market value determination complex. In our analysis, we use both a land value of $4,000 per acre and an inflated value of $7,000 per acre.
- There were possible environmental remediation costs to be considered under a land purchase between Florida and U.S. Sugar. Some of the land that was supposed to be purchased is elevated sandy soil that critics argue is not ideal for restoring the Everglades, and thousands of acres of the company's property are contaminated with high levels of copper, DDT, selenium, arsenic, and other chemicals. Some of these factors were part of several negotiated projects, but in our analysis we do not estimate the environmental costs directly, and only note that while this

[1] See both the Banting Appraisal Report and the Sewell Appraisal Report, available on the SFWMD website at https://my.sfwmd.gov/ pls/portal/ docs/page/common/newsr/rog_appraisal_banting_report_2008_11_10.PDF and also at https://my.sfwmd.gov/portal/page/portal/common/newsr/rog_appraisal_sewell_report_2008_11_10.pdf.

[2] Kennedy and Schmitz (2009).

could be an added expense to the SFWMD, these problems arise in a majority of the Everglades restoration projects[1].

In the analysis, simulations are conducted for alternative quota levels and for alternative supply and demand price elasticities using Microsoft® Excel. Given the observed supply and demand quantities at the base-price level, linear supply and demand curves are used to determine: (1) the market clearing equilibrium given the initial amount of land used to produce sugar and a specific import quota and (2) the market clearing equilibrium given a reduction in the amount of land used to produce sugar and a specific import quota. The domestic quantities and prices are then used to calculate the respective changes in producer and consumer surplus resulting from each scenario.

The base-level raw-sugar quantities and prices used in these simulations are based on 2004/05 data obtained from the Sugar and Sweeteners Outlook (USDA, 2008). This marketing year was chosen as it was deemed to be a normal marketing year based on weather conditions and other exogenous factors. Total U.S. demand was 9.079 million metric tonnes (mmt), which was comprised of 7.597 mmt from domestic production and 1.482 mmt from imports. The status quo price of raw sugar was U.S. 22.92 cents per pound ($505.30 per metric tonne [mt]). The base-level import quota, used as the status quo in this analysis, was 1.482 mmt.

The U.S. own-price sugar supply elasticities range between 0.10 and 0.70 (Tyers and Anderson, 1992; Lopez, 1989, 1990). Gardiner et al. (1989) use an aggregate own-price sugar supply elasticity of 0.50. Based on these estimates, in this analysis we adopt supply elasticities of 0.25, 0.50, and 0.75. Demand elasticities, in the literature, range from -0.10 to -0.60 (Lopez, 1989, 1990; Tyers and Anderson, 1992; Gardiner et al. 1989; Uri and Boyd, 1999). Based on these estimates, we employ a demand elasticity of -0.50.

In Table 2 (see Appendix) we examine scenarios in which 100,000; 150,000; and 180,000 acres of Florida sugar-producing land were removed from production. Based on a raw value yield of 4.17 short tons per acre, or 3.78 metric tons per acre (USDA, 2008), the corresponding reduction in production levels for the alternative acreage removal levels is determined. Based on these yields, a leftward shift in the supply curve in the amount of 378.2, 567.3, and 680.8 thousand metric tonnes, respectively, occurs when areas of 100,000; 150,000; and 180,000 acres are removed from production. A much smaller buyout was agreed to than what our analysis considered. In addition, legal costs and other peripheral costs related to this project must ultimately be incurred to accomplish the final results. Our analysis only considers the costs directly related to the buyout, the costs already incurred in construction on the A-1 property, and an estimate of additional STA construction costs[2]. Thus, our analysis underestimates the costs of purchasing for restoration purposes land from U.S. Sugar[3]. Hence the benefit-cost ratio is overstated.

Importantly, our analysis does not directly estimate the environmental impact of the land buyout project. Various benefits to society will be produced through a number of channels, including improved water quality, enhanced wildlife habitat, increased tourism, and a variety of other positive externalities. We calculate the lower bound at which policy makers value these environmental benefits in order to justify the land buyout on economic grounds.

This study illustrates the interaction between law and economics. The economic downturn necessitated a smaller land purchase, but the limited areas targeted for purchase ultimately helped the SFWMD comply with legal requirements to improve water quality. Additional purchases may need to be made to satisfy the judicial requirements. While it appears that additional costs will be incurred to fully comply with judicial orders, and are part of the overall costs to restore the Everglades, it is likely that there were substantial cost savings associated with this endeavor due to the ability to work with willing sellers in a timely manner rather than utilizing the power of eminent domain, which usually involves substantial litigation costs and where the government often pays the premium value of land at its highest and best use. These additional costs and savings are additional collateral issues that are not included in the analysis.

3.1. Buyout impacts at the national level. Scenarios are conducted in which the government payment ($4,000 per acre) is equal to the value of the land, and the government payment ($7,000 per acre) is greater than the value of the land under three alternative acreage reduction levels and two alternative price elasticities of supply. The results of alternative acreage buyouts from the national perspective are shown in Table 2, corresponding to Figure 1. Consider

[1] Responsibility for the cleanup costs for pollution generally falls to the state and SFWMD. If the sugar industry were taxed to restrict pollution and the value of sugar-producing land were reduced, the costs to the SFWMD and other Florida taxpayers for cleanup would be reduced.

[2] While there may be some debate on what costs to include in our analysis, the benefit-cost ratio remains less than one in all the scenarios considered above even though the actual size of the benefit-cost ratio depends on the magnitude of the costs of the project. This is because the costs do not enter the numerator in the benefit-cost calculations.

[3] Our analysis does not consider the impact of lease agreements that were part of the proposed land buyouts where U.S. Sugar would be permitted to lease the land just sold from the SFWMD for various periods of time.

the scenario in which 150,000 acres are removed from production, the government payment is $4,000 per acre, and a supply elasticity of 0.25 is used. The direct cost to the government of purchasing this land plus associated restoration costs is $1,301.5 million. There is no net benefit to U.S. Sugar as the payment received for the land is equal to its value. The net gain to the remaining domestic sugar producers is $316.7 million while the loss to domestic consumers is $395.4 million. This results in a net loss to society of $1,380.1 million, with a corresponding negative benefit-cost ratio of -0.0604. It is important to note that the reason the benefit-cost ratio is negative is due to the loss in consumer surplus associated with increased domestic sugar prices combined with the lack of benefit to U.S. Sugar as the land purchase price is no greater than the value of the land. The negative benefit-cost ratio exists because the environmental benefits from the land buyout are not fully taken into account.

When evaluating the impacts of the land purchase on U.S. Sugar, one must consider more than simply the purchase price and the appraised land values. At the time of the initial proposal to purchase a portion of the EAA, U.S. Sugar was reported to be under financial distress. Had U.S. Sugar been forced to dispose of its assets prior to the buyout? One could argue that with the forced liquidation of agricultural land of the magnitude owned by U.S. Sugar, the land would have likely brought a price much lower than the market value used in this analysis.

This raises several important issues for our analysis. First, in several of our scenarios we consider a purchase price of $4,000 per acre. This results in a zero net benefit to U.S. Sugar. Downward pressure on land values, as mentioned previously, would increase the difference between the purchase price and the effective value of the land to U.S. Sugar. This would increase the per acre net benefit to U.S. Sugar from the buyout. Another potential area in which U.S. Sugar may have benefited is through the public's perception of its financial viability. Prior to the buyout, U.S. Sugar may have faced challenges in obtaining operating loans given the uncertainty related to its future viability. News of a potential land buyout by the State of Florida immediately improved the company's ability to borrow money. Thus, given the financial condition of U.S. Sugar at the time leading up to the buyout, expectations related to the buyout may have provided increased net benefits to U.S. Sugar[1]. Shortly after the proposed sugar land buyout, the prosperity of the sugar industry increased because of sharply rising sugar prices. Between March 2009 and October 2010, sugar prices roughly doubled (Figure 4, see Appendix).

If the government were to buy the U.S. Sugar land at a price ($7,000 per acre) that exceeds the value ($4,000 per acre), there would be a net gain to U.S. Sugar from the buyout of $3,000 per acre. The direct cost to the government of purchasing this land plus associated costs would increase to $1,751.5 million. The net benefit to U.S. Sugar would be $450 million. The impact on the remaining domestic producers and consumers would be unchanged from the previous scenario as the amount of land removed from production would be the same as that in the previous scenario[2]. While the net loss to society would remain at $1,380.1 million, the benefit-cost ratio would increase to 0.2120 due to increased benefits to U.S. Sugar. However, the benefit-cost ratio would remain below one regardless of the value placed on sugar land.

In the above models, the benefit-cost ratios from the proposed U.S. Sugar land buyout are very low by any standards regardless of the supply price elasticities used in the calculations (Just, Hueth, and Schmitz, 2008; Schmitz and Zerbe, 2009). As a result, the environmental benefits needed to make the benefit-cost ratios greater than one would have to be significant.

3.2. Buyout impacts at the state level. We also examine the net benefit from the proposed land buyout from Florida's perspective. Scenarios are conducted where the government payments are $4,000 per acre versus $7,000 per acre. Results are derived for three alternative acreage reduction levels and two alternative price elasticities of supply. The state-level results are shown in column two of Table 3, corresponding to Figure 2 (see Appendix). As before, we consider the scenario in which 150,000 acres are removed from production, the government payment is $4,000 per acre, and a supply elasticity of 0.25 is used. The cost to the government and the impact on U.S. Sugar do not change from that shown for the national model. The direct cost to the government of purchasing this land plus associated expenses remains at $1,301.5 million while there is no net benefit to U.S. Sugar as the payment received for the land is equal to its value. The net gain to the remaining Florida sugar producers is $48.8 million while the loss to Florida consumers is $23.7 million. This results in a net loss to society (Florida) of

[1] Rumor has it that U.S. Sugar was made financially solvent with the announcement of the government buyout. Banks obviously viewed lending to U.S. Sugar more favorably than they did prior to the buyout. There actually were net benefits to U.S. Sugar in the sense that its credit rating was increased. Bankers' perception of net worth based on appraised land values is discounted according to the saying "a bird in the hand is worth two in the bush."

[2] As land is removed from sugar production, the price of land will increase as a result of decreased availability of sugar-producing land. Our analysis captures the increase in producer surplus to the remaining sugar producers from the price increase as a result of the land buyout.

$1,276.4 million, with a corresponding benefit-cost ratio of 0.0193.

Even with a government payment of $7,000 per acre there still yields an overall net loss to society in the amount of $1,276.4 million. As before, this occurs because the increase in the government payment of $3,000 per acre is offset by an equivalent increase in rents received by U.S. Sugar. The direct cost to the government of purchasing this land plus associated reclamation expenses increases to $1,751.5 million while the net benefit to U.S. Sugar is $450 million. The impact on the remaining Florida producers and consumers is unchanged from the previous scenario as the amount of land taken out of production is the same as that in the previous scenario. While the net loss to the State of Florida remains at $1,276.4 million, the benefit-cost ratio increased to 0.2713 due to the increased benefits to U.S. Sugar. As a result from the State of Florida perspective, the benefit-cost ratios are greater than those at the national level. Even so, the benefit-cost ratios are below one.

3.3. Impact of increased imports. One factor that has not been considered in the previous analyses is a possible response through increased sugar imports to the proposed U.S. Sugar land buyout. Since the United States uses import quotas to bolster the price of sugar produced in the United States, it could potentially expand the import quota in reaction to the reduction in sugar production resulting from the sugar acreage buyout. To model this scenario we allow the import quota to be expanded by the amount taken out of production through the sugar acreage buyout (Figure 1). These quantities are in the amount of 378.2, 567.3, and 680.8 thousand metric tonnes, respectively, for acreage reductions of 100,000, 150,000, and 180,000 acres.

Table 4 (see Appendix) presents these results for both a $4,000 and $7,000 per acre buyout given a supply elasticity of 0.50. As can be seen, the equivalent expansion of the import quota to offset the reduction in supply negates any effects to the remaining producers or consumers. Their welfare remains at the status quo level. In the case of the $4,000 per acre buyout, U.S. Sugar does not receive excess rents as it is only compensated by an amount equal to the market value of land. As a result the net cost to society is exactly equal to the government expense.

In the case of the $7,000 per acre buyout, the remaining producers and consumers continue at their status quo welfare level. However, U.S. Sugar now receives positive rents. In the case of the 150,000-acre scenario, U.S. Sugar benefits in the amount of $450 million while the government incurs a cost of $1,751.5 million. This results in the same net benefit to society. However, the benefit-cost ratio resulting from this scenario is now 0.2569.

3.4. Environmental Equivalent. Each of the scenarios analyzed within the context of the U.S. sugar market has shown a net loss to society from the proposed U.S. Sugar land buyout. It is assumed that rational agents would not enter into a sugar land purchase project that would create a loss to society. As a result, there must be some benefits not included in our analysis that accrue to society that would bring the net benefit of this buyout to at least a breakeven point[1]. When we consider the environmental rationale behind this government project we identify an Environmental Equivalent that would bring the net benefit-cost ratio of this project to one. The Environmental Equivalent consists of environmental benefits, such as added wildlife, net of costs[2] (we also calculate later the Environmental Equivalent needed to obtain benefit-cost ratios of various magnitudes greater than one, recognizing that policy analysts are not in a position to determine the benefit-cost ratio necessary for a project to be deemed appropriate.)

However, decisions often are not made solely on economic grounds. Thus there could be a shortfall in the Environmental Equivalent needed to generate a benefit-cost ratio of one or greater for a given project. This happens in the case where the notion of an Environmental Equivalent is replaced or augmented by a Political Lobbying Equivalent or even a Political Corruption Equivalent that can partly or fully make up for the shortfall between benefits and costs in benefit-cost calculations.

Table 5 (see Appendix) shows the Environmental Equivalent for a benefit-cost ratio of one for six scenarios using a price elasticity of supply of 0.5 and a $7,000 price per acre. This value ranges from $1,088.1 million with 100,000 acres from Florida's perspective to $1,496.7 million with 180,000 acres from the national perspective.

The concept of an Environmental Equivalent as related to benefit-cost ratio calculations is presented in Figure 5. Hypothetically, for a benefit-cost ratio of one, the Environmental Equivalent necessary would be much less than the Environmental Equivalent necessary to achieve a larger benefit-cost ratio. For example, Mather Economics (2010) concluded that the benefit-cost ratio resulting from restoring the Everglades was 4.0.

[1] See the discussion of the categories of potential benefits from Everglades restoration in Mather Economics (2010).

[2] We also did not analyze the potential for cleanup cost savings that result from taking land out of agricultural production and preventing additional application of phosphorus and other nutrients.

The relationship between benefit-cost ratio calculations and the Environmental Equivalent can be illustrated with respect to the legal hurdles associated with the buyout discussed earlier. By ignoring the legal costs, we overstate the benefit-cost ratio for the sugar land buyout. Likewise, we understate the Environmental Equivalent needed to achieve a given benefit-cost ratio. The addition of legal costs will lower the benefit-cost ratio and will raise the dollar value of the Environmental Equivalent.

3.5. Final agreement. A final agreement was reached on the land purchase in late 2010 that involved the State of Florida purchasing 26,800 acres of land from U.S. Sugar for $7,365 per acre, at a total of $197.4 million. This final agreement encompassed a much smaller land area than did the earlier proposals. While final plans, as of January 2012, are not yet completed, the parcels are slated to be used to construct a series of STAs and other water quality treatment projects, which was one of the purported goals of the 187,000-acre scenario. The reduction in acquisition size and the associated reduction in capability to construct restoration projects on the land raise issues with respect to which inputs contribute to the potential environmental benefits. Will a land buyout that is only 15 percent the size of an alternative plan result in only 15 percent of the environmental benefits associated with the larger acreage? Conversely, if it were the STA providing the environmental benefits, would the environmental benefits double if the number of STAs were built twice? These scale issues are critical for conducting appropriate benefit-cost analysis.

As pointed out earlier, even though Governor Crist initiated the buyout of U.S. Sugar land to clean up the Everglades, and even though the processes were largely unrelated, acquiring some land in the EAA would have been necessary to fulfill the EPA's response to Judge Gold on September 3, 2010, where the EPA issued an Amended Determination to ensure Florida meets the Everglades water quality standards.

In terms of benefit-cost analysis, the land that had been used to start construction of the A-1 Reservoir is now planned to be used to improve water quality. In order to create a scenario where the land purchased is utilized for water projects, we include the costs ($300 million) already incurred for construction of the reservoir project. It is the general consensus that these costs would have been incurred in construction of the STA or other water quality feature regardless of the original plans for a reservoir.

In order to compare earlier proposals with the final agreement we examine a hypothetical purchase of 187,000 acres at a cost of $4,000 per acre (our figure for "market value") along with the actual agreement to purchase 26,800 acres at a cost of $7,365 per acre. Our comparisons of each of these scenarios includes both a cost of $401.5 million for STA construction on the newly acquired land, as well as $300.0 million to account for costs already incurred toward STA construction[1]. Our analysis also accounts for producer and consumer impacts in the sugar industry, a lease benefit from a no-cost lease to U.S. Sugar for three years (valued at $400 per acre per year, nominal value), and the net sales benefit to U.S. Sugar. As shown in Table 6, the 187,000-acre project results in a net welfare loss of between $1.0 and $1.3 billion and a benefit-cost ratio of 0.0967 to 0.1219 depending on whether the pre-acquisition restoration costs are included. Alternatively, the smaller project then results in a welfare loss of between $0.5 and $0.8 billion and a benefit-cost ratio of between 0.1248 and 0.1872. It is important to note that in the case of the 187,000-acre buyout, we assume the per acre purchase price is equal to or closer to our market value of the land, resulting in a zero net benefit to U.S. Sugar. An Environmental Equivalent of over $1.309 billion is required for the benefits of this project to equal the corresponding costs with the purchase of 187,000 acres at $4,000 per acre. Although the per acre land acquisition price is greater in the final agreement, the decreased amount of land acquired significantly decreases the overall cost of the project, resulting in a smaller Environmental Equivalent of $786.8 million being necessary for the 26,800-acre project. This implies that less environmental and related benefits are necessary for the smaller project to breakeven. However, it does not imply that less environmental benefits actually exist.

Mather Economics (2010) finds a benefit-cost ratio of 4.04 based on benefits that include groundwater purification, real estate, park visitation, open space, commercial and recreational fishing and hunting, and wildlife habitat (in addition, their calculations of the net present value of these benefits employed a 20- to 50-year time horizon that would tend to increase their benefit-cost ratio). We determine that the Environmental Equivalent, through the use of revealed preferences, needs to be large to achieve a benefit-cost ratio of 4.0. The Mather Economics study (2010) of the full $11.5 billion Everglades restoration effort over a 20- to 50-year time frame, noted that the best estimate is that restoration will generate an increase

[1] Cost estimates for constructing water quality projects to meet the 10 ppb standard discussed above range from $400 million to $1.5 billion, depending on what final plan is approved by the federal court. While these expenses will not all be incurred on land acquired from U.S. Sugar, the cost of just over $700 million is used as an estimate of the costs to construct projects on these properties, and assumes that STAs will be constructed.

in economic welfare of approximately $46.5 billion in net present value terms that could range up to $123.9 billion. This analysis assumes that 83,500 acres of land in the EAA would ultimately be taken out of agricultural production, with 43,500 acres being used for STA construction and an additional 40,000 acres used for reservoir storage.

The Environmental Equivalent required for different benefit-cost ratios, given the final land purchase agreement of 26,800 acres, is presented in Table 6 (fifth and sixth columns). In the case of the fifth scenario, the environmental benefits resulting from this project would need to be over $1.766 billion to achieve a benefit-cost ratio of 2.0. Alternatively, the environmental benefits would need to be nearly $3.6 billion to achieve a benefit-cost ratio of 4.0 (that is identified in the Mather Economics study, 2010).

Conclusions

The State of Florida proposed buyout of land owned by U.S. Sugar to restore the Everglades required significant accompanying environmental benefits to be justified on economic grounds. In calculating the Environmental Equivalent needed to generate benefits greater than costs, we recognize that the Environmental Equivalent approach to program implementation can be undermined by non-economic arguments. Often policies are introduced within the context of Public Choice Theory, where a Political Lobbying Equivalent or Political Corruption Equivalent plays a key role.

In our analysis, we did not consider the impact of this project on the cost of other Everglades restoration projects or on the cost of complying with Court Orders requiring land acquisition to build more water quality projects on an accelerated timeframe. It is generally recommended in benefit-cost analysis that several projects be considered to achieve a specific goal. It may well be that the original proposed U.S. Sugar land purchase would have demonstrated increased merit if interrelated projects were implemented simultaneously because of potential complementarities. The greater the complementarity among projects that provide environmental benefits, the larger the economies of scale in providing benefits from efforts to clean up the Everglades. However, the benefit-cost analysis of joint projects is beyond the scope of this paper.

Even though the sheer awe-inspiring size of the initially proposed purchase of 187,000 acres from U.S. Sugar did not materialize, the bold vision still remains and is the starting point or first step toward accomplishing what is needed for the Everglades restoration. The smaller purchase executed in 2010 still focused on acquiring lands from a willing seller that are strategically located for water quality improvements. By acquiring lands strategically aimed at improving the quality of water flowing to the Everglades, progress can be made toward correcting this pervasive environmental issue that continues to hinder overall Everglades restoration efforts.

It is not unusual for controversy to follow large environmental projects such as the original U.S. Sugar land buyout, especially in difficult economic conditions. This controversy exists even though the Everglades restoration has been widely recognized for benefits to tourism, job creation, and sustaining resources for both the natural and built environments. The economic value analyses generally show a large economic benefit from the Everglades restoration[1].

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[1] See e.g., Mather Economics (2010; finding a 4 to 1 return on investment from Everglades restoration); Varela (2005; with the implementation of CERP, one could expect an EAA sugarcane farm to incur monetary loss); Milton et al. (1999; annual benefits of Everglades restoration are $342.2-$406.5 million or $3.42-$4.07 billion over a ten-year period. However, these benefits decline if restoration imposes high costs through water restrictions, loss of farmland acreage, and annual household taxes).

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Appendix

Table 1. Timeline of policy and legal events related to the U.S. Sugar land purchase

10/06/2011	Governor Rick Scott and Florida DEP unveil an alternative plan to U.S. EPA's Amended Determination for achieving water quality targets. The plan utilizes land purchased in 2010 from U.S. Sugar but purports to improve water quality with projects that cost hundreds of millions of dollars less than EPA's proposal.
05/06/2011	Florida Legislature approves a 30% reduction in the amount of funding the SFWMD will have for Everglades restoration, water quality improvements, flood control, and water supply. Existing law is changed so that increasing ad valorem funding requires legislative approval.
04/26/2011	Judge Gold enters an order allowing the U.S. EPA to take over Florida's water quality permitting. The decision can be used to enforce the Amended Determination requirements. Numerous comments in the order focus on Florida's failure to timely reach water quality standards.
03/22/2011	Judge Moreno adopts Special Master recommendations – noting that the vast majority of scientific experts agree that the EAA A-1 site will have greater environmental benefit if construction on the Reservoir does NOT continue and the land is utilized for water quality treatment.
11/18/2010	The Florida Supreme Court rules on the issue of Bond Validation, finding that the certificates of participation bonds can be used for the purchase because it provides a valid public purpose, with exception of funding for the option to buy additional acres.
11/02/2010	SFWMD responds to U.S. EPA Amended Determination stating that it cannot / does not have the fiscal capacity to complete the projects EPA set forth, including land acquisition above and beyond the U.S. Sugar purchase and project construction on those lands.
10/12/2010	SFWMD closes on purchase of approximately 26,800 acres from U.S. Sugar.
09/03/2010	EPA issues Amended Determination requiring 42,000-acre expansion of Stormwater Treatment Areas, including use of the 26,800 acres purchased from U.S. Sugar to build treatment projects.
08/30/2010	Special Master to Judge Moreno recommends relieving the SFWMD from requirements to construct the EAA A-1 Reservoir because of changed circumstances and the potential use of the land for water quality treatment.
08/12/2010	SFWMD votes to approve purchase of 26,800 acres of land from U.S. Sugar, with 10-year option to purchase remaining land reinitiate construction.
03/31/2010	Judge Moreno grants motion seeing a declaration of violations of water quality consent decree; requires EAA A-1 Reservoir reinitiate construction.
05/13/2009	SFWMD approves revised purchase of 73,000 acres of land from U.S. Sugar, with 10-year option to purchase remaining land.
01/13/2009	Miccosukee Tribe files motion for administrative hearing seeking a declaration that the December 2008 approval of the U.S. Sugar purchase is valid. This case is appealed to the Florida Supreme Court.
01/06/2009	New Hope and Okeelanta Corporations (subsidiaries of Florida Crystals) file motion for administrative hearing seeking a declaration that the December 2008 approval of the U.S. Sugar purchase is invalid. This case is appealed to the Florida Supreme Court.
12/18/2008	SFWMD approves revised purchase of 180,000 acres of land from U.S. Sugar
10/13/2008	SFWMD files Complaint for Validation, seeking to validate $2.2 billion in Certificates of Participation. The Miccosukee Tribe and the New Hope and Okeelanta Corporations object to validation. The validation is appealed to the Florida Supreme Court.
07/28/2008	Judge Gold grants summary judgment for Friends of the Everglades and the Miccosukee Tribe, requiring EPA to develop a specific timeframe for state compliance with water quality standards.
06/24/2008	Acquisition of U.S. Sugar is announced – 187,000 acres of land and U.S. Sugar assets.
06/01/2008	Work suspended on the EAA A-1 Reservoir, citing NRDC, NWF, and Sierra Club v. U.S. Army Corps of Engineers.

Table 2. Surplus gains, losses, and benefit-cost ratio (national perspective) of government buyout, with national producer and consumer welfare: e_d = -0.5 ($1,000 USD)

Components	Area	Total					
		100,000 acres		150,000 acres		180,000 acres	
		e_s = 0.25	e_s = 0.75	e_s = 0.25	e_s = 0.75	e_s = 0.25	e_s = 0.75
$4,000/acre buyout							
Government cost	*cdf*	$1,101,500	$1,101,500	$1,301,500	$1,301,500	$1,421,500	$1,421,500
Net benefit to USS	*cdf – cdf*	$0	$0	$0	$0	$0	$0
Net producer gain (Non-USS)	p_2acp_1	$215,951	$136,746	$316,747	$201,297	$374,949	$238,818
Net consumer loss	p_2bep_1	-$265,558	-$167,947	-$395,369	-$250,747	-$472,333	-$300,068
Net benefit	$(p_2acp_1) + (cdf - cdf) - (p_2bep_1) - (cdf)$	-$1,151,108	-$1,132,701	-$1,380,122	-$1,350,949	-$1,518,884	-$1,482,750
Benefit-cost ratio	$((p_2acp_1) - (p_2bep_1)n + (cdf - cdf)) / (cdf)$	-0.0413	-0.0283	-0.0604	-0.0380	-0.0685	-0.0431
$7,000/acre buyout							
Government cost	*Abf*	$1,401,500	$1,401,500	$1,751,500	$1,751,500	$1,961,500	$1,961,500
Net benefit to USS	*abf – cdf*	$300,000	$300,000	$450,000	$450,000	$540,000	$540,000
Net producer gain (Non-USS)	p_2acp_1	$215,951	$136,746	$316,747	$201,297	$374,949	$238,818
Net consumer gain	p_2bep_1	-$265,558	-$167,947	-$395,369	-$250,747	-$472,333	-$300,068
Net benefit	$(p_2acp_1) + (abf - cdf) - (p_2bep_1) - (abf)$	-$1,151,108	-$1,132,701	-$1,380,122	-$1,350,949	-$1,518,884	-$1,482,750
Benefit-cost ratio	$((p_2acp_1) - (p_2bep_1) + (abf - cdf)) / (abf)$	0.1787	0.1918	0.2120	0.2287	0.2257	0.2441

Source: Author's calculations.
Note: Government costs include land procurement expenses, STA construction expenses, and pre-acquisition costs from abandoned restoration projects.

Table 3. Surplus gains, losses, and benefit-cost ratio (Florida's perspective) of government buyout, with Florida producer and consumer welfare: e_d = -0.5 ($1,000 USD)

Components	Area	Total					
		100,000 acres		150,000 acres		180,000 acres	
		e_s = 0.25	e_s = 0.75	e_s = 0.25	e_s = 0.75	e_s = 0.25	e_s = 0.75
$4,000/acre buyout							
Government cost	*dej*	$1,101,500	$1,101,500	$1,301,500	$1,301,500	$1,421,500	$1,421,500
Net benefit to USS	*dej – dej*	$0	$0	$0	$0	$0	$0
Net Producer gain (Non-USS)	p_1cdp_0	$33,256	$21,059	$48,779	$31,000	$57,742	$36,778
Net Consumer loss	p_1bap_0	-$15,933	-$10,077	-$23,722	-$15,045	-$28,340	-$18,004
Net benefit	$(p_1cdp_0) + (de - dej) - (p_1bap_0) - (dej)$	-$1,084,177	-$1,090,518	-$1,276,443	-$1,285,545	-$1,392,098	-$1,402,726
Benefit-cost ratio	$((p_1cdp_0) - (p_1bap_0) + (dej - dej)) / (dej)$	0.0157	0.0100	0.0193	0.0123	0.0207	0.0132
$7,000/acre buyout							
Government cost	*cfj*	$1,401,500	$1,401,500	$1,751,500	$1,751,500	$1,961,500	$1,961,500
Net benefit to USS	*cfj – dej*	$300,000	$300,000	$450,000	$450,000	$540,000	$540,000
Net producer gain (Non-USS)	p_1cdp_0	$33,256	$21,059	$48,779	$31,000	$57,742	$36,778
Net consumer gain	p_1bap_0	-$15,933	-$10,077	-$23,722	-$15,045	-$28,340	-$18,004
Net benefit	$(p_1cdp_0) + (cfj - dej) - (p_1bap_0) - (cfj)$	-$1,084,177	-$1,090,518	-$1,276,443	-$1,285,545	-$1,392,098	-$1,402726
Benefit-cost ratio	$((p_1cdp_0) - (p_1bap_0) + (cfj - dej)) / (cfj)$	0.2264	0.2219	0.2713	0.2660	0.2903	0.2849

Source: Author's calculations.
Note: Government costs include land procurement expenses, STA construction expenses, and pre-acquisition costs from abandoned restoration projects.

Table 4. Surplus gains, losses, and benefit-cost ratio of government buyout, with national producer and consumer welfare with increased imports: e_d = -0.5 ($1,000 USD)

Components	Total		
	100,000 acres	150,000 acres	180,000 acres
	e_s = 0.50	e_s = 0.50	e_s = 0.50
$4,000/acre buyout			
Government cost	$1,101,500	$1,301,500	$1,421,500
Net benefit to USS	$0	$0	$0
Net producer gain (Non-USS)	$0	$0	$0
Net consumer loss	$0	$0	$0

Table 4 (cont.). Surplus gains, losses, and benefit-cost ratio of government buyout, with national producer and consumer welfare with increased imports: e_d = -0.5 ($1,000 USD)

Components	Total		
	100,000 acres	150,000 acres	180,000 acres
	e_s = 0.50	e_s = 0.50	e_s = 0.50
Net benefit	-$1,101,500	-$1,301,500	-$1,421,500
Benefit-cost ratio	0.0000	0.0000	0.0000
$7,000/acre buyout			
Government cost	$1,401,500	$1,751,500	$1,961,500
Net benefit to USS	$300,000	$450,000	$540,000
Net producer gain (Non-USS)	$0	$0	$0
Net consumer gain	$0	$0	$0
Net benefit	-$1,101,500	-$1,301,500	-$1,421,500
Benefit-cost ratio	0.2141	0.2569	0.2753

Source: Author's calculations.
Note: Government costs include land procurement expenses, STA construction expenses, and pre-acquisition costs from abandoned restoration projects.

Table 5. Producer, consumer, and environmental impacts, and benefit-cost ratio of a government buyout, considering Florida and U.S. producer and consumer welfare: e_d = -0.5 and e_s = 0.5 ($1,000 USD)

Components	Total		
	100,000 acres	150,000 acres	180,000 acres
$7,000/acre buyout with Florida producer and consumer gains			
Government cost	$1,401,500	$1,751,500	$1,961,500
Net benefit to USS*	$300,000	$450,000	$540,000
Net producer gain (Non-USS)	$25,788	$37,909	$44,937
Net consumer gain	-$12,346	-$18,413	-$22,020
Environmental Equivalent***	$1,088,058	$1,282,003	$1,398,583
Net benefit	$0	$0	$0
Benefit-cost ratio	1.0000	1.0000	1.0000
$7,000/acre buyout with national producer and consumer gains			
Government cost	$1,401,500	$1,751,500	$1,961,500
Net benefit to USS*	$300,000	$450,000	$540,000
Net producer gain (Non-USS)	$167,457	$246,164	$291,798
Net consumer gain	-$205,765	-$306,877	-$367,000
Environmental Equivalent**	$1,139,808	$1,362,213	$1,496,702
Net benefit	$0	$0	$0
Benefit-cost ratio	1.0000	1.0000	1.0000

Source: Author's calculations.
Note: Government costs include land procurement expenses, STA construction expenses, and pre-acquisition costs from abandoned restoration projects.* Net benefit to U.S. Sugar (USS) is comprised of government payment less $4,000 land value. ** Environmental Equivalent is the amount of perceived environmental gains necessary to result in a net benefit of one.

Table 6. Producer, consumer, and environmental impacts, and benefit-cost ratio of government buyout, considering U.S. producer and consumer welfare: e_d = -0.5 and e_s = 0.5*

Components	Buyout with national producer and consumer gains					
Acres in buyout	187,000	26,800	26,800	26,800	26,800	26,800
Purchase price per acre	$4,000	$4,000	$7,366	$7,366	$7,366	$7,366
Appraised value per acre	$4,000	$4,000	$4,000	$7,000	$7,000	$7,000
Government cost-land	$748,000	$107,200	$197,400	$197,400	$197,400	$197,400
Gov't cost-STA construction	$401,500	$401,500	$401,500	$401,500	$401,500	$401,500
Gov't cost-Sunk costs	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000
Net sales benefit to USS**	$0	$0	$90,200	$9,800	$9,800	$9,800
Lease benefit to USS***	$218,837	$31,363	$31,363	$31,363	$31,363	$31,363
Net producer gain	$302,239	$46,211	$46,211	$46,211	$46,211	$46,211
Net consumer gain	-$380,923	-$55,631	-$55,631	-$55,631	-$55,631	-$55,631

Table 6 (cont.). Producer, consumer, and environmental impacts, and benefit-cost ratio of government buyout, considering U.S. producer and consumer welfare: e_d = -0.5 and e_s = 0.5*

Components	Buyout with national producer and consumer gains					
Indicators including sunk restoration costs						
Environmental Equivalent (EE)****	$1,309,347	$786,757	$786,757	$867,157	$1,766,057	$3,599,813
Net benefit	-$1,309,347	-$786,757	-$786,757	-$867,157	-$867,157	-$867,157
Benefit-cost ratio w/o EE	0.0967	0.0271	0.1248	0.0353	0.0353	0.0353
Benefit-cost ratio w/ EE	1.0000	1.0000	1.0000	1.0000	2.0000	4.0400
Indicators excluding sunk restoration costs						
Environmental Equivalent (EE)****	$1,009,347	$486,757	$486,757	$567,157	$1,166,057	$2,387,813
Net benefit	-$1,009,347	-$486,757	-$486,757	-$567,157	-$567,157	-$567,157
Benefit-cost ratio w/o EE	0.1219	0.0431	0.1872	0.0530	0.0530	0.0530
Benefit-cost ratio w/ EE	1.0000	1.0000	1.0000	1.0000	2.0000	4.0400

Source: Author's calculations.
Note: The first scenario involves the proposed 187,000-acre buyout at $4,000 per acre. The second through sixth scenarios involve the actual 26,800-acre buyout at alternatives of a $4,000 purchase price and an approximately $7,366 per acre purchase price with alternative EE levels. * Dollar values, with the exception of per acre prices, are in thousand dollars. **Net benefit to USS is comprised of the government payment less an appraised value of either $4,000 or $7,000 per acre. ***The lease benefit to USS represents a lease benefit from a no-cost lease to U.S. Sugar for three years (valued at $400 per acre, per year, nominal value). **** The Environmental Equivalent is the amount of perceived environmental gains necessary to result in a net benefit of zero.
It is increased in scenarios 3 and 4 to obtain B/C ratios of 2.00 and 4.04.

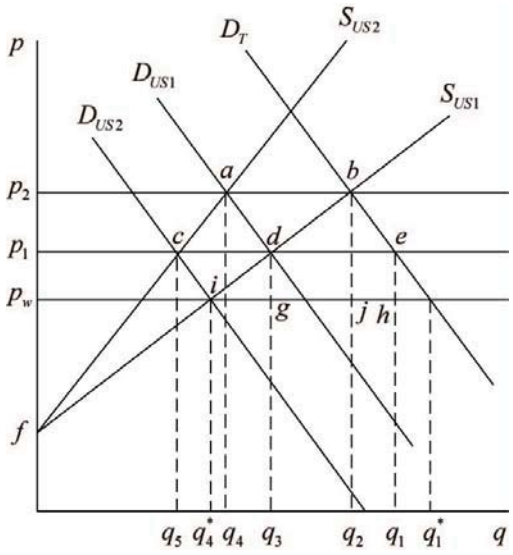


Fig. 1. Impact of U.S. Sugar land buyout

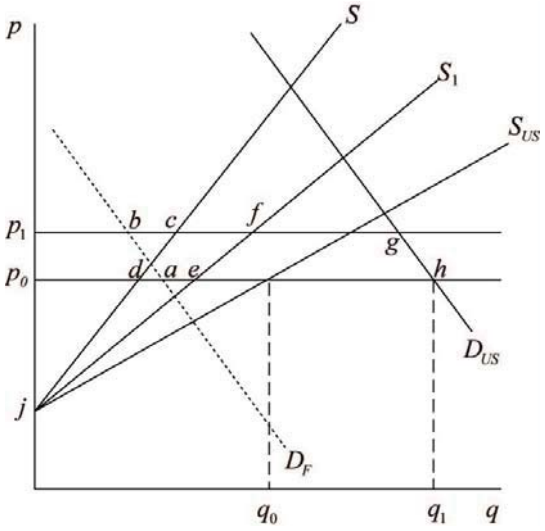


Fig. 2. Impact of U.S. Sugar land buyout: Florida vs. United States

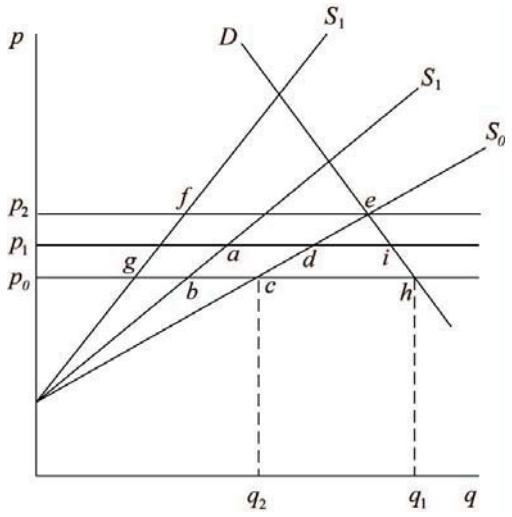
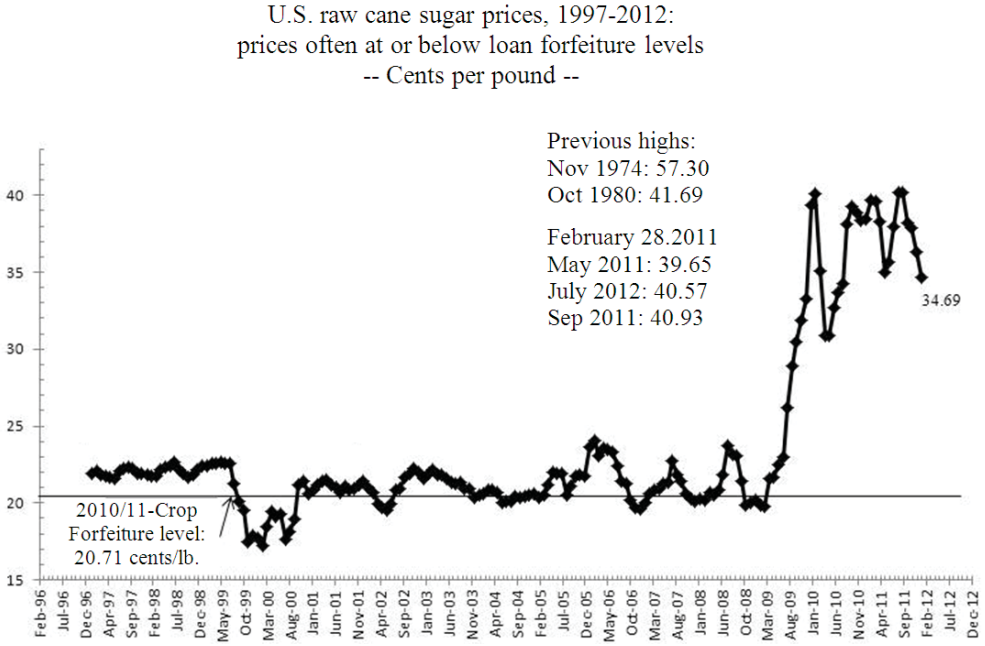
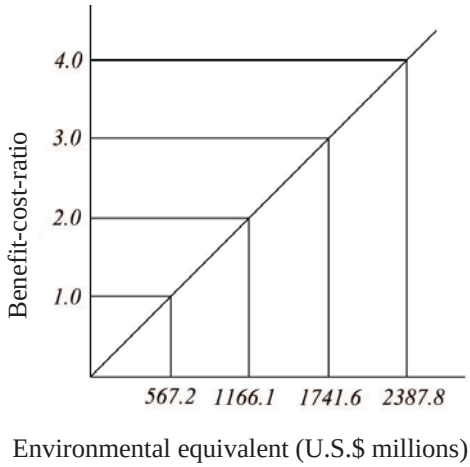


Fig. 3. U.S. Sugar land buyout and land values



Source: USDA, Raw cane sugar, nearby #14 contract. Delivered New York. Monthly average prices. January 1997-January 2012. FSA-calculated forfeiture range.
Notes: Published future prices. Actual sales often forward contracted at levels well below futures' quotes.

Fig. 4. U.S. raw cane sugar prices (1996-2012)



Note: see Table 6 for related data.

Fig. 5. Example of relationship between benefit-cost ratios and environmental equivalents