The Public Funding of Land Acquisitions and Easement Purchases in Virginia

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The Thomas Jefferson Program in Public Policy at the College of William & Mary

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Any remaining mistakes are our own.

Abstract

We conducted a study to identify the state of publicly funded land conservation programs in the Commonwealth of Virginia for The Nature Conservancy. The study looks at three questions. First, how many localities have publicly funded land acquisition programs and purchase of development rights (PDR) schemes in Virginia? Second, to what extent are these land conservation programs influenced by State and Federal Chesapeake Bay regulations? Third, what motivates localities to establish land conservation programs? We administer a Qualtrics-designed online survey to collect information on these programs and run a probit regression to help give statistical significance to our findings. We find that 17 localities have land acquisition programs and 11 have PDR schemes; five have both. In addition, we find that the role of federal and state regulations is unclear. Finally, our probit models show that per capita income is a statistically significant variable. In the ultimate analysis we conclude that a relatively high per capita income increases the likelihood a locality institutes a land conservation program and that the role of federal regulations, public interest, and desire to preserve agricultural lands are also important motivating factors.

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Part I

Introduction

We conducted this study in an effort to understand what motivates localities in the Commonwealth of Virginia to engage in conservation activities. For the purposes of this study, localities are defined as independent cities or counties, and do not include unincorporated towns. The main component of this study was a 35-question, web-based survey that was administered statewide. The two main questions asked whether a locality: 1) had a land conservation program; and 2) engaged in the purchase of development rights (PDRs) or land easements. The former refers to the purchase of land by a locality to preserve green space in the community for a variety of purposes, while the latter refers to the purchase of the rights to build on or otherwise develop land for commercial, residential, and/or agricultural use.[1] The survey inquired about the impact of the Chesapeake Bay Preservation Act and Total Daily Maximum Load (TDML) requirements in land conservation initiatives. Finally, we included questions to discern the political and economic motivations for conservation policies.

The remainder of this report is split into seven additional sections. Part II describes the methodology, discussing the details of the survey and the econometric models that were employed in our analysis. Part III reviews the literature, examining a variety of academic, professional, and legal sources from the public, private, and media sectors. A number of common themes arose from the literature review including the impact of the Chesapeake Bay, the role of powerful interest groups, the efficacy of Environmental Protection Agency regulations, and citizens' willingness-to-pay for conservation programs. These themes influenced the survey's development and provided a lens through

[1] Although there are a variety of conservation programs, the survey focused on these two types of programs at the direction of the client.

which to interpret and understand data generated from the survey. Part IV and V examine two case studies, James City County and Virginia Beach respectively, in an effort to contextualize the data. Part VI assesses data outcomes. Part VII proposes areas of future research and presents our conclusions.

MAJOR RESEARCH QUESTIONS

- *How many localities have land conservation programs in Virginia?*
- *What motivates localities to establish land conservation programs?*
- *How do Chesapeake Bay restrictions impact the development of land conservation programs?*

Part II

Methodology

In designing this report, the team had to resolve several issues. The first was to refine the research questions. Through negotiations with our client we refined the initial research proposal in order to identify the specific research questions that we would address. The second was to determine how to address our inquiry. This section discusses the methodology that we constructed as well as an assessment of our research limitations.

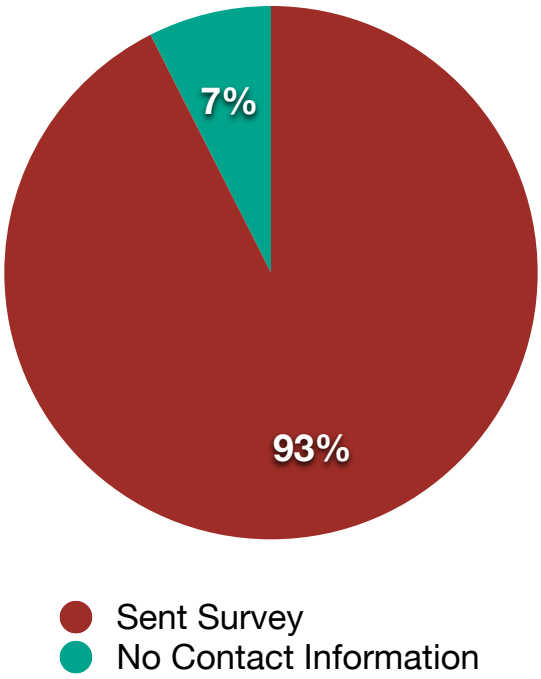
Before settling on a course of action the team identified a number of initial constraints. These influenced the outcome of the final product and therefore merit a brief discussion. First, we faced time limitations, as the project had to be initiated and completed within one academic semester. Thus, data had to be collected quickly. Second, the data collection mechanism had to ensure that the team could store, present, and analyze the data with relative ease. Finally, the team had limited financial and human resources. In the absence of these limitations, our methods may have changed significantly.

The Survey. From the beginning, the team decided to rely on a method of self-reporting to address our research questions as it was infeasible to visit every single Virginia locality. We then determined that our survey had to be conducted electronically for efficiency and ease of data collection. The next step was to determine the sets of questions to be asked. In drafting these questions, the team was guided by the literature and advised both by the client and its faculty advisers. Once a beta version of the survey was completed, the team administered it to representatives of James City County (JCC). The team was interested in feedback about the survey content as well as technical issues such as the ease of use, logic in the order of questions, clarity of language, and correct use of terminology. Feedback from JCC,

faculty advisers, and the client was incorporated into our final survey. The survey in its entirety is found in **Appendix I**.

During the course of selecting an online survey program, the team experimented with a variety of online survey tools including *SurveyMonkey*, *Google Forms*, and *Qualtrics*. Ultimately, we chose *Qualtrics* for two reasons. One, it is highly recommended in the social sciences for qualitative and quantitative research. Two, and more crucially, the software created an individualized question path for each respondent, eliminating unnecessary questions based on previous answers. For example, once a respondent marked she did not have a land conservation program, questions meant to elicit specific information about land conservation programs were eliminated. This ensured that respondents were not burdened with an excess of questions. The team hoped that this would increase ease of use for the respondent, resulting in a higher response rate and more accurate responses.

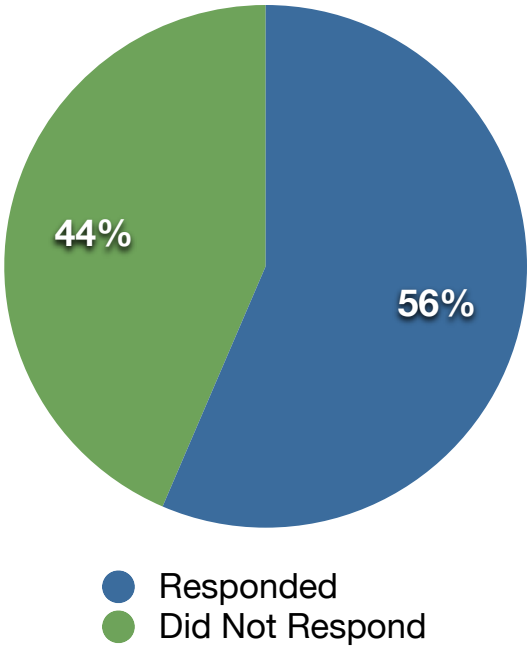
Figure 1. Distribution of survey.



The team took several other measures to ensure a high response rate. Contact information from each of 134 localities was collected during an initial internet search. Next, team members contacted all localities (via telephone and email) in order to obtain the contact information of the appropriate person(s) in the locality to respond to conservation-related questions. A pre-written script was used to standardize communication with localities. Given time constraints, we decided to contact localities only three times. After three unsuccessful attempts to identify contacts for a given locality, we dropped the locality from the survey sample. Unfortunately, the research team was unable to obtain reliable contact information for ten Virginia localities.

We released the survey on October 12, 2011 to a total of 124 localities, from the total of 134 cities in counties in Virginia. This is shown in ***Figure 1***, to the left. The survey included a personally addressed, yet standardized, email with a letter of endorsement from the Director of the Thomas Jefferson Program in Public Policy included as an attachment. The link

Figure 2. Survey response rate. (N=124)



to the survey was included in the body of the email. Respondents were asked to complete the survey within a week.

After the survey's initial dissemination, we conducted two rounds of follow-up emails that urged localities to complete the survey in a timely fashion. As before, emails were personalized and scripted. The final round of emails to localities was sent on November 2, 2011 and provided a final deadline of November 9, 2011. The email also informed localities that any responses received after the survey-expiration date would not be included in this report. 68 surveys were received prior to the deadline and two surveys were received after the deadline and were thus omitted from our analysis.[2] Thus, the overall response rate is 54.8 percent. This is shown in ***Figure 2***, to the left. The number and breadth of responses allowed us to gather interesting qualitative conclusions regarding the state of land conservation programs in Virginia.

Limitations. One limitation of our study is the method of survey administration, which may have impacted responses. Because the survey was sent via email to work addresses, respondents had to take the survey during the day, within their normal work hours. Respondents could have encountered frequent interruptions. It may have been preferable to administer the survey in a controlled space and within a designated period of time. Consequently, some respondents may have approached the survey with more rigor and care than others. Additionally, electronic communication may have affected the response rate. Given the broad variety of anti-spam software, it is quite possible that the survey entered spam folders. It is not uncommon for employees to be inundated with a high flow of emails each day, so the survey emails could have been buried in the potential respondents' inboxes and thus went overlooked. Finally, some respondents commented that they had issues with the abrupt conclusion of the survey. Instead of a "submit" button, the survey automatically closed after the last question was answered, leaving

[2]It should also be noted that those surveys were not fully completed.

respondents without a chance to review their answers. In four instances, this resulted in multiple submissions from the same locality.

A second limitation is the nature of the survey questions. As one respondent noted, "some of the questions were very open to interpretation, which may lead to an inconsistency in answers among jurisdictions." Certainly, this is a valid concern. However, taken as a whole, the purpose of this research was first to determine which localities maintained land conservation programs, as well as the shape that these programs took across Virginia. Questions were crafted to be as unambiguous as possible but also to elicit a wide range of answers. When designing questions to gather information on establishing conservation programs, the team was intentionally broad with wording to allow respondents latitude in interpreting questions and formulating answers. In addition to questions asked, other unasked questions may have provided additional key information. The team had to weigh additional questions against providing a relatively user-friendly survey and, thus, was unable to ask all, potentially relevant questions about these programs and the motivations behind them.

Additionally, there are some potential concerns about the potential for a self-selection bias. Respondents could have chosen to participate for political or personal motivations. For instance, an individual may be compelled to participate when her locality has a conservation program simply because it highlight her locality's successes. Conversely, those without programs may have been less likely to respond for a variety of issues, including disinterest in the land conservation programs. The geographic location of the locality may have also influenced the propensity to respond. Virtually all (with exception of two) localities in the southwestern section of Virginia failed to respond to our survey (see survey response map in the **Appendix II**). Furthermore, given variation in size and priorities, some localities do not have individuals or units working on land conservation issues. Oftentimes, this required offices to pull together a team, conduct research, and/or make educated guesses in order to complete the survey. This could have resulted in inaccurate information about funding, the duration of programs, and public opinion.

Part III

Literature Review

During the initial stages of research we conducted a review of current literature regarding land conservation and its possible connections to federal and state pollution regulations, such as the Clean Water and Chesapeake Bay Preservation Acts. We also conducted interviews with two Virginia localities (as discussed later in the report Parts IV and V). The interviews highlighted different locality characteristics that may be pertinent to the land conservation programs and practices that they eventually adopted. What follows below is a list of our expectations regarding the state of land conservation programs in Virginia based on our literature review and interviews with local government representatives.

Chesapeake Bay pollution requirements will have a significant impact on localities adopting land conservation programs. With the goal of preserving the Chesapeake Bay from pollutants harmful to marine life, three states (including Virginia), the District of Columbia, the Environmental Protection Agency, and the Chesapeake Bay Commission signed an agreement in the summer of 2000.[3] This agreement, titled *Chesapeake 2000*, reaffirmed a collective commitment on the part of state and federal representatives to reduce Bay pollutants (such as phosphorous and nitrogen which have collectively depleted oxygen zones for oysters and other living resources) as part of a broad goal to maintain a balanced ecosystem for future generations. In addition to several other prominent goals of the agreement, *Chesapeake 2000* pledged the collective entities' determination in developing, promoting and achieving "sound land use practices which protect and restore

[3] United States. Chesapeake Bay Commission. *Chesapeake 2000 Agreement.* June 28, 2000. Accessed September 26, 2011. http://www.chesapeakebay.net/content/publications/cbp_12081.pdf.

watershed resources and water quality" in the Bay.

As reflected in a recent *Washington Post* article in September, environmental experts have historically expressed concern regarding the impact of storm water runoff into the Bay (such as Tropical Storm Lee during September of this year), which "produced the second-largest water flows from the Susquehanna River into the bay since Hurricane Agnes in June 1972."[4] Beyond concerns that such storm runoff serves as an "expressway for pollution," other environmental experts have indicated that as much as 500 million gallons of diluted sewage has washed into Maryland bay waters alone and routinely mixes with runoff from farms washed in livestock manure, fertilizer, and suburban runoff from streets, rooftops, and lawns. A report from the *Chesapeake Bay Foundation* indicated that "roughly 300 million pounds of polluting nitrogen reaches the bay" annually.[5]

Localities that do not engage in either land acquisition or purchase of development rights programs will have significant industries (i.e. agricultural, commercial, new housing development) that are vital to the local economy and inherently conflict with environmental conservation regulations. In his article regarding the federal Clean Water Act, Oliver Houck extensively detailed the history of the act and the creation of Total Maximum Daily Load (TMDL) requirements on impaired state waters.[6] Houck goes on to explain the politically charged nature of this issue and provides compelling empirical evidence of lagging progress made by Chesapeake Bay watershed states despite the Environmental Protection Agency's (EPA) most ardent efforts at enforcing federal pollution guidelines. Related to this, Houck points to powerful lobbying firms that represent farming and housing development organizations that work to stifle the effectiveness of federal water pollution regulations. Noting the implications for future Clean Water Act enforcement, Houck writes that the EPA has yet to prove

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[4] Fear , Darryl. "Chesapeake Takes a Beating from Storm - The Washington Post." Washington Post: Breaking News, World, US, DC News & Analysis. September 13, 2011. Accessed November 20, 2011. http://www.washingtonpost.com/national/health-science/chesapeake-takes-a-beating-from-storm/2011/09/13/gIQAKNVaQK_story.html?wpisrc=nl_headlines.

[5] "Water Quality Issue: Nitrogen and Phosphorus Pollution." Chesapeake Bay Foundation. Accessed November 30, 2011. http://www.cbf.org/page.aspx?pid=913.

[6] Houck, Oliver A. "The Clean Water Act Returns (Again): Part I, TMDLs, and the Chesapeake Bay." *Environmental Law Reporter*, March 2011, 10208-0228. Accessed September 26, 2011. http://elr.radcampaign.com/news-analysis/41/10208/clean-water-act-returns-again-part-i-tmdls-and-chesapeake-bay.

whether they can hold states accountable, as the issue of clean water is "being tested in two venues where the problems are among the most acute and their solutions the most resisted: Chesapeake Bay and Florida. As go Chesapeake and the Sunshine State, so will go the future of clean water for years to come."

Echoing the political and legal debate between EPA regulators and the farming industry, Darryl Fears described in a July 2011 *Washington Post* article how the Farm Bureau filed a request in federal court to block the EPA's recently released plan to reduce pollution sediment in the bay.[7] Specifically, opponents of EPA regulation assert that the calculation of acceptable pollution limits should reside with the states instead of the federal government and that the planned "pollution diet" advocated by the EPA could cost billions of dollars and "drive farmers in the Chesapeake Bay watershed out of business." As reflected in R. David Simpson's article in the Canadian Journal of Agricultural Economics, "about 46 percent of reactive nitrogen entering the Chesapeake Bay comes from agriculture."[8] As an indication of how extensive this battle is between regulators and commercial industry, the National Association of Home Builders recently joined the lawsuit alongside the Farm Bureau.[9]

There will be a positive relationship between existing land conservation programs and per capita income. As noted in a 2004 study in Cuyahoga, Ohio, researchers assessed local citizens' willingness-to-pay (WTP) for green space conservation by utilizing the Contingent Valuation method administered via survey.[10] Citizens were asked questions that related to how much money they would be willing to spend in additional tax dollars for the funding of green space

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[7] Fears, Darryl. "Alarming 'dead Zone' Grows in the Chesapeake." *The Washington Post: National, World & D.C. Area News and Headlines - The Washington Post*, July 24, 2011. Accessed November 07, 2011. http://www.washingtonpost.com/national/health-science/alarming-dead-zone-grows-in-the-chesapeake/2011/07/20/gIQABRmKXI_story_1.html.

[8] Simpson, R. D. "Allocating Land for an Ecosystem Service: A Simple Model of Nutrient Retention with an Application to the Chesapeake Bay Watershed." *Canadian Journal of Agricultural Economics* 59, no. 2, 259-80. Accessed September 26, 2011. http://onlinelibrary.wiley.com/doi/10.1111/j.1744-7976.2010.01214.x/full.

[9] *Ibid.*

[10] Blaine, T. W., and F. R. Lichtkoppler. "Willingness to Pay for Green Space Preservation: a Comparison of Soil and Water Conservation District Clientele and the General Public Using the Contingent Valuation Method." *Journal of Soil and Water Conservation*59, no. 5 (September 1, 2004): 1-12.

conservation programs in their area. Ultimately, researchers concluded via regression analysis that the profile for a citizen willing to pay more for conservation programs was "a high income resident with a strong preference for conservation who was offered a low bid amount." That is, the additional money he would be willing to pay for a conservation program would be a relatively low amount. Although this result may be intuitive, researchers pointed out that the level of statistical significance they found towards the bid amount proves that survey respondents took the survey "very seriously and considered their opinions very carefully." This research is also supported by an international study from 2006 conducted in China that sought to determine local citizens' WTP for green space conservation programs in the city of Hangzhou.[11] Specifically, researchers concluded that the WTP a higher premium (via taxes) for green space conservation was "directly tied to gender, income level, and residential-ownership status." In a city where the median household income was $5,000 (U.S. dollars), "the willingness to pay more than $24 per year [for green space conservation] increased with income level."

During an interview with a James City County representative that was responsible for the administration of Purchase of Development Rights programs (PDR), the team was told that there had historically been social pressures from wealthy landowners in other localities with respect to engaging in PDR transactions. Specifically, this representative indicated that wealthy landowners would pressure other members of this upper-level socioeconomic class to sell off development rights to a locality as a status symbol and also as a sign of philanthropic intent and capability. This local official indicated that in general there were three groups of landowners that might engage in PDR transactions: wealthy landowners, farm families, and working class families that happened to own land. With respect to the second and third groups, our interviewee indicated that such groups would be less likely to engage in PDR transactions since they depend heavily on the land for income and/or would be more hesitant to restrict development rights (and subsequently income-generating capability) for future generations. He stated that an especially interesting question would be to ask is, "Who among the three groups is more attracted to PDR programs?" That question was not asked within our final survey, but other questions about the farming industry, development interests, and general public support were asked.

[11] Chen, Bo, Bao Zhiyi, and Zhy Zhujun. "Assessing the Willingness of the Public to Pay to Conserve Urban Green Space: The Hangzhou City, China, Case." *Journal of Environmental Health* 69, no. 5 (December 2006): 26-30.

Part IV

Case Study 1: James City County

Overview. As part of this study we visited two Virginia localities to obtain additional information about the land conservation programs currently being administered throughout the state. Specifically, the purpose in conducting two case studies is to compare and contrast two localities within the Hampton Roads area to better understand how and why conservation programs developed in those localities. This section covers James City County.

Locality Description. James City County (JCC) has a population of 67,000 people[12] out of the total state population of 8 million. JCC citizens have a median annual income of $73,000 compared to the state average of $59,000. ***Map 1*** shows JCC in relation to other Virginia localities. The home ownership rate in this locality is 76.7 percent compared to the state average of 59.2 percent. JCC is a major tourist destination due to the historic Jamestown Settlement within its boundaries and nearby

[12] "James City County QuickFacts from the US Census Bureau." State and County QuickFacts. October 27, 2011. Accessed November 07, 2011. http://quickfacts.census.gov/qfd/states/51/51095.html.

Map 1. Location of James City County (JCC in red)

SOURCE: This work is in the public domain in the United States because it is a work of the United States Federal Government under the terms of Title 17, Chapter 1, Section 105 of the US Code.

theme parks. This gives JCC tremendous incentive to preserve natural spaces that serve as an additional revenue source. Additionally, JCC has a large retirement population that accounts for 21 percent of its 67,009 citizens,[13] which provides decreased incentives to urbanize despite its close proximity to the College of William and Mary and nearby national parks. In 1980, JCC reportedly had over 7,000 acres of wetlands.[14] This has influenced how much development occurred over the last several decades. Specifically, wetlands can be especially difficult to develop and, consequently, has led to little (if any) resistance from citizens or prospective developers against the local government's efforts in acquiring such areas for conservation.

Land Conservation Programs. JCC represents an example of a mature land conservation program. This locality has

[13] "James City County QuickFacts from the US Census Bureau." State and County QuickFacts. 2011. Accessed November 20, 2011. http://quickfacts.census.gov/qfd/states/51/51095.html.

[14] Moore, Kenneth A. "Tidal Marsh Inventories." Center for Coastal Resources Management. Accessed November 20, 2011. http://www.ccrm.vims.edu/wetlands/tidal_wetlands/tidal_marsh_inventories.html.

established two programs: green space conservation and Purchase of Development Rights (PDR). Starting in 1997, JCC established a land acquisition program that led to the acquisition of 1,315 acres of land for a total cost of $20.8 million. In 2001, JCC established a PDR program that has "eased" the development of over 518 acres of land, costing the locality more than $1.8 million dollars. In 2005, JCC introduced a $20 million bond referendum on the ballot for local citizens to decide whether funds could be used to finance a portion of land acquisition and PDR programs for the purposes of preserving historic, scenic, agricultural, forest, and environmentally sensitive lands in the area. After the referendum was approved by 76 percent of the voters, JCC expended approximately $5 million in bond purchases for both land acquisition and PDR transactions. Approximately $15 million in bond purchasing capability remains (of which $2 million are designated as funds for the PDR program). The accompanying tax hikes to pay off the bond are noteworthy, and highlight the community's commitment to conservation.

With respect to PDR programs, another JCC official indicated that the locality had successfully conducted five PDR transactions since the establishment of the program and had two pending transactions in the queue at the time of the interview. One prominent theme highlighted as a difference between JCC land acquisition and PDR programs was that the latter was a much more time-consuming process. It was described as a process saddled with firmly entrenched steps that had to be taken prior to the approval of a PDR and concrete rules that must be considered in the early stages of negotiation.

The process includes: (1) hiring an independent appraiser to evaluate the land's market value, (2) determining if there are any restrictions regarding the parcel of land in questions, and (3) submitting the proposed PDR to a review committee to determine if the stated appraisal is reasonable. The entire PDR process can take as long as five to six months and is considered to be quite lengthy when compared to a land acquisition transaction, which can happen over a much shorter period of time. Regarding the rigid rules that must be considered, the following are included in the calculation of a property's perceived value by the locality: condition of the property (developed versus undeveloped), lot size, number of allowed dwellings on parcels of land, and other factors.

Tax Implications. The 2005 bond referendum that won voter approval resulted in an additional one-cent tax increase for every $1,000 in assessed real estate taxes. JCC representatives indicated that the structure of the Virginia tax code leads localities to depend heavily on property taxes for revenue. As indicated by

the JCC official, "higher property values mean higher levels of resources" available to the locality which leads to higher expectations on the part of local citizenry in terms of conservation management and other quality of life issues. Ultimately, higher expectations lead to greater support for local government initiatives such as land conservation. However, this local official indicated that what has impeded further progress within the land conservation effort is that state funding for conservation has collapsed in recent years as a result of the recession that began in December 2007.

Federal and State Regulation Impact. One JCC official indicated that federal and state water pollution regulations such as the Clean Water Act and Total Maximum Daily Load requirements on impaired state waters were a very significant factor in the adoption of a land conservation program. As proof of this assertion, the local official indicated that the locality has taken active measures in creating four Watershed Implementation Plans (WIPS) that are geared towards reducing pollutants in local bodies of water and account for 75 percent of the locality's water areas.

Major Takeaways. Regarding PDR programs, one JCC representative indicated that there are wide variances in terms of how such programs are administered with respect to determining the value of the land during PDR negotiations and calculating a fair amount of compensation to landowners. With respect to the former point, some localities have predetermined land values published in a local document while others hire an independent appraiser. Regarding the latter point, some localities provide a regressive form of compensation based on the landowner's income while others simply provide a check for the agreed upon price originating from independent appraisals.

Lastly, the following topics were deemed as noteworthy for inclusion: (1) both local officials believed that there were between 10 and 20 localities with active land conservation programs throughout the state, (2) neither official believed that conflict existed between conservation proponents and commercial developers due to an abundance of areas elsewhere that were available for development, and (3) localities were viewed as the "weak link" within the land conservation hierarchy primarily due to a lack of financial resources. Conservancy groups, such as *The Nature Conservancy*, were deemed vital to positively advancing conservation activities.

Part V

Case Study 2: City of Virginia Beach

This second case study describes Virgina Beach's land conservation programs. Compared to James City County, programs at Virginia Beach are somewhat older. Interesting comparisons arise given the city's geographic, socioeconomic, and industrial characteristics. This section examines some of the reasons for the programs' success, explored in depth during an interview with a city official.

Overview. Virginia Beach's characteristics make it the predictable site of a "perfect storm". Virginia Beach is at once the most populated city in the Commonwealth and one of the most ecologically diverse communities east of the Blue Ridge Mountains. One would expect that balancing these two competing interests (population growth and sustainable development) polarizes city politics. By and large, however, this is not the case. Virginia Beach's programs possess broad support from citizens and citizen associations. In addition, it enjoys the backing of political, bureaucratic, and industrial leaders. Our conversation with a city official reveals that, as was the case in JCC, land conservation programs seem to be a function of the specific conditions of each locality.

Locality Description. Virginia Beach was established as an independent city in 1962 with the merging of the City of Virginia Beach and Princess Anne County. Its location with respect to other Virginia localities is shown in Map 2. It is the largest city in the Commonwealth with a population of about 430,000. It

Map 1. Location of the City of Virginia Beach (VA Beach in red)

SOURCE: This work is in the public domain in the United States because it is a work of the United States Federal Government under the terms of Title 17, Chapter 1, Section 105 of the US Code.

encompasses 497.3 square miles and harbors 23 miles of beach. In addition, the city posesses 64 square miles of waterways. All of these factors have influenced the development of the community into a resort city, highly dependent on tourism. Median income is $53,242, which is below average for Virginia, but is relatively high when compared to the immediate region. In addition, tax rates are relatively low.

The city's political structure is fairly unique. Anticipating the political polarization of today, City Council members are elected at large. In addition, they may not run as Democrats or Republicans. One presumes that such arrangement diffuses polarization given that candidates must appeal to the broadest section of the electorate to be elected. Policy would tend to reflect the views of the average voter, rather than the narrow interests of a polarized few.

VA Beach depends on its beaches for its tourism. Its 23 miles of beach front have numerous access points. Significant portions of the beach are owned by different government and nonprofit entities, including the Commonwealth, land trust organizations, and the federal government. The federal government's involvement stems from three military bases located in Virginia Beach: Joint Expeditionary Base

Little Creek- Fort Story, Naval Station-Oceana, and Damn Neck Fleet Training Center. These facts significantly inform the level of conservation within Virginia Beach.

The City balances multiple, potentially conflicting interests: protecting its high biodiversity, managing limited water resources, and dealing with high growth development. In the 1980s the it began constructing a management plan that would take into considerations these factors and prioritize the ways in which the city would develop in the coming years. During this planning phase, the the Natural Heritage Foundation played a pivotal role by conducting an inventory of natural areas that lent themselves for protection. The final product pointed to a critical reality: any land conservation program must be "locally driven, locally involved, and [meet] local interests"--the changing politics of Richmond and Washington would be unlikely to yield continuous and sustainable support.

This was achieved, in part, because city stakeholder share similar financial incentives that favor land conservation. As explained by the city official, Virginia Beach is highly dependent on the quality of its water, rivers, and beaches to maintain its vibrant tourism industry. When tracts of land adjacent to waterways are protected, the city ensures a positive impact on its beach and on water quality. In turn, this generates higher property values. The city official proposed that while they have "strayed from pure ecological reasons" for the land conservation, maintaining this cycle of value was essential for the continued support of land conservation programs.

Land Conservation Programs. Broad political support has given the City great latitude in identifying the types of opportunities to pursue. Rather than awaiting permission from the state legislature, Virginia Beach has stretched state rules to fund the conservation of land. As initially crafted by proponents, land conservation activities are intricately connected to the city's fiscal health and employment prospects. Without this "cycle of value" the institution of these programs would disappear.

Virginia Beach posses two distinct land conservation programs: 1) Land Acquisitions and 2) Purchase of Development Rights (PDRs). VA Beach's land acquisition was established shortly after the turn of the millennium. In 2001, the city allocated about $30 million to pursue the purchase of properties for public land conservation interests. This initiative has resulted in over 4,000 acres of land protected. As of today, the city retains about $7 million. The remaining funds are in the process of being disbursed.

Selecting properties for purchase occurs in accordance with the city's environmental management plans. Properties are selected on the basis of

environmental need. The City often finds itself working in tandem with land conservation organizations. The Trust for Public Land and the Chesapeake Bay Foundation contribute to the city's efforts with financial resources, expertise, and publicity. In addition, the Department of Defense is a regular contributor to land purchase initiatives around its bases, and subsidizes City activities in this regard.

The City's PDR program is Virginia Beach's most mature land conservation initiative. Established in the mid 1990s, this PDR program is based on Agricultural Reservation Process (ARP) and has funded the purchase of development rights for about 5,000 acres. The funding is appropriated on a case by case basis by the City Council. Once a property of interest is approved for purchase, the city purchases Treasury Bills which, when mature, will pay for the value of the property.

PDR transactions attract a range of different people from across different income levels. Interestingly, a city official noted that small rural communities often act in unison. If a community generally agrees that PDRs schemes are sensible idea, most of them will jump on board with the initiative. The city does not actively recruit landholders, but hopes that word of mouth will increase participation.

The management of the final sale of both land conservation programs is handled by the City's real estate department. The process involves two independent appraisals. The City will pay the higher appraisal or fair market value. With regards to the efficiency of the programs, one city official noted that the land acquisition process is quicker than the PDR process, which is encumbered by legal and administrative obstacles.

Other Initiatives. Virginia Beach is unique in several ways. One of the most important way it is distinct from other communities is the range of civic involvement in land and water conservation issues. The breadth and scope of these groups is a function of true citizen interest in these initiatives, reflected also in the number of publicly funded land conservation initiatives. For example, there are seven active citizen groups committed to protecting seven major watersheds within Virginia Beach. Their efforts have shifted city and private resources to rehabilitate waterways in ways that promote business and a clean environment. This strong civic support and seemingly well developed understanding about the fundamental connection between economic development and a sustainable environment pervades the City of Virginia Beach and is a key contributor to the success and support of its land conservation programs.

Major Takeaways. As was the case in James City County, the reasons that led to the creation and management of important land conservation programs in Virginia Beach are highly localized. They

respond to incentives unique to Virginia Beach including the tourism industry, political structure, and demographics. With regards to the tourism industry, the relationships between well protected open spaces are quite obvious and are likely to remain.

One city official noted that one condition that might change, and with it become an obstacle to land conservation initiatives is the changing political landscape. Generally, fringe conservative forces (closely allied with the Tea Party movement) do not approve of the use of public funds for land conservation purposes. Were these groups to capture a significant share of City Council positions, the public purchase of land for conservation purposes would necessarily be re-addressed.

Overall, however, if conditions remain unchanged it is unlikely that VA Beach's commitment to land conservation will fade.

Part VI

Survey Results

This section analyzes the data, with specific attention to observable qualitative trends. We begin by noting who responded to our survey. Next, we look at data we collected regarding the number and characteristics of land conservation programs within Virginia. Finally, we identify some of the factors that lead localities to establish land conservation programs.

Respondents. The question "who responded to our survey?" is important because it informs a reading of our results. Not surprisingly, the trends in responses are striking both visually and substantively. (Appendix II shows the distribution of responses graphically.) For instance, 79 percent of responses came from localities within the Chesapeake Bay Watershed region, the remaining 21 percent were from localities outside of the Watershed region.

Of the non-respondents, most are in the mountain region (southwest Virginia). A notable difference between those localities that responded and those who did not is income. Northern Virginia, which had a relatively high response rate, has an average median income level well above the state average. However, the median income level of the mountain region is below the state average. As previously discussed, an initial hypothesis of the study is that income plays an important role in localities' decisions to initiate land conservation programs. This information weaves nicely into our initial expectation.

It also presents some issues, because it feeds into our suggestion that our results may, in fact, suffer from self-selection bias. Poorer localities may be under-reported, giving us an incomplete

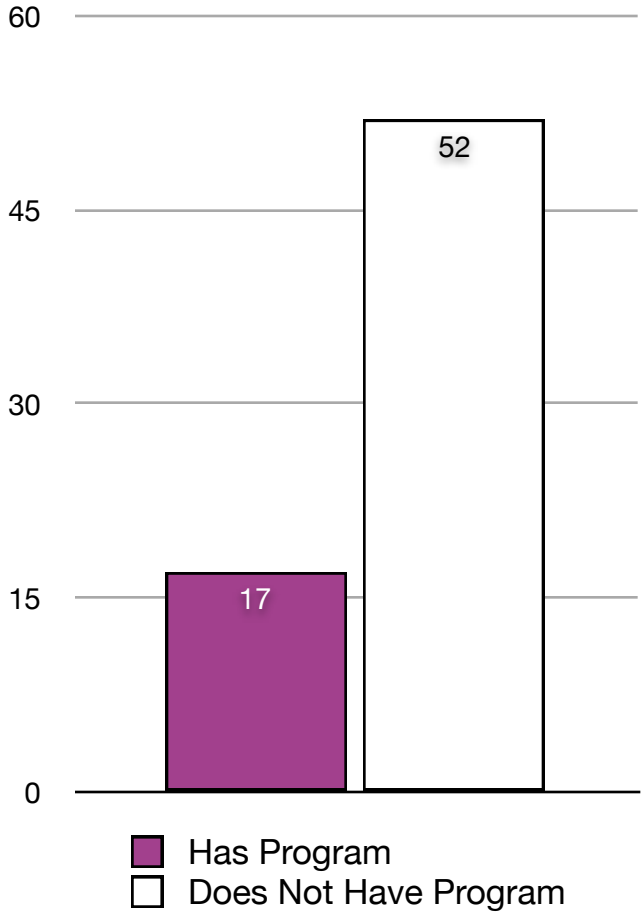
picture of what is really occurring statewide. However, we can say with relative confidence that we have substantial evidence regarding the *real* number of land conservation programs within the Watershed region and in the northern and eastern parts of the State.

Conservation Programs within the State

Land Acquisitions. Of 68 survey respondents, only 15 reported having a land acquisition program in their localities.[15] This compares to 52 that did not. Of the 52 localities that reported not having a land acquisition program, 40 (77 percent of this subgroup) said that they have not introduced a measure to implement such a program. ***Figure 3*** includes this information. Each of these 15 land acquisition programs is distinct, which reflects the needs and realities of each locality. As reasons to engage, localities cited flood reduction, parkland preservation, extension of trails, protection of the water supply, maintenance of view sheds, the preservation of historical battlegrounds and other landmarks, and to help support the "compatible land use buffer program" for properties surrounding a nearby military base.

There are also different funding and acquisition mechanisms utilized by localities, some are more aggressive than others. One locality said that the "acquisition of land occurs only when the county is approached by a property owner who has a strong interest in having [the] property preserved." Several other localities indicated that they only acquire land through private donations. However, some localities actively seek out properties to purchase or engage in eminent domain.

Figure 3. Number of Locality Land Conservation Programs in Virginia *(includes JCC and Virginia Beach, not surveyed but interviewed)*



Most of the 15 have a hybrid of acquisition mechanisms that include those just mentioned and others, such as proffer dedication/agreements, fee simple purchase, and conservation easements.

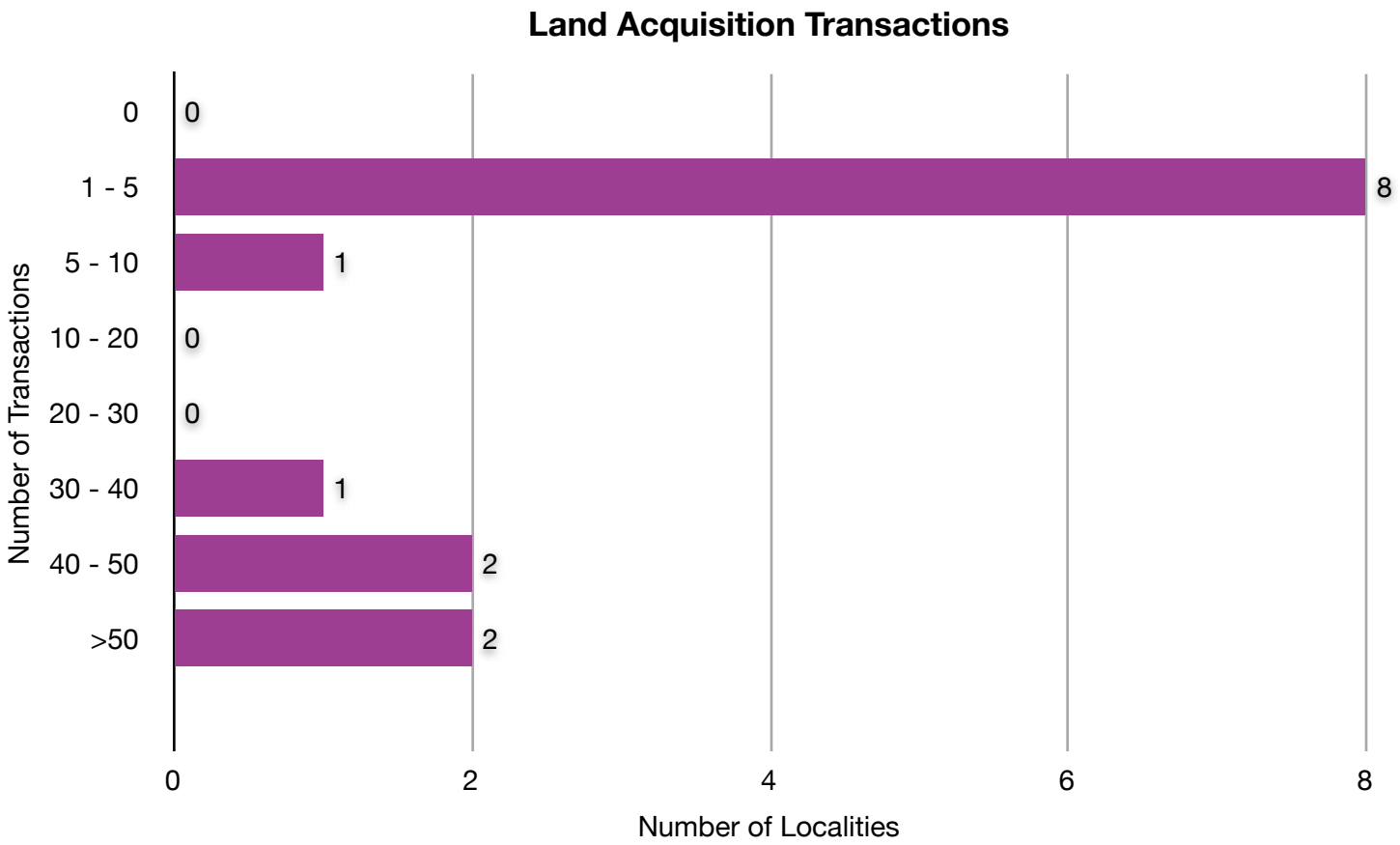
[15] This is shown graphically in Appendix III

Figure 4. Public Funding for Land Acquisition Programs in Virginia ($US thousands)

Programs range from the informal, that are done on an *ad hoc* basis, to formal. They may also be incorporated to some extent in the locality's Comprehensive Plan or capital improvement program. One county has secured a conservation easement program through its County's Conservation Easement Authority. Some localities reported that their zoning ordinances also include provisions for open/green space.

Six of the programs were between five and 10 years old, and five localities had much older programs that have been in place for more than 20 years. ***Figure 4***, above, shows funding for land conservation programs. Total expenditures reported by

Figure 5. Number Land Acquisition Transactions in Virginia by Locality



localities ranges from less than $50,000 to more than $20 million.

Figure 5, above, shows the number of land acquisition transaction by locality. Eight localities reported that they acquired between one and five properties, and four localities reported having acquired 40 or more properties.

Purchase of Development Rights (PDR). Fifty-nine out of 68 respondents (87 percent) did not have a PDR program. Appendix IV shows the geographical distribution. Nine out of 68 respondents (13 percent) indicated having such a program. This information is contained in ***Figure 6.*** When asked about the maturity of their

Figure 6. Number Locality PDR Programs in Virginia (*includes JCC and Virginia Beach, not surveyed but interviewed*)

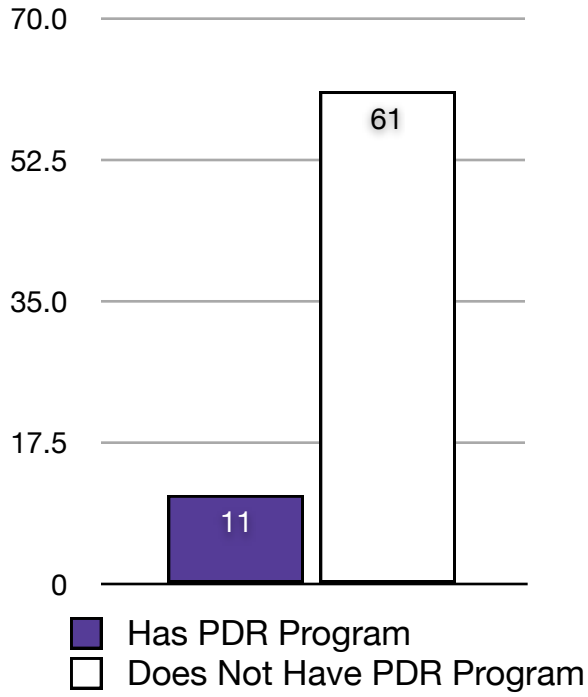
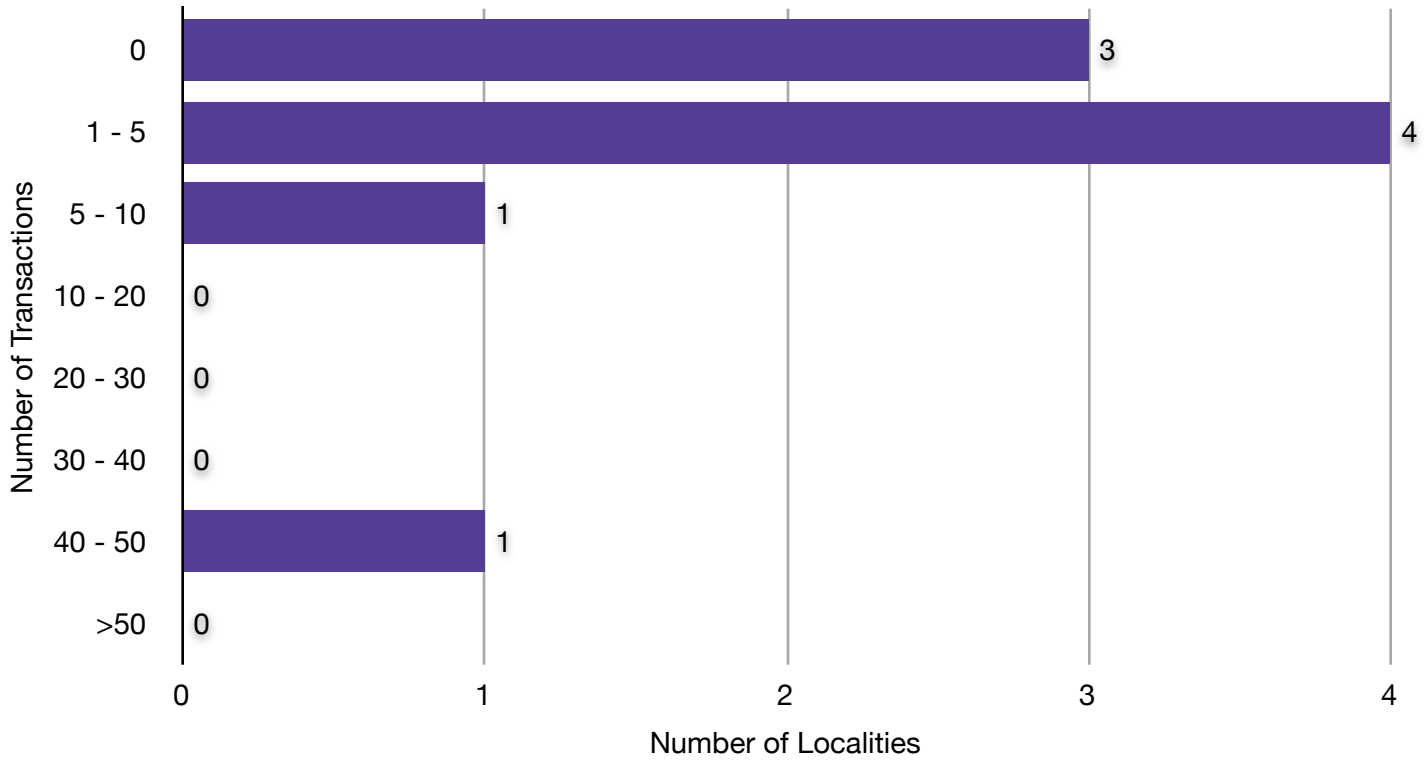


Figure 7. Public Funding for PDR Programs in Virginia ($US thousands)

PDR program, five out of the nine respondents (56 percent) indicated that their PDR program was between one and five years old, while three out of nine respondents (33 percent) reported having a program in existence between five and ten years. ***Figure 7*** (above) shows the distribution of PDR funding levels ranging from less than to over $50,000 to $20 million. With respect to the number of PDR transactions that had been successfully completed, four out of nine respondents (44 percent) indicated that they had obtained between one and five transactions, and three out of nine respondents (33 percent) reported zero transactions to date. This is shown in ***Figure 8*** (Page 25).

Other Programs. Of the 68 survey respondents, 53 (78 percent) indicated that they had another program aimed at land conservation. Explanations for what these other programs entailed varied considerably. However, the top two most frequently cited descriptions included that of 1) Planned Unit Development (PUD) or Cluster Developments and 2) ordinances that encouraged landowners to not develop land for uses that would conflict with agricultural or forestry purposes in exchange for tax benefits. With respect to the length of time that these other programs have existed, 29 out of 53 (55 percent) indicated ten or more years while 24 out of 53 (45 percent) indicated between one and

Figure 8. Number PDR Transactions in Virginia by Locality



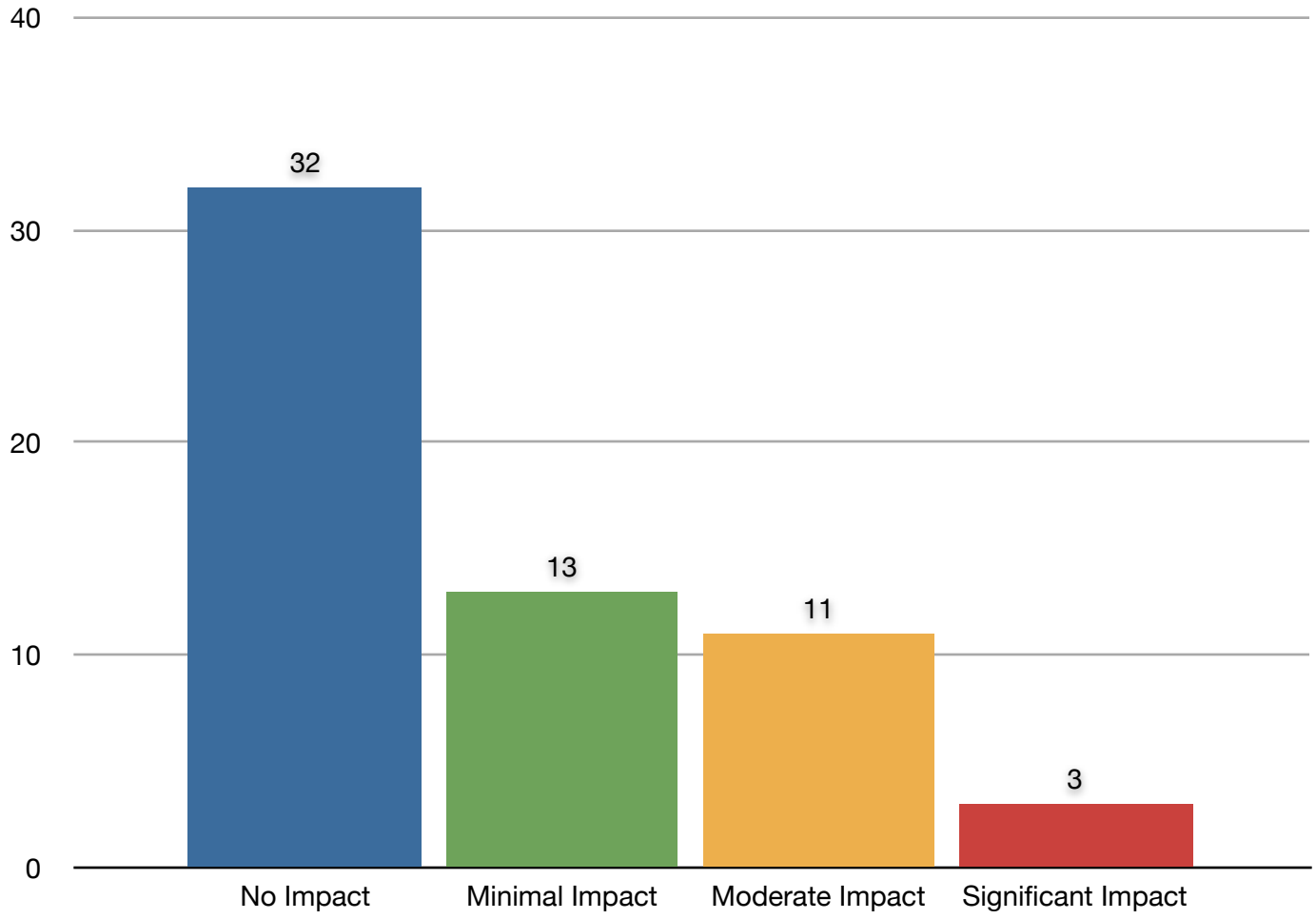
ten years in duration. These are noted in Appendix IV.

Assessing motivations

This paper's third question broadly examines: what motivates localities to establish land conservation projects? The latter part of the online survey attempted to identify these factors. Conversations with city officials from Virginia Beach and James City County suggested to the team that land conservation initiatives were a result of a confluence of factors. While the survey results do not identify any consistent critical factors that drive land conservation programs, the interviews and the data show that citizen support for these programs is a necessary, if not sufficient, condition for their creation. The analysis shows that water quality concerns, tourism industry support, and income are important determinants that, when combined with citizen support, are likely to result in conservation programs.

At the outset of this project, federal and state regulations were hypothesized as possible catalysts for the creation of land conservation initiatives. Specifically, we wanted to know the effects of the Clean Water Act, Chesapeake Bay Preservation Act, and Total Maximum Daily Load requirements on conservation schemes. In ***Figure 9*** (Page 26), a majority of cities and counties reported that these regulations had no impact on their land conservation

Figure 9. The Impact of State and Federal Regulations on Conservation Programs in Virginia



initiatives. More information is needed to flesh out the reasons as to why this is the case. Note, however, that responses are evenly split--half note these regulations have an impact, the other half disagrees.

When asked to comment on the impact of federal and state regulations, some noted that "*land conservation program[s] [could] positively influence water quality.*" However, several noted that while the "acts may have created some interests [sic] in open/green space" it seems likely that preservation efforts would have continued to grow without these regulations: "even without this mandate, we'd have extensive conservation efforts." As one respondent put it, in the final analysis the precise impact of these mandates can be debated because *"some regulations are still evolving.*"

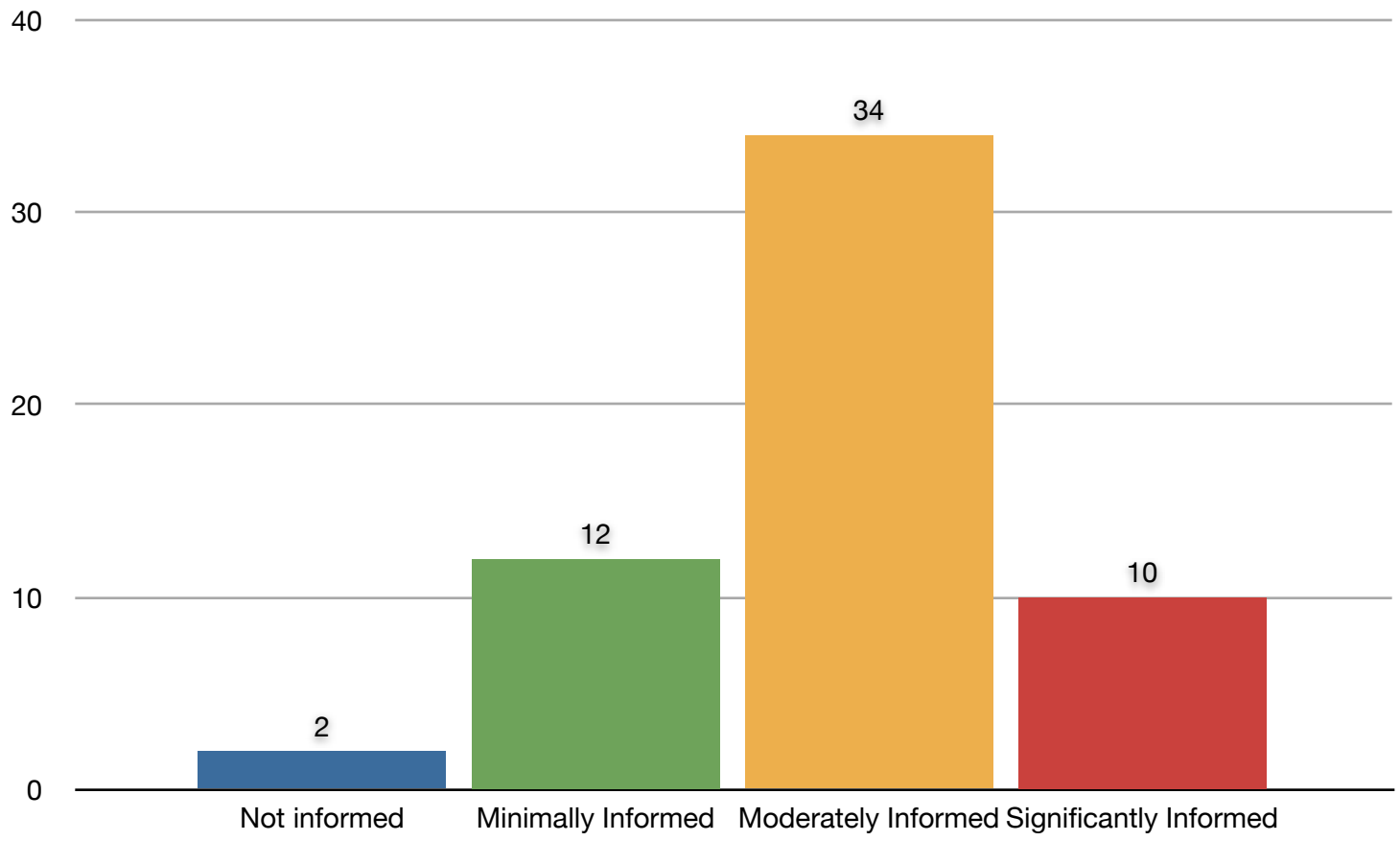
It is sensible to believe that local politics play a more important role than federal or state politics. ***Figure 10***, (page 27), shows how informed citizens are with regards to politics and tax-related issues. As can be gleaned from the evidence, most localities report that their citizens are keenly attuned to local politics. In part, this

is expected; local issues are likely to have a large impact on citizens of a community (this is especially true for smaller communities). At the same time, constituents of these communities are more likely to feel the impact of local policy (relative to decision-making in Richmond or Washington, for instance).

In light of the data, one can assume that citizens are likely to be informed about land conservation programs where they exist. Questions 33 and 34 of the survey attempted to address this issue by inquiring about controversy with regards to land acquisition and PDR programs. Overall, there are two interesting trends. First, a majority of respondents conveyed that both PDRs and land acquisition schemes are controversial to a degree. However, land conservation programs are generally not "significantly" controversial in localities with land conservation programs. A majority of localities with land acquisition programs suggest that the program is minimally controversial. The same is true for a plurality of localities with PDR programs.

Second, land acquisitions are, in aggregate, more controversial than PDR schemes. This may be the case for a number of reasons, including: a) PDRs are less expensive than land acquisitions, b) people may object to public purchase of lands but look favorably on the protection

Figure 10. How Informed Are Citizens With Regards to Local Politics and Local Tax Issues?



of land, and c) people may be less informed generally about PDRs and take no opinion on the matter.

One important variable to consider is the relative importance of certain industries in a local economy. Localities were asked to rank the importance of the following sectors: commercial agriculture, housing developments, and commercial forestry. If any of these are important, their goals may conflict with land conservation initiatives. The results are interesting and shown graphically in ***Table 1*** below.

First, there are commonalities across all localities. The majority of localities with land conservation programs said that commercial development is "significantly important" to their local economies. In addition, housing industry is ranked as "moderately to significantly important." Finally, commercial forestry is not important or minimally important to localities sampled. The evidence suggests that localities with land conservation programs are dynamic; their housing and commercial development is important to the community. Given that they do have land conservation programs it follows that these industries do not feel threatened by public land acquisitions or PDR schemes. The reasons for this may vary, but it may very well be that both of these industries

Table 1. Relative Importance of Select Industries Across Localities With Land Conservation Programs

	Localities with:	
	Land Acquisition Programs*	**PDR Programs****
Commercial Agriculture	1 - 3	5
Housing	4 - 5	4 - 5
Commercial Development	5	5
Commercial Forestry	1 - 3	2

Localities with land conservation programs were asked to identify the importance of four industries (agriculture, housing, commercial development, and forestry) in their local economies. Options:

1=Not Important
2=Minimally Important
3=Probably Important
4=Moderately Important
5=Significantly Important

benefit from high property values that accompany well protected open space for the public. The impact of commercial forestry is less evident, but we surmise that commercial industry and land conservation programs are at odds in some instances.

Second, a majority of localities with PDR initiatives report that commercial agriculture is significantly important to the local economy; a plurality of localities with land acquisition programs report that commercial agriculture is not. It seems that land acquisition programs may be viewed as a threat to commercial agriculture, even if it does not buy up arable land. In cities and counties where agriculture is important, PDRs may be more sensible politically. For instance, citizens of agrarian communities may be more attached to their land than counterparts elsewhere. It follows then that they would feel uncomfortable selling it to the local government. Another possibility speaks to the flexibility of PDRs which can protect certain sections of a property, leaving others for farming and other development. This arrangement may be more appealing to individuals residing in communities with an important agriculture industry.

Overall, the most significant trend points to the fact that land conservation is not necessarily at odds with industrial development. This was also evident from the Virginia Beach and JCC case studies. Where Virginia Beach has an overriding interest in keeping its waterways and beaches clean, JCC has an overriding interest in keeping the feel of a small colonial town alive, especially with respect to the famous Jamestown Settlement which serves as a popular tourist attraction. Localities will move to protect open spaces where interests align. In both these cases industrial interests intersect with citizen support for land conservation initiatives. Because land acquisitions and PDRs differ in their mechanism, communities that are willing to conserve land are likely to find an option that fits their needs adequately.

These conclusions are supported by several survey responses. Question 30 attempted to identify the determinants of these land conservation initiatives. If respondents indicated they had a land conservation program, they were asked to select the reasons for its establishment. They were presented with the following options:

- Water quality concerns
- Citizens' initiatives to conserve space
- Desire to protect land to keep agriculture viable
- Concerns about sprawl
- Recreational needs
- Other

The results are surprising. Respondents consistently cited two reasons as principal motivators: "Citizens' initiatives to conserve space" and "Desire to protect land to keep agriculture viable". This doesn't necessarily suggest a contradiction because

both reasons may be intricately connected. It is unclear from the way the question is phrased for instance, who expresses interest (and how said interest is communicated to decision-makers) in keeping agriculture viable in a community. Is it the agricultural industry? Is it the citizens themselves? This remains unresolved, but intuition suggests that it is probably a mix of both.

Another interesting trend shows what is relatively unimportant. Recreational needs consistently appear at the bottom of the rankings. Important information can be gathered from those who selected "other" reasons. These responses suggest that land conservation programs are established in response to a confluence of relevant, local interest. One community notes the need to "preserv[e] [the locality]'s rural, agricultural heritage". Another suggests land conservation support relates to the "importance of tourism and maintaining community character". Still another suggest that the "[a]ctual top priority is recreational". In all, responses continue to suggest that localities do not implement these programs in a vacuum, but that they are carefully thought out and receive a certain degree of citizen support.

In reading and interpreting these results caution is recommended. We not again some of our limitations here. Broadly speaking, there are two issues at play in responses to this Question 30 in particular. First, there are issues regarding bias that must be acknowledged. Communities that have land conservation programs may be different in some fundamental regard when compared to communities that don't. Therefore, it is not clear that replicating determinants in communities without land conservation programs will yield, for instance, a PDR or land acquisition scheme. Second, City officials answered several questions based exclusively on perception. How educated they are with regard to a localities' happenings is unknown. Although we have collected sufficient data to be comfortable with the conclusions made here, it may very well be that the "true" determinants remain unknown.

The map in Appendix II shows interesting trends that contextualize our results. Most respondents come from areas protected under the Chesapeake Bay Watershed regulations. Furthermore, respondents seem to be located along the eastern coast and mid-to-northern part of the state. These regions represent areas of high development with relatively high per capita income in comparison to the rest of the state. This stands in stark contrast to those areas that did not complete the survey, namely the southwestern part of Virginia. These localities are less impacted by watersheds and tend to have more mountainous terrains and lower per capita income than other parts of the state. Therefore, conclusions drawn from the qualitative analysis relates uniquely to those areas successfully surveyed.

Additional information is required to extrapolate key findings to the southwestern region that we were unable to collect data from.

Part VII

Conclusion

Our report presents three key findings. First, out of 68 localities samples, our study finds that 11 Virginia localities have PDR programs, 17 have land acquisition programs, and 5 have both. Second, within our sample, we find that the impact of state and federal regulations on land conservation programs is inconclusive. While some localities mention the regulations as a key motivator, others dismiss it entirely. Third, the qualitative analysis evidences that 1) citizen desire for land conservation as well as 2) commercial agriculture interests drive these localities to establish PDR and land acquisition programs. We show that land conservation programs are likely the result of a confluence of factors, including, crucially, an alignment between the interest of industry and citizens. Both the VA Beach and JCC case study demonstrate that mature land conservation programs are likely to be successful when there is an overriding interest by local industry (tourism in both cases) to join forces with citizens that favor conservation. VA Beach industry is moved to protect watersheds and beach areas for tourism purposes. Similarly, JCC protects lands to preserve spacious, semi-rural feel of the county that keeps land values relatively high. Overall, citizen interest seem to be the necessary, but not sufficient, determinant of land conservation programs. The sufficiency condition seems to vary from locality to locality.

A probit regression model (See Appendix VI) afforded us an opportunity to establish statistically significant linkages between certain variables and the likelihood of any given locality establishing land conservation programs. Our regressions were, in the aggregate, inconclusive as well. We did find that the impact of median income is statistically significant; a higher median income increases the probability of a locality establishing a land conservation programs.

This makes intuitive sense and weaves nicely into our qualitative analysis. A land conservation program is likely to occur when a) citizens demand it, b) industry supports it, and c) the locality has sufficient resources to fund said programs. An alignment of these three conditions may meet a necessary and sufficient analysis.

Recommendations for Future Research

Future research can provide an even deeper understanding of the motivations beyond conservation programs in Virginia. One area of study would be to aggressively target the localities that did not respond to the survey to 1) determine whether they have programs, and 2) to decipher the motivations for having or not having such programs. This will also strengthen any statistical analyses that may be conducted in the future. Larger data sets make it easier to identify trends and make conclusive findings.

We did not find willingness-to-pay studies about conservation programs in Virginia during our research. Recall that income played an important role in the decision to have a program. However, one would not expect a linear relationship between income level and expenditures on conservation. At some point, citizens' willingness-to-pay will decrease regardless of how wealthy they are. Localities and their citizens' have a variety of priorities. Conducting a willingness-to-pay study that examines conservation relative to other publicly funded programs (education, public works, etc.) would provide an interesting perspective on the issue.

This feeds into another area of future research: identifying more explanatory variables. The data analyses and literature review showed that while one issue may be of importance, how they interact with other variables may be of more significance. In the regression analyses, we saw that in most cases the explanatory variables explained about 25 percent of the dependent variables. This is evidence that more issues than presented in this study influence a locality's likelihood to have a conservation program of any sort.

Appendices

Appendix I: The Survey

1. What is the name of your locality?

2. Note: For Questions #2-7, land acquisition refers to the process in which a local government purchases land directly a landowner in order to keep such land undeveloped. Does your locality engage in land acquisition for conservation purposes (also includes conservation of park land)?

    - Yes
    - I don't know
    - No

3. If your locality does engage in land acquisition for conservation purposes, please provide a brief (maximum of three sentences) description of the program in your locality.

4. How long has your land acquisition program been in effect?

    - Less than 1 year
    - Between 1 and 5 years
    - Between 5 and 10 years
    - Between 10 and 20 years
    - Longer than 20 years

5. If your locality does engage in land acquisition for conservation purposes, please indicate how much money has been allocated to this program since its establishment.

    - Less than $50,000
    - Between $50,000 and $100,000
    - Between $100,000 and $250,000
    - Between $250,000 and $500,000
    - Between $500,000 and $1 million
    - Between $1 million and $5 million
    - Between $5 million and $10 million
    - Between $10 million and $20 million
    - Greater than $20 million

6. How many land acquisitions have been obtained since the establishment of your locality's program?

    - Zero
    - Between 1 and 5
    - Between 5 and 10
    - Between 10 and 20
    - Between 20 and 30
    - Between 30 and 40
    - Between 40 and 50
    - Greater than 50

7. If your locality does not engage in land acquisition for conservation purposes, has your locality ever introduced a measure to implement such a program (within the last 10 years)?

    - Yes
    - I don't know
    - No

8. Note: For Questions #8-13, purchase of development rights refers to the process in which a local government purchases the rights to develop particular land from a landowner in order to keep the land undeveloped. Does your locality engage in the purchase of land development rights?

    - Yes
    - I don't know
    - No

9. If your locality does engage in the purchase of land development rights, please provide a brief (maximum of three sentences) description of the program in your locality.

10. How long has your purchase of development rights program been in effect?

    - Less than 1 year
    - Between 1 and 5 years
    - Between 5 and 10 years
    - Between 10 and 20 years
    - Longer than 20 years

11. If your locality does engage in the purchase of development rights, please indicate how much money has been allocated to this program since its establishment.

    - Less than $50,000
    - Between $50,000 and $100,000
    - Between $100,000 and $250,000
    - Between $250,000 and $500,000
    - Between $500,000 and $1 million
    - Between $1 million and $5 million
    - Between $5 million and $10 million
    - Between $10 million and $20 million
    - Greater than $20 million

12. How many purchases of development rights have been obtained since the establishment of your locality's program?

    - Zero
    - Between 1 and 5
    - Between 5 and 10
    - Between 10 and 20
    - Between 20 and 30
    - Between 30 and 40
    - Between 40 and 50
    - Greater than 50

13. If your locality does not engage in the purchase of land development rights, has your locality ever introduced a measure to implement such a program (within the last 10 years)?

    - Yes
    - I don't know
    - No

14. Does your locality have any other type of program that encourages green space or land conservation?

    - Yes
    - I don't know
    - No

15. If your locality does have any other type of program that encourages green space or land conservation, please provide a brief (maximum of three sentences) description of the program in your locality.

16. How long has this other type of program been in effect?

    - Less than 1 year
    - Between 1 and 5 years
    - Between 5 and 10 years
    - Between 10 and 20 years
    - Longer than 20 years

17. If your locality does engage in the purchase of development rights, please indicate how much money has been allocated to this program since its establishment.

    - Zero
    - Between 1 and 5
    - Between 5 and 10
    - Between 10 and 20
    - Between 20 and 30
    - Between 30 and 40
    - Between 40 and 50
    - Greater than 50

18. If your locality does not have any other type of program that encourages green space or land conservation, has your locality ever introduced a measure to implement such a program (within the last 10 years)?

    - Yes
    - I don't know
    - No

19. If your locality did introduce a measure to implement a green space or land conservation program that was not approved, please indicate the reason(s) for non-approval.

    - Lack of support by the local legislative body.

- Lack of taxpayer support (via public hearings, failed ballot initiatives, etc.).
- Lack of financial resources to create the program.
- Opposition by one or more interest groups (i.e. farming companies, commercial developers, residential developers, etc.).
- Conservation easement or purchase of development rights would not have resulted in provision of public spaces (i.e. parks for public use, etc.).
- Influential Developer (s)
- Influential Landowner (s)
- Other

20. If you marked "Other" on the previous question, please provide an explanation (maximum of three sentences).

21. If your locality did introduce a measure to implement a green space or land conservation program that was not approved, please indicate whether your locality would consider pursuing such a program again in the future.

    - Definitely Not
    - Probably not
    - Maybe
    - Probably yes
    - Definitely yes

22. If your locality would consider pursuing such a program in the near future, please indicate when this might occur.

    - Within 1 year
    - Within 2 years
    - Within 5 years
    - Within 10 years
    - Beyond 10 years
    - I cannot estimate when this might occur.

23. What impact has the Clean Water Act, Chesapeake Bay Preservation Act, Total Maximum Daily Load (TMDL) pollutant requirements on bodies of water, or other environmental regulations impacted your locality's decision to implement or not implement a green space or land conservation program?

    - No impact
    - Minimal impact
    - I don't know
    - Moderate impact
    - Significant impact

24. If there was an impact, please explain (maximum of three sentences).

25. How important is commercial agriculture to your local economy?

    - Not important
    - Probably not important
    - I don't know

- Minimally important
- Moderately important
- Significantly important

26. How important are new housing developments to your local economy?

    - Not important
    - Probably not important
    - I don't know
    - Minimally important
    - Moderately important
    - Significantly important

27. How important is new commercial development to your local economy?

    - Not important
    - Probably not important
    - I don't know
    - Minimally important
    - Moderately important
    - Significantly important

28. How important is commercial forestry to your local economy?

    - Not important
    - Probably not important
    - I don't know
    - Minimally important
    - Moderately important
    - Significantly important

29. Is your locality part of the Virginia Chesapeake Bay Watershed (i.e. does water, rain or other fluid runoff from the land within your locality drain into the Chesapeake Bay making such runoff subject to Total Maximum Daily Load limits)?

    - Yes
    - I don’t know
    - No

30. If your locality has a land conservation or Purchase of Development Rights program, please rank the reasons why.

    - Water quality concerns
    - Citizens' initiative to conserve space
    - Desire to protect land to keep agriculture viable
    - Concerns about sprawl
    - Recreational needs
    - Other

31. Please explain what was meant by marking "Other."

32. Please rate how informed the majority of your local citizens are with respect to politics and tax-related issues (i.e., proposed tax changes, bond referendums, etc.) in the locality.

    - Not informed
    - Minimally informed
    - I don't know
    - Moderately informed
    - Significantly informed

33. Please note how controversial of a topic land acquisitions are in your locality.

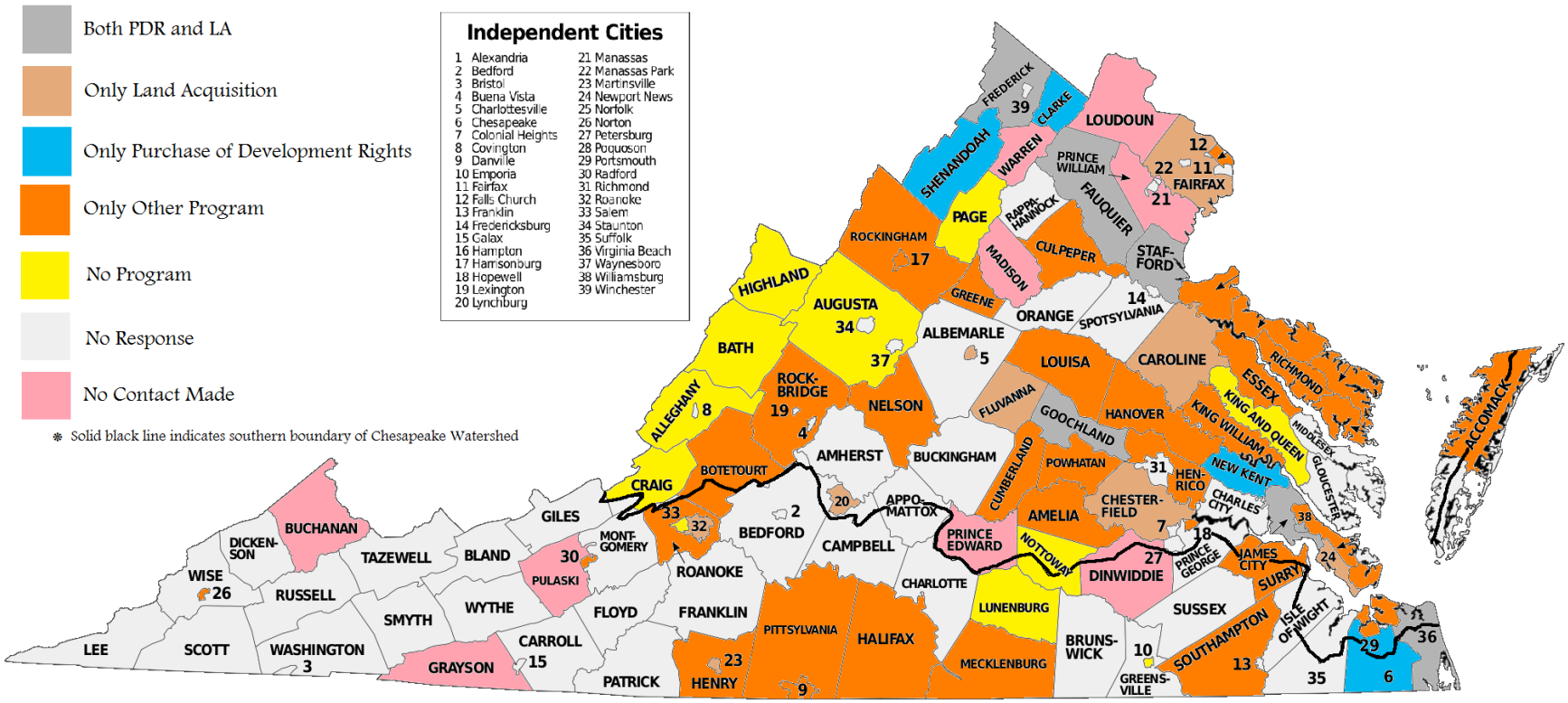
    - Not controversial
    - Minimally controversial
    - I don't know
    - Moderately controversial
    - Significantly controversial

34. Please note how controversial of a topic Purchase of Development Rights (PDRs) are in your locality.

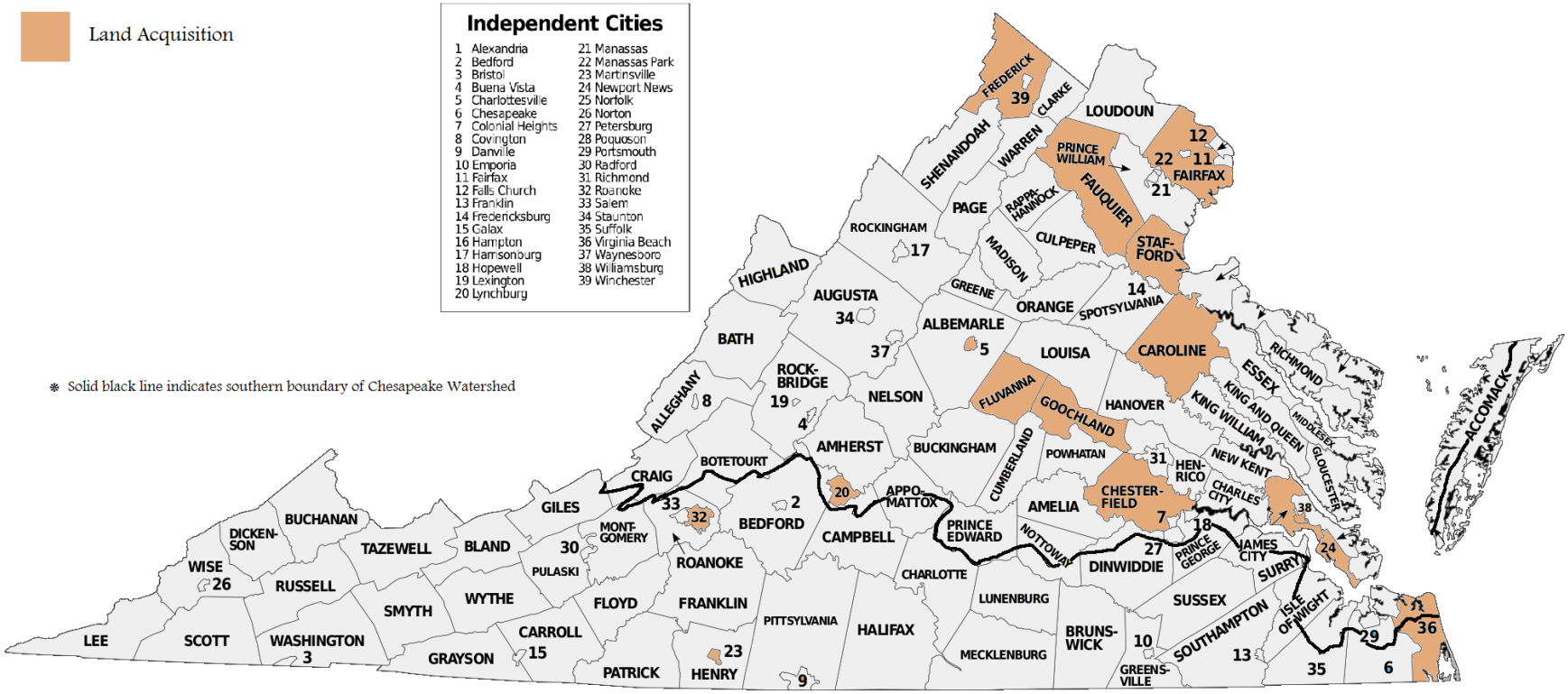
    - Not controversial
    - Minimally controversial
    - I don't know
    - Moderately controversial
    - Significantly controversial

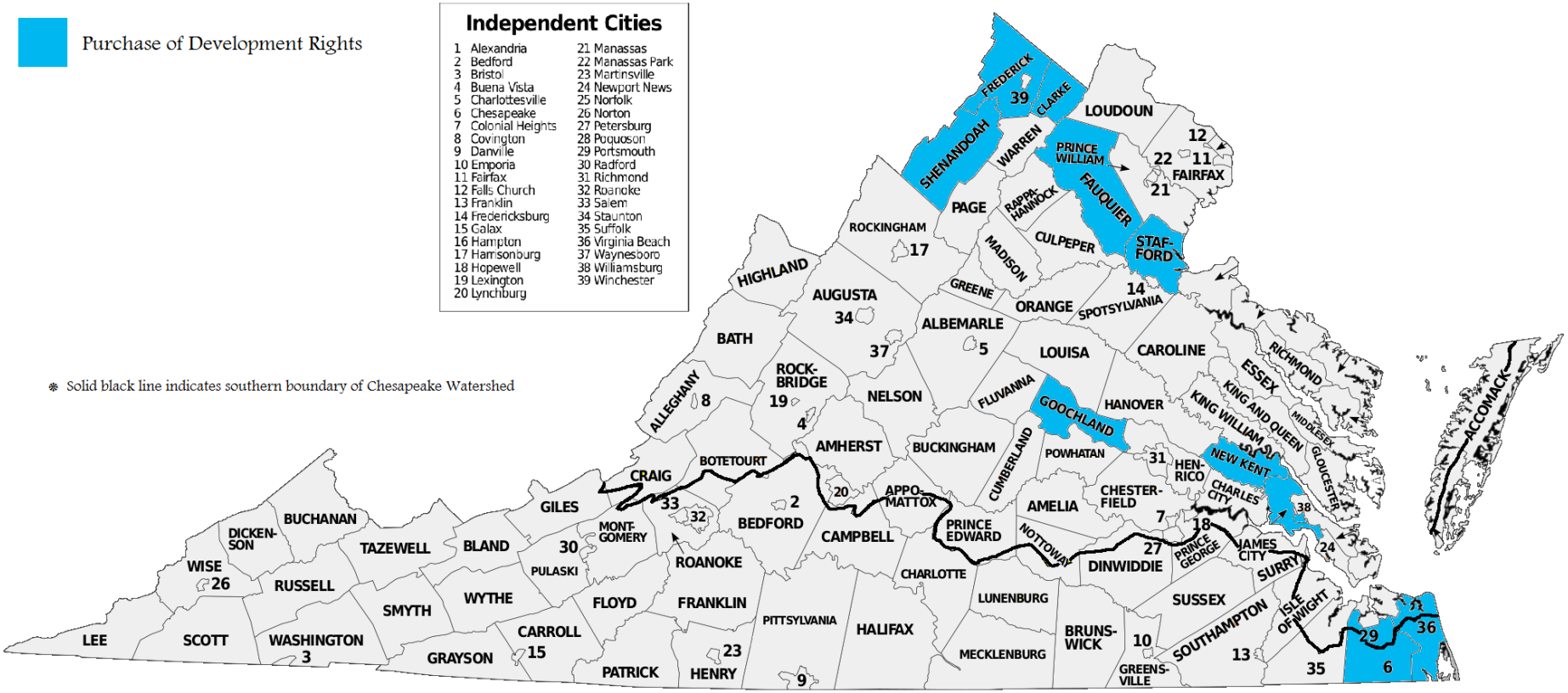
35. Please provide any general comments regarding this survey.

Appendix II: Survey Response Map



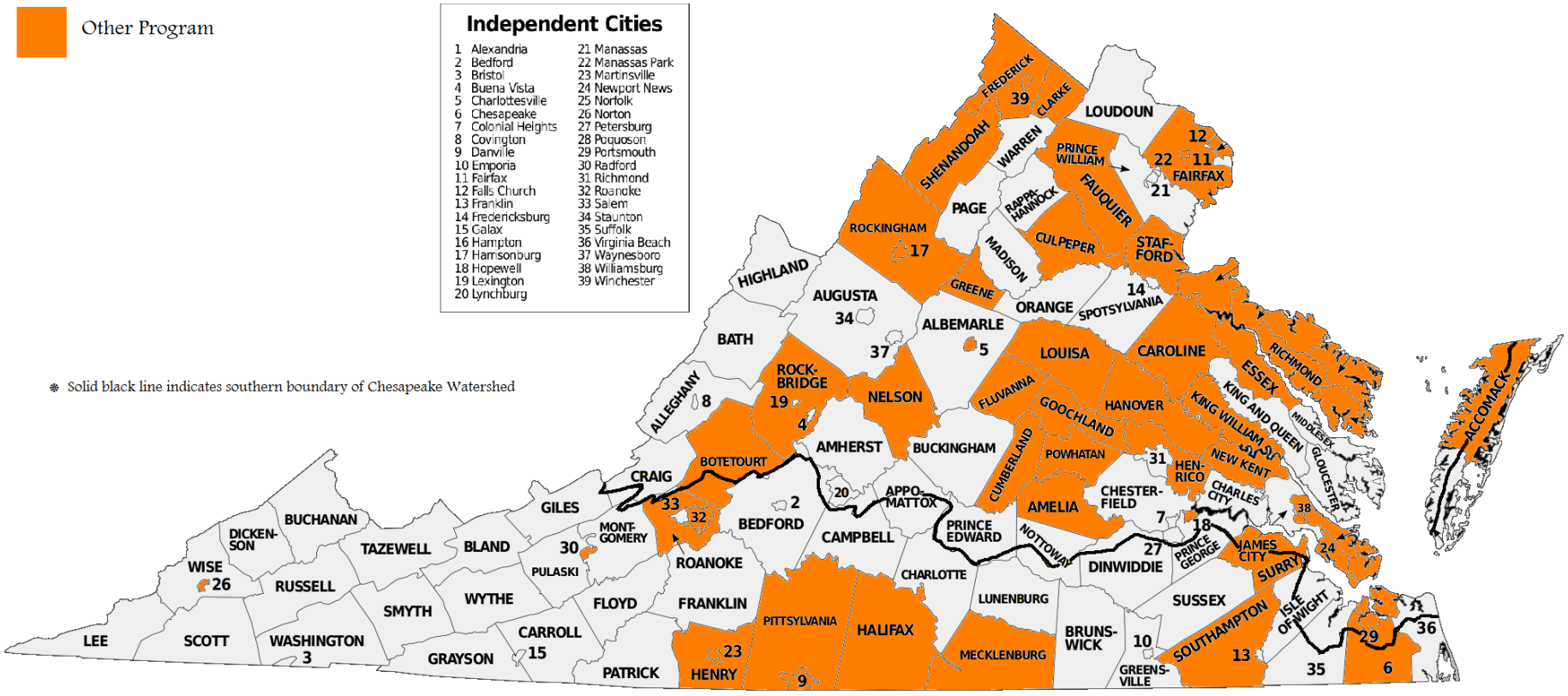
Appendix III: Publicly Funded Land Acquisition Programs In Virginia





Appendix IV: Publicly Funded PDR Programs In Virginia

Appendix V: "Other" Land Conservation Programs In Virginia



Appendix VI

ANALYSIS OF THE PROBIT REGRESSION MODEL AND DISCUSSION OF THE VARIABLES

The Probit Regression Model and Discussion of the variables. At the core, the main question of this study is: What factors increase a locality's tendency to choose land conservation and/or PDR programs? The survey served as a means of gathering this information. We found that while many localities do not have either of these programs, they do engage in some sort of conservation activity. The qualitative analysis discussed in the body of the report provided much insight into the types of programs and the corresponding motivations in Virginia. Accordingly, we conducted a probit regression analysis to test the statistical significance of these factors or variables. The first regression is based on responses from the 68 survey respondents. To not bias the results, the two case studies were not included because they did not respond to the final survey and information was gathered from them in-person. A second regression was conducted to see whether including these two localities affected out econometric findings.

There are various types of regression models available when trying to answer research questions via statistical analysis. Depending on the question and the form the variables take, one model may be preferred over the other. The probit model is commonly used when asking probability or tendency to choose questions. The econometric question is roughly: did this individual choose option A? The answer is in a "yes or no" form. Thus the analysis in this report asks four questions: (1) Did the locality choose land acquisition? (2) Did the locality choose PDR? (3) Did the locality choose both land acquisition and PDR? (4) Did the locality choose another conservation program? These questions are the dependent variables and were labeled *la*, *pdr*, *both*, and *other*, respectively. These are called "dependent" because their value is dependent

upon other factors or explanatory variables, which are called such because they are tested to explain the outcomes of the dependent variable.

For this regression analysis, the independent variables were pulled from various sources. Since an issue of interest was the impact the Chesapeake Bay Protection Act, Total Maximum Daily Load (TDML), and other federal and state regulations have on the decision to institute a conservation program, this question in the survey was pulled out as an explanatory variable. However, many localities did not answer this question, among others. Responses to the question of impact were either significant, moderate, minimal, or no impact. Assigning the omitted responses as "no impact" would be inaccurate and misrepresent the data. One option to solve this problem of missing observations was to eliminate theses incomplete localities entirely from the data set. However, this would eliminate other important information and cause other problems in the analysis. The other option was to create multiple variables for the one. The question of regulation impact was broken up into the aforementioned response categories, making them binary variables that take the value of "yes" and "no" and coded as one means a "yes" and zero means a "no." In the regression, these variables are *TDMLsig*, *TDMLmod*, *TDMLmin*, and *TDMLno*. The same process was done for the same reasons with the question that asked about the impact of commercial interests in the local economy. This variable is listed as *commsig*, *commmod*, *commmin*, and *commno*. It should be noted that this "fix" does not correct entirely for the missing observations. Those omissions will make it harder to conclusively predict behavior.

The last explanatory variable pulled from the survey was whether the locality is located in the Chesapeake Bay Watershed. This was of interest because these localities are most directly affected by the issues addressed in many of the federal environmental regulations for Virginia. This too is a binary variable, was coded as the other binary variables, and is listed as *watershed*.

The other explanatory variables that were included in the regression were not pulled from the survey. Information gathered from the literature review and case studies introduced questions about the impact of income and population on the tendency to choose conservation programs. The median incomes levels for the year 2009 were obtained for each locality from the U.S. Department of Agriculture's Economic Research Service.[1] The population density estimates for the year 2010 was obtained for each locality from the U.S. Census Bureau was obtained from the U.S. Census Bureau.[2] These variables are listed as *medianinc09* and *popdens10*, respectively.

The last variable in the regression is *richmond* or the distance each locality is from the City of Richmond. It was thought that the distance a locality was to the state capital may influence its tendency to engage in publically funded conservation programs. It is possible that closeness to Richmond may decreases apprehension towards government interventions. This variable also served the purpose of providing another continuous variable in the regression. A shortcoming of the probit model is that it functions best (consistently predicts outcomes consistent with observations in the data) when there are a reasonable number of continuous variables.

Discussion of regression results. When interpreting a regression analysis, one looks for statistical significance in the effect the explanatory variables have on the dependent variable. This is determined estimating whether there is at most a five percent chance that the outcome will occur (called the p-value) by coincidence and not because of the effects of the explanatory

[1] "County-level unemployment and median household income for Virginia." U.S. Department of Agriculture, Economic Research Service. http://www.ers.usda.gov/Data/Unemployment/RDList2.asp?ST=VA. Last visited November 13, 2011.

[2] "Population, Housing Units, Area, and Density: 2010 - State -- County / County Equivalent 2010 Census Summary File 1" U.S. Census Bureau. http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.ST05&prodType=table

variables. If the p-value of a variable is less than 0.05, then that variable has statistical significance. If it is equal to or greater than 0.05, then the variable is not considered statistically significant. While this rejection level is somewhat arbitrary, it is the standard most widely accepted by researchers. Some do use 0.10 as the rejection level, but this means that there is less confidence that the outcomes predicted by the model are due to the explanatory variables. Similarly, if a researcher used .01 as the rejection level, that would place an extremely high degree of confidence in the conclusion that the explanatory variables really did impact the outcome of the dependent variables. Please note that while variables may not have statistical significance, it does not mean that they do not influence the dependent variable. It just means that the effects are not conclusive.

As mentioned above, four regressions were conducted with *la*, *pdr*, *both*, and *other* as the dependent variables, each a different conservation program. Again, all of the regressions had the same explanatory variables: *TDMLsig*, *TDMLmod*, *TDMLmin*, *TDMLnog*, *CommSig*, *CommMod*, *CommMin*, *CommNo*, *watershed*, *Richmond*, *medianinc09*, and *popdens10*. When *la* was used as the dependent variable, *medianinc09* and *TDMLmod* had statistical significance with p-values of 0.048 and 0.015 respectively, which are both less than the 0.05 rejection level previously discussed. Higher levels of income increase the likelihood that a locality will choose to have a land acquisition program. Based on the literature review, a variable expected to have significance was *medianinc09*. Since a locality's tax review is influenced by the wealth of its residents, higher income levels can provide increased resources for localities, and thus make localities more likely to fund conservation programs. Additionally, localities that allow federal conservations regulations to have moderately impact how they decide conservation activities also have an increased likelihood that they will choose to institute a land acquisition program.

In order to contextualize the magnitude of the effects of the explanatory variables, we created a model that presents the change in the predicted probability (in percentage points) that a "representative" locality would experience with changes in the explanatory variables. This representative locality has the average values for all continuous variables, and the median value for binary variables. The representative locality varies across all of the regression models. This allows us to discuss the results in terms of the "average" Virginia locality (a baseline). The predicted probability baseline for having a land acquisition program is 18.57 percent, 5.6 percent for PDRs, 0 percent for both land acquisition and PDRs, and 90.35 percent for other programming. It is through the lens of this representative locality that we interpret the marginal effects of explanatory variables. A marginal effect is the effect that a one unit change in the explanatory variable has on the independent variable.

The marginal effect of a $1,000 increase on the likelihood of having a land acquisition program is 0.8 percentage points. With the baseline probability of 18.57 percent, a $1,000 increase in the median income level means that the representative locality's probability of having a land acquisition program is 19.37 percent. This indicates that while income is a significant factor, its individual impact is quite small.

The marginal effect of *TDMLmod* was much larger than that of income. If a locality indicated that the federal regulations moderately influenced the decision, then it was 66.2 percentage points more likely to have to a land acquisition program. This means that with the baseline probability of 18.57 percent, the representative locality would have a probability of having a land acquisition program is 84.77 percent. The representative locality is otherwise not inclined to have this program, but the federal regulations shifts this to a near 100 percent likelihood of having a land acquisition program. Even though this is a large effect, we must note

that this does not infer causality. It is possible that is not the regulations themselves but the underlining issues the regulations address that influence the decision to institute a land acquisition program. Furthermore, respondents who read this question may have provided a normative statement of importance of the federal regulations in lieu of actually indicating the role this this played in the decision to have a land acquisition program.

An interesting finding is the lack of statistical significance of the other degrees federal regulation influence in the decision to have the program. Even if a 10 percent rejection level was used, the variables would not be significant, as their p-values were well over 0.1. If a moderate impact increased the propensity to engage, then one would think that a significant impact would as well.

The McFadden's R^2 is a calculation that determines how much of effects of the dependent variable can be explained by the aggregate of the explanatory variables in the regression. When looking at the McFadden's R^2, we see that this regression only captures 21.5 percent of the variation in *la*. There is still 78.5 percent of the activity in *la* that is not explained. Two variables were omitted from the regression because of missing survey responses for those questions. This dropped the number of observations to 65 out of a possible 68. In an already small sample population, missing three observations can have a meaningful impact on how much of the variation in the dependent variable can be explained. If there is less to observe, then it is more difficult to derive trends.

In the regression with *pdr* as the dependent variable, the variable of significance is *medianinc009* with a low p-value or 0.003. As median income increases by $1,000, the propensity to institute a PDR program increases at a rate of 0.7 percentage points. This is the same trend when land acquisition is the dependent variable. The representative locality's

baseline probability for PDRs is 5.26 percent. So, the marginal effect of median income translates to 5.96 percent likelihood, which is virtually no change. The significance of this variable is consistent with the results anticipated from the literature review and case studies. This is also consistent with the phenomenon addressed in the James City County case study that discussed how in one locality, the ability to sell one's development rights was a status symbol. It also suggests that large increases in median income are necessary to have a large impact.

If a 0.1 rejection level is used, then the variable *TDMLsig* has statistical significance, with a 0.085 p-value. If a locality allows the federal conservation regulations to significantly impact the decision to have a PDR program, then it is 72.6 percentage points more likely to have said program. With the baseline probability of 5.26 percent, the marginal effect would change the probability to 77.86. Since this question subjective in nature, the line between moderate and significant impact may be blurred. Therefore it is not entirely surprising that same impact level is not significant and the same rejection level. There is still a connection between the federal conservation regulations and having a related program.

Due to issues with how variables interacted in the regression, several variables were omitted from the regression. One was *watershed*, which indicates whether a locality is or is not in the Chesapeake Watershed area. It would be interesting to see the impact that being this area has on the likelihood to have a particular program. Localities in this region are most impacted by the federal conservation regulations that pertain to Virginia. Since variables that measure this issue have significance, one would suppose that being in the Chesapeake Watershed would also have an impact.

The McFadden's R^2 for this regression indicates that 33 percent of the regression is explained by the explanatory variables. This regression does a better job of accounting for the

variation in the dependent variable than the previous regression, but not by much. In addition to *watershed* the variables *CommNo* and *CommMin* were omitted in this regression. Recall that the latter two variables measure the level of impact commercial industry has on the local economy.

As in the previous two regressions, when *both* was the dependent variable, *medianinc09* was significant with a p-value of 0.018. As the median level of income increases by $1,000, the propensity to have both a PDR and land acquisition program increases by 0.004 percentage points. This is a change of almost zero, and is an even smaller impact than in the previous regressions. This is highlighted by the representative locality that has a baseline probability of zero percent for having both programs. Thus a change of 0.004 percentage points is still a zero probability of having both programs. Median income is not a driving factor in choosing to implement both programs.

Six explanatory variables were omitted from this regression due to missing survey responses; that is half of the total variables of interest. Since a variable's significance can also be affected by the influence of other variables (including more or less variables affects the weight each explanatory variable has on the outcome of interest), so the addition of those omitted variables could increase or decrease the significance of income on the propensity to institute both PDR and land acquisition programs. Curiously, the McFadden's R^2 indicates that 47.8 percent of the regression is explained by the explanatory variables, which is curiously high given the R^2 values of the other regressions and the amount of observations in this one. This may be misleading given the limitations with the regression.

In the regression with *other* as the dependent variable, the variable *medianinc09* was very significant with a p-value of 0.013. As the median income level increases by $1,000, the likelihood to have a program other than PDR or land acquisition increases by 1 percentage point.

This is much larger increase than seen in the previous regressions. The representative locality has a baseline probability of 90.35 percent. Thus, a $1,000 increase in median income results in the probability of 91.35 for the representative locality. This representative locality was otherwise inclined to have an "other" program, and income was not the driving factor. Most localities that reported having an "other" program said they incorporated green space conservation in zoning or also received properties as designated greenspace donations by property owners.

The variables *popdens2010* and *watershed* would be significant if the 10 percent rejection level was used, as their p-values are 0.094 and 0.067 respectively. As in the previous regressions, several variables were omitted due to missing responses to survey questions (*TDMLsig*, *CommNo*, and *CommMin*). Curiously, *watershed* has a negative impact on the dependent variable. This means that if a locality is in the Chesapeake Watershed, then it is less likely to have a conservation program other than PDR and/or land acquisition. This could possibly mean that these localities are more likely to engage in these aggressive approaches to conservation than less formal and aggressive programs. It is difficult to tell with limited information from localities. More observations in the regression and less omitted variables may change how this story is told. *Popdens10* increase the likelihood of having a program other than PDR and/or land acquisition. The McFadden's R^2 indicates that 22.6 percent of the regression has been explained by the explanatory variables.

Median income level is the one variable that is consistently significant despite the issues with omitted variables due to missing responses. Federal conservation regulations also influence the likelihood to have a program, but not as consistently as income. Overall, these variables had small effects on the outcome. However, the trend shows that an aggregate of factors work better to tell the whole story of conservation activities in Virginia.

Regression 2: Survey Respondents and the Case Studies. As previously discussed, this second regression analysis was conducted to include the case studies localities in the data set to see how they affected the regression outcome. Because of the limited amount of localities with PDR and/or land acquisition programs, it was of interest to see if these localities affected the statistical conclusiveness of qualitative findings.

Median income level remained the most consistently significant variable in the regression. In fact, for land acquisition, PDR, and both programs, the significance of median income gained strength. This is to be expected because the City of Virginia Beach and James City County both have income levels that are greater than the state average and have well-funded PDR and land acquisition programs. The marginal effect of income increased as well, but only slightly (See Table 4). Interestingly, when *other* was the dependent variable, median income was no longer significant at the 0.05 rejection level. However, with a p-value of 0.073, it is significant at the 0.10 rejection level. This is actually consistent with the analysis that did not include the case studies and the qualitative analysis. It makes sense that localities that have formal PDR and land acquisition programs are less likely to have informal, ad hoc conservation activities.

Another difference is the significance of the federal conservation regulations. The degree of impact changed in statistical significance. In Regression 1, a moderate degree of impact was statically significant and the higher degree of impact was not. However, in Regression 2, the reverse was true. When *pdr* and *la* are the dependent variables, *TDMLsig* is significant with p-values of 0.04 and 0.048 respectively. Like median income, the marginal effects were only slightly larger but still small (less than 1 percentage point). *TDMLmod* was also significant in the land acquisition regression with a p-value of 0.018. Its marginal effect on having a land

acquisition was the same as *TDMLsig*. Allowing federal conservation regulations impact the decision to have land acquisition program either at a moderate or significant level means it is 67 percentage points more likely that there will be said program. The representative locality's baseline probability for land acquisition is 20.92 percent. Thus, marginal effect is a probability of 87.92. The representative locality is otherwise not inclined to have this program, but the federal regulations shifts this to a near 100 percent likelihood of having a land acquisition program. In the regression that looked at likelihood to have both PDR and land acquisition programs, federal conservation regulations variables did not have statistical significance. The variables *popdens10* and *watershed* were not significant when the case studies were included in the data set.

Reasons for results. Sample size played a major part in the regression results. The total population of Virginia localities is 134. In general, the minimum standard for sample population is 120 "individuals" because of the added strength to conclusions drawn from the analysis. The actual sample population is 68 respondents. While this response rate of 54.8 percent is considered "good" for a survey, the number of individuals in the sample is quite low. The inclusion of just two localities in the data affected the results of the regression, making the effects of some explanatory variable stronger and others weaker or not significant. Thus, it is a logical inference that an increased survey response rate would change the effect of the explanatory variables and possibly even the conclusiveness of the results.

It is also likely that there is omitted variable bias, meaning that there is at least one variable that should be included in this regression that was not that can provide more information about the dependent variables and change the weight of the pull the other variables have in the regression. This was evident in the low R^2 values and the small marginal effects. Something else is at play in the likelihood to have a conservation program.

Heteroskedasticity may also be a concern. This is when some of the explanatory variables are correlated with each other, meaning that as one changes, so does the other. If this is the case, it is difficult to determine what is affecting the dependent variable. It is also possible that one of the explanatory variables are correlated to the unobserved variables or those variables not included (and thus unaccounted for) in the regression. Because the variables are unobserved, it is difficult to correct for this problem.

TABLE 1. Motivating Factors in Conservation Programming (survey responses)†

	Model 1: Land acquisition	Model 2: Purchase of development rights	Model 3: Both LA and PDRs	Model 4: Other Programming
Median income level, 2009	0.00003** (0.00001)	0.00006** (0.00021)	0.00008** (0.00004)	0.00006** (0.00002)
Population density, 2010	0.00018 (0.00012)	-0.00042 (0.00036)	0.00030 (0.00041)	0.00046* (0.00027)
Distance from City of Richmond	0.00388 (0.00012)	0.00713 (0.00763)	0.00580 (0.00877)	-0.00194 (0.00496)
In Chesapeake Watershed	0.03836 (0.65488)	--	--	-1.21856* (0.66415)
Impact of regulations on decision				
Significant	1.33592 (1.07314)	2.46183* (1.42774)	--	--
Moderate	1.96019** (0.81986)	0.68212 (1.187968)	--	-0.87931 (0.85527)
Minimum	1.05802 (0.81973)	1.22435 (1.07666)	9.9720 (577.2116)	-0.70625 (0.74480)
None	0.78773 (0.67524)	0.81251 (0.80571)	9.1311 (577.2093)	-0.36516 (0.64061)
Impact of commercial industry on local economy				
Significant	0.33625 (0.80421)	0.19341 (1.05044)	0.31444 (1.00793)	0.33367 (0.83905)
Moderate	-0.78973 (1.01492)	0.47203 (1.15673)	--	1.34073 (0.92098)
Minimum	--	--	--	--
None	--	--	--	--
	N = 65	N = 68	N = 68	N = 67

**Significant at $p < 0.05$ *Significant of $p < 0.10$ Standard error in parentheses †Beta coefficients

TABLE 2. Motivating Factors in Conservation Programming (w/ case studies)†

	Model 1: Land acquisition	Model 2: Purchase of development rights	Model 3: Both LA and PDRs	Model 4: Other Programming
Median income level, 2009	0.00003** (0.00001)	0.00006** (0.00021)	0.00009** (0.00004)	0.00003* (0.00002)
Population density, 2010	0.00017 (0.00012)	-0.00041 (0.00035)	0.00038 (0.00039)	0.000434 (0.00027)
Distance from City of Richmond	0.00362 (0.00012)	0.00589 (0.00767)	0.00476 (0.00896)	-0.00034 (0.00496)
In Chesapeake Watershed	-0.05443 (0.64299)	--	--	-0.77729 (0.59623)
Impact of regulations on decision				
Significant	1.92993** (0.97484)	2.74803** (1.33961)	10.789 (631.052)	-0.85070 (1.00705)
Moderate	1.95237** (0.82489)	0.56959 (1.19512)	--	-0.33125 (0.79928)
Minimum	1.11952 (0.83426)	1.22130 (1.08065)	10.8757 (631.0547)	-0.33889 (0.71163)
None	0.92681 (0.68871)	0.93167 (0.81287)	10.0898 (631.0525)	-0.22286 (0.61038)
Impact of commercial industry on local economy				
Significant	0.36297 (0.80421)	0.22512 (1.09072)	-0.13825 (1.00793)	0.59087 (0.83905)
Moderate	-0.43732 (0.96091)	0.61625 (1.17604)	-0.03156 (1.53721)	1.00705 (0.83023)
Minimum	--	--	--	--
None	--	--	--	--
	N = 67	N = 70	N = 70	N = 69

**Significant at $p < 0.05$ *Significant of $p < 0.10$ Standard error in parentheses †Beta coefficients

TABLE 3. Marginal Effects of Motivating Factors in Conservation Programming (survey only)

	Model 1: Land acquisition	Model 2: Purchase of development rights	Model 3: Both LA and PDRs	Model 4: Other Programming
Median income level, 2009	0.00768** (0.00000)	0.00669** (0.00000)	0.00004 (0.00000)	0.01020** (0.00000)
Population density, 2010	0.04690 (0.00003)	-0.04580 (0.00003)	0.00015 (0.00000)	0.07830 (0.00004)
Distance from City of Richmond	0.00104 (0.00143)	0.00076 (0.00084)	0.00000 (0.00000)	-0.00033 (0.00084)
In Chesapeake Watershed	0.01016 (0.17154)	--	--	-0.13222 (0.05767)
Impact of regulations on decision				
Significant	0.47851 (0.38799)	0.72623* (0.39445)	--	--
Moderate	0.66183** (0.22473)	0.10682 (0.24933)	--	-0.21402 (0.25187)
Minimum	0.35239 (0.29563)	0.23705 (0.28267)	0.99860 (1.16327)	-0.15858 (0.19675)
None	0.21711 (0.18401)	0.09780 (0.11372)	0.452 (40.346)	-0.06424 (0.11317)
Impact of commercial industry on local economy				
Significant	0.08220 (0.17817)	0.01895 (0.09231)	0.00000 (0.00033)	0.06459 (0.18746)
Moderate	-0.16080 (0.14539)	0.06611 (0.20324)	0.00000	0.12807* (0.07044)
Minimum	--	--	--	--
None	--	--	--	--
	N = 65	N = 68	N = 68	N = 67

**Significant at $p < 0.05$ *Significant of $p < 0.10$ Standard error in parentheses

TABLE 4. Marginal Effects of Motivating Factors in Conservation Programming (w/case studies)

	Model 1: Land acquisition	Model 2: Purchase of development rights	Model 3: Both LA and PDRs	Model 4: Other Programming
Median income level, 2009	0.00966** (0.00000)	0.00794** (0.00000)	0.00018 (0.00000)	0.03060* (0.00000)
Population density, 2010	0.04910 (0.00004)	-0.04960 (0.00035)	0.00000 (0.00000)	0.06850 (0.00006)
Distance from City of Richmond	0.00104 (0.00154)	0.00072 (0.00095)	0.00000 (0.00000)	-0.00009 (0.00119)
In Chesapeake Watershed	-0.01586 (0.18986)	--	--	-0.15125 (0.08599)
Impact of regulations on decision				
Significant	0.66503** (0.23693)	0.80835** (0.27979)	1.0000 (0.0000)	-0.27979 (0.37855)
Moderate	0.66730** (0.21771)	0.09382 (0.25257)	--	-0.09217 (0.21421)
Minimum	0.38999 (0.30215)	0.25827 (0.30436)	0.99998** (0.3021)	-0.09372 (0.21229)
None	0.27265 (0.19573)	0.12798 (0.13123)	0.75 (46.06)	-0.05641 (0.15456)
Impact of commercial industry on local economy				
Significant	0.09567 (0.19696)	0.02483 (0.10726)	0.00000 (0.00033)	0.17553 (0.25117)
Moderate	-0.11039 (0.96091)	0.10272 (0.25297)	0.00000 (0.00006)	0.17553* (0.09961)
Minimum	--	--	--	--
None	--	--	--	--
	N = 67	N = 70	N = 70	N = 69

**Significant at $p < 0.05$ *Significant of $p < 0.10$ Standard error in parentheses

Appendix VI: Funding Levels

TABLE 5. Funding levels of localities with land acquisition programs, in 1,000s*

1.	Caroline County	< $50
2.	Charlottsville City	$1,000 - $5,000
3.	Chesterfield County	< $50
4.	Fairfax County	> $20,000
5.	Fauquier County	N/A
6.	Fluvanna County	$500 - $1,000
7.	Frederick County	< $50
8.	Goochland County	$250 - $500
9.	Hampton City	N/A
10.	James City County	> $20,000
11.	Lynchburg City	$100 - $250
12.	Martinsville City	$50 - $100
13.	Newport News City	$1,000 - $5,000
14.	Roanoke City	$5,000 - $10,000
15.	Stafford County	$50 - $100
16.	Virginia Beach City	$50 - $100
17.	Williamsburg City	$10,000 - $20,000
18.	Winchester City	$250 - $500

*Based on Survey Responses

TABLE 6. Funding levels of localities with PDR programs, in 1,000s*

1.	Chesapeake City	$1,000 - $5,000
2.	Clarke County	$50 -100
3.	Fauquier County	$10,000 - $20,000
4.	Frederick County	< $50
5.	Goochland County	$250 - $500
6.	New Kent County	N/A
7.	Shenandoah County	$100 - $250
8.	Stafford County	$50 - 100
9.	Williamsburg City	$500 - $1,000
10.	James City County	> $20,000
11.	Virginia Beach City	> $20,000

*Based on Survey responses

The Funding of Public Land Acquisition and Easements Purchases in Virginia

Presented by,
Jennifer C. Gore
Taylor Q. Lam
Thomas Vargas-Castro

December 8, 2011

Research Questions

- How many localities have a land conservation program?
- How many localities have a land acquisition program?
- How many localities engage in the purchase of development rights (PDRs)?
- How much do the various federal regulations for the Chesapeake Bay influence decisions to implement conservation programs?
- Other factors?

Land Conservation Implications

- Chesapeake Bay Health & Viability
- Battle Between Industry & Regulation
- Dynamic Between Income & Willingness to Pay

Initial Hypotheses

- Total Maximum Daily Load (TMDL) requirements will significantly impact localities' decision to adopt conservation programs.

- Localities that don't engage in land conservation programs will have a heavy reliance upon commercial industries.

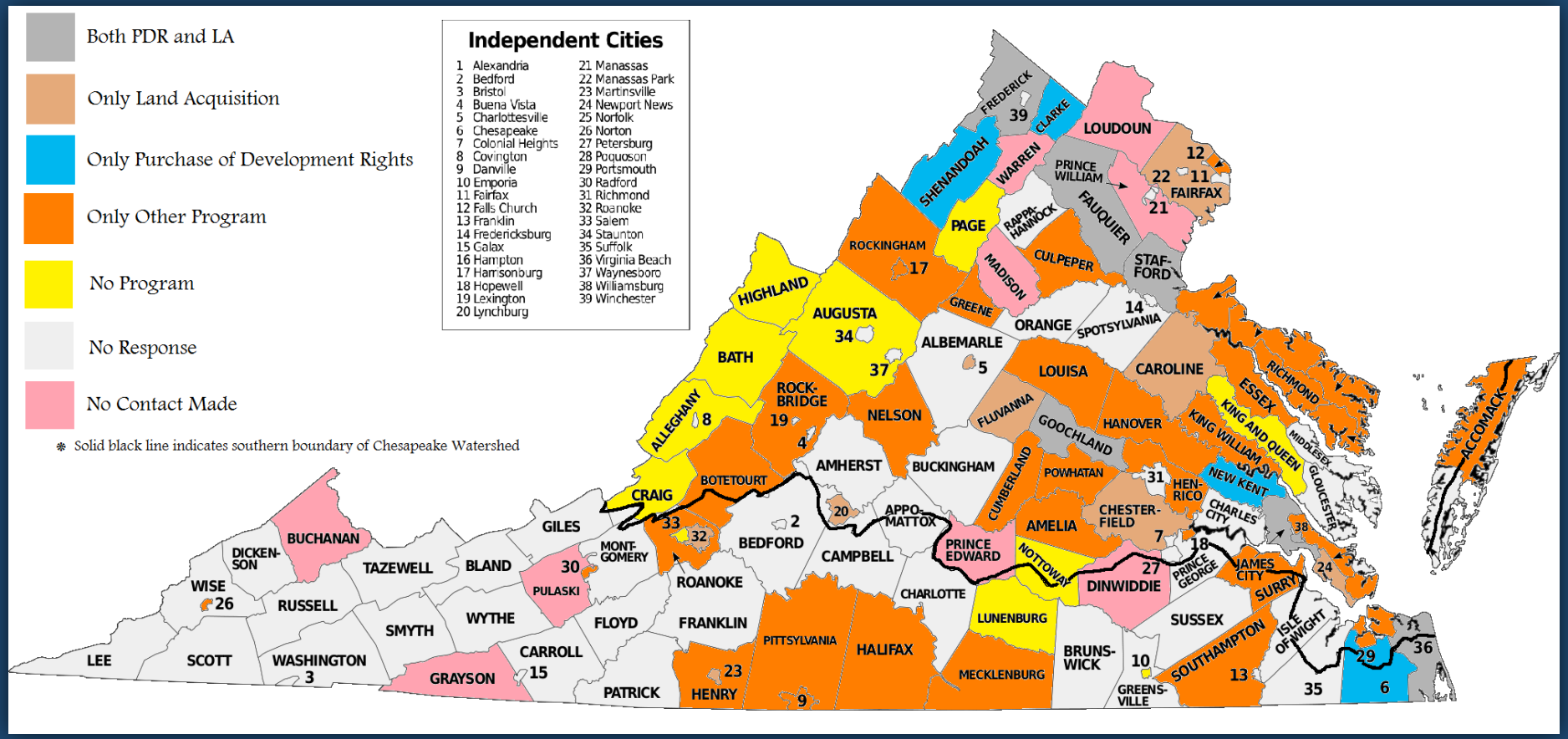
- There will be a positive relationship between land conservation and per capita income.

Survey Methodology

- Survey
  - Self-reporting
  - 35 questions, several transformations
  - Online software: *Qualtrics*
- Contacts
  - Contacted 124 of 134 localities
  - Released October 12, closed November 9.
- Response rate: 54.8%

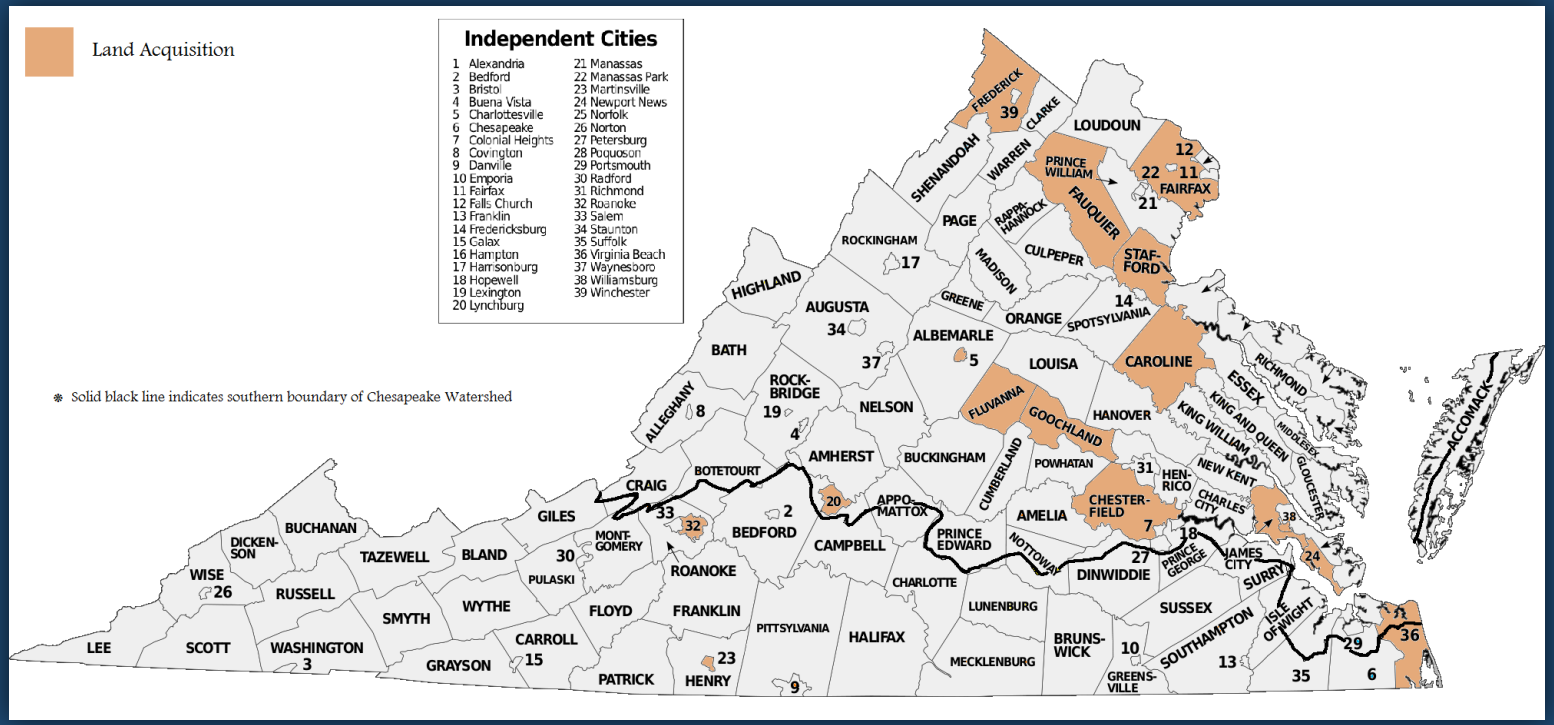
Survey Results

Programs Across Virginia



Land Acquisition

Answer	Responses	%
Have LA Program	17	24%
No LA Program	53	76%
Total	70	100%



Land Acquisition

Length of Program's Existence

Answer	Responses	%
Between 1-5 Years	1	7%
Between 5-10 Years	7	43%
Between 10-20 Years	3	14%
Longer than 20 Years	5	36%
Total	16	100%

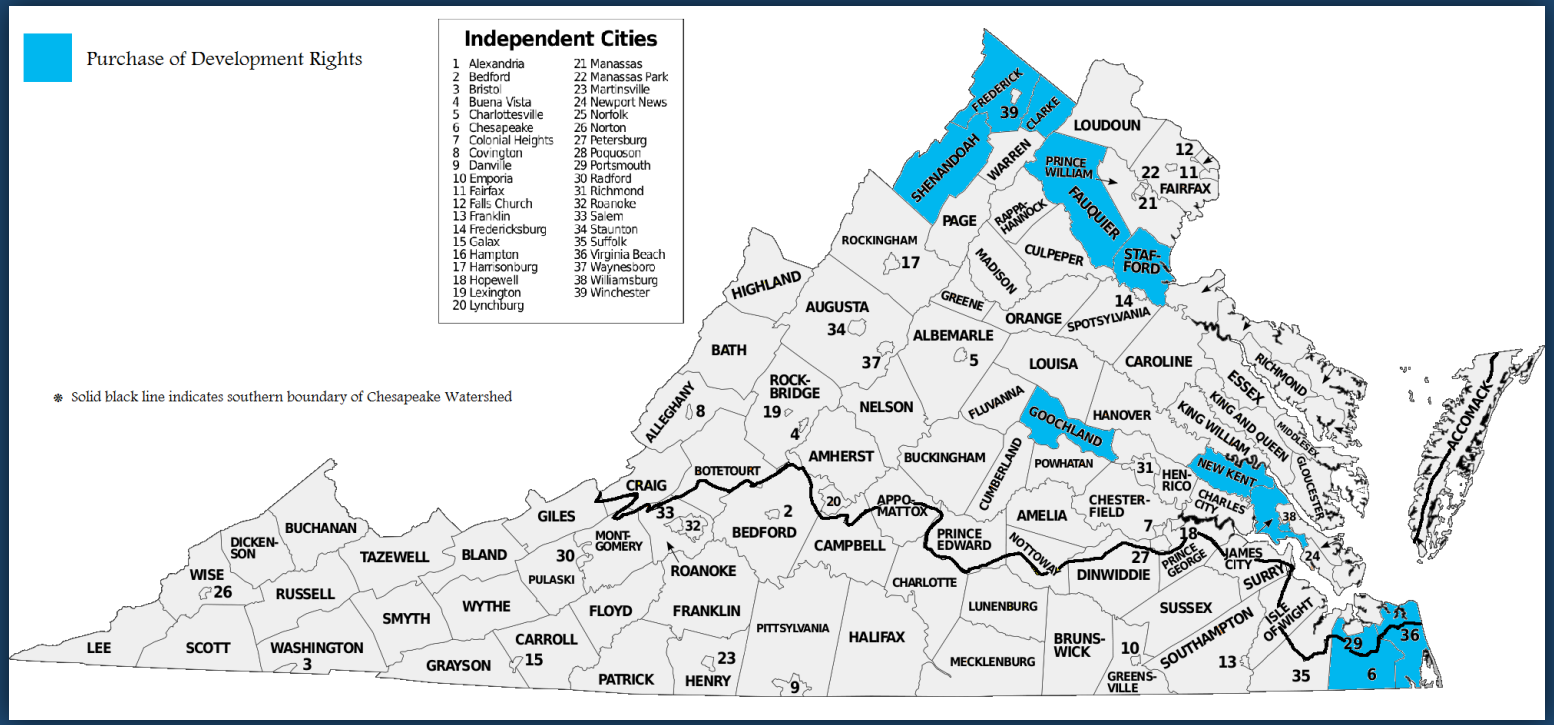
Land Acquisition

Program Funding Levels

Answer	Responses	%
Less than $50K	3	21%
Between $50K-$100K	2	14%
Between $100K-$250K	1	7%
Between $250K-$500K	2	14%
Between $500K-$1M	1	7%
Between $1M-$5M	2	14%
Between $5M-$10M	1	7%
Between $10M-$20M	1	7%
Greater than $20M	3	7%
Total	17	~100%

Purchase of Development Rights

Answer	Responses	%
Have PDR Program	11	16%
No PDR Program	59	84%
Total	70	100%



Purchase of Development Rights

Length of Program's Existence

Answer	Responses	%
Between 1-5 Years	5	46%
Between 5-10 Years	4	36%
Between 10-20 Years	1	9%
Longer than 20 Years	1	9%
Total	11	100%

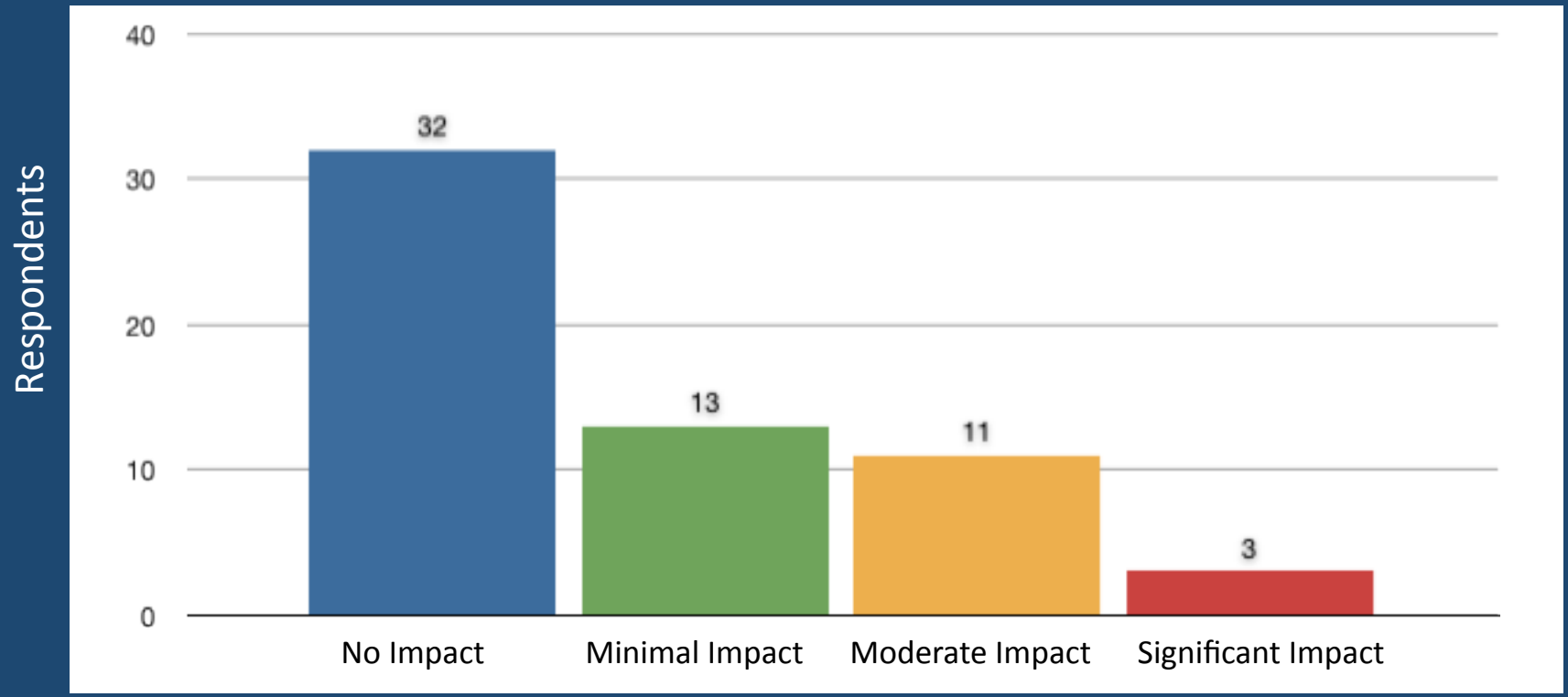
Purchase of Development Rights

Program Funding Levels

Answer	Responses	%
Less than $50K	1	9%
Between $50K-$100K	2	18%
Between $100K-$250K	1	9%
Between $250K-$500K	2	18%
Between $500K-$1M	1	9%
Between $1M-$5M	1	9%
Between $5M-$10M	0	0%
Between $10M-$20M	1	9%
Greater than $20M	2	18%
Total	11	~100%

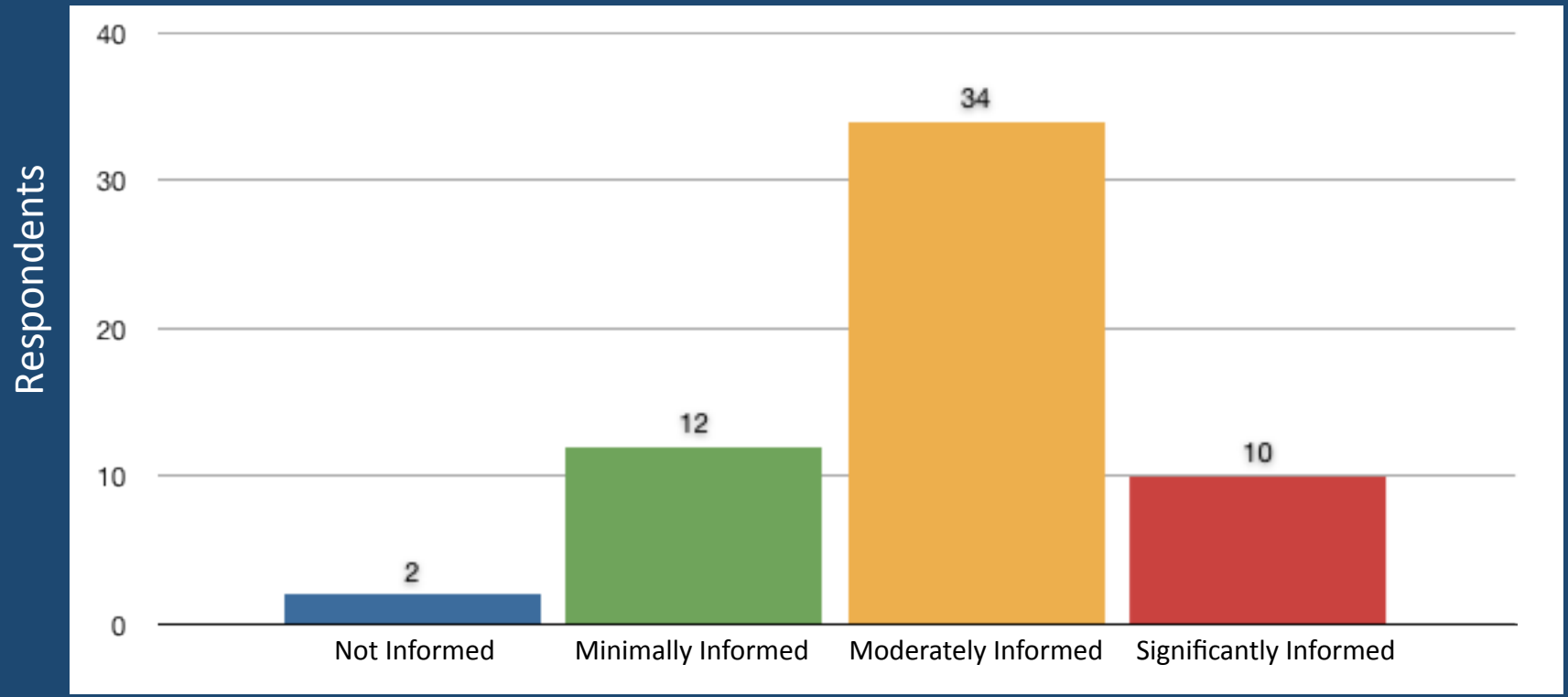
Motivations

What is the effect of state and local regulations on establishing land conservation programs?



Motivations

How informed are citizens with respect to local politics and tax issues?



Motivations

- How controversial are land acquisitions and PDRs?
  - Controversial to a degree
    - Relatively uncontroversial for localities with land conservation programs
  - Land acquisitions are more controversial than PDRs.

Motivations

Importance of industries across localities with land conservation programs.

	Land Acquisition Programs*	PDR Programs**
Commercial Agriculture	1-3	5
Housing	4-5	4-5
Commercial Development	5	5
Commercial Forestry	1-3	2

*N=15, **N=9

Localities with land conservation programs were asked to identify the importance of four industries (agriculture, housing, commercial development, and forestry) in their local economies. Options:

1=Not Important
2=Minimally Important
3=Probably Important
4=Moderately Important
5=Significantly Important

Motivations

- What motivates localities to establish land conservation programs?
  - Desire to protect land to keep agriculture viable
  - Citizens' initiatives to conserve space
- Necessary, but not sufficient condition

Statistical Analysis

TABLE 1. Marginal Effects of Motivating Factors in Conservation Programming (survey only)

	Model 1: Land acquisition	Model 2: Purchase of development rights	Model 3: Both LA and PDRs	Model 4: Other Programming
†Median income level, 2009	0.768** (0.000)	0.669** (0.000)	0.004** (0.000)	1.02** (0.000)
†Population density, 2010	4.69 (0.003)	-4.58 (0.003)	0.015 (0.000)	7.83* (0.004)
In Chesapeake Watershed	1.016 (0.172)	--	--	-13.22* (0.058)
Impact of regulations on decision				
Significant	47.851 (0.388)	72.623* (0.394)	--	--
Moderate	-66.183** (0.225)	10.682 (0.249)	--	-21.402 (0.252)
	N = 65	N = 68	N = 68	N = 67

**Significant at $p < 0.05$ *Significant of $p < 0.10$ Standard error in parentheses †Measured in 1000s

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TABLE 2. Marginal Effects of Motivating Factors in Conservation Programming (w/case studies)

	Model 1: Land acquisition	Model 2: Purchase of development rights	Model 3: Both LA and PDRs	Model 4: Other Programming
†Median income level, 2009	0.966** (0.000)	0.794** (0.000)	0.018** (0.000)	3.06* (0.000)
Impact of regulations on decision				
Significant	66.503** (0.237)	80.835** (0.280)	100.00 (0.000)	-27.979 (0.379)
Moderate	66.730** (0.218)	9.382 (0.253)	--	-9.217 (0.214)
	N = 67	N = 70	N = 70	N = 69

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	N = 67	N = 70	N = 70	N = 69

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Key Findings

- There are 24 localities w/ conservation programs
- Chesapeake Watershed important but inconclusive
- Federal regulations conclusively important
- Confluence of Motivations: Agriculture viability, Citizens initiative to conserve greenspace, water quality, tourism industry, and flood abatement

Recommendations for Future Research

- More aggressively target localities that did not respond
- Identify more variables of interest
- Willingness-to-Pay research in Virginia

Questions?