THESIS

INCENTIVES FOR CONSERVATION EASEMENT: A SYSTEMATIC LITERATURE REVIEW AND AN EMPIRICAL EVALUATION OF STATE TAX CREDITS IN COLORADO

Submitted by

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ABSTRACT

INCENTIVES FOR CONSERVATION EASEMENT: A SYSTEMATIC LITERATURE REVIEW AND AN EMPIRICAL EVALUATION OF STATE TAX CREDITS IN COLORADO

A conservation easement (CE) is a legal agreement between private landowners and government entities or non-profit organizations that is widely used as a mechanism to protect private lands from development and promote long-term ecological, recreational, and agricultural benefits. Donated CEs in the US are eligible for tax benefits at both the federal and state levels. As the adoption of easements has increased over the years, understanding how these incentives impact easement donation rates is warranted. This study focuses on two interrelated research objectives related to tax incentives for CE: (1) a systematic literature review on CE tax incentives throughout the US, and (2) a county-level analysis of the impact of state tax incentives on easement acres in Colorado.

In the first study, we reviewed 74 peer-reviewed and grey literature related to tax incentives for CE published between 2000 and 2023. Studies were selected by thematic coding approach and were analyzed under five themes: (1) economic implications of easement incentive programs, (2) environmental and ecological implications, (3) landowner and land trust perceptions of easement incentives, (4) tax as a motivating factor to donate easements, and (5) opportunities and barriers to participation in CEs. Findings show a significant increase in CE donation with tax incentives, especially in states like Colorado and South Carolina, which have a transferable tax credit, but the benefits from tax incentives are not evenly distributed. Various studies also found significant

challenges associated with CE donation, including but not limited to inflated appraisals, misuse of the available credit, and administrative complexities. Moreover, landowners' decision to donate a CE is not only influenced by tax incentives, but also by several other factors, including a sense of attachment to their land, the preservation of land for future generations, and the land's ecological importance. In the second study, we examined the impacts of state tax incentives on CE enrollment in Colorado. We employed a fixed-effects panel regression to analyze a panel dataset of 64 Colorado counties spanning the period from 1995 to 2022 (n = 1792). Results showed that the presence of a state tax credit is significantly associated with an increase in CE acres. While the number of easement holders, educational attainment, population density, income, and public land were positively correlated with easement acres, the price of land was negatively correlated. Overall, these studies improve our understanding of the critical role of tax incentives in easement donation. The findings could be used by policymakers to design easement tax policies that enhance the program's efficiency and meet its conservation objectives. The findings also provide valuable insights and have implications for similar incentive programs for other conservation programs, such as forest carbon programs in the US.

Keywords: conservation programs; easements; forest landowners; forest policy; tax incentives

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1.1. Introduction

Conservation easements (CEs) are voluntary legal agreements between landowners and a conservation agency that restrict the use of land to protect its conservation values, including open space, recreational opportunities, historical resources, and ecological benefits (Farmer et al. 2011). Conservation agencies are nonprofit land trusts or government entities that monitor and enforce the terms of the easement throughout the duration of the agreement or contract (Lindstrom 2007). Landowners willing to participate in CEs voluntarily give up their rights to develop their property. While land ownership can remain with the owner, the development rights are transferred to conservation agencies either through donation or by the purchase of the rights. CEs have emerged as an innovative conservation tool to address the mounting land pressure or exaction resulting from urbanization and development. According to the National Resources Conservation Service, more than 2.6 million acres of land in the United States (US) were lost for development between 2012 and 2017. CEs can aid in preserving ecosystem services such as water resources, carbon sequestration, wildlife habitat, and biodiversity and safeguarding the historical and cultural values of the property that will span multiple generations (Heritage Conservancy 2025). Of 61 million acres of protected lands in the US, more than 20 million acres are conserved through easements (Land Trust Alliance 2024).

CEs are becoming popular in the US due to their contributions to conserving land from development and associated tax benefits (Fishburn et al. 2009 and Reeves et al. 2018). The total

acreage of land under easements increased from 12 million acres in 2010 to over 20 million acres in 2020 (Land Trust Alliance 2024). Over the years, the adoption of easements has varied across the US, with some states showing higher enrollment rates than others (Figure 1). This could be influenced by the presence of active land trusts, state conservation priorities, land ownership types and objectives, tax incentive programs, and landowner knowledge or awareness of easement programs. As of 2020, Colorado, Maine, and Montana had conserved the most land through easements, with approximately 2.5 million, 2.4 million, and 1.7 million acres, respectively. Many states from the Midwest and Northeast had relatively low acreage enrolled in easements. For instance, Delaware had only 5,221 easement acres, followed by North Dakota with 3,816 acres (Land Trust Alliance 2024). While some New England states had low enrollment, the percentage of private land in easement was highest in this region, with easements in Maine covering 13% of its total private land, followed by Vermont (12.72%) and New Hampshire (7.41%). States such as Florida and Nevada had the lowest percentages of private land enrolled in the easement program.

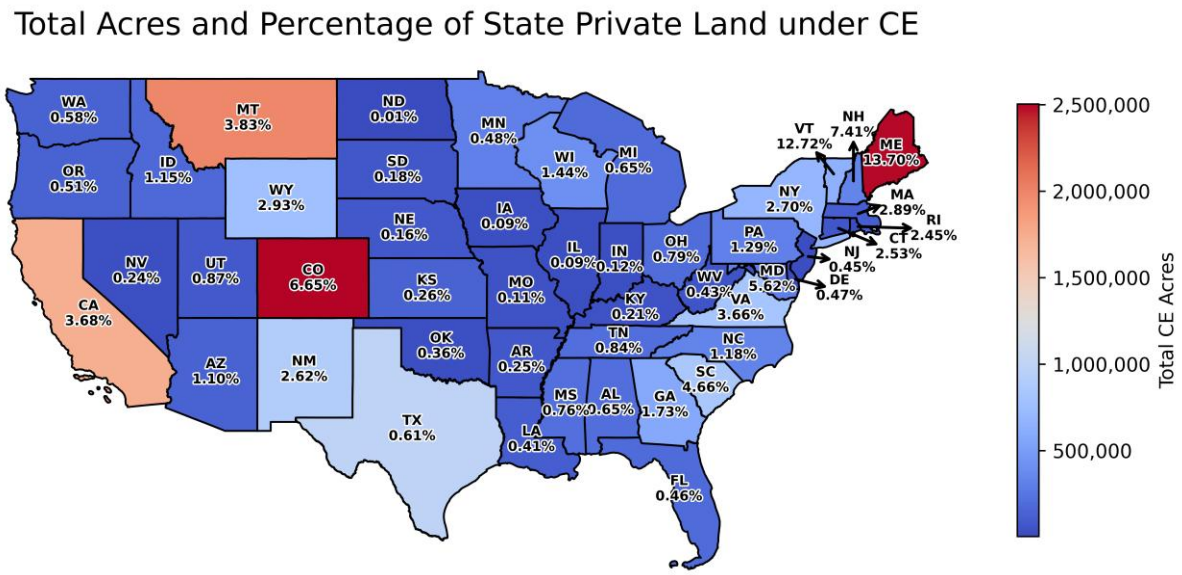

Figure 1. Total conservation easement (CE) acres and percentage of state private land under easement as of 2020. *Note*: Data source: Land Trust Alliance 2024

The distribution of CEs in the US can be influenced by various social, ecological, environmental, and financial factors. Amongst these, the significant tax benefits have been shown to be one of the most influential drivers of donated easements (Fishburn et al. 2009; Sundberg 2007). Donors of CEs are eligible for both federal and state tax incentives when offered by the state. For federal income tax purposes, the Tax Reform Act of 1976 amended the deduction policies for charitable gifts and allowed the donation of at least a 30-year easement exclusively for conservation purposes to be treated as charitable contributions (Asbury 2016). This means that easement donors can receive tax benefits in the form of deductions on their federal income tax returns. The Tax Treatment Extension Act of 1980 replaced the 30-year duration requirement, establishing that contributions should be granted in perpetuity (Public Law No. 95-30, 91 Stat. 126). In 2006, the US Congress increased the deduction limit from 30% to 50% of the Adjusted Gross Income (AGI) in the year the easement was donated. The carry-forward period was also increased from 5 years to 15 years, allowing donors to carry forward the unused deductions if the total deduction exceeds their taxable income for that tax year. Farmers and ranchers who make more than 50% of their gross income from "the trade or business of farming" are eligible for an enhanced tax benefit, enabling them to deduct up to 100% of their AGI (U.S. Code 2020, 26 U.S.C. § 170). While this incentive was enacted temporarily in 2006, it was made permanent in 2015 (Land Trust Alliance 2016). In addition to the income tax deduction, qualified easements also receive estate tax benefits. This involves the exclusion of 40% of the property value, up to a maximum of $500,000, from the value of the estate.

State tax incentives for CEs complement federal incentives and are made available to landowners in the form of state income tax credits and property tax exemptions. Most state

incentives enable landowners to recover some of the cost of conveying the easements with state income tax credits. Easement donors can use tax credits to offset their state taxable income. In other words, donors can take dollar-for-dollar reductions in their state tax liability. All state tax credit programs started in or after 2000, with the exception of North Carolina's program, which began in 1983 but was terminated in 2014. Currently, fourteen mainland US states and Puerto Rico offer state tax credits, with changes to these incentives taking place over the years (Table 1). The type, valuation of tax credits, and carryforward period for qualifying donations vary across states. Tax credits are transferable or non-transferable, meaning they can or cannot be sold on the secondary market. Transferable credits are generally sold at a discount, and there is no cap on the amount that can be sold. As of 2024, five states, including Colorado, Georgia, New Mexico, South Carolina, and Virginia, offer transferable tax credit incentives, while others offer non-transferable tax credits. States such as Florida and Maryland offer property tax incentives to donated easements. In Florida, donated easements qualify for partial or full exclusion from property taxes, whereas in Maryland, lands donated to Maryland Environmental Trust, or the Department of Natural Resources are exempt from property taxes for 15 years from the date of donation.

In most states, the amount of tax credit is a percentage of the appraised value of the easement, ranging from 25% to 100% of the fair market value. However, there is a credit cap per easement or year, which ranges from $5,000 to $5 million, with some states imposing no cap. For example, Colorado's transferable tax credits are issued for 90% of the fair market value up to a maximum of $5 million per easement. Many states also restrict maximum state credit allowances, with aggregate caps ranging from $500,000 in Arkansas to $100 million in Virginia. The carry-forward period and refundability are other important provisions associated with excess or unused

credits. The carry-forward period is the time during which landowners can use unused credits. Most states offer at least a 5-year carry-forward period. Some states (Colorado, Massachusetts, and New York) also provide full or partial refunds of excess credits to donors under certain circumstances. A refundable credit is the difference the landowner receives back if the tax credit exceeds their state tax liability.

Table 1. State tax incentives for donated conservation easements in the US.

State	Tax credit valuation	Tax credit cap	Aggregate cap	Carryforward period (years)	Transferable	Refundable
Arkansas	50% of FMV	$50,000 ($5,000 per year	$50,0000	10	No	No
California	55% of FMV	No Cap	No Cap	8	No	No
Colorado	90% of FMV	$5 million	$45 million	20	Yes	Yes[a]
Connecticut	50% of FMV	No cap	No cap	25	No	No
Delaware	40% of FMV	$50,000 per taxpayer	$1 million	5	No	No
Georgia	25% of FMV	$250,000(for individual donors) $500,000(for corporate donors)	$4 million	10	Yes	Unknown
Iowa	50% of FMV	$100,000	Unknown	20	No	No
Maryland[b]	100% of FMV	$5,000 per year ($10,000 per year for a couple)	$200,000	15	No	No
Massachusetts	50% of FMV	$75,000	$2million	10	No	Yes
Mississippi	50% of transaction costs of the donated easement	$10,000 per transaction	No Cap	10	No	No
New Mexico	50% of FMV	$250,000	No Cap	20	Yes	No
New York	25% of school district, county, and town property taxes	$5,000 per year	No Cap	Not Applicable	No	Yes
Puerto Rico	50% of FMV		$15 million	10	No	No

South Carolina	25% of FMV or $250 per acre	$52,500 per year	No Cap	Indefinite	Yes	No
Virginia	40% of FMV	$50,000	$100 million	13	Yes	No

Note: Incentive policies in all states are as of 2024.
Florida provides partial or full exemption from property taxes for donated easements. The reduction in property taxes is determined by state and local law.
[a] Partial refund starting in 2021.
[b] Lands donated to Maryland Environmental Trust or the Department of Natural Resources are exempt from property tax for 15 years from the date of donation. The maximum credit per year is either the amount of state income taxes owed for that year or $5,000, whichever is smaller.

A number of studies have previously reviewed literature on CEs. Merenlender et al. (2004) reviewed the organizational arrangements (easements held by land trusts) of easements and their contributions to the preservation and restoration of biodiversity and found that the information on protected resources is too aggregated or widely scattered to identify what is actually conserved through the program. Kabii and Horwitz (2006) assessed studies from the US, Australia, and other countries that focused on landowner decision-making for easements and found five influential determinants, including economic dependence on the property, private property rights, trusts in the easement mechanism, and equity and ethics in nature conservation. Along the same lines, Kemink et al. (2021) summarized the factors influencing landowner participation in perpetual CEs using Ostrom's social-ecological framework and found that the contract length and private property rights were highly associated with easement adoption decisions. Another review study by Reeves et al. (2018) examined the impact of CEs on surrounding property values and found that properties located near easements may experience an increase in value, potentially increasing tax revenues.

As easement tax incentive programs continue to evolve and circumstances on the ground change, questions surrounding easement benefits, valuation, appraisal, and other implications of incentives have become particularly important and of great interest among landowners, non-profit land trusts, real estate investors, legal professionals, appraisers, local governments, conservation

organizations, and policymakers. While a large body of literature has examined various facets of federal and state easement tax incentives nationwide, a comprehensive synthesis of the implications of tax incentives for donated easements is still lacking. This review aims to address this knowledge gap by focusing on three key questions: (1) What are the economic and environmental impacts of tax incentives? (2) Do tax incentives promote easement donations? (3) How do landowners perceive easement incentive programs, including the associated challenges and opportunities?

This study makes a few contributions to the literature on CEs. First, it expands the research on conservation programs by focusing on easements. Second, this study covers data from the last 24 years and provides a better understanding of the economic and ecological implications of tax incentives, landowner behavior and decisions surrounding easement adoption, and diverse challenges associated with easement incentive programs across the country. Third, the findings of this study are also expected to provide directions for future research on policies and incentives related to easements. Overall, this study aims to synthesize existing research to provide valuable insights for policymakers in understanding the economic and environmental impacts of CE tax incentives and the key factors influencing CE donations. This ultimately helps to enhance the design and implementation of forest and land conservation policies that align with state, regional, and national conservation priorities.

1.2. Methodology

We conducted a systematic review of literature focused on CE tax incentive programs by using a stepwise process that involved literature search, screening, identification, coding, data extraction, and analysis (Figure 2). For the literature search, we used Google Scholar and collected

English-written articles from the US. Key terms used for the literature search included “conservation easements," "conservation easement tax credit,” "conservation programs," "tax incentives," and "transferable tax credit". We screened a total of 924 articles by carefully reviewing their title, abstracts, and keywords and filtered out the studies from outside the US and those unrelated to easement incentives. After checking for duplicates, we organized 69 articles in a coding spreadsheet to identify those that met our additional inclusion criteria. We again screened them and coded ‘Yes’ or ‘Maybe’ if they were related to CE tax incentives or were uncertain at this point. As a next step of identification, we scanned the full text of articles and excluded five studies that did not include a direct assessment of easement incentive programs. Next, using the snowball sampling technique, we expanded our search and performed backward and forward searches of articles selected in the identification step (Floress et al. 2019). Backward search involved examining the bibliography section, whereas forward search involved examining other articles (in Google Scholar) that had cited the selected articles. We collected 13 additional studies from backward searches and 8 from forward searches. These articles underwent the same screening and identification processes, resulting in the exclusion of an additional 11 articles.

As a part of coding, we categorized articles by publication year, type of publication (peer-reviewed or other), geographical focus, and the type of tax incentives they examined (state, federal, or both). We then extracted information related to the incentive analyzed in the study, the data and methods utilized, and the main findings of the study. Based on the study objectives and main findings, we identified five themes: (1) economic implications of easement incentive programs, (2) environmental and ecological implications, (3) perceptions of landowners and land trusts about, (4) tax incentive as a motivating factor for easement donation, and (5) challenges associated with

implementation and usage of easement tax incentives. The findings of each article were synthesized and summarized with respect to each theme.

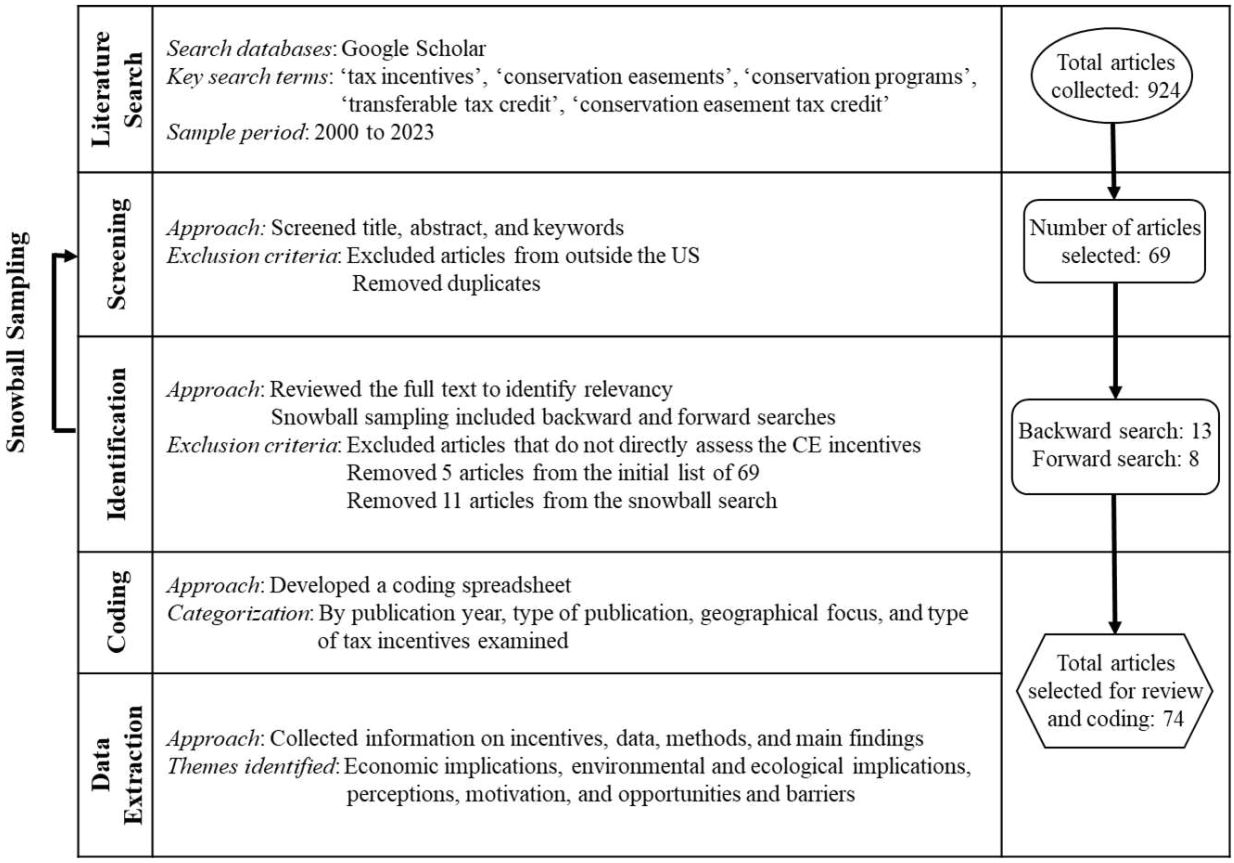

Figure 2. Steps for the systematic review of literature on conservation easement (CE) incentives.

1.3. Results and Discussion

1.3.1 Economic implications

Policy intervention in the form of tax incentives can influence the frequency of easement transactions. Parker and Thurman (2018) find a 40% increase in easement flow following an increase in the deduction limit in 2006, and a 200% increase in Colorado and South Carolina after the introduction of state tax credits. Sundberg (2011) finds that states offering higher tax credits see a significant increase in the number of donated easements. Along the same line, McGaffin et al. (2012) and Soppelsa (2015) argue that states offering transferable tax credits experience higher easement transactions than states that do not offer such credits. For instance, in Colorado, the average number of donated easements doubled and the number of acres protected tripled within four years following the adoption of transferable tax credits (Zweibel & Copper 2010). Taylor (2012) further examines the impact of tax credits and presents a contrasting result, showing a significant positive impact on easement donations only during the initial implementation period. Parker (2002) supports this, finding that state income tax credits could significantly boost CE donations initially but may not have a lasting impact.

Tax incentives also subsidize easement donations by reducing the opportunity cost of retiring future development rights and profits (Taylor 2012). Although it is generally anticipated that the market value of development-restricted lands reflects their value for non-farm use, such restrictions may negatively impact their market prices or result in a valuation at a discounted rate (Anderson and Weinhold 2008; Butler et al.2012).

CEs provide private tax incentives to offer public economic benefits. In Colorado, the cumulative public economic benefit of the tax credit program to state taxpayers is estimated to be about $20,000 per acre conserved (Seidl et al. 2023). Easement grantors also receive additional

financial advantages such as lower property taxes and reduced estate valuation (Oppenheimer 2000). As studied by Reeves et al. (2020), in Georgia, the CE designation qualifies landowners for lower property tax assessments, providing significant financial relief, especially for owners with large tracts of land. Additionally, by reducing estate tax valuation, CEs alleviate financial burdens on heirs (Lindstrom 2005; Lindstrom 2007; Phelps 2019). This may, however, reduce the tax base of the town/municipality as land development rights are transferred to conservation organizations and trusts. Moreover, to maintain service levels, the tax burden may shift to other properties due to increased property tax rates (King and Anderson 2003; Anderson and King 2004). For example, the value of residential parcels adjacent to easements increased in two counties of Maryland (Geoghegan et al. 2003). Similarly, in Vermont, easement establishments initially increased property taxes, but they became tax-neutral in the long run due to rising property values in areas with low supply and high demand (King & Anderson 2003). These properties often experience positive externalities, which are reflected in higher housing prices. Although CEs reduce the taxable value of conserved land, they can boost local tax revenues by increasing the value of surrounding properties (Reeves et al.2018). This was particularly observed by Chamblee et al. (2011) in Buncombe County, North Carolina where CEs raised nearby residential property values by 11%, with the effect decreasing more gradually over distance compared to fee simple conservation. Similarly, Mittal (2014) found that CEs in Worcester, Massachusetts also increased surrounding property values, though the effect declined at a rate of 1% per unit of squared distance.

The economic impact of using easement tax credits also depends largely on how they are structured and who is using them. Tax credits that are transferable or can be sold on the secondary market offer land-rich, cash-poor landowners financial flexibility by providing additional cash flow while also helping them offset their state tax liability. Such donors represent a small group of

taxpayers who can recoup the donation value from savings on income taxes, or sometimes even more than the entire value of the donations in states offering transferable tax credits (Parker and Thurman 2018). For landowners who are unable to use all the tax credits, it may make more economic sense, from a devaluation perspective, not to carry forward unused credits to future years. Landowners may also find it less attractive if the tax credit is non-refundable (Nickerson et al. 2009). However, Parker and Thurman (2018) find significantly greater tax benefits of donations to high-income landowners compared to low-income landowners. Because a lower easement donation price reduces landowner income, wealthier individuals are more likely to donate easements. Between 2003 and 2012, 17% of easements were donated by taxpayers with annual income exceeding $500,000 (Parker and Thurman 2019). The constantly evolving regulations and the unique situation of each landowner make it challenging to fully understand the nuances of easement tax policies. For example, between 2000 and 2007, Colorado landowners and neighboring property owners faced challenges during IRS audits of easements (Kirk 2008). Therefore, careful tax planning (Horton et al. 2017) and consultation with tax professionals and appraisers experienced in easements are crucial for navigating the intricacies of tax policies and ensuring compliance with regulations (Farmer et al. 2015).

The use (and misuse) of easement credits has been a highly debated topic in the easement market due to concerns over inflated appraisals and insider deals. There are cases of non-traditional land donors, such as real estate developers and promoters with no conservation value entering the easement market for tax benefits only (Kibler and Radney 2024). As the allowable tax incentive is mostly based on appraisals (Seidl et al. 2020), such donors tend to submit inflated, unrealistic appraisals of easements to increase associated tax deduction and credit. Overvaluation of easements may also lead to substantial revenue losses for governments (Halperin 2011;

McLaughlin 2016; Osswald M.C. 2016). However, in some cases, very low or negligible easement valuation done by the IRS is rejected by courts, which assign higher values such that it reflects the true economic impact of conservation easements (McClure 2009). There is also evidence of tax abuses by syndicate tax shelter entities, such as LLC, who secures an inflated value for the land, places a conservation easement on it, and then promotes the LLC to investors as a way to gain tax benefits (Land Trust Alliance 2020). This may lead to Treasury losses and an increased financial burden on the state, which undermines its ability to achieve conservation goals and priorities. It is unsurprising that this is an important issue for the IRS as they view CE as a potential source of tax evasion (Swift 2010). The IRS opened many easement audits and found defective deduction claims (e.g., 96 of 108 CEs in Colorado) (Korngold 2009). In response, they have expanded and enforced new rules, restrictions, and reporting requirements to curb the exploitation of tax incentives. Many state governments are also initiating efforts to identify appropriate alternative methods for measuring the number of allowable tax credits (Glenn et al. 2019). In Colorado, Seidl et al. (2020) used the estimated expected value of lost opportunity or benefits from conveying easements and found that this could help maintain fiscal control over easement program size while continuing to conserve valuable private working lands.

While tax incentives have played a crucial role in providing economic benefits to the public, inefficiencies in the market due to issues such as thin markets, information failures and uncertainty remain a subject of several long-running discussions (Keske et al. 2009). Specifically, uncertainty may arise about the long-term protection of conservation values of the land and loss of future land-use options for landowners. Another related policy inefficiency lies in the regressive nature of CE tax benefits which disproportionately favor wealthier landowners and limits broader participation (Wolf 2012). McLaughlin (2004) also points out that poorly designed incentives may

be prone to abuse and emphasize the importance of balancing government revenue losses with the long-term social and environmental benefits of land conservation. To improve the effectiveness and efficiency of these conservation easement tax incentives Halperin (2011), suggested the replacement of charitable deduction with direct government grants or refundable tax credits administered by an expert agency, similar to the Low-Income Housing Tax Credit model. Wolf (2012) also supports a shift from current tax deduction with a refundable tax credit which can increase private land conservation by making CE participation more accessible.

1.3.2 Environmental and ecological implications

The effectiveness of tax incentives for CE to enhance the environment and ecosystem services cannot be overlooked. State-level tax incentives in various states are tailored according to certain requirements of landowners as they need to meet specific conservation goals and enhance environmental sustainability. For example, in Colorado, the CE tax credit program in association with Great Outdoors Colorado (GOCO) has conserved approximately 2.1 million acres of land throughout the state (Seidl et al. 2017) and state investment in CE has conserved nearly 1.5 million acres of critical habitat. These easements protected wildlife habitats, maintained water quality and also contributed $195 million to the state's economy (Seidl 2020). Similarly, state-level incentives in Georgia identified and targeted 111 ecologically valuable parcels, ensuring the protection of critical conservation features (Hardy et al. 2016). As mentioned in Huff (2003) the Virginia Land Preservation Tax Credit Program contributed to biodiversity conservation and water quality improvement as it has been successful in protecting large areas of forested land. Also, the state's special assessment for Wildlife Habitat program in Oregon provided tax reductions for landowners who manage their land to benefit wildlife habitats which has encouraged sustainable agricultural practices and the preservation of critical habitats for various species (Huff 2003). Soppelsa (2015)

further finds an increase in the conservation of undeveloped land annually and consistent gains for several years after state tax benefits were implemented. Around 57,000 acres of undeveloped land were protected annually, enhancing biodiversity and preserving natural habitats.

The expansion of tax incentives for CE donation has a myriad of environmental and ecological implications. Tax deductions associated with CEs have improved the open space preservation by 10-20%, promoting biodiversity and hence the economy of the area (Simpson 2002). For example, significant land donations made by developers of Spring Island in South Carolina contributed to preserve natural landscape. Similarly, Allegheny Power in West Virginia secured a $15 million tax deduction by donating a large area to federal government, contributing to conservation efforts (Simpson 2002). These are the two examples that demonstrate the economic viability of conservation. While these environmental and ecological benefits are evident along with economic ones, challenges persist in how tax incentives are structured and implemented. Particularly, current policy ties the size of tax benefit to the development value of a property rather than its ecological value, which can result in permanent protection of land with limited environmental benefit (Sundberg 2013; Looney 2017b). For instance, as a result of tax incentives, the number of CEs may increase significantly, but their quality may decline (Parker and Thurman 2019). Landowners may compromise the ecological goals of the CE program as they are encouraged to donate easements that protect land with lower conservation value due to the presence of generous tax incentives. Moreover, some CEs may have significant ecological value, whereas others may have limited ecological value (Rissman et al. 2007). Colinvaux (2012) argued that easements placed on golf courses or scenic lands could be overvalued and may not yield significant conservation benefits. Thus, stricter criteria may be necessary to check whether the provided tax incentives align well with true conservation goals such as biodiversity protection and

maintenance of landscape connectivity. Similarly, Morris (2008) has mentioned the importance of greater public accountability to ensure that tax incentives are well supporting the broader conservation objectives including ecological integrity and sustainable land management. To optimize the conservation potential of the CE projects, Parker and Thurman (2019) highlight the necessity of stricter standards, deliberate implementation, and thorough oversight by land trusts, conservation agencies and policymakers.

While discussing the environmental implications of CEs, it is important to consider how the availability of tax incentives make those outcomes possible. For example, working forest CEs have promoted sustainable forestry, water protection and enhanced biodiversity conservation largely because of tax incentives and cost-sharing programs that offset the financial burden on landowners (Tesini 2009). Federal initiatives such as the Agricultural Conservation Easement Program (ACEP) and the Healthy Forests Reserve Program (HFRP) enhances biodiversity, supports endangered species recovery, and boosts carbon sequestration. Similarly, the ranchers on Montosa Ranch were benefitted through tax incentives as through CEs as they were able to protect 10,000 acres of critical wildlife habitat (Wright et al. 2007). These examples illustrate that; availability of financial incentives makes conservation more feasible for private landowners.

In addition to the impact of state tax incentives and their conservation outcome, federal tax incentives play an equally crucial role in driving land conservation outcomes across the country. Humphrey (2010) explained how effectively the federal income tax deductions made land preservation attractive to landowners, which prevented urban sprawl and ensured long-term ecological health. The role of these federal tax incentives was further highlighted by Morrisette (2001) in protecting critical habitats such as bald eagle nesting sites in Wyoming, blue oak woodlands in California, and wetlands in South Carolina. Conservation of diverse natural habitats

such as forests, wetlands and grasslands aided in maintaining the integrity of ecosystems, rural landscapes and securing ecologically significant private lands (Kay 2016).

1.3.3 Perceptions of landowners and land trusts

Landowners and land trusts have different perceptions about CE tax incentives. While some landowners appreciate the financial benefits they gain through tax incentives, others remain concerned about the long-term implications and potential loss of control over their land (Gattuso 2008). Tax incentives provide an opportunity to offset the economic costs of preserving their land, which is often appreciated by the landowners. In that case, McLaughlin (2007) highlighted that transferable state tax credits are particularly appealing, as they offer financial flexibility without sacrificing liquidity. Absentee landowners, who generally prioritize long-term conservation over immediate financial returns from tax incentives, tend to benefit more from this type of financial flexibility (Farmer et al 2015).

Landowners who participate in CE programs may experience varying levels of satisfaction with CE tax incentives, depending on their past experiences. Generally, people were satisfied with the fair compensation and administrative support provided by the Purchase of Agricultural Conservation Easement (PACE) programs and had a positive response towards them (Schilling et al. 2019). In some cases, landowners were intrinsically satisfied by protecting wildlife habitats and preventing urban sprawl, described as a “warm glow” effect by Cross et al. (2011). Although the landowners were emotionally satisfied, concerns were often raised about the economic returns of protecting the land, particularly when the compensation offered through tax incentives fell short of the perceived market value (Roddewig 2019). In the case of perpetual easements, when future land use is restricted, the property’s long-term value is decreased, worsening the economic

concerns raised above. In addition to this, some landowners believe that the tax incentives do not accurately reflect the true value of their land, highlighting a conflict between financial compensation and conservation ethics, as emphasized by Cross et al. (2011) and Roddewig (2019). Existing socioeconomic disparities also influence landowners' perceptions of CE and access. Van Sant et al. (2021) found that CEs are viewed more favorably by elite white landowners, primarily because they have the ability to leverage the significant tax benefits and also maintain control over their land. Sundberg & Dye (2006) noted that incentives are more attractive to landowners with substantial tax liabilities, whereas they may be less attractive to those with comparatively lower tax liabilities. Overall, we find mixed perceptions of landowners towards CE tax incentives, where the incentives are viewed affirmatively by some but may not be as effective or just satisfactory for others, which highlights broader social and economic inequities in program accessibility.

Regarding the perception of land trusts, they consistently regard CE tax incentives as crucial instruments for achieving conservation goals. Suter et al. (2014) emphasize that tax incentives, especially transferable ones, are vital for engaging landowners and securing long-term environmental protection. These incentives align well with the land trust's goal of achieving sustainable conservation outcomes, which further facilitates partnerships between landowners and land trusts (McLaughlin 2007). However, certain limitations in the current structure of the CE tax incentive program are also affecting land trusts' perception of them. Administrative complexities and inefficiencies in the existing system were among the major concerns highlighted by McLaughlin and Pidot (2013). To improve the efficiency of CE tax incentive programs, land trusts advocate for various reforms, including streamlining the application process and expanding their reach among various groups of landowners (Suter et al. 2014).

Awareness and education play a significant role in influencing landowner's perceptions and participation in CE programs. When landowners clearly understand the tradable income tax credits available when they enter into this market, it enhances their participation, and they are generally found to have a positive perception towards CE tax incentive program (McGaffin et al. 2012). Increasing awareness among the landowners turned out to improve the effectiveness of CE programs. Many landowners do not have sufficient knowledge of tax incentive programs, including their benefits and the application process (Braddock and Heinen, 2021; Hoag et al. 2002). These kinds of tax incentives are beneficial, but their effectiveness could be increased if they are simplified and explained to landowners with better outreach efforts to increase awareness and participation (Butler et al. 2010).

1.3.4 Tax incentive as a motivating factor of easement donation

Financial incentives have been identified as one of the important factors motivating landowners to enroll in CEs. Morrisette (2001) and Brown et al. (2023) found that tax deductions and direct payments serve as primary motivators for participation of landowners in CEs. These kind of financial incentives make the landowners' participation economically feasible by offsetting the opportunity costs of foregone development (Brain et al. 2014). For example, federal and state tax benefits, such as income, inheritance, and property tax deductions, encourage landowners to participate and conserve their land, especially those with agricultural operations. According to Farmer et al. (2015), landowners who are dependent on their land's productivity are more motivated to participate, as the financial incentives attract them. These incentives alleviate financial burdens, making conservation efforts more appealing to landowners (Humphrey 2010; Taylor 2012). High-income individuals consider these kinds of financial incentives most important as tax benefits can be advantageous for them (Parker and Thurman 2018). State-level programs,

such as Colorado's $100,000 refundable tax credit, highlighted by Oppenheimer (2000), demonstrate how regional policies can increase participation. Gattuso (2008) and Eagle (2011) emphasize that the landowner's decision to conserve land is closely tied to their perception of the benefits versus the costs. However, Cross et al. (2011) argue that if those financial benefits are perceived as insufficient, this may discourage landowners from becoming involved.

Landowner motivations often depend on how they used their property before donating a conservation easement and their connection to the land. Brockett et al. (2003) identified various groups of landowners, including new, absentee, passive, production-oriented, and amenity-oriented landowners, each of them having different priorities for conserving their land. For example, production-oriented landowners valued the financial incentives and practical benefits that enhance long-term productivity in their land. Some farmers and ranchers view CEs pragmatically as they may consider the ability to retain farming or forestry rights while making sure the land is protected from development as important (Parker & Thurman 2018; Oppenheimer 2000). Amenity-oriented landowners are influenced by the aesthetic and recreational attributes of the property. This group of individuals may give more priority to scenic beauty and ecological health which drives them to participate in CE program (Cross et al. 2011; Hemby et al. 2022; Oppenheimer 2000). On the other hand, absentee landowners often view their land as an investment and have a strong desire to preserve the property value of the land and its orientation towards social norms and family traditions (Petrzelka et al. 2015; Hemby et al. 2022). Although absentee landowners may be less directly involved in land management, external factors such as tax benefits and expectations from the community shape their decisions (Cross et al. 2011; Hemby et al. 2022). Particularly, those absentee landowners who are driven by family heritage often show a deep emotional connection to their land, which further affects the choice they make in

conservation (Farmer et al. 2015). There is a growing category of landowners, often called new landowners, who are generally discovering their land's potential and management practices. Motivation of this group of people is mostly determined by their curiosity towards the CE tax incentives program, sustainable goals of conservation and how they are impacted by the existing norms within their community (Hemby et al. 2022).

In addition to the financial benefits, education, awareness, and government programs and policies that support CE tax incentives also have a positive impact on easement adoption (Lamichhane et al. 2021). A well-informed landowner is more likely to engage in conservation, as awareness enhances trust in the process and the perceived benefits of easements (Cross et al. 2011; Hemby et al. 2022). This is also supported by the findings of Lamichhane et al. (2021), which highlight that populations with higher income or better education have generally helped the development of CEs. Similarly, legal structures and state or federal policies that reduce complexities and offer additional assurances about CE tax incentives inspire landowners to participate (Parker & Thurman 2018; Oppenheimer 2000). Many landowners consider financial tax incentives secondary as they are intrinsically motivated by a desire to protect their land's natural and ecological features (Parker & Thurman2018; Cross et al. 2011). Some of them are motivated due to altruistic values or a strong sense of responsibility towards conservation (Cross et al. 2011). Ecological outcomes of conserving the land may be prioritized by these group of landowners over personal financial benefit and they readily accept reduced financial compensation to protect critical habitats. Additionally, environmental stewardship, habitat protection, and a sense of involvement in conservation often outweigh financial considerations (Farmer et al. 2015). Kemink et al. (2023) suggest that individuals who are well aware of habitat threats and have accepted responsibility for habitat protection are more likely to participate in the easement

program. Besides this, considerations regarding legacy serve as a significant motivator as the aspiration to maintain their land's character, natural beauty, or ecological integrity for their descendants is a recurring motive of landowners who are involved in CEs (Cross et al. 2011; Farmer et al. 2011). Family consensus is one of the most important factors, as collective decisions among family members help determine whether to enter into easement agreements (Oppenheimer 2000). Moreover, attachment to a place or connection to a piece of land is a primary driver (Horton et al. 2017). Altruistic and community-oriented goals of preserving natural landscapes, biodiversity and open spaces for future generations also influence landowners to enter CEs (Korngold 2010; Ernst & Wallace 2008). The sense of urgency to protect their own property from ongoing development activities in the neighborhood also motivates landowners to participate in CEs (Farmer et al. 2015). Moreover, community rules and regulations, and public demand also have a great role in influencing people to participate in conservation easements (Hemby et al. 2022). People were found mostly driven by the expectations and support of their communities as social networks and influences from peers act as strong motivators (Hemby et al. 2022).

1.3.5 Challenges associated with implementation and usage of easement tax incentives

Significant challenges exist that hinder landowners' participation in and implementation of CE programs. Widespread lack of awareness and knowledge about the CE tax incentive programs is the most crucial barrier (McGaffin et al. 2012; Vercammen 2019). When easement programs were first introduced, landowners were comparatively aware, but it declined over time and especially, the new landowners are unaware of the tax incentives for easements (Cooper 2023). Similarly, the minority and low-income landowners are particularly lacking awareness regarding the benefits and processes involved in CE programs (Reeves et al. 2018; Colinvaux 2013). Butler et al. (2012) noted that the issue was exacerbated by misinformation and confusion about the

program requirements, indicating a need for improved communication and education regarding the conservation programs.

In addition to these challenges, the economic aspects of CE tax incentives is still controversial. The compensation offered through CE programs fails to align with the land's potential development value mostly in case of perpetual conservation easements, that restrict the land use for future (Catherine 2011 and Roddewig 2019). Moreover, the high costs associated with creating and maintaining CE, including expensive appraisals, legal reviews, and the expenses of ongoing monitoring and evaluations for tax incentive purposes, limit the participation of smaller and historically underserved landowners in easements (Van Sant et al. 2021). The financial tax incentives provided may not be sufficient to cover the associated cost, especially in high-value real estate markets (Colinvaux 2013). Moreover, CEs are often characterized by thin markets and high transaction costs in which inconsistent price signals and limited transactions make it difficult to value properties accurately, leading to inefficiencies and discouraging participation (Keske C.M. 2009).Some additional barriers to participation in CE programs were identified by Braddock and Heinen (2021) which include high upfront costs, unclear eligibility requirements, and insufficient public awareness of available programs.

Despite the broadly positive outlook, challenges such as inconsistency in the enforcement of CE tax incentives and intricate legal and administrative procedures persist that affect perceptions of landowners towards CE tax incentives. Administrative complexity emerges as a major deterrent to landowner's participation. Hoag et al. (2002) document widespread frustration among landowners regarding excessive paperwork and insufficient guidance. Some landowners demonstrated the necessity of simplifying the application process and increasing public awareness to strengthen the impact of CEs (Eagle 2011). Landowners' participation was also discouraged by

the inconsistent monitoring and enforcement of CE tax incentives (Colinvaux 2013). Regulatory compliance and enforcement requirements often create barriers to landowner's involvement in easements. Increased IRS scrutiny and resource-intensive monitoring processes have led to delays and frustration for both landowners and conservation organizations (McLaughlin 2017). The intricate legal and administrative procedures associated with CE donation discourage many landowners, especially the small-scale ones from participating (Colinvaux 2013; Gattuso 2008). Complicated paperwork, legal fees, and ongoing compliance checks can be difficult for many landowners to comprehend (Colinvaux 2013). Along the same line, Huff (2003) pointed out that strict eligibility criteria and ongoing responsibilities to maintain tax benefits can be challenging for all landowners to meet, which further discourages their participation in CE. Thus, landowners with limited resources find these challenges burdensome, which deters their participation, though they have strong conservation interests.

With all these challenges evident, improvements to CE programs are widely recommended by several studies. McLaughlin (2013) suggests a need for reforms that improves program effectiveness and better align conservation outcomes with public goals. Informational campaigns, workshops, and collaborations with local organizations are crucial for spreading awareness among landowners about CE benefits and requirements (Colinvaux 2013; Huff 2003). Land trusts have been working to conduct these kind of outreach programs among landowners to address the various misconceptions about tax incentives (Braddock and Heinen 2021).While conducting various campaigns and outreach events, they should be tailored to meet the needs and level of understanding of minority and low-income landowners, so that they can be equitably advantaged from CE tax incentive programs (Van Sant et al. 2021).

1.4. Conclusions

In this systematic literature review, we synthesized the findings from multiple studies and analyzed the CE tax incentives program in the US. We addressed the key research questions focusing on assessing the economic, environmental, ecological and social implications of CE tax incentives, landowners' perceptions and motivating factors for easement donations and several challenges associated with implementation. The findings provide insights on both the strengths and weakness of current CE tax incentive mechanisms as highlighted by several studies and also offer certain guidance for policymakers on improving program design and implementation.

The findings indicate that CE tax incentives especially the transferable state tax credits have been successfully increasing the number of easement donations as it reduces the opportunity costs of forgone development and offers financial flexibility to landowners. However, several studies raised concerns regarding equity and accessibility, emphasizing that wealthier, more educated, and better-informed landowners disproportionately benefit from the programs. Additional challenges such as inflated appraisals, misuse of tax credits, and complex administrative or legal procedures also affect CE adoption, especially among small-scale and underserved landowners. On the environmental side, CE tax incentives were found to have contributed to the protection of wildlife habitats and biodiversity in various US states but studies have also raised concerns that the financial benefits are not always aligned with the conservation value of the land. The studies reviewed found varying perception of tax incentives among landowners and land trusts. Mostly the landowners had a positive view towards incentives and also some of them viewed the conservation values more favorably. Majority of the studies found financial incentives serving as key motivator for CE donation for some landowners whereas others

reported landowners were substantially motivated by intrinsic values including place attachment, family legacy, altruism, stewardship and community norms. Nevertheless, certain challenges and barriers including limited awareness, high transaction costs, complex administrative structures, excessive paperwork and uneven access to benefits continue to influence the broader level CE donations.

Overall, the findings of this study highlight the need for policy reform, including the formulation of stricter and standardized valuation methods for CEs to maximize the impact of CE tax incentives. Several research gaps have been identified for future research including the need for studies which examine the long-term economic and ecological impacts of CE tax incentives particularly in states with the provision of state-level tax credits. Thus, by synthesizing the existing knowledge and findings on CE tax incentives across the US, this review provides a foundation for future research and insights for policymakers to design conservation programs considering equity, efficiency, and ecological integrity.

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CHAPTER 2. IMPACT OF STATE TAX INCENTIVES ON CE ADOPTION: A COUNTY-LEVEL ANALYSIS IN COLORADO

2.1. Introduction

Conservation easements (CE) are growing as a very important tool for private land conservation in the United States. As a legally binding agreement between landowners and land conservation organizations, CEs are known for restricting the use of land by landowners to ultimately protect its ecological, scenic, and agricultural attributes. While most of these agreements are permanent, some are negotiated for a shorter duration. Perpetual CEs are the most common type as they ensure land conservation for future generations. These agreements are unique because the development rights of the land are transferred to another entity or land trust that is responsible for easement's conservation objectives, but the landowner still retains possession of the land (Lindstrom 2009). Development rights refer to the ability to subdivide or develop land, including the extraction of gas or minerals, which are forfeited under a CE (The Nature Conservancy 2024). In recent years, with the increase in urban expansion, population growth and wildlife habitat loss, CEs stand out as a very important mechanism to preserve natural landscapes and promote sustainable land use (Rissman and Merenlender 2008).

CEs have been widely adopted across the US, with variations in total acres and the number of CE transactions across states. According to the Land Trust Alliance, as of 2020, more than 20 million acres of land nationwide were protected through easements. The states in the Intermountain West have extensively adopted easements due to various reasons such as private landholdings, the tradition of ranching the land and the availability of state-level tax incentives (Cross et al. 2011; Land Trust Alliance 2024; Keske et al. 2007). For example, Colorado and Montana are two leading

states in terms of acreage enrolled, with approximately 2.5 million and 1.9 million acres of easements, respectively. States in other regions such as California, Virginia, New York, and Maryland also have around 1.7 million, 0.8 million, 0.7 million, and 0.3 million acres of land enrolled in easements, respectively (Land Trust Alliance 2024). These numbers reflect the growing importance of CEs in balancing private land conservation while also ensuring environmental and economic sustainability.

The variation in the distribution of easements across different states may be attributed to differences in land use patterns, conservation priorities, and policies (Fishburn et al. 2009). Regarding policy, donated CEs qualify for tax incentives in the form of tax deductions or credits at the federal and state levels. Landowners who voluntarily give up their land use rights for conservation purposes are eligible to receive these incentives. The Tax Reform Act of 1976 introduced a federal tax incentive for donated CEs in the US (Tax Reform Act of 1976, Pub. L. No. 94-455). This act identified easements as a charitable contribution eligible for federal income tax deductions. Over the years, this incentive has been expanded and refined multiple times to encourage greater participation by landowners. In 1980, the Tax Treatment Extension Act made the provision of CE tax deduction permanent (Tax Treatment Extension Act of 1980, Pub. L. No. 96-541). Later, in 2006, the maximum deduction was increased from 30% to 50% of a landowner's adjusted gross income, and the carry forward period was also increased from five years to fifteen years (Pension Protection Act of 2006, Pub. L. No. 109-280). These enhanced incentives were made permanent later in 2015 by the PATH Act (Protecting Americans from Tax Hikes Act of 2015, Pub. L. No. 114-113). In addition to federal tax incentives, several states offer financial incentives to donated easements, mostly in the form of state income tax credits. The state tax incentive began in 1983 in North Carolina but was terminated in 2014 (Conservation Trust for

North Carolina 2025). Over the years, states have modified their easement incentive programs by adjusting tax credit percentages, maximum credit limits and provision of transferability. The structure, amount, and type of state-level tax incentives vary depending on state-specific policies. For example, some states have provisions for the transferability of tax credits, allowing landowners to sell or transfer excess credits to other landowners if their tax liability is insufficient to use them fully. Similarly, some states have a fixed maximum credit amount that can be provided per easement or have a limit on the total number of credits that can be issued annually. As of 2024, fourteen US states and Puerto Rico offer state-level tax incentives for donated easements. Of these, five states, Colorado, Georgia, New Mexico, South Carolina and Virginia, offer transferable tax credits, whereas the remaining states offer non-transferable tax credits (Land Trust Alliance 2024).

One of the earliest and well-recognized state tax credit programs was implemented in Colorado in 2000. Easement donors were allowed to claim a tax credit equal to 100% of the Fair Market Value (FMV) of the donated easement, capped at $100,000 per donation and with an unlimited aggregate cap. Over the years, both the credit percentage and the maximum amount allowed per donation have undergone subsequent revisions. From 2003 to 2006, 100% of the first $100,000 of FMV plus 40% of any additional FMV of the donation with a higher cap of $260,000 was allowed. From 2021 to 2026, easement donors can claim a tax credit of 90% of the FMV of donated CE with a maximum credit of $5 million per easement at an increment of $1.5 million per year. For easements donated starting from 2027 to 2031, tax credit certificates are issued for 80% of the donated value up to a maximum of $5 million per donation (State of Colorado 2025). In addition, Colorado has set an aggregate cap of $45 million, which means the total amount of credit issued to all the donated easements in Colorado cannot exceed $45 million in a given year.

A number of past studies have examined the CE state tax incentives in various contexts, including their role as a motivating factor for CE adoption, their impact on land conservation outcomes, implications on property tax valuations, and effects on surrounding property values. For instance, Oppenheimer (2000) found that landowners are more likely to participate in CEs if the financial benefits outweigh the cost of conserving the land and participating. Anderson and King (2004) argued that tax incentives primarily encourage landowners to make conservation decisions rather than public good considerations and also cautioned that poorly structured tax incentives may reduce overall social welfare. Along the same line, Sundberg (2007) found that the quantity of land enrolled in easement increased due to tax incentives, raising questions regarding the quality of conserved land. Taylor (2012) found that state tax credits significantly increased CE donations specifically during the initial years of implementation of these tax credits. For agricultural landowners, tax deductions and credits were important as they believe that they could help alleviate financial burdens and achieve long-term economic security (Farmer et al. 2015; Humphrey 2010). However, Gattuso (2008) and Eagle (2011) argued that other factors, including cash payments and ecosystem services compensation, could motivate landowners to participate in easement programs. Parker and Thurman (2019) also raised concerns about the declining quality of CEs, as people are more likely to donate their land for tax benefits, despite having low conservation values.

Studies focused on Colorado have examined the effectiveness of tax incentives from various angles. Suter et al. (2014) found that tax credits in Colorado have influenced land trust behavior, making them more likely to hold donated easements that are eligible for tax credits. Seidl et al. (2017) estimated that Colorado residents received between $5.5 and $13.7 billion in public benefits from conserved lands, which further supported the presence of state tax policies. McGaffin et al. (2012), Suter et al. (2014), and Seidl (2020) demonstrated that the broad participation of

landowners in easements in Colorado is encouraged by its tax incentive framework; however, concerns regarding the equity and efficiency of these incentives exist. Keske et al. (2009) found that, despite increased and expanded CE adoption across the market, it remains inefficient due to information failures, thin markets, and policy uncertainty.

In summary, the literature on CE have used quantitative or qualitative techniques to assess the impacts of tax incentives on easement adoption. While qualitative studies were primarily based on legal and historical analysis, case-law reviews, interviews with members of land trusts and policy evaluations to explore landowners' willingness to participate in easement programs and factors affecting enrollment, quantitative studies were mostly based on national data for assessing wider implications of tax incentives on property tax revenues and surrounding property values. Therefore, there has been a lack of analysis on the localized effects of tax incentives on easement adoption. This study aims to fill this research gap by examining the impacts of state tax incentives on county-level easement donations within Colorado. By examining easements across 64 counties in Colorado from 1995 to 2022, this study seeks to explore the linkage between state tax policy and acreage donated for easements each year. This study also examines how differences in socio-economic and demographic factors across these counties influence the adoption of CEs.

Overall, this study makes a few contributions to the existing literature on incentives for CEs. First, it expands research on the impacts of state tax credits on easement adoption, specifically from state-level to county-level analysis. Second, this study covers data from 1995 to 2022, covering a period of 28 years. Overall, we expect the findings from this study will improve our understanding of land conservation policies and their economic and environmental implications. It will also strengthen the discussions surrounding the roles of financial incentives in private land conservation. The findings of this study can also help conservation organizations design targeted

outreach programs to keep landowners informed about CE tax incentives and encourage participation. This will provide guidance to the design of state-level easement policies for promoting the preservation of private land for the benefit of the public.

2.2. Methods

2.2.1 Study area

This study focuses on the state of Colorado, which consists of an abundance of natural resources and prioritizes conservation. With more than 2.5 million acres of easements across 64 counties, Colorado ranks first in terms of acres conserved through easement nationwide (Land Trust Alliance 2025). Colorado also consists of one of the oldest easement state tax incentive programs in the US. To examine the impact of the tax incentive program on easement adoption, we used counties as the cross-sectional units and years (1995-2022) as the dimension of time. We employed a panel data structure that facilitates the identification of within-county changes in easement acres over time, while also controlling for unobserved, time-invariant county-level characteristics, including socio-economic, demographic, and administrative factors (Wooldridge 2020).

2.2.2 Data sources and description of variables

The panel dataset included observations from all 64 counties in Colorado over a 28-year period, resulting in a balanced panel structure. Yearly data were collected for the dependent and independent variables from various sources (Table 2). The dependent variable is the percentage of private land with CE by county and year. The independent variables are categorized into two groups: (1) easement-related and (2) socio-economic characteristics of the county. These were identified by the review of relevant literature. Easement-related variables included CREDIT, CATEGORY, and the number of easement holders (EH). CREDIT represents the presence or

absence of state tax credit, CATEGORY represents the amount of tax credit available for donated easement, and EH represents the number of easement holders. EHs are the entities or organizations that are responsible for enforcing the provisions of the easement. Socio-economic characteristics included INCOME, EDUCATION, POPULATION density, PUBLIC LAND, and LAND PRICE. INCOME represents the average household income of the county, EDUCATION represents the percentage of people aged 25 and older with an associate degree or higher educational attainment, PUBLIC LAND represents a sum of federal, state, and tribal acres, and LAND PRICE represents the average land price per acre.

CE acres and the number of EHs were sourced from Colorado Natural Heritage Program, Colorado Ownership, Management and Protection (COMaP) (COMaP 2024) and National Conservation Easement Database (NCED) (National Conservation Easement Database 2025). Tax credit incentives and category information were collected from the Colorado Department of Revenue Taxation Division and the Colorado Department of Conservation (State of Colorado 2025). Income and population data were derived from the Bureau of Economic Analysis. Education statistics were retrieved from the US Census Bureau and Federal Reserve Economic Data. Private and public land data were obtained from Headwater Economics and the Bureau of Land Management socioeconomic profile. Land price data was gathered from the US Census Bureau National Agricultural Statistics Service.

Table 2. Variable description and their sources

Variable	Description	Source
Dependent Variable		
CE	% of private land enrolled in CE	CNHP, COMaP, NCED
Independent Variables		
CREDIT	Binary indicator: 1 if state tax credit is present; 0 otherwise	Colorado Department of Revenue, Colorado Department of Conservation
CATEGORY	Maximum amount of tax credit allowed per CE donation per landowner	Colorado Department of Revenue, Colorado Department of Conservation
EH	Number of easement holders	CNHP, COMaP, NCED
INCOME	Average personal income (thousands of dollars)	Bureau of Economic Analysis
POPULATION	Population density	Bureau of Economic Analysis
EDUCATION	% of people 25 years or older with an associate degree or higher	Federal Reserve Economic Data, US Census Bureau
PUBLIC LAND	% of public land (Federal, State, and Tribal)	Headwaters Economics, Bureau of Land Management
LAND PRICE	Price per acre of land	USDA National Agricultural Statistics Service

Notes: CE, Conservation Easement; EH, Easement holder; CNHP, Colorado Natural Heritage Program; COMaP, Colorado Ownership, Management and Protection database; NCED, National Conservation Easement Database; USDA, United States Department of Agriculture

2.2.3 Data analysis

To analyze the impact of state tax incentives and other socioeconomic factors on easement adoption in Colorado, we expressed acreage enrolled in easement as a function of easement-related variables, socioeconomic characteristics of the county, and various other unobservable factors:

$$CE_{it} = f(\text{CREDIT}_{it}, \text{CATEGORY}_{it}, \text{EH}_{it}, \text{INCOME}_{it}, \text{POPULATION}_{it}, \text{EDUCATION}_{it}, \text{PUBLIC LAND}_{it}, \text{LAND PRICE}_{it}, \text{UNOBSERVABLES}_{it})$$

We employed a fixed effects panel regression model with county fixed effects, using county-level annual data from 1995 to 2022:

$$\ln(y_{it}) = \beta_0 + \beta_1 x_{1it} + \cdots + \beta_p x_{pit} + \alpha_i + \varepsilon_{it} \quad (1)$$

where ln (y_{it}) is the natural logarithm of the percentage of private land enrolled in conservation easements in county *i* during year *t*, x_{pit} is a set of *p* independent variables that vary over time and across counties. These include easement-related variables and socio-economic characteristics, including CREDIT, CATEGORY, EHs, INCOME, POPULATION, EDUCATION, PUBLIC LAND, and LAND PRICE. β_0 represents the overall intercept term, β*'s* are the slope coefficients associated with each explanatory variable, α_i is the unobservable county-specific fixed effect, and ε_{it} is the idiosyncratic error term. Empirical estimation of equation (1) and all other analyses were conducted by using R 4.3.1 software.

2.3. Results

2.3.1 Summary of easement acres in Colorado

Figure 3 presents the total acres enrolled in CE in Colorado between 1995 and 2022. Easement acres increased markedly beginning in the 2000s, when the state introduced a tax credit for donated easements. The acres enrolled in CE continued to increase in subsequent years, peaking at approximately 246423 acres in 2007 and 263168 acres in 2017. This trend may correspond to the increase in maximum credit allowed per donation from $260,000 in 2004 to $375,000 in 2007 and from $375,000 in 2014 to $1.5 million in 2015. However, enrollment acres have declined noticeably after 2018.

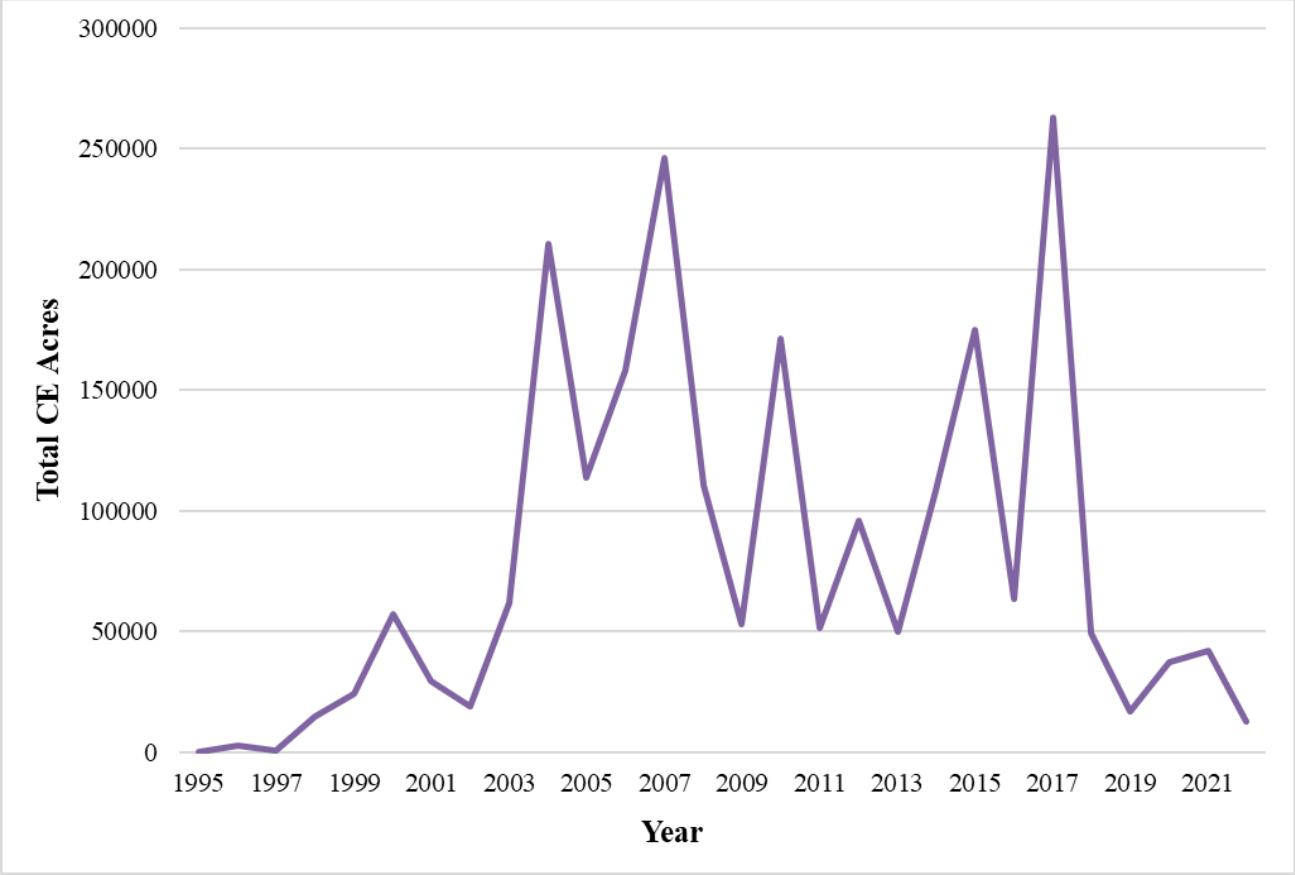

Figure 3. Trend of conservation easement adoption in Colorado between 1995 and 2022

Figure 4 shows the total easement acres in each county between 1995 and 2022. We found a heterogeneous distribution of CE across Colorado counties. Counties such as Las Animas, Pueblo, Costilla, Crowley, Routt, and Otero had the highest total CE acreage. For example, Las Animas County had around 290,000 private acres under easement, followed by Pueblo and Costilla County with around 180,000 and 126,000 acres, respectively. Conversely, there are some counties with no significant easement enrollment.

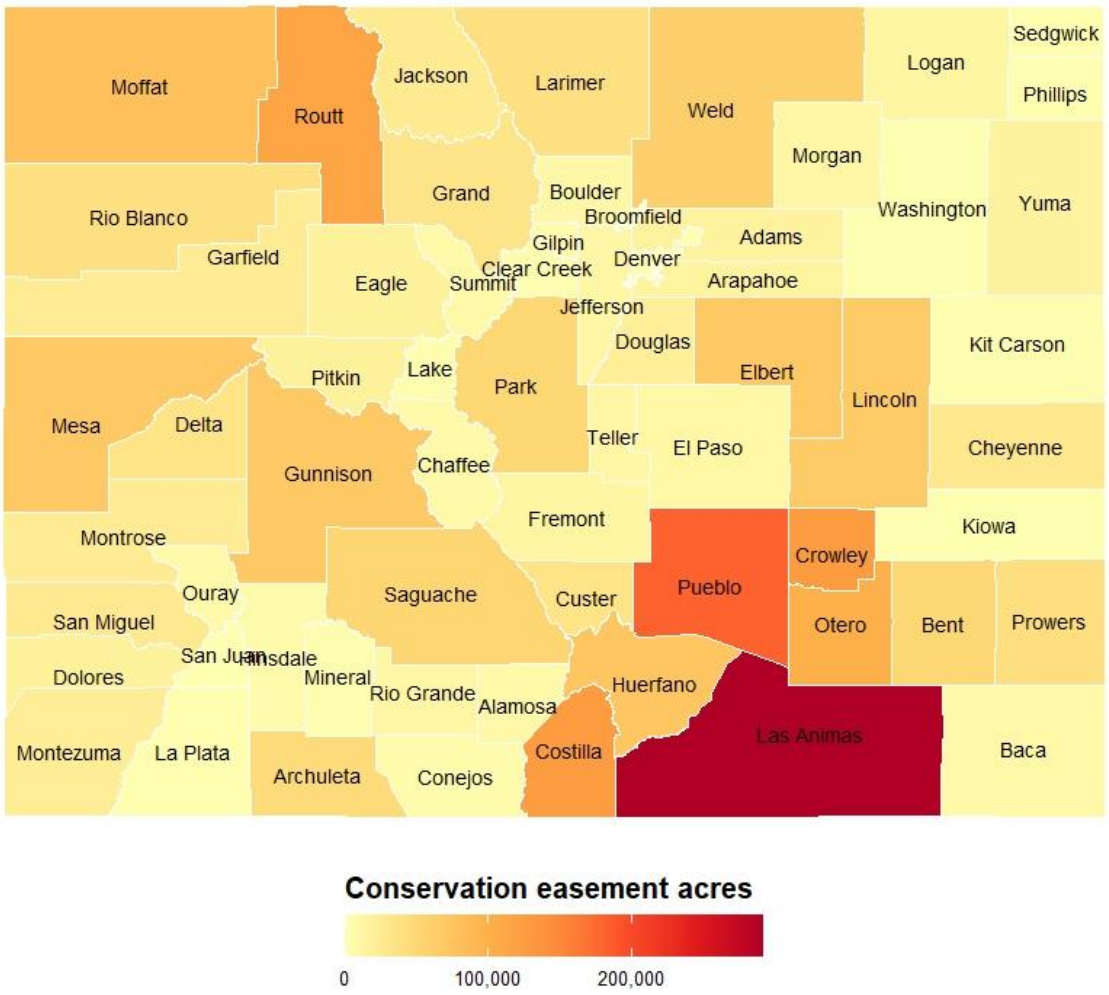

Figure 4. Total easement acres by county between 1995 and 2022

2.3.2 Fixed effect panel regression results

Table 3 shows the results of the county-fixed effects panel regression. The CREDIT representing the presence of a state tax credit in a given year had a statistically significant positive effect of 0.052 on the CE enrollment at the 5% significance level. This suggests that the presence of a tax credit may increase easement enrollment by approximately 5.2%, holding all the other factors constant. EH was a significant predictor in the model at the 1% significance level, indicating a strong positive relationship between the number of easement holders and acres enrolled. The coefficient of 0.203 suggests that a one-unit increase in the number of holders could result in a 20.4% increase in easement acres. The elasticity for EH is 0.160, which means a 1% increase in EH corresponds to a 16.1% increase in easement enrollment. While CATEGORY had a positive impact of 0.006, the effect is not statistically significant. The elasticity of 0.005 suggests that a 1% increase in the credit amount corresponds to 0.5% increase in easement acres.

All socioeconomic variables had no significant effect on CE enrollment. INCOME, POPULATION, EDUCATION, and PUBLIC LAND had positive associations with CE enrollment whereas LAND PRICE had a negative relationship. INCOME had a very low coefficient value and positive elasticity of 0.0032, showing a negligible insignificant change in easement acres with rising income. Similarly, population density had a very low coefficient and elasticity of 0.0008. This suggests that population changes in a county have minimal influence on CE enrollment. Regarding EDUCATION, we found a positive coefficient and elasticity of 0.00018 and 0.0070, respectively. With the 1% increase in the proportion of educated people, easement acres are expected to increase by 0.70%. Contrastingly, the coefficient for LAND PRICE is negative, with the elasticity of -0.0020. Meaning, a 1% increase in land price corresponds to a 0.20% reduction in easements. The coefficient and elasticity for PUBLIC LAND are 0.02389 and

2.2680, respectively. A 1% increase in public land area is associated with a 2.27% increase in easement acres, ceteris paribus. This suggests that counties with a higher proportion of public land tend to have more land enrolled in easements.

2.3.3 Model fit and diagnostic check

To accurately estimate the effects of tax incentives on easement acres in Colorado, we compared several models and performed diagnostic tests. Several potential model specifications, including pooled OLS, one-way fixed effects (county and year fixed effects), two-way fixed effects, and random effects models, were estimated. First, the Lagrange multiplier F-test was used to assess the presence of county-level effects. The test ($F=4.42$, $P<0.001$) rejected the null hypothesis of no county-level effects, indicating the fixed effects model is preferred over pooled OLS. We also compared model performance using Akaike Information Criterion (AIC), and it was again in favor of the county fixed effects model ($AIC_{FE}=596.93$) over the pooled OLS model ($AIC_{OLS}=741.96$). Finally, to compare the fixed effects and random effects models, the Hausman test was used. With a chi-squared statistic of 22.97($df=8$, $p=0.004$), the null hypothesis that the random effects model is consistent was rejected. This further supports the fixed-effects model as the most appropriate one for this analysis.

Table 3. Estimates from the county fixed effects panel regression model for predictors of CE enrollment in Colorado Counties

Variable	Coefficient	Elasticity
CREDIT	0.0523*	0.0429
	(0.0212)	
EH	0.2036***	0.1609
	(0.0065)	
CATEGORY	0.0005	0.0046
	(0.0005)	
INCOME	<0.0001	0.0032
	(<0.0001)	
POPULATION	(<0.0001)	0.0008
	(<0.0001)	
EDUCATION	0.0002	0.0070
	(0.0009)	
LAND PRICE	-(<0.0001)	-0.0020
	(<0.0001)	
PUBLIC LAND	0.0239	2.2680
	(0.0153)	
Adjusted R^2	0.3791	
F-statistic	145.571	
Observations	1792	

*p<0.05, **p<0.01, ***p<0.001

Note: Standard errors (SE) are reported in parentheses.

2.4. Discussion and Conclusions

Colorado has been one of the leading states in adopting CEs to protect the state's private land from development. As of 2020, approximately 72% (2.5 million acres) of Colorado's total protected land is under easement, a significant growth from 1.51 million acres in 2010 (Land Trust Alliance 2024). This demonstrates the importance of easements as a key conservation tool in the state. This study aimed to analyze the impact of state tax incentives and other socioeconomic factors on easement donations in Colorado, using county-level panel data from 1995 to 2022.

Our analysis showed a sharp increase in easement donations after 2000, coinciding with the introduction of the transferable state tax credit program. The spike in 2007 could be attributed to the policy changes and landowners taking full advantage of the extension of the carryforward period from 5 to 15 years, which was implemented in 2006. Our regression results showed a statistically significant positive effect of state tax credit on CE acres. This corroborates the findings of previous studies, which indicated that tax policy can induce land conservation (Parker and Thurman 2018; Sundberg 2011). Parker and Thurman (2018) observed an increase in easement donations in Colorado and South Carolina after the introduction of tax credits, as their elasticity estimates of -2.4 to -6.1 indicate that landowners are highly responsive to reductions in the after-tax cost of conservation. Sundberg (2007) also found that a larger amount of tax incentives could have a positive impact on CE creation and donation. In contrast, the amount of state tax incentives did not have a statistically significant effect on easement donations in our analysis. Thus, we argue that the presence of tax incentives is more important than the actual amount offered. This may be due to the threshold effects, where the incentive reaches a level that is sufficient to motivate most willing landowners, and further increase in amount beyond that point do not necessarily lead to

additional CE donations. This finding was further supported by Taylor (2012), who found a significant effect of tax incentives on CE donations only during the initial implementation period. In the long run, the effect could be small and statistically insignificant.

Regarding the number of EHs, we found a strong positive association with easement adoption in Colorado counties. Land trusts play an important role in the preservation of large tracts of land (Taylor 2012). To encourage landowner participation in easement programs, many land trusts are considering lowering transaction costs and also offering technical expertise (Albers and Ando 2003). Through targeted outreach efforts and community engagement, such as educating landowners about the benefits of easements, assisting with the application process and building long term relationships, local land trusts can increase landowner participation in CEs (Hemby et al. 2022). Thus, land trust decisions and institutional capacity could drive the growth of easements (Fishburn et al. 2009). We also found a positive relationship between easement acres and income, a finding consistent with previous studies, which suggest that high income landowners are more likely to participate in CE programs as they receive more benefits from the donations than low-income landowners and are better positioned to forgo development income (Parker and Thurman 2018, 2019). Along the same line, Crehan et al. (2005), Fishburn et al. (2009), and Lamichhane et al. (2021) found a positive impact of GDP on the growth of easements. However, Sundberg (2007) and Suter et al. (2014) argue that the introduction of transferable tax credits enables even low-income landowners with small tax liabilities to participate in CE programs, as the unused credits can be sold to others. Population density also had a positive impact on easement acres, corroborating findings of several previous studies (Crehan et al. 2005; Yuan-Farrell et al. 2005; Taylor 2012). However, some other studies argue that dense population might have very few

parcels of land with high conservation values, thereby decreasing the amount of land available for donations (Albers and Ando 2003; Cropper et al. 2012).

Education and public land also had a positive effect on easement acres. Educated landowners are more likely to understand the program and are aware of tax incentive structures for CE donations (Cross et al. 2011; McGaffin et al. 2012). Landowners who are unaware of CE tax incentive programs and the application process may be deterred from participation due to the complexity of the administrative process involved (Braddock and Heinen 2021; Hoag et al. 2002). Public land covariate also showed a positive but insignificant impact on easement donations. Proximity of private lands to public lands (federal, state, and tribal lands) such as national parks and forests may encourage landowners to enter conservation (Colorado State University Extension 2008). Regarding the price of land, we found a negative relationship with easement enrollment, suggesting that lands with higher value, mostly representing increased development pressure, have a lower chance of enrolling in easement. This finding corroborates that of Taylor (2012) and Fishburn et al. (2009), who found that farmlands with higher values and other areas at greater development pressures significantly reduce CE donation rates.

This study examined the role of tax incentives on CE donations by using panel data from 1995 to 2022. Overall, the findings highlight the important roles of state-level tax incentives and land trusts in increasing CE participation in Colorado. These results reinforce the idea that both the financial incentives and institutional infrastructure could play a key role in shaping landowners' participation in conservation efforts. This study had a few limitations. First, the easement information was collected from COMaP and NCED, which may not have captured all CEs in the state. Additionally, the COMaP data do not indicate whether easements received tax incentives prior to 2011, making it difficult to distinguish between donated and purchased easements. Since

tax incentives apply only to donated easements, this limitation may result in either under or over estimation of the effects of tax incentives depending on the proportion of purchased easements included. Second, this study focuses on Colorado, which has one of the oldest and well-established transferable state tax credit programs and a large number of land trusts. Thus, the findings could not be generalized to other states with different policies, socioeconomic, and demographic structures. Future research could expand this study to other states, both with and without incentives, to compare the effectiveness of tax incentive programs.

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APPENDIX

Table A.1. Conservation easement Acres and Counts Held by Land Trust Organizations in Colorado as of 2020

Organization	CE Acres	CE Count
Colorado Cattlemen's Agricultural Land Trust	673000	409
Colorado Open Lands	435154	537
Palmer Land Conservancy	136515	137
Colorado West Land Trust	125763	600
Colorado Wildlife Heritage Foundation	65234	9
Montezuma Land Conservancy	46022.1	91
Aspen Valley Land Trust	43947	216
Rio Grande Headwaters Land Trust	28194	49
Douglas Land Conservancy	26708	83
La Plata Open Space Conservancy	20346	232
Mountain Area Land Trust	17310	86
Eagle Valley Land Trust	13160	37
Estes Valley Land Trust	9881	173
Colorado Headwaters Land Trust	9185	66
San Miguel Conservation Foundation	7895.2	18
Central Colorado Conservancy	4527.44	37
Crested Butte Land Trust	4068.36	39
Southern Plains Land Trust	1992.89	5
Access Fund	1560	11
South Metro Land Conservancy	72.25	4

Note: Data source: Land Trust Alliance, National Land Trust Census (2020)

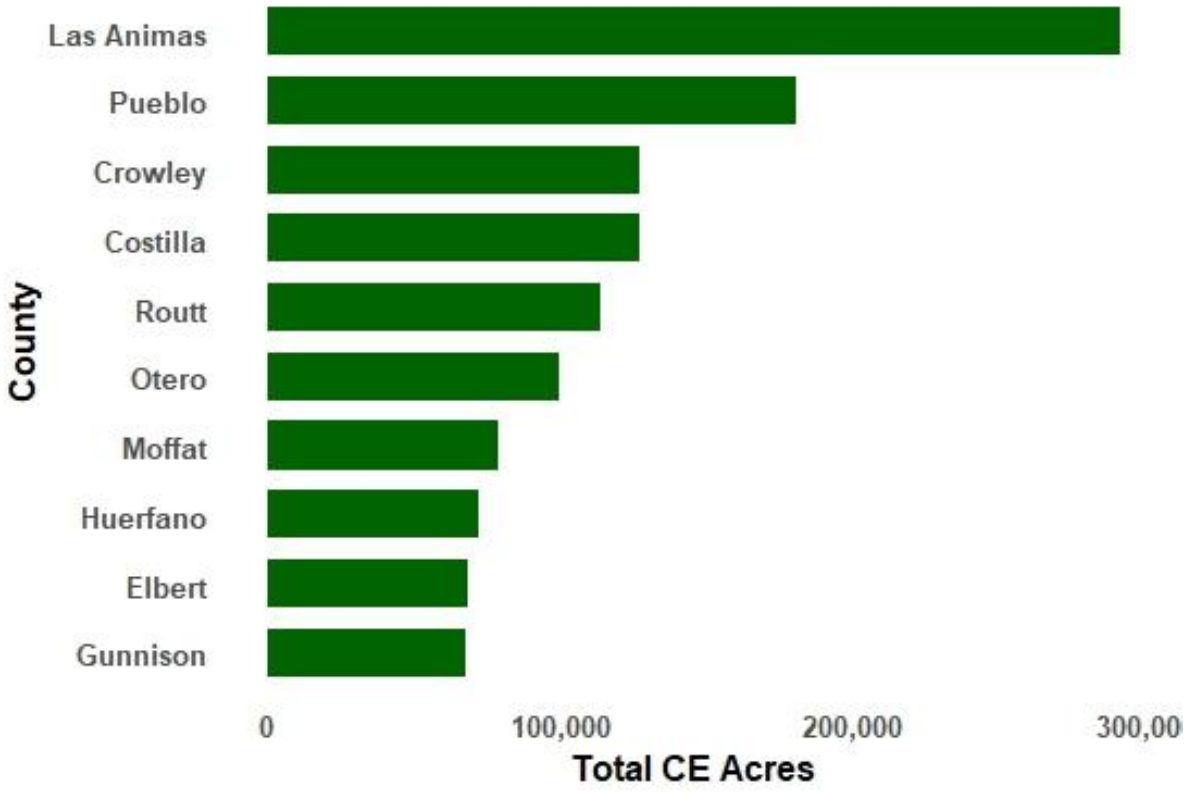

Figure A.1. Top 10 counties in Colorado by total conservation easement acres

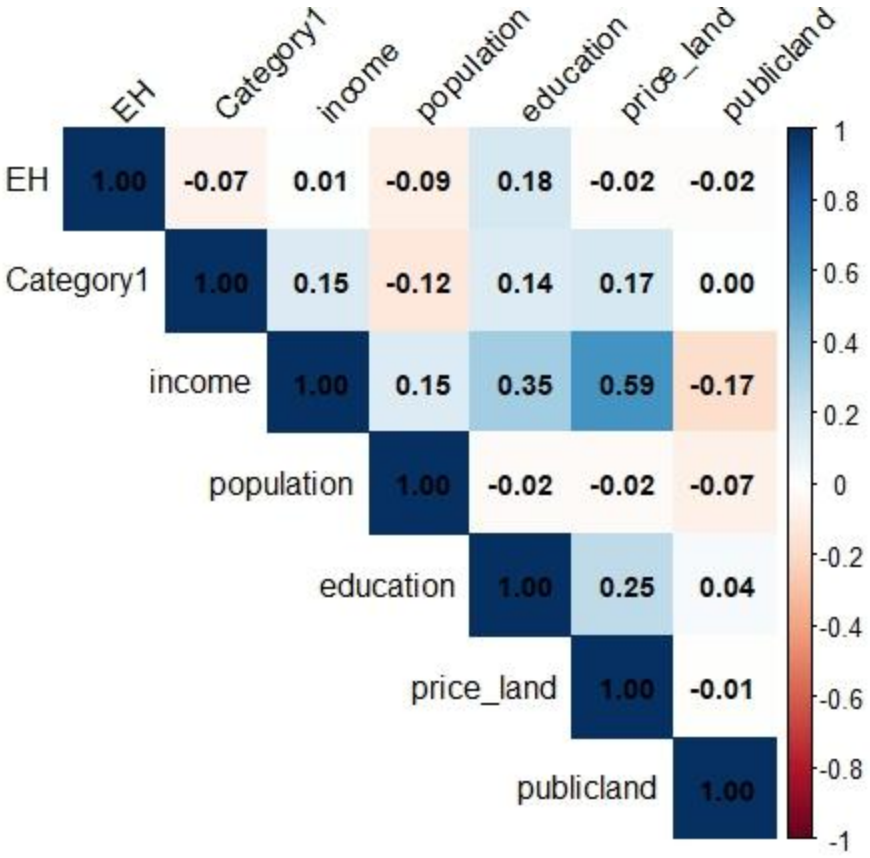

Figure A.2. Correlation plot of the independent variables

Table A.2. Summary of Colorado Conservation Easement Tax Credit Provisions by year (2000–2031)

Year	Credit Amount Based on the Donation's Fair Market Value (FMV)	Maximum Credit Allowed per Donation	Aggregate Annual Cap
2000 to 2002	100% of FMV	$100,000	Unlimited
2003 to 2006	100% of the first $100,000 of FMV plus 40% of any additional FMV	$260,000	Unlimited
2007 to 2010	50% of FMV	$375,000	Unlimited
2011 to 2012	50% of FMV	$375,000	$22 million
2013	50% of FMV	$375,000	$34 million
2014	50% of FMV	$375,000	$45 million
2015 to 2020	75% of the first $100,000 of FMV plus 50% of any additional FMV	$1.5 million	$45 million
2021 to present	90% of the donated value of a landowner's CE	$5 million (credits more than $1.5 million are issued in $1.5 million increments per year)	$45 million (2021-2024) $50 million (2025 onwards)
2027 to 2031	80% of the donated value of a landowner's CE	$5 million per donation (credits more than $1.5 million are issued in $1.5 million increments per year)	$50million