Why Drill for Oil in Florida?

Tiny industry, huge risks

Prepared for Natural Resources Defense Council

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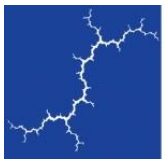

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1. SUMMARY

Why drill for oil in Florida? Both current production and the prospects for future expansion are minimal. Yet efforts continue to develop small amounts of oil and gas, at the expense of Florida's sensitive natural resources, including the Everglades. Expanded exploration and drilling would cause irreparable harm to Florida's natural resources and would jeopardize the state's leading industry, tourism. On the other hand, the small size of Florida's oil industry means that there would be very little economic harm from imposing a statewide legislative ban on well stimulation techniques, such as hydraulic fracturing (also known as fracking) or acidizing, that could cause significant environmental damages.

Oil drilling and production employs less than a thousand of Florida's workforce of nearly 10 million people. Its share of state GDP (gross domestic product, i.e. the value of all goods and services produced in the state) is less than 0.2 percent – essentially invisible in comparison to the 9.5 percent of Florida GDP supported by tourism. Likewise, Florida oil production is a small fraction (less than 0.0006, which is one-sixteenth of one percent) of U.S. oil production; 22 other states produce more. Broadly speaking, oil production does not matter to the Florida economy, and Florida does not matter to oil production.

Florida has two oil-producing regions: at the western end of the Panhandle, bordering Alabama; and in southern Florida, in and around the Big Cypress National Preserve, a key part of the Everglades ecosystem. In 2017, the northern (Panhandle) region accounted for about three-quarters of the state's modest oil output and more than 99 percent of its natural gas production. Yet owners of private mineral rights in the Everglades have been granted approvals to explore for more oil. For example, a Texas-based oil company began destructive seismic exploration in sensitive ecosystems in the Big Cypress National Preserve in its quest to find more oil, which will presumably be followed by exploratory well drilling. Private mineral rights owners have also applied to search for oil on a mixture of private and state lands just to the north of the Big Cypress National Preserve and on lands in western Broward County.

The fossil fuel industry's interest in oil production in and near the Everglades threatens public lands, natural resources, wildlife, water supplies – and losses to Florida tourism, a vastly larger industry than oil. In 2016, out-of-state visitors, both domestic and international, spent $88 billion in Florida and supported 1.4 million jobs, which is one-sixth of the state labor force. Attempts to value Florida's natural resources, which are both of benefit to residents and a major draw for tourism, have produced estimates in the billions of dollars per year. Wildlife viewing and fishing each support more than 50,000 jobs in the state. Losing any noticeable part of tourism to oil exploration and production makes sense only to private mineral rights owners and the fossil fuel industry.

Energy experts doubt that there is enough oil in Florida to support a substantial industry. But even if it were possible to switch from a tourism-based state economy to an oil-based one, would it be good for Floridians economically? The oil industry is unusually volatile, in Florida and elsewhere. Tourism-related employment is remarkably stable by comparison: since 1990, Florida hotel and restaurant jobs are up 75 percent, and Florida real estate and rental jobs are up 50 percent.

Oil well stimulation techniques such as fracking and acidizing facilitate production from unconventional oil deposits. In Florida, acidizing is more likely to be used than fracking due to the state's geology, in which porous limestone houses aquifers used for drinking water supplies (see Section 5, below). Waste water from these techniques can contain hazardous pollutants and pose threats to groundwater aquifers – crucial sources of Florida's drinking water. Proposals for a statewide legislative ban on fracking and acidizing techniques have been introduced, with bipartisan support, into both houses of the state legislature. While a statewide ban has not yet been adopted, at least 77 county or municipal governments have adopted local bans or resolutions opposing fracking. Since oil production plays such a small role in the Florida economy, and reserves are estimated to be quite small, there would be little economic loss from passing a legislative statewide ban on fracking and acidizing.

Florida possesses clean energy resources and related employment opportunities, which could be more sustainable for Florida's economy than oil. The Sunshine State lags behind many other states in the development of solar energy – the Solar Energy Industries Association ranks Florida third in the country for rooftop solar potential, but only twelfth in solar capacity installed. However, solar power could employ many more than the current 8,600 people in Florida if the state promoted renewable energy more vigorously. Unlike oil spills and fossil fuel emissions, solar panels do not destroy the beaches, natural resources, and wildlife that draw so many tourists to Florida and fuel its economy.

2. OIL PRODUCTION AND THE FLORIDA ECONOMY

2.1. Jobs due to oil production

Florida's civilian employment is more than 9,700,000 in total.[1] According to the federal Bureau of Labor Statistics and the Florida Department of Economic Opportunity, mining and logging (including oil drilling) accounts for only 5,800 Florida jobs, and 5,100 of those jobs are outside the oil industry – about 1,600 jobs in logging[2] and 3,500 in "mining, except oil and gas."[3] This leaves only about 700 jobs in oil and gas production, which is less than one in every 13,000 jobs in the state.

These numbers pale in comparison to the tourism industry (see Section 4 below), which accounts for more than one million jobs in the state, or one-sixth of the state workforce.

[1] U.S. Department of Labor, Bureau of Labor Statistics, "Economy at a glance: Florida," https://www.bls.gov/eag/eag.fl.htm. Last visited October 12, 2018.

[2] U.S. Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW), https://www.bls.gov/cew/. Last visited October 12, 2018.

[3] Florida Department of Economic Opportunity, 2018, "Florida's May Employment Figures Released," http://lmsresources.labormarketinfo.com/library/press/release.pdf.

Much higher, misleading figures for oil industry employment have been published,[4] including an outlier estimate from the oil industry itself. The American Petroleum Institute (API) claims that the oil and gas industry contributes $23.2 billion to the Florida economy and supports 286,800 jobs in the state.[5] The source of this claim is a study of the oil and gas industry's contribution to the national economy done for API by the accounting firm PricewaterhouseCoopers (PwC).[6]

The PwC study defines the oil and gas industry as including gas stations, fuel dealers, natural gas distribution companies, asphalt paving and roofing, and other petroleum products manufacturing and wholesaling. Oil and gas production, supporting activities for oil and gas, and refining represented less than half of national total employment in PwC's sprawling definition of the industry. PwC did not provide a breakdown of employment by individual activities for Florida, but since the state has so few jobs in oil and gas production, and no refineries, actual oil production and processing must account for very little of PwC's Florida employment estimate. Rather, the state's alleged huge numbers of "oil industry" jobs, as perceived by API and PwC, must almost exclusively consist of gas stations and the like.

2.2. Oil's share of Florida GDP

As with employment, oil represents only a tiny sliver of Florida's economic activity, or gross domestic product (GDP). In 2017, state GDP was $967 billion, or almost a *trillion* dollars.[7] Of that total, mining of all sorts, including but not limited to oil and gas production, accounted for just $1.6 billion, or 0.2 percent of the state's total GDP (see Figure 1 below).[8]

[4] One academic study made the implausible estimate that there were 18,621 Florida jobs in the production of natural gas and petroleum (Alan Hodges et al., "Economic contributions of agriculture, natural resources, and food industries in Florida in 2015," available at: https://fred.ifas.ufl.edu/media/fredifasufledu/economic-impact-analysis/reports/Economic-Contributions-of-Agriculture-Natural-Resources-and-Food-Industries-in-Florida-in-2015-Full-Report.pdf.) That estimate is more than 2 percent of all oil and gas production jobs nationwide, even though Florida produces only 0.06 percent of the nation's oil (see Section 2.3 below). The study's employment estimates relied exclusively on the IMPLAN model, without any discussion of data quality or alternative sources. IMPLAN develops proprietary datasets and does not explain its sources for individual data items. As the developers of IMPLAN have noted, they frequently receive questions about differences between their estimates and public data sources (IMPLAN Group, Comparison of IMPLAN Source Data for Employment and Labor Income, https://implanhelp.zendesk.com/hc/en-us/articles/115009505747-Comparison-of-IMPLAN-Source-Data-for-Employment-and-Labor-Income).

[5] American Petroleum Institute, Oil and Natural Gas Stimulate Florida Economic and Job Growth, https://www.api.org/~/media/files/policy/jobs/oil-gas-stimulate-jobs-economic-growth/map/florida.pdf.

[6] PricewaterhouseCoopers, 2013, "Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy in 2011," https://www.api.org/~/media/Files/Policy/Jobs/Economic_Impacts_ONG_2011.pdf.

[7] U.S. Commerce Department, Bureau of Economic Analysis, https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1. Last visited October 12, 2018.

[8] Due to the small size of the mining industry, a further breakdown separating oil and gas from other mining is not available.

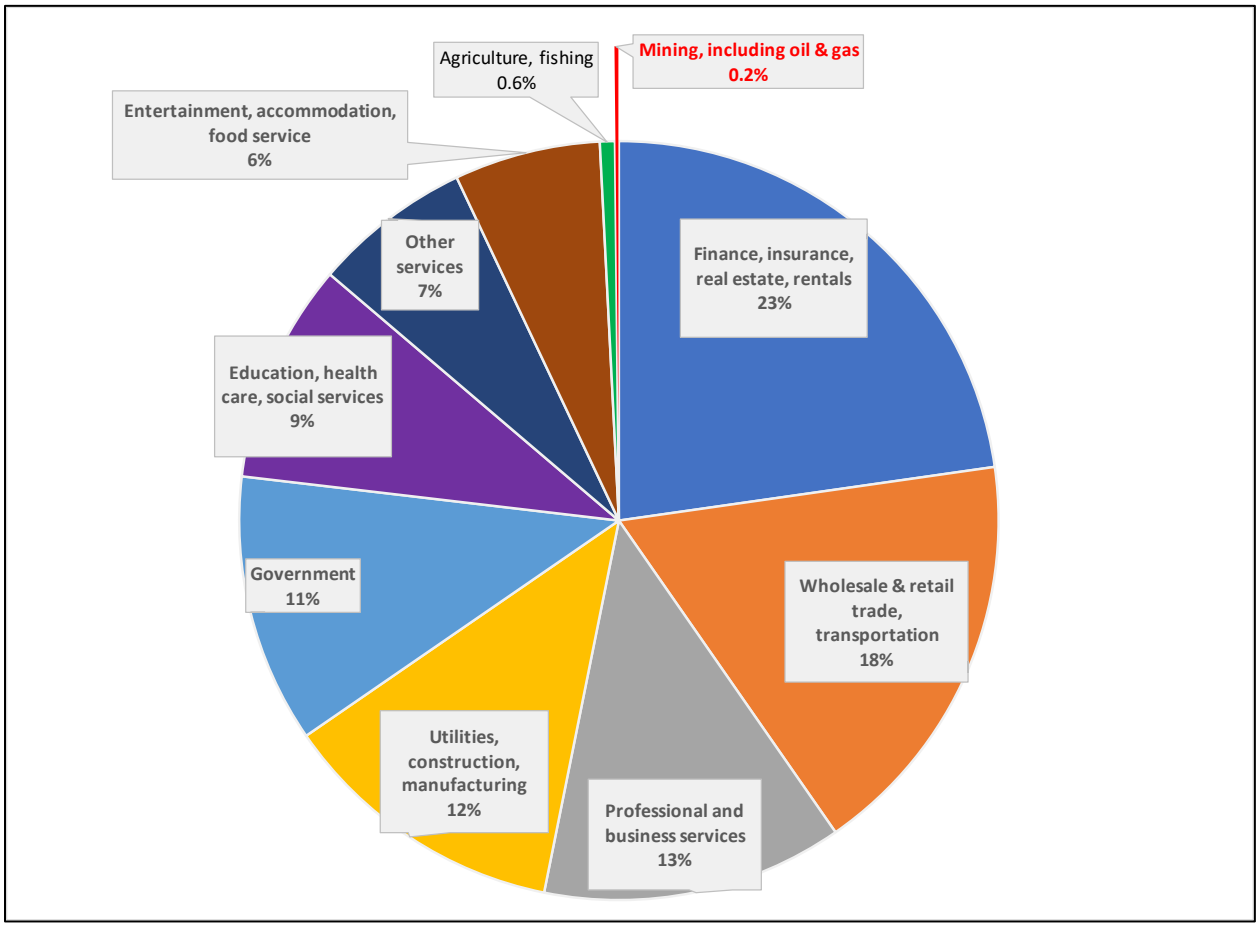

Figure 1. Shares of Florida GDP by industry, 2017

Source: Calculated from Bureau of Economic Analysis data

Tourism, widely seen as Florida's leading industry today (see Section 4 below), does not appear as a category in GDP data. However, tourism undoubtedly accounts for much of entertainment, accommodation, and food service, as well as significant parts of rentals, transportation, and trade, and perhaps other sectors as well. Thus, if tourism were shown as a sector of Florida GDP, it would be a major contributor to the state total – unlike oil and gas.

2.3. Florida oil production

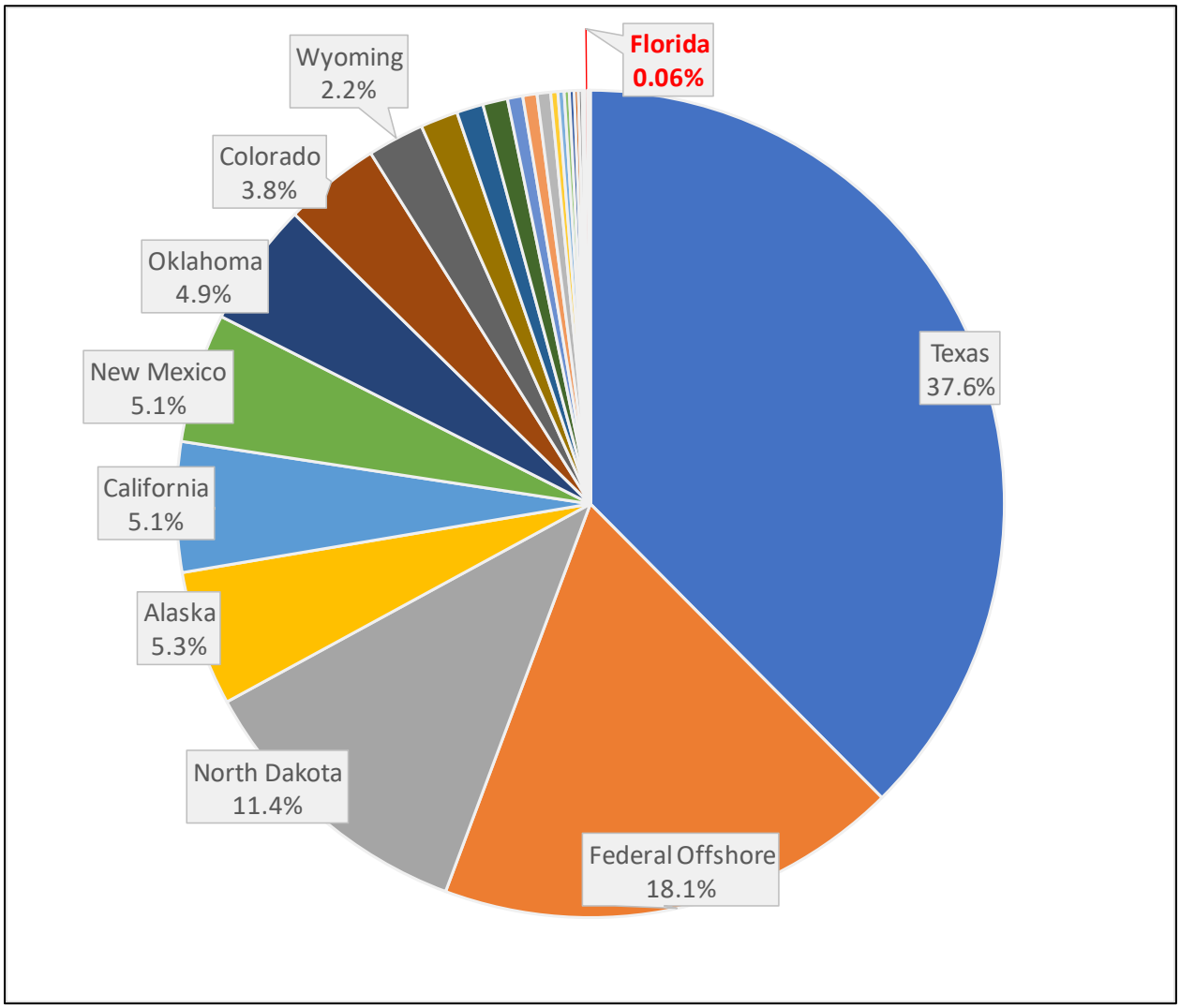

Figure 2. Crude oil production by state, 2017

Source: U.S. Energy Information Administration (EIA) data

Florida oil production peaked in 1978, at roughly 130,000 barrels per day (bbl/day), but has declined sharply since then, falling to roughly 5,000 bbl/day by 2017.[9] A few oil fields were discovered and produced in the 1980s, all relatively small, but they too have declined, and there have been no

[9] U.S. Energy Information Administration, "Florida state profile, 2017," available at: https://www.eia.gov/state/analysis.php?sid=FL. Last visited October 12, 2018.

discoveries since 1988.[10] In 2017, Florida ranked only 23rd among the 33 oil-producing states, accounting for only 0.06 percent (one-sixteenth of one percent) of total U.S. oil production.[11] (The eight named states in Figure 2, other than Florida, plus federal offshore wells, produced 93.3 percent of the nation's oil.) Today the state has less than 0.1 percent of the nation's crude oil reserves, similar to its share of production.[12]

In summary, the oil industry represents an insignificant fraction of Florida employment and GDP, and Florida represents an insignificant fraction of U.S. oil production. Broadly speaking, oil production does not matter to the Florida economy, while Florida does not matter to oil production.

3. DRILLING IN THE EVERGLADES

Florida has two oil-producing regions: a northern one at the western end of the Panhandle, bordering Alabama; and a southern one, known as the Sunniland oil trend, in south Florida, which spreads over the southwest Everglades.[13] The oil fields within this trend include Raccoon Point and Bear Island, which are located within the Big Cypress National Preserve (hereinafter, "Big Cypress" or "Preserve").[14]

In 2017, Florida produced a total of 5,269 bbl/day of oil.[15] The northern oil fields produced about three-quarters of the state's oil and more than 99 percent of its natural gas. In comparison, the five active oil fields in south Florida produced only about one-quarter of the state's oil (1,367 bbl/day) and virtually no natural gas in 2017.[16] Raccoon Point and Bear Island, the two oil fields within Big Cypress, produced only 716 bbl/day in 2017, which is less than one-seventh of the state total for the year.[17] Nonetheless, oil companies have continued to express interest in searching for oil in the Everglades.

The fossil fuel industry has set its sights on new parts of the Everglades in its pursuit of oil, including the Big Cypress National Preserve, which is a part of the National Park System. Located just to the north of

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[10] *New Frontiers: A once-booming Florida oil industry tries to get back to the past*, S&P Global Platts, January 7, 2013, http://blogs.platts.com/2013/01/07/florida_oil/.

[11] U.S. Energy Information Administration, "Crude oil production," https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm. Last visited October 12, 2018.

[12] U.S. Energy Information Administration, "Florida state profile, 2017," https://www.eia.gov/state/analysis.php?sid=FL . Last visited October 12, 2018.

[13] Florida Department of Environmental Protection, "Florida Production 2000 to 2018," https://floridadep.gov/water/oil-gas/documents/state-production-data. Last visited October 12, 2018.

[14] U.S. Department of Interior, National Park Service, *Big Cypress National Preserve, A National Preserve - One Land, Many Uses*, https://www.nps.gov/bicy/learn/historyculture/preserve-one-land-many-uses.htm. Last visited October 12, 2018.

[15] Calculated from Florida Department of Environmental Protection (DEP), "Florida Production 2000 to 2018," https://floridadep.gov/water/oil-gas/documents/state-production-data. Last visited October 12, 2018.

[16] *Id.*

[17] *Id.*

Everglades National Park, Big Cypress covers over 700,000 acres that includes much of the western Everglades.[18] Providing 42 percent of the water flowing into Everglades National Park, the Big Cypress basin is a vast hydrologic network — among the least altered environments remaining in south Florida. Water flows on the surface in marshes and sloughs and below ground through porous substrate in aquifers. Big Cypress Swamp is a significant aquifer recharge area.[19] The Preserve is also home to a wide range of wildlife, including endangered species such as the Florida panther, the wood stork, the red-cockaded woodpecker, and the American alligator.[20] More than a million people visited Big Cypress annually from 2013 to 2016.[21]

Much of the surface of the current Preserve was once owned by the Collier family, after whom Collier County, Florida, is named. The Colliers sold their surface ownership within the original Preserve to the National Park Service in the 1970s but retained ownership of the minerals (oil and gas) beneath the surface. Subsequently, the Colliers conveyed additional acreage to the National Park Service to create the "Addition Lands," significantly expanding the northeast portion of the Preserve.[22]

The federal government attempted to purchase the Colliers' mineral rights beneath the Preserve and other nearby public lands in and near the Everglades in the early 2000s because, according to then-Florida governor Jeb Bush, the purchase was needed to stop "oil drilling in two of the most environmentally-sensitive areas of the state."[23] Various appraisals valued the Colliers' private mineral rights beneath Big Cypress, the Florida Panther National Wildlife Refuge, and Ten Thousand Islands National Wildlife Refuge from $5 million to $475 million; in 2003, the federal government agreed to purchase the Colliers' mineral rights within these areas for $120 million.[24] However, the purchase fell

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[18] Trista L. Thornberry-Ehrlich, Colorado State University, *Big Cypress National Preserve Geologic Resource Management Issues Scoping Summary*" (2005), available at: https://nature.nps.gov/geology/inventory_embed/publications/s_summaries/BICY_scoping_summary_20050228.pdf.

[19] National Park Service, "*Big Cypress National Preserve Geologic Resource Evaluation Report*" (2008), available at: https://nature.nps.gov/geology/inventory_embed/publications/reports/bicy_gre_rpt_view.pdf.

[20] National Park Service, "Revised Environmental Assessment for A Proposed Oil and Gas Plan of Operation: Nobles Grade 3-D Seismic Survey within Big Cypress National Preserve proposed by Burnett Oil Company, Inc.," 1, 11 (2016), available at: https://parkplanning.nps.gov/document.cfm?parkID=352&projectID=53498&documentID=71803.

[21] Calculated from data found at: National Park Service, "Big Cypress NPRES Stats Report Viewer," available at: https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20(1904%20-%20Last%20Calendar%20Year)?Park=BICY. Last visited September 19, 2018.

[22] National Park Service, "Revised Environmental Assessment for A Proposed Oil and Gas Plan of Operation: Nobles Grade 3-D Seismic Survey within Big Cypress National Preserve proposed by Burnett Oil Company, Inc.," 1, 2 (2016), available at: https://parkplanning.nps.gov/document.cfm?parkID=352&projectID=53498&documentID=71803.

[23] Elizabeth Glass Geltman, *Huffington Post*, "Drilling in Big Cypress: Rejected Bush Plan to Purchase Florida Mineral Rights Looks Genius in Retrospect," January 7, 2016, available at: https://www.huffingtonpost.com/elizabeth-glass-geltman/more-drilling-in-big-cypr_b_8912882.html.

[24] U.S. Department of Interior, Office of the Inspector General, "Special Report on the Agreement for Acquisition and Donation of the Mineral Estate between the United States and Collier Family," June 2, 2005, available at: https://www.doioig.gov/sites/doioig.gov/files/BCNPforWEB.pdf.

through, so the mineral rights beneath these sensitive public lands remain in the hands of the Colliers and other private interests.[25]

Oil and gas activities in the greater Big Cypress Swamp predate the creation of the Preserve: the first well to produce oil in Florida was drilled, in the Sunniland trend, in 1943.[26] Existing oil production facilities in the Preserve, however, are confined to two relatively small areas, the Bear Island and Raccoon Point fields.[27] Currently, oil exploration is underway in new parts of the Preserve not impacted by earlier oil development.

The Colliers have leased their mineral rights beneath Big Cypress to the Texas-based Burnett Oil Company, which has begun the first of four planned phases of seismic oil exploration within 110 square miles of the Preserve, largely consisting of wetlands.[28] Burnett Oil's seismic testing uses 33-ton "vibroseis" trucks to drive through the Preserve and apply vibrating plates to the surface to send seismic signals underground to map potential oil.[29] The vibroseis vehicles and other supporting off-road vehicles and seismic survey crews have already damaged wetlands and wildlife habitats in the Preserve, including deep soil rutting and compaction, and cutting down and driving over slow-growing, mature dwarf cypress trees and other wetland vegetation.[30] Tourism in Big Cypress declined by one-sixth in 2017, which is when these seismic activities began.[31]

While several conservation groups oppose additional oil exploration in Big Cypress, opposition to oil development in the Everglades is not limited to environmental interests. Edward Glab, who worked at ExxonMobil for 25 years and is now Co-Director of the Global Energy Security Forum at Florida

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[25] Elizabeth Glass Geltman, *Huffington Post*, "Drilling in Big Cypress: Rejected Bush Plan to Purchase Florida Mineral Rights Looks Genius in Retrospect", January 7, 2016, available at: https://www.huffingtonpost.com/elizabeth-glass-geltman/more-drilling-in-big-cypr_b_8912882.html.

[26] American Oil & Gas Historical Society, 2018, "First Florida Oil Well", available at: https://aoghs.org/petroleum-pioneers/first-florida-oil-well/. Last visited October 12, 2018.

[27] Florida Department of Environmental Protection, "Interactive Map of Permitted Wells" available at: https://ca.dep.state.fl.us/mapdirect/?focus=oilandgas. Last visited October 12, 2018.

[28] Jenny Staletovich, *Miami Herald*, "Florida judge clears way for Big Cypress oil exploration," April 24, 2017, available at: https://www.miamiherald.com/news/local/environment/article146501559.html.

[29] National Park Service, "Revised Environmental Assessment for A Proposed Oil and Gas Plan of Operation: Nobles Grade 3-D Seismic Survey within Big Cypress National Preserve proposed by Burnett Oil Company, Inc.," 1, 18-20 (2016), available at: https://parkplanning.nps.gov/document.cfm?parkID=352&projectID=53498&documentID=71803; Burnett Oil Company, Inc., "Nobles Grade 3-D Seismic Survey Big Cypress National Preserve and Big Cypress National Preserve Addition Plan of Operations" at Exhibit 7 (2014), available at: https://parkplanning.nps.gov/document.cfm?parkID=352&projectID=53498&documentID=66527.

[30] Quest Ecology (2018), "Phase I Seismic Survey Inspection Report: Big Cypress National Preserve," available at: https://assets.nrdc.org/sites/default/files/seismic-survey-inspection-big-cypress-20180531.pdf?_ga=2.242765314.1247387956.1533845179-137203527.1533845179.

[31] Calculated from National Park Service data available at: https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20(1904%20-%20Last%20Calendar%20Year)?Park=BICY. Last visited October 12, 2018.

International University, was quoted as follows: "maps do not show any exploitable shale in the state of Florida… the potential in Florida to produce a significant amount of oil is simply not there… We can find [oil] in many places where the risk to the environment is far less than it is here in Florida. So, I say, stay out of the Everglades."[32] This sentiment was echoed by a former Assistant Secretary of the U.S. Department of the Interior, the late Nathaniel P. Reed, who was integral in creating Big Cypress National Preserve.[33]

4. TOURISM AND THE VALUE OF NATURE

4.1. Valuing tourism and the environment

Unlike oil production, tourism is big business in Florida – based heavily on the state's extraordinary and unique natural resources, including the Everglades. An academic study commissioned by Visit Florida, the state's official tourism marketing corporation, found that out-of-state visitor spending in 2016 accounted for $88 billion in GDP (9.5 percent of Florida's total GDP), and supported 1.4 million jobs (17.1 percent of Florida employment).[34] The Florida Fish and Wildlife Conservation Commission reports that fish and wildlife recreation, such as hunting, freshwater and saltwater fishing, wildlife viewing, and recreational boating are big businesses in the state, contributing billions of dollars annually to the state economy and creating tens of thousands of Florida jobs.[35] For example, recreational boating contributed $10.4 billion to the economy and created 82,700 Florida jobs in 2013; recreational saltwater fishing contributed $6.6 billion and created 96,800 jobs in 2015.[36]

Focusing solely on Big Cypress, the National Park Service found that in 2015, 1.1 million visitors to the Preserve spent $87 million in nearby communities, supporting 1,225 local jobs.[37] Thus tourists visiting the Preserve in 2015 created more jobs than the entire Florida oil and gas industry does at present (see Section 2.1).

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[32] Luis Hernandez, *WLRN*, "Energy Pro: Florida is not a Big Oil State. So Why Drill?," August 17, 2015, available at: http://www.wlrn.org/post/energy-pro-florida-not-big-oil-state-so-why-drill.

[33] Nathaniel P. Reed, *Sun-Sentinel*, "Pristine Big Cypress worth preserving," April 11, 2016, available at: http://www.sun-sentinel.com/opinion/commentary/fl-viewpoint-drilling-20160411-story.html.

[34] Oxford Economics, "The Economic Impact of out-of State Visitors in Florida: 2016 Calendar Year Analysis," available at: http://www.floridatrend.com/public/userfiles/news/pdfs/florida-visitor-economic-impact-study-2016data.pdf

[35] Florida Fish and Wildlife Conservation Commission, "Socioeconomic Assessment," available at: http://myfwc.com/about/overview/economics . Last visited November 13, 2018.

[36] *Id.*

[37] National Park Service, "2015 Big Cypress Tourism Benefits Calculated," available at: https://www.nps.gov/bicy/learn/news/2015-big-cypress-economic-benefits.htm. Last visited September 19, 2018.

The value of nature extends beyond its proven ability to attract tourists. A 2012 study found that Everglades restoration will create $46.5 billion in ecosystem benefits.[38] The restoration is a multi-year, multi-billion-dollar project that could be thwarted by oil drilling; the estimated benefits, however, are several times larger than the cost of the restoration process. Most of the benefits are in groundwater purification, real estate values (homes are worth more if located near cleaner water), wildlife habitat, and hunting.[39]

Another study found that the value of carbon storage in Everglades' mangroves was $2 billion to $3.4 billion. Loss of adequate freshwater flows through the Everglades could cause degradation of the mangroves and the release to the atmosphere of large quantities of carbon currently stored in the mangroves.[40]

Even these multi-billion-dollar estimates fail to convey the true value of irreplaceable natural environments and endangered species. The value of nature can be of utmost importance, without having a well-defined price tag attached. Beyond the large estimated prices for the Everglades' ecosystem services lies its dignity as a unique ecosystem and a home to species that live nowhere else in the world. Thus, cost-benefit analyses cannot fully comprehend the meaning of losing the incalculable values that the Everglades provides, whether to oil exploration, careless economic development, or climate change.[41]

4.2. Escaping volatility: The value of predictable growth

The oil industry in Florida is not only small; like the industry elsewhere, it varies significantly and unpredictably from year to year.

[38] Mather Economics (2017), "Measuring the Economic Benefits of America's Everglades Restoration," available at: https://www.evergladesfoundation.org/wp-content/uploads/sites/2/2017/12/Report-Measuring-Economic-Benefits-Exec-Summary.pdf.

[39] *Id*.

[40] Meenaksi Jerath, *et al*., (2016) "The role of economic, policy, and ecological factors in estimating the value of carbon stocks in Everglades mangrove forests, South Florida, USA", *Environmental Science & Policy* 66, 160-169. Available at: https://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=190254.

[41] *See* Frank Ackerman and Lisa Heinzerling (2004), *Priceless: On Knowing the Price of Everything and the Value of Nothing* (New York: The New Press); Frank Ackerman (2017), *Worst-Case Economics: Extreme Events in Climate and Finance* (London: Anthem Press).

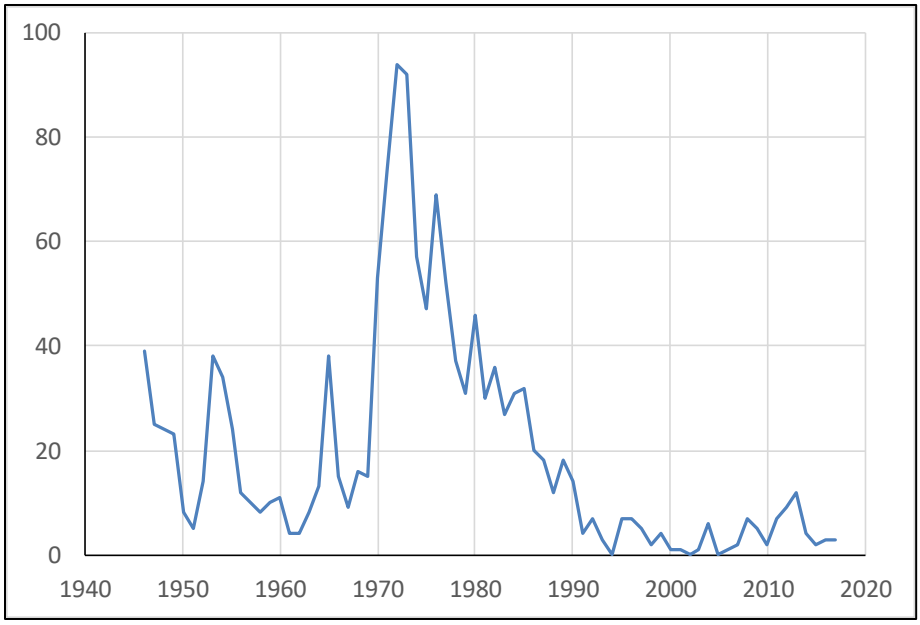

Figure 3. Florida oil and gas drilling permits issued by year, 1946-2017

Source: Calculated from Florida DEP, Oil and Gas Permit Database, https://floridadep.gov/water/oil-gas/documents/oil-and-gas-permit-database.

Figure 3, showing annual drilling permits, reveals the erratic rhythm of the Florida oil industry.[42] Because production from an existing oil well declines over time, additional drilling is required to maintain or expand production. The annual drilling permits data suggest that this has been a constantly fluctuating process. Expansion of the oil and gas industry would provide the "opportunity" to connect more of the state economy to the wildly unstable pattern shown in Figure 3.

The instability of the oil industry is not unique to Florida. Academic research has found that oil prices are more volatile than almost all other prices, especially since the 1980s.[43] The volatility of oil prices has a significant, negative effect on future GDP growth.[44]

In contrast, the nearly steady growth of tourism-related employment is reflected in Figure 4. Since 1990, Florida hotel and restaurant employment has grown by 75 percent, while real estate employment has grown by 50 percent. Both series slumped around the time of the Great Recession, in 2008-2010, but soon recovered. The small downward blip near the end of the hotel and restaurant series occurred in September 2017, when a Category 4 hurricane, Irma, made landfall in Florida. Tourism-related jobs

[42] Due to the small size of the state's industry, there do not appear to be any data on Florida oil production employment over time.

[43] Eva Regnier (2007), "Oil and energy price volatility," *Energy Economics* 29, 405-427.

[44] Hui Guo and Kevin L. Kliesen (2005), "Oil price volatility and U.S. macroeconomic activity," *Federal Reserve Bank of St. Louis Review* 87, 669-683.

generally do not pay as much as oil industry jobs, but in Florida they are hundreds of times more numerous, and far more reliable from year to year. Thus, any oil development that could jeopardize Florida's tourism industry would not be a net gain for the state economy.

Figure 4. Monthly employment in Florida hotels and restaurants, and real estate

Source: U.S. Department of Labor Bureau of Labor Statistics, Current Employment Statistics, as reported by Florida Department of Economic Opportunity, http://www.floridajobs.org/labor-market-information/data-center/statistical-programs/current-employment-statistics. Data series began in January 1990.

5. PROPOSED STATEWIDE FRACKING BAN IN FLORIDA

Hydraulic fracturing, or fracking, is a technology that has allowed production of oil and gas from so-called "unconventional" reservoirs across the United States. Hydraulic fracturing is a form of "reservoir stimulation" – broadly, a set of practices used to increase oil and gas production. Due to the state's geology, hydraulic fracturing will likely not be a key technology for producing oil in Florida. However, a different well stimulation technique, known as matrix stimulation, has been used in some cases and is proposed for wider use. Acid matrix stimulation or "acidizing" is the most common form of matrix stimulation and could allow greater exploitation of Florida's unconventional oil. Acidizing dissolves portions of the oil-bearing rock formations through the injection of acid mixed with water and other chemicals, allowing oil to more easily flow to the wellbore. Acidizing techniques threaten groundwater resources since Florida oil fields generally lie deeper than the shallow aquifers that provide the state with fresh drinking water.

Throughout the drilling, fracking or acidizing, and subsequent production activities, operators must manage and dispose of several types of waste. Wastewater, including so-called "produced water" and "flowback,"[45] is by far the largest waste stream that the oil and gas industry produces.[46,47] Operators may temporarily store produced water in tanks or pits, recycle it for reuse in subsequent fracking or acidizing, or dispose of it using underground well injection.[48] Once a well is no longer producing economically, the operator typically plugs the well with cement to prevent fluid migration from outlying formations into the well and to prevent downward drainage from inside the well.[49] If wells are not properly plugged or the plugs deteriorate, polluted waste water may escape into the environment.[50] Spills and leaks of oil and gas wastewater are also one of the leading causes of environmental impacts from oil and gas operations, particularly impacts to water resources and soils.[51]

Groundwater is one of Florida's most valuable natural resources. Around 93 percent of Florida's population depends on groundwater for drinking water, far more than any other state in the nation.[52] Florida aquifers are vulnerable to contamination because large areas are characterized by well-drained sandy soils overlying porous limestone. A shallow water table and high rainfall increase the potential for contamination to reach the groundwater.[53] Thus, the use of fracking and acidizing techniques should be extremely concerning to Floridians since it threatens to pollute their drinking water.

Concerns about Florida's drinking water and other resources have fueled attempts to ban fracking and acidizing statewide, although they have not yet succeeded. In the 2018 Florida legislative session, a

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[45] Produced water is water that is naturally occurring in subsurface geologic formations and that is co-produced with oil and gas. Produced water can vary from nearly fresh to many times saltier than seawater, and may contain naturally occurring contaminants such as hydrocarbons, heavy metals, salts, and naturally occurring radioactive material, as well as chemicals intentionally added to assist in drilling, completion, well stimulation, maintenance, enhanced recovery, and other activities. Flowback is used reservoir stimulation fluid that later returns to the surface. In addition to stimulation chemicals that were intentionally added to the fluid, flowback can also contain products of chemical reactions between the stimulation fluid and subsurface formations and fluids, as well as varying amounts of produced water.

[46] *See, e.g.,* United States Government Accountability Office. (2012). *Report to the Ranking Member, Committee on Science, Space, and Technology, House of Representatives; Energy-Water Nexus; Information on the Quantity, Quality, and Management of Water Produced during Oil and Gas Production*; John Veil, Veil Environmental, LLC. (2015). *U.S. Produced Water Volumes and Management Practices in 2012,* Prepared for the Ground Water Protection Council.

[47] U.S. Government Accountability Office, Unconventional Oil and Gas Development: Key Environmental and Public Health Requirements 1, 13 (2012), http://www.gao.gov/assets/650/647782.pdf.

[48] *Id*.

[49] *Id*.

[50] *Id*.

[51] *See, e.g.,* Kharaka, Y. K., & Dorsey, N. S. (June 2005). "Environmental issues of petroleum exploration and production: Introduction." *Environmental Geosciences*, 12(2), 61-63; Otton, J. K. (2006). Environmental aspects of produced-water salt releases in onshore and estuarine petroleum-producing areas of the United States - a bibliography. Retrieved from U.S. Geological Survey Open-file report 2006-1154: http://pubs.usgs.gov/of/2006/1154/pdf/of06-1154_508.pdf; U.S. EPA. Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/236F, 2016.

[52] Edward A. Fernald, Water Resources Atlas of Florida 116 (1998).

[53] *Id.* at 145.

Republican State Senator and a Republican State Representative introduced proposed legislation that would have banned "well stimulation" techniques such as fracking and acidizing.[54] While it failed to pass, proponents of this legislation hope that a statewide ban will be reintroduced in the 2019 Florida legislative session.[55] Even former energy company executives have publicly supported a statewide fracking ban, citing both economic and environmental concerns.[56]

Opponents of the statewide fracking ban include Associated Industries of Florida and the Florida Petroleum Council. One news report described these groups as "the lone two voices in opposition in a sea of organizations that came out in support of the statewide ban."[57] Industry arguments against a statewide fracking ban include the risk of sending the "wrong message" about fracking to the rest of the country, and the assertion that a fracking ban would lead to litigation if it would deprive property owners of their rights to extract oil.[58]

Economic arguments in support of fracking in other parts of the country do not always apply to Florida. Such arguments have often emphasized the benefits of increased employment and wages, as well as royalty and lease payments to local landowners. In the case of fracking or acidizing in the Everglades, there will be no royalty or lease payments made to the federal government, because the subsurface mineral rights are privately owned.

One recent study of fracking in other states, by prominent environmental economists, compares the carefully measured economic benefits of fracking with its negative effects, as valued by households, finding a modest net benefit. Yet self-reported values, as the study points out, can be distorted by lack of public information on the risks associated with the technology.[59] If people were better informed about the environmental impacts of fracking, they might have more negative evaluations of the technology, tipping the cost-benefit balance against fracking.

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[54] Florida Senate, SB 462 (2018), https://www.flsenate.gov/Session/Bill/2018/462/BillText/Filed/HTML; Florida House of Representatives, HB 237 (2018), https://www.myfloridahouse.gov/Sections/Documents/loaddoc.aspx?FileName=_h0237.docx&DocumentType=Bill&BillNumber=0237&Session=2018.

[55] Greg Stanley, "Bill to ban fracking for oil and gas dies in Florida legislature again," *Naples Daily News,* March 16, 2018, available at: https://www.naplesnews.com/story/news/local/florida/2018/03/16/fracking-ban-bill-dies-florida-legislature-second-year-conservationists-hopeful-2019/431395002/.

[56] John Hall and John Hushon. "Commentary: Fracking not worth risk in Florida," *Naples Daily News*, December 15, 2017, available at: https://www.naplesnews.com/story/opinion/contributors/2017/12/15/commentary-fracking-not-worth-risk-florida/941533001/

[57] Ana Ceballos, "Senate Panel Ignores Petroleum Industry Pleas, Advances Fracking Ban," *Florida Politics*, February 5, 2018, available at: http://floridapolitics.com/archives/255436-senate-panel-ignores-petroleum-industry-pleas-advances-fracking-ban.

[58] *Id.*

[59] Alexander W. Bartik, Janet Currie, Michael Greenstone, and Christopher R. Knittel (2018), "The Local Economic and Welfare Consequences of Hydraulic Fracturing," National Bureau of Economic Research, https://ssrn.com/abstract=2692197.

Another high-profile economic study, which may be more relevant to Florida, provided a detailed examination of changes in housing prices in Pennsylvania near fracking sites.[60] It found large, negative effects of fracking on nearby house prices – losses of 9.9 to 16.5 percent – for homes dependent on groundwater wells.[61]

While Florida has not yet banned fracking or acidizing, at least 77 counties and municipalities have passed resolutions or ordinances banning these practices.[62] How much difference would a statewide ban make to the Florida economy? The answer is, very little. The small size of the state's oil industry and reserves (as discussed in Section 2) means that a statewide ban on fracking and acidizing would pose little risk to Florida's economy.

6. JOBS FROM CLEAN ENERGY

In clean energy, unlike oil and gas, jobs can be created without threatening the Everglades or other natural environments. The Sunshine State lags far behind other, less sunny parts of the country in the development of solar power. According to the Solar Energy Industries Association (SEIA), Florida had total installed solar capacity of 1,893 megawatts (MW) in 2017, generating 0.65 percent of the state's electricity. Florida ranked third in the country for rooftop solar potential, but only twelfth for cumulative solar capacity installed. There were about 8,600 jobs in the solar industry in the state in 2017 – more than ten times that year's Florida oil industry employment, but far below the solar industry's percentage of the state labor force in many other states, such as North Carolina and Massachusetts.[63]

Most of the state's 1,893 MW of solar capacity was in large-scale, utility-owned projects (where costs per kilowatt-hour are lower than from rooftop panels). Owners of smaller solar installations, such as rooftop solar, typically rely on net metering connections, allowing them to sell solar electricity to the grid. The Florida Public Service Commission reported that in 2017, net metering connections provided 197 MW of solar energy.[64] As elsewhere in the country, solar power costs are continuing to drop in

[60] Lucija Muehlenbachs, Elisheba Spiller, and Christopher Timmins (2015), "The Housing Market Impacts of Shale Gas Development," *American Economic Review* 105(12): 3633–3659.

[61] *Id.*

[62] Food and Water Watch, "Local Resolutions Against Fracking", available at: https://www.foodandwaterwatch.org/insight/local-resolutions-against-fracking. Last visited September 19, 2018.

[63] Solar Energy Industries Association, "Florida Solar," available at: https://www.seia.org/state-solar-policy/florida-solar. For another study finding 11,000 Florida jobs in solar and other renewable energy in 2014, see Environmental Entrepreneurs, "Clean Jobs Florida: Sizing Up Florida's Clean Energy Jobs Base and its Potential," available at: http://cleanjobsflorida.org/wp-content/uploads/2014/10/FINAL.FloridaJobsReport_101014_LR.pdf.

[64] Florida Public Service Commission, "Consumer Renewable Energy Systems: 2017," available at: http://www.psc.state.fl.us/ElectricNaturalGas/CustomerRenewableShowYear?folder=2017.

Florida. SEIA found the state had a 47 percent decline in solar power prices in the last five years, making solar investments much more affordable.

Florida has plenty of room for expansion of solar power and solar jobs in the years ahead. More vigorous state policies to promote renewable energy could help jump-start the industry. And there is an added bonus to harnessing solar energy: unlike oil spills and fossil fuel emissions, rooftop solar panels do not destroy the beaches, water resources, and wildlife that draw so many tourists to Florida and fuel its economy.