

Alternative methods for substantiating payments for conservation easements in Colorado

Andrew Seidl, Rebecca Hill and Lauren Mangus¹

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- Colorado House Bill 19-1264 is to investigate an alternative method to establish the amount of tax credits for which a qualified conservation easement contribution would be eligible.
- Conservation easements can be valued based on the expected estimated value of lost opportunity the landowner is suffering to convey the easement or the expected estimated value of the benefits to society from the ecosystem services protected or nurtured by the easement.
- A spreadsheet-based tool to investigate the approaches covered in this report is found [here](#) and the report summary is found [here](#).
- We investigate three ways to evaluate opportunity cost: 1) Appraisal (status quo), 2) Geographic Area Rate Caps (GARC), and 3) Average Assessed Land Value (AALV).
- The AALV approach is strictly preferred across all hypothetical land types to the status quo.
- The GARC approach yields the highest easement payment for highly valued parcels.
- For average parcels the estimated payment varies by only 2-3% across mechanisms, but 14% for low value parcels, and 62% for highly valued parcels.
- We describe three means to evaluate the public benefits: 1) Scores based on a conservation index, 2) benefit transfer and 3) selected enhancement practices under CSP.
- We also discuss Total Economic Valuation and hybrid approaches including the creation of a conservation easement clearinghouse or marketplace and propensity score valuation as possible alternatives.
- The benefit transfer methodology yields the highest payments for all but the low category parcel.
- Benefit transfer estimated payments are higher than opportunity cost and on the three other benefits-based approaches demonstrating a positive return on investment to Colorado taxpayers.
- Landowners with low land use conversion pressure will benefit from the public benefits approach relative to an opportunity cost approach.
- Landowners with high conversion pressure would be better suited to opportunity cost approaches for the valuation of their easement.
- Benefits-based calculations are broadly in line with opportunity cost-based calculations having a similar estimated effect on hypothetical parcel payments.
- Benefits-based approaches protect directly the ecosystem services valued by the public while opportunity cost approaches may not.
- An alternative method for substantiating payments for conservation easements would incentivize a more diverse portfolio of conserved land and potentially improve the efficiency of the program.
- An alternative approach could conserve our valuable private working lands while maintaining fiscal control over the size of the conservation easement program.

¹ The authors are Professor, Research Scientist and Research Assistant, respectively, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, Colorado, USA. Please address any comments or questions to: andrew.seidl@colostate.edu.

Introduction

Conservation easements have been the primary private lands conservation tool in Colorado for the past quarter-century. Colorado's conservation easements permanently prevent the conversion of working landscapes, open spaces and wildlife habitat into commercial, industrial and residential uses. Currently, conservation easement contracts are intended to compensate landowners for the lost opportunity to convert their lands to uses valued more highly in the real estate market including surface development rights, water rights, and sometimes energy development rights.

Easements can provide a variety of public and private (neighborhood) benefits by maintaining relatively low intensity private land uses including: community separators, reduced costs of community services, increased community real estate values, improved air and water quality, reduced greenhouse gas emissions, maintenance or improvement of wilderness, woodlands and wildlife habitat, tourism and outdoor recreation opportunities, unfettered views, and more vibrant rural economies and communities (e.g., Seidl, et al., 2017; Bergstrom, et al., 1985; Magnan, et al., 2012). Conceptually, policies and programs implemented with taxpayer money should maximize benefits to the public for minimum cost to the public. Here, we hope to understand better how current conservation easement-based programs operate and how alternative approaches might improve their effectiveness from the perspectives of rural landowners and the taxpaying public.

Colorado House Bill 19-1264 motivates this work. Passed on June 3, 2019, Section 14.5 of HB19-1264 calls for the director of the Division of Conservation to convene a working group to investigate "an alternative method to the appraisal process set forth in section 39-22-522 (3.3) to establish the amount of tax credits for which a qualified conservation easement contribution would be eligible." We proceed systematically, first focusing on the status quo and then investigating other programs and mechanisms for valuing the conservation of private lands. Potential alternative approaches for valuing conservation easements are developed and evaluated based on their likely effects on public and private stakeholders.

Current programs and recent history of conservation easements in Colorado

The policy and institutional milieu surrounding private lands conservation using conservation easements in Colorado is complex and can involve local, state, and federal agencies, for profit and not-for-profit service providers and organizations, as well as landowners. Here, we focus on state level taxpayer supported programs, but our alternatives are informed by the variety of compensatory programs and mechanisms in Colorado and elsewhere.

Currently, market valuation of a conservation easement in Colorado is estimated by an appraiser as the opportunity cost of the easement; the lost market value of the land due to the easement. The landowner can then receive compensation up to the value of the lost market opportunity from conveying the easement. This compensation may come in the form of a direct payment, but direct financial payments rarely exceed 50% of the appraised easement value. The landowner can count the difference between the direct payment they receive and the appraised easement value as a donation, or bargain sale, which can generate state tax credits and federal tax deductions for the landowner, estate/inheritance tax benefits, and/or tax benefits (CCALT, 2017).

Colorado's current conservation easement tax credit program, C.R.S. § 39-22-522 (2019), was established in 2000 based on the 1964 federal income tax credit program, I.R.C. § 170(b)(1)(E) (Watkins, 2017). The program allows a landowner to claim a state income tax credit for conveying a conservation easement donation equal to 75% of the first \$100,000 of the fair market value of the donation and 50% of all donations greater than \$100,000. In no case shall the credit exceed \$5 million per donation and credits will be issued in increments of no more than \$1.5 million per year, which is reached at a donation of \$2,950,000 (HB19-1261)

The tax credit certificate is transferable and can be traded on a secondary market (Colorado Department of Regulatory Agencies, 2019). The sale of the tax credit, typically 83–85% of the face value of the credit, is taxable income to the landowner, like a direct payment. The requirement of an appraisal to establish lost opportunity also qualifies the donated portion of the easement for federal income tax deduction. In addition, the Colorado Great Outdoors Conservation Trust (GOCO) frequently supports conservation easement purchases that provide at least a 50% match from other sources and contributes to large scale conservation practices (Great Outdoors Colorado, 2019). These two state programs have resulted in more than 2.1 million acres of private land protected by a conservation easement (Seidl et al., 2017). Since 1992, Coloradans have invested \$1.1 billion in conservation easements with an estimated public return on investment to Colorado taxpayers of \$4 - \$12 (Seidl et al., 2017).

Concerns about the current program that alternatives might address include:

- The cost of appraisals and other costs of conveying an easement;
- The length of time it takes to conclude a conservation easement contract;
- Despite landowner interest, uncertainty around outcomes and valuation methodology have resulted in low enrollment relative to available credits;
- Payments that reflect opportunity cost will minimize the cost to taxpayers, but not necessarily maximize the public benefits to them nor prioritize the most beneficial lands;
- A lack of explicit consideration of the public social, cultural, economic, and ecological benefits of program participation.

Alternative approaches to value conservation easements

We explore existing programs, tools, and mechanisms that could be used to value and encourage private land conservation. Broadly considered, Payments for Ecosystem Services (PES) programs have been implemented widely in the United States through contracts and partnerships including private sector, public sector and non-profit organizations to address a variety of environmental issues. Monetary incentives are offered to land stewards (sending region stakeholders) to manage their lands to benefit businesses, government agencies and/or society (receiving region stakeholders) when markets fail to do so.

PES programs are popular where land stewards cannot be compelled to manage their lands in consideration of other stakeholders and where sending region stakeholders are less affluent than receiving region stakeholders. These compensatory programs incentivize landowners to cultivate ecosystem service benefits (or reduce costs) where markets have not developed for those services. The ecosystem services provided through PES contracts could include carbon sequestration, biodiversity, water quality, flood control, and other off-site or non-consumptive benefits to land management (Table 1).

Table 1: Summary of Current U.S. Programs and Tools	
Conservation Easement Program or Tool	Program Summary
Payments for Ecosystem Services (PES)	Payments for management practices that generate ecosystem service benefits or reduce operational costs.
Conservation Reserve Program (CRP)	A competitive program featuring 10-15 yr. contracts that compensate the landowner for ecosystem services stewardship with an emphasis on soil health, condition, and crop rotation. Federal Farm Bill program managed by the USDA Farm Service Agency (FSA).

Environmental Benefits Index (EBI)	Each parcel is assigned a score calculated using a multi-factor environmental benefits index. It can be thought of as a payment (cost) adjustment. Originated in the Conservation Reserve Program under Federal Farm Bill legislation.
Conservation Stewardship Program (CSP)	Provides financial assistance through a 5-year contract to farmers and ranchers who meet threshold levels of conservation practices on the entire agricultural operation. Federal Farm Bill program managed by USDA Natural Resources Conservation Service (NRCS).
Regional Conservation Partnership Program (RCPP)	Helps partner organizations or agencies to solve ecosystem-service challenges on a regional or watershed scale where funding and/or greater management may be needed. Establishes a partnership between large oversight bodies and the NRCS to address critical conservation needs.
Environmental Quality Incentives Program (EQIP)	Provides financial and technical assistance for adopting conservation practices to agricultural producers to address natural resource concerns and deliver environmental benefits. Federal Farm Bill program managed by USDA FAS.
Propensity Score Valuation	Valuation of land based on biological, ecological, and economic importance. Valuation is used to strategically target parcels that are more likely to convert to higher density uses and that currently provide high priority ecosystem services.
Audubon Conservation Ranching Program	Marketing incentive-based program for ranchers to adopt sustainable, pro-animal welfare and pro-bird protection practices on their property in return for Audubon Society labeling on a product.
Other Compensation Methods:	
Geographic Area Rate Caps (GARC)	Provides a flat rate payment based on a regional average of lost opportunity due to land conversion. The flat-rate payment can incorporate different values for different land types. Used by USDA NRCS for wetland property payments.
Adjusted Assessed Land Value (AALV)	Uses a multiplier to adjust the local tax authority's assessed land value to an approximate appraisal value. Used by United States Fish and Wildlife Service for Real Property Land Acquisition.
Transfer of Development Rights (TDR)	An urban planning tool that creates market for development credits featuring lower density in a sending zone and higher density in a receiving zone. Provides a market-based solution to urban/rural planning. Used by Boulder County, Colorado.
California Carbon Market	A cap-and-trade program in which the government sets a cap on the amount of carbon permitted in an area, and allows individuals and firms to trade in order to meet that cap. The cap-and-trade program allows producers to generate revenue by selling carbon-offset credits. The offsets are purchased by industrial polluters. It thus creates a market for and incentive to reduce pollution.
Water Markets	Markets for the sale of water. Common under prior appropriation water rights regimes. Can be restricted by use (agricultural, commercial, residential), by watershed/geography, or management district/institution or can simulate a free market. Due to the essential nature of water, treatment as a private good has been criticized.
Traditional Real Estate Transactions	Markets for the sale of land where buyers and sellers reach an agreed upon price.

Market-based compensatory programs (such as, cap-and-trade mechanisms for pollution, water rights markets, fishing rights, traditional real estate markets and carbon markets) can be advantageous from the perspective of fiscal responsibility. Market-like institutions can be formed by government and other stakeholders can be expected to efficiently manage resources in view of the incentives they face. For example, Transfer of (or Tradeable) Development Rights (TDR) is a market created for the density or intensity of land use. Municipalities and/or counties establish a baseline density of development (e.g., one house per acre), designated density sending zones (more rural or suburban areas) and receiving zones (more urban or urban infill areas). If a developer would like to propose an urban development at higher density than the baseline, they must purchase density credits from the sending zone. The value of density credits is driven by the real estate market, thus is one time and appraisal-based, and those parcels in sending zones that have no remaining credits become permanently protected. The TDR creates a self-correcting market for development density that should result in a higher density urban core and a lower density periphery that reduces the fiscal impact of requisite infrastructure and service provision (Boulder County, 2019).

In California, the private sector also plays a role in conservation funding through its carbon credit cap-and-trade program. This program was started in 2013 by the California Air Resources Board. It limits the amount of greenhouse gas emissions for large corporations and offers a market-based program to trade carbon credits in its place (Air Resources Board, 2019, p.1). A cap-and-trade program commonly establishes a maximum amount of carbon release by the private sector and divides this amount among carbon emitters in the form of carbon (pollution) credits. These credits can be bought and sold in a market to assure the carbon quota is reached at the least cost.

California's cap-and-trade program regulates specific business operation emissions by capping the amount of greenhouse gas emissions emitted through a state-specific evaluation program (Mandatory Reporting of Greenhouse Gas Emission Regulation) and in return for the cap, they allow for a market-based trading system (California Air Resources Board, 2012). Each business operation can trade the carbon credits they will not use at a public auction. The auction price was \$16.85 per carbon credit in 2019 (California Air Resources Board, 2019). Since 2015, when the program increased to encompass 85% of greenhouse gas emission pollution sources, the credit allotment totals have been slowly decreasing annually (California Air Resources Board, 2019). This approach could benefit Colorado if taxpayers were interested in supporting a program that returns investments in carbon sequestration, which may or may not incidentally nurture and reward other ecosystem service benefits. A similar biodiversity or other ecosystem service credit or offset program could be designed to align incentives with private land conservation. There are no examples of this to date that we are aware of.²

Water markets have been used throughout the western United States as water is a scarce resource and the marginal value of water varies by use. Water markets treat water as a commodity that can be transferred and reallocated through trade. Water transactions are voluntary and have the potential to reallocate water to its most efficient use. Many mechanisms for orchestrating water rights transfers have been implemented including water auctions, water banks, as well as individualized sales and leases. While in theory water markets may lead to greater efficiency, due to the complexity of the transfers we often see thin markets and few transactions. In addition, water is essential for life and treating it as a private good to be traded and rationed based on willingness-to-pay can often be controversial (Lachman et al., 2016).

Land is commonly traded in real estate markets and in general have fewer uncertainties and complexities relative to water markets. Real estate transactions involve willing sellers and buyers who negotiate on an agreed upon price. Conservation easements could be transacted in a similar format as both landowners and land trusts know what they are willing to pay or accept for a conservation easement. Potentially, a land trust could play the role of conservation broker, not unlike the brokerages managing carbon credit transactions. Like any market or third-party brokerage arrangement, protections would have to be put in place to ensure these transactions are fair, free

² Forest Trends, Ecosystem Marketplace, Publications: <https://www.forest-trends.org/publications/?filter=ecosystem+marketplace#filter>

from collusion and all federal and state laws are observed and enforced.

Private sector incentives also can be incorporated directly into product information through labelling programs that recognize desirable production practices (see, for example, Forest Stewardship Council (FSC) certified timber, Rainforest Alliance certified coffee, dolphin safe tuna). In the Western U.S., the Audubon Conservation Ranching Program serves as an illustration of the use of private sources to support private land conservation. This program offers a market-based approach that places an emphasis on leveraging private funds to conserve private ranch lands in return for beef marketing opportunities with the Audubon Society (Audubon Conservation Ranching, 2017, p. 2). This program leverages private funds to build a payment for ecosystem services system that benefits taxpayers because it offers a business relationship, land improvement services, and federal as well as state conservation easement program services for little direct cost.

Scaling private lands conservation of individual properties to effective ecosystem and watershed management is a persistent concern with the effectiveness of programs. The Regional Conservation Partnership Program (RCPP) provides an example of a solution to habitat fragmentation, coordination and efficiency of management. RCPP was created for NRCS to co-invest with partners to implement projects that provide regional conservation benefits. In the past RCPP enrolled land through other conservation programs, but in the 2018 Farm Bill the program was altered allowing for direct enrollment in RCPP contracts with annual funding of up to \$300 million nationwide.

RCPP projects place an emphasis on project outcomes and are designed to enhance ecosystem services such as water quality and quantity improvements and habitat restoration at the regional or watershed scale (National Sustainable Agriculture Coalition, 2019). With this funding structure, the RCPP has been able to expand by paying for the ecosystem services provided to the regional organization instead of paying multiple landowners for their easement land, these payments are then passed on to individual landowners by the regional organizations. Examples of acceptable regional organizations under the RCPP include: Agricultural or silvicultural producer associations, farmer cooperatives or other groups of producers, state or local governments, American Indian tribes, municipal water treatment entities, water and irrigation districts, conservation-driven nongovernmental organizations and institutions of higher education. An analogous list, including, for example, land trusts, could be established for conservation easements.

We are mindful there are dimensions of these programs that potentially are useful to the Colorado conservation easement discussion over the longer term or in context of a broader policy landscape. Here we focus on approaches, programs and tools that are more evolutionary than revolutionary to the current approach organized around four common characteristics of conservation programs implemented at the state level.

A Framework for Alternative Compensation Methods for Conservation Easements

We identified a dozen program elements and tools that could be useful to an alternative method for substantiating payments for conservation easements, each with implications for landowners and for the public. We consider these elements organized into four broad categories. Each program establishes:

1. a value or values of the conservation easement (opportunity cost or public value);
2. the term of the easement (term or in perpetuity);
3. the timing and basis of payments (one off or periodic); and
4. the unit of payment (by area or by legal entity).

Table 2: Summary of Program Elements or Mechanisms

Element or mechanism	How does it work?	Programs that Employ Mechanism
1. Approaches to compensate for the value of an easement		
Conservation Practice Incentive Payments	Incentive payments to landowners for certain conservation practices on acreage dedicated to the program.	Payments for Ecosystem Services, Environmental Quality Incentives Program, Conservation Stewardship Program
Tiered Payments for Performance	Progressive, incremental payments to landowners for successful implementation of targeted practices on dedicated land. Can be cast in terms of greater payments for progressively more conservation focused or conservation benefitting practices or progressively less payment for more landowner control over chosen practices.	Payments for Ecosystem Services, Environmental Quality Incentives Program, Conservation Stewardship Program
Payments Based on Ecosystem Services	Payments to landowners based on targeted ecosystem services on conserved acreage.	Payments for Ecosystem Services, Environmental Quality Incentives Program, Conservation Stewardship Program, Regional Conservation Partnership Program.
Payments Based on Appraisal Value	Payment to landowners based on the value of land given up by conveying an easement as reflected in the real estate market and calculated by a real estate appraiser.	Adjusted Assessed Land Value Analysis, Current Colorado and Federal Conservation Easement Programs
Cost/Benefit Based	Payments based on the net benefits provided by conservation easement acreage.	Conservation Reserve Program
Bundling of Enhancements to Receive Greater Payment	Payments based on ecosystem service enhancements to acreage on conserved property.	Conservation Stewardship Program
Carbon Market Buyouts	Using a cap and trade program to sell carbon-offset credits between landowners with high carbon sequestration value and high pollution corporations	California Carbon Market
Menu of Eligible Payments	Payments offered to a variety of land upgrades and services on conservation easement acreage.	Environmental Benefits Index, Environmental Quality Incentives Program, Conservation Stewardship Program
Location Based Payments	Payments for geographic importance (e.g., elk habitat) to target species and/or ecosystem services on conserved lands.	Geographic Area Rate Caps, Adjusted Assessed Land Value Analysis, Regional Conservation Partnership Program, Propensity Score Valuation
Leveraging Private Funds	Use of independent private funds (e.g., foundations, corporations or impact investors) to support conservation efforts.	Regional Conservation Partnership Program, Audubon Conservation Ranching Program

2. Easement or contract term		
Easement in perpetuity	Conservation easement is placed permanently on the property title with no date of expiry.	Current Colorado and Federal Conservation Easement Programs.
Fixed Term Contract with Possible Renewal	Contract with landowners over specific periods of time for acreage in conservation programs. Such program contracts are rarely shorter than 5 yrs. nor longer than 25 yrs. Preferred by landowners due to flexibility. Less attractive to taxpayers due to uncertainty and real estate speculation. Rolling, annually renewed, contracts is one way to reduce program participation motivated by speculation.	Payments for Ecosystem Services, Conservation Reserve Program, Conservation Stewardship Program, Geographic Area Rate Caps, Regional Conservation Partnership Program, California Super Williamson Act.
3. Timing of Compensation		
Annual or Distributed Payment	Annual payments to landowners for conservation easement acreage or conservation practices.	Payments for Ecosystem Services, Conservation Reserve Program
One Time Payment	Single payment to landowners for conservation easement acreage.	Transfer of Development Rights, California Carbon Market (potentially) Status quo for Colorado easement programs.
4. Compensation unit		
Acre Based	Payments based on the total amount of acreage encumbered or enrolled. Such an approach benefits owner of larger or more operations.	Adjusted Assessed Land Value Analysis. Almost all programs including Colorado's current easement programs.
Operation based	Payments based upon ownership, not size, and limits are placed upon the number of parcels each landowner may place in the program. Such an approach benefits landowner with smaller or fewer operations.	Most Farm Bill programs have a 3-operation limit for each landowner.

Moreover, conservation easements can be valued from two perspectives:

1. The expected estimated value of lost opportunity the landowner is suffering to convey the easement; or
2. The expected estimated value of the benefits to society from the ecosystem services protected or nurtured by the easement.

Currently conservation easements in Colorado are valued using a real estate appraisal, which values the easement at the foregone market value also known as 'opportunity cost.' Parcels with high residential or commercial development potential will have higher per acre easement values regardless of the ecosystem service benefits to society. A program based on the appraisal method will pay more for conveying easements against parcels at the greatest risk for conversion to higher density uses and less for those away from the path of development. The approach is intensive and specific to each case and is, therefore, relatively expensive and time consuming. It suggests the spot (market) price best captures the future land use opportunities for the parcel.

The traditional appraisal-based method depends heavily on locating ‘comparable’ sales, which can be challenging when many potential and currently conserved and unencumbered acreages are atypical on important dimensions. It is not uncommon to find properties that do not reduce in market value as a result of the easement due to an increasing interest in conservation properties calling the current appraisal-based approach into question. Moreover, opportunity cost approaches are thought to be fiscally responsible because the taxpayer burden is no more than what the landowner is giving up. However, such a payment creates little incentive to the landowner to choose to convey an easement when the land is not located in the direct path of development. The opportunity cost approach is an approximation for the private benefits foregone by conveying an easement, ignoring the public and private value of the resources preserved.

Geographic Area Rate Cap (GARC) is an approach to compensatory programs that circumvents the parcel appraisal process. A GARC has the advantage of reducing the transactions costs of an appraisal-based approach while retaining the opportunity cost valuation as the underlying compensation philosophy. A GARC sets value limits based on an analysis of comparable transactions within a geographic location, much like a property tax assessment model or a real estate value estimator or algorithm such as Zillow. In this way the rate reflects an average opportunity cost for the market area (Nebraska Natural Resources Conservation Service, 2011).

Once an average opportunity cost has been estimated, the GARC is set at a proportion (up to 100%) of the average easement value for the market area. GARC payments differ from the traditional appraisal-based method as the rate is based on a geographic region as opposed to parcel specific information. This broader geographic scale reduces the individual landowner’s costs of conveying an easement by eliminating the need to conduct an appraisal. Since the payment level is based on averaging observed transactions, property owners with less desirable parcels are more likely to enroll than those with more desirable parcels. This source of inefficiency is known as adverse selection, also called the ‘lemon problem’, the importance (costliness) of which increases with variability in the value of the easement (Akerlof, 1970)

Traditionally GARCs represent the maximum per acre payment that the landowner can receive for the easement and are intended to prevent landowners from receiving payments above fair market value. Compared to appraisers, managers of GARC programs have more latitude to recognize public values generated by parcels by setting the rate cap percentage higher to reflect the additional public benefits generated.

The NRCS established GARC payments in Colorado for the Grassland Reserve Program (GRP) and Wetland Reserve Program (WRP). The rate caps across Colorado varied widely from as low as \$170 per acre to as high as \$2,240 per acre. At its peak in 2011 WRP obligations in Colorado totaled over \$1.7 million and a total of 19,643 acres were enrolled over the life of the program (NRCS Conservation Programs, 2019). The GRP and WRP determine contract or term easement value as the lowest among the appraised value, the geographic rate cap or a landowner offer. The federal Agricultural Act of 2014 established the Agricultural Conservation Easement Program (ACEP) to repeal and replace GRP and WRP programs. Although NRCS manages programs that employ GARCs across the United States, in Colorado the ACEP program currently does not use the GARC payment method as the cost of performing area wide market assessments was prohibitive. The NRCS is not precluded from employing it in the future. It is most useful and dependable when there are many, similar transactions in a region.

Adjusted Assessed Land Valuation (AALV) uses an assessment-based system to analyze the development value of an easement. It has similarities to a GARC in that it analyzes secondary data to arrive at an approximate opportunity cost estimate. However, AALV uses assessor information rather than sales data, which is at the same time somewhat more subjective and likely to suffer from imprecision at the specific parcel level, but also much more plentiful and more likely to generate statistically robust projections. Statistical analysis of the difference between the market value and the assessed value provides “a consistent and reliable estimate of market value” (United States Fish and Wildlife Service, 2008). This system of analysis could prove useful in agricultural areas when properties are similar in use and per acre market value but could be less accurate in residential and commercial areas (United States Fish and Wildlife Service, 2008). Like a GARC, AALV should create fewer

temporal and financial hurdles but will also suffer from the lemon problem in enrollment. Theoretically, AALV should approximate the appraisal value. We were unable to locate an AALV in operation to understand better whether theory and practice are aligned.

Alternatively, conservation easements could be valued and compensated based on the public benefits they protect and nurture for society. The IRS conservation purposes test outlined in Section 170h of the internal revenue code lists conservation factors admissible to qualify for tax credits. Although they currently are used only to provide a threshold for eligibility, they align well with conservation easement valuation that includes public benefits. The IRS conservation test, defines four conservation factors for public benefit purposes (26 U.S. Code 170):

- The preservation of land areas for outdoor recreation
- The protection of natural habitat of fish, wildlife, plants or similar ecosystems
- The preservation of open space
- The preservation of an historically important land area or a certified historic structure

Benefits-based approaches have the advantage of encouraging or incentivizing stewardship of the ecosystem services the public aims to protect rather than simply protecting the land and trusting the management plan will be carried out and enforced. Landowners in low development regions, endowed with high or unique natural capital will favor this suite of approaches. Unfortunately, many of the benefits of private land conservation to society are not directly visible in the real estate market. Most people recognize investments in good schools and low crime result in higher valued homes. Similarly, higher density development results in lower tax burdens, and views of working landscapes, access to outdoor recreation, wilderness and wildlife increase residential property values.

Benefits valuation can progress from simple tick boxes of benefit categories, to ranges of ecological or cultural value within categories, to tiers of desirable practices meant to create or ensure benefits, to economic valuation of those values through benefits transfer, to specific Total Economic Valuation of a parcel. We discuss the desirability of each and the tools to undertake such assessments in turn.

The Conservation Reserve Program (CRP) can be considered one of the largest PES programs in the United States. Since 1986, CRP has enrolled 1.9 million acres and generated over \$2 billion in payments to landowners in Colorado (United States Department of Agriculture, 2018). CRP uses a renewable 10 to 15-year term contract in which farm and rangeland is managed for greater environmental benefits (United States Department of Agriculture, Farm Service Agency, 2019). CRP is a voluntary and competitive program that has implemented a variety of strategies for selection and enrollment into the program. CRP provides annual rental payments to the landowner each year they are enrolled in the program.

Early on CRP was focused on erosion control and enrollment decisions were based on bids by individual landowners. If the landowner's rental rate request in their bid was less than a pre-determined regionally specific Maximum Acceptable Rental Rate (MARR), the bid was accepted and the land was adopted into the program (Hellerstein, 2017). The MARR is calculated based on soil productivity and area average cropland rental rates (Johnson and Clark, 2000).

In 1990 the Conservation and Reform Act extended the CRP and recognized the importance of a variety of conservation goals beyond erosion control. The calculation for the MARR was modified to be dependent on the Soil Rental Rate (SRR). SRRs are assigned based on the productivity of the soils; the more productive the soils the higher the rate, which can reach as high as 150% of the county's average agricultural land rental rate (Johnson and Clark, 2000). CRP also introduced the Environmental Benefits Index (EBI) to incorporate conservation goals beyond erosion control. These two innovations have evolved but continue to be a part of CRPs enrollment mechanisms and the EBI score plays a crucial part in CRP bid rankings (Hellerstein, 2017).

The EBI rates provide a means to rank across parcels the stewardship of ecosystem services on private land where conservation easements are to be conveyed as justification for greater payments, higher priority for inclusion in a program, and potentially for maximizing net returns to taxpayer investments in conservation. The CRP EBI uses a point-based system to rank parcels based on the environmental services they provide such as quality of water, erosion mitigation, and wildlife biodiversity.

The CRP EBI provides an excellent starting point for a potential listing or dashboard approach to benefits estimation. Its strength is in its simplicity where either a yes-no or a position on a 3- or 5-point scale for each component of the index could create a relative public benefits score. The CRP EBI ranks bids on six factors: Wildlife habitat benefit; water quality benefit; on-farm benefits from reduced erosion; benefits that are likely to endure beyond the contract period; air quality benefits; and cost. The challenges of an index approach include interpreting the sum of the component scores, as typically the default is equal weighting of each component or, perhaps subsection, as well as assigning financial compensation based on the score or score thresholds. In addition, the role of the parcel in the broader landscape, scaling, threshold and neighborhood effects are not addressed in the CRP EBI.

Propensity Score Valuation (PSV) is a related index approach that provides a means to combine ecosystem services and geographic area payment systems with the residential value of a property. PSV generates a land value based on “the sum of the assessed agricultural value and the median residential value resulting from matching the economic ‘score’ (i.e. total value) of each parcel” (Mellinger, 2018, pp. 70). Similarly, a biological score is calculated from ecological significance and the probability of future residential use. PSV potentially could benefit Colorado conservation easement programs by offering a payment system that values land in development, its biological value, and its agricultural value. While PSV holds the promise of addressing some issues of the CRP EBI, it too suffers from the challenges of summing, ranking and assigning financial values.

Tiered incentive payments are used in the Conservation Stewardship Program (CSP) to capture broad levels of public benefit creation without giving the unrealistic impression of precision in summing, scaling, or measuring categories of benefits. Rather than benefit categories, it provides compensation for adopting three tiers of practices that are viewed as creating or providing stewardship for those benefit categories. CSP assists farmers to create conservation practice improvement plans for their land. CSP places an emphasis on safeguarding and generating ecosystem services such as biodiversity, carbon sequestration, and soil investments. CSP increases ecosystem services by helping farmers and ranchers implement or expand land practices such as “cover crops, rotational grazing, ecologically-based pest management, buffer strips, and the transition to organic farming – even while they work their lands for production” (National Sustainable Agriculture Coalition, 2019). CSP contracts are relatively short term; 5 yrs. Annual payments under CSP are predetermined by practice implemented. These payment rates are re-evaluated each year, differ by state and are determined based on the current costs of material and labor as well as the “fair marketplace compensation for opportunity costs that may arise” (NRCS, 2019). A list of practices and the associated payments by state can be found on the NRCS CSP [webpage](#).

Compensation for adopting practices is easier to apply universally than comparing benefit categories across parcels, but it is also more generic and does not necessarily track performance or improvement in public benefit stewardship. If the approach were to include baseline measures and periodic assessment of public benefits, then pay-for-performance could be implemented. However, the payment schedule should reflect the periodic assessments and could not be one-off unless it were simply a compliance-based reporting as is the current practice in Colorado.

The Environmental Quality Incentives Program (EQIP) is managed by the NRCS and aims to build land specific programs for landowners who adopt conservation practices. EQIP pays landowners for services based on general improvement practices but will pay more for specific land practices such as the implementation of organic farming. The EQIP program provides technical assistance, in addition to the financial assistance that other programs offer, to landowners in order to plan, install and maintain their land management practices. EQIP

provides baseline payment for the presence of these ecosystem services and tiered payments for performance to enhance them. EQIP's program format could work for Colorado conservation easement programs by offering foundational or baseline payments that protect private lands from conversion coupled with incentive payments for practices that could enhance public conservation benefits. This program format allows for foundational conservation practices with room to add practices as future needs arise.

The tools of economic valuation can be used to improve the additivity of unlike categories of public benefits. The most straight forward approach, called 'benefits transfer,' was adopted in Colorado by Seidl et al. (2017) and the TPL (2008, 2014) where 11-12 categories of ecosystem services found on conserved private lands were identified and quantified and per acre values from the economics literature were derived to estimate the public benefits from protection. Benefits transfer values can be made more robust through statistical modeling called 'meta-analysis.' Benefits transfer and meta-analytic approaches are useful because they allow unlike categories of benefits to be summed, they are relatively inexpensive, can be applied broadly, and provide more accurate values for public benefits than the default, which is precisely zero. They suffer when the baseline literature is unlike the situation to which the values are being applied and when the values are not neatly portrayed on a per acre basis.

A solution to the imprecision of these approaches is to conduct site level Total Economic Valuation studies drawing from the portfolio of indirect market and nonmarket valuation tools available (ELD, 2015). Appraisal information adequately captures the private benefits that would accrue to a potential buyer. However, the private and public benefits to neighbors, the broader community and potential visitors are not captured in an appraisal. Economic valuation techniques can be used to evaluate the additional contributions or detriments to society of a land use choice, potentially focusing on the categories of the CCBI score card at the site level. The strengths and weaknesses of progressing through the public benefit valuation tools are fully analogous to progressing from AALV, to GARC, to site appraisal-based methods for estimating the opportunity cost of conveying an easement.

Conservation easements can be in force for a specific length of time, or term, or can be in perpetuity. Term easements provide the landowner flexibility and may increase the rate of enrollment in conservation easement programs. However, term easements increase the likelihood of speculation, loss of the public benefits that taxpayers invested in, and a failure to fully capture the public benefits of the easement due to uncertainty regarding future use of the property. As a result, landowners should expect lower payments for term easements than for easements conveyed in perpetuity. Means to mitigate these concerns include term contracts designed with options for perpetuity and/or rights of first refusal on renewal of the contract or rolling term contracts. A term easement is perhaps better termed a conservation contract or pay-for-performance agreement in order to avoid confusion for policy makers and landowners as to the timeframe of the commitment. We differentiate an 'easement' from a performance or practice 'contract' based on whether it is in perpetuity or term.

To take advantage of federal tax deductions and, currently, Colorado state tax credits, the conservation easement must be conveyed in perpetuity and its value must be estimated via the appraisal method. State legislation passed in 2019 opens the possibility for a term contract to qualify for the state tax credit with the approval of the Division of Conservation. The CRP and other programs use 5-20 yr. contracts for conservation practices and California's Williamson Act featured rolling 25 yr. term easements to reduce the likelihood of speculative program enrollment. Here we explore only perpetual easements due to the policy climate and stakeholder preferences in Colorado.

Currently, Colorado landowners receive a one-time tax credit and/or payment for a conservation easement. As described above, tax credits for a particularly valuable easement could be rolled out over several years. Other programs award annual payments. Pay-for-performance approaches lend themselves to periodic payments, or tiered, predetermined increases, following performance appraisals. Annual or pluri-annual payments, much like an annuity payment or pension, would be unpopular with taxpayers for easements conveyed in perpetuity. This could be particularly attractive when a program is valuing an easement based on the implementation of practices that do not reap rewards until several years into the program or to incentivize continued land stewardship. At this

juncture, we evaluate only one-time payments, but may want to address additional alternatives in the future, particularly if benefit compensation is under consideration.

Lastly, most conservation programs are designed on a land area basis allowing for larger operations, conserving more land, to receive higher payments than smaller operations. An alternative could be to base the payment on an operation level as opposed to a land area level like the RCPP and EQIP. In Colorado, current payment limits effectively cap the acreage enrolled under a single easement, causing larger landowners to convey several easements. More acres can enroll under the cap in areas with low conversion pressure due to the lower value of lost opportunity. Each easement contract has fixed conveyance costs reducing per acre costs of participation associated with larger parcels. Here, we explore more fully only those mechanisms that make payments on a land area basis.

Evaluation of Options for an Alternative Evaluation Method

We explore scenarios that are most likely to capture the perspectives of Colorado stakeholders and provide a feasible and defensible alternative to the status quo for conservation easements in the state. We identify two groups of stakeholders, landowners and other Colorado taxpayers, and evaluate the scenarios from their perspectives. We have narrowed to two the dimensions of variation for the alternative methods for substantiating payments for conservation easements scenarios based on our review of the literature and familiarity with the stakeholders: calculation of opportunity cost and calculation of the public benefits. Therefore, we assume for the time being the easement is in perpetuity, the payment mechanism is one-off, and compensation is on a per acre basis. New legislation or protocols may be required for the payment schemes to be implemented. Payments could continue to use tax credits or some other equivalent form of direct transfer from the state.

Opportunity Cost Approach

An opportunity cost approach is the difference in market value of the parcel with versus without the easement. It does not address or consider the public benefits of the easement beyond the four federal and state eligibility requirements. The market value of the easement is influenced by several factors including:

- Restrictions on surface development and the development pressure of the parcel.
- Restrictions placed on the sale of water rights associated with the parcel.
- Restrictions in energy and mineral rights associated with the parcel.

We have three ways to evaluate the opportunity cost of the lost market value from a conservation easement: Appraisal (status quo), GARC and AALV. Costs incurred by the landowner as well as the expected returns will vary across these methods. The costs incurred by the landowners will vary by evaluation method but not by the lost market value of the parcel, as appraisals and administrative fees are not dependent on the parcel's valuation. The expected return to the landowner will vary by valuation method and by the estimated opportunity cost of the lost market value due to the easement. Expected returns/payments to the landowner with a relatively high lost market value property will be highest under the appraisal approach followed by AALV and then GARC. Relatively low lost market value properties will have the opposite order of preference and size of expected payment.

Formal appraisal is the highest cost to the landowner, typically about \$20,000 (Colorado Coalition of Land Trusts, 2010), so will be preferred by landowners who can spread the cost over more acres. Landowners typically will experience lower up-front costs with the GARC and AALV methods, as they do not require parcel specific appraisals. Additionally, conservation easements have conveyance fees that are intended to cover the administrative costs associated with the easement contract. Fees can vary substantially depending on individual parcel characteristics (for example, whether the landowner owns the mineral rights) as well as by the land trust holding the easement. For this analysis we use fees outlined by the Colorado Cattlemen's Agricultural Land Trust (CCALT) (2019). Conveyance fees total approximately \$63,000 per contract involving tax credits under current legislation. If other compensation mechanisms are adopted by the state, conveyance fees may change.

We simulate the expected payments for three hypothetical 1,000-acre parcels representing low, average and high lost market value due to the easement under the status quo appraisal and GARC methods net the expected landowner costs. We expect the AALV to approach the value derived by the appraisal method without the appraisal costs. However, we do not have an actual example of this approach to be confident of this assertion.

The opportunity cost of a conservation easement in terms of lost market value is largely location-dependent so hypothetically we could envision a parcel in southeastern Colorado to represent low, south-central Colorado to represent average and north-central Colorado to represent high conversion pressure. Average expected returns on a 1,000-acre parcel are gleaned from the literature (Seidl et al., 2018) and scaled to represent parcels with high conversion pressure (30% increase in payment) and parcels with low conversion pressure (30% decrease in payment) (Table 3).

Average appraisal, GARC and AALV values were gleaned from the literature and translated into landowner payments, which will be some proportion of the opportunity cost of lost market value minus the landowner costs of entering the easement. The formulae for these calculations are shown in Equations 1 -3 below.

To facilitate meaningful comparisons across scenarios we look at the following payment mechanisms for each of the opportunity cost-based compensation scenarios: 1) The current valuation approach where compensation is set at 75% of the first \$100,000 and 50% of the remaining value (Payment Mechanism 1, PM1); 2) Compensation set at 75% of the easement value (including the first \$100K) (PM2); 3) Compensation set at 90% of the easement value (PM3). The payments reported in Table 3 represent the value of the claimable state tax credit under each payment mechanism, and do not include any match or other outside financial compensation.

	Low			Average			High		
	PM 1	PM2	PM3	PM 1	PM2	PM3	PM 1	PM2	PM3
Status Quo	344,850	521,275	642,130	517,500	780,250	952,900	690,150	1,039,225	1,263,670
GARC	315,000	466,500	572,400	537,000	799,500	972,000	1,132,000	1,692,000	2,043,000
AALV	364,850	541,275	662,130	537,500	800,250	972,900	710,150	1,059,225	1,283,670

Equation 1: Calculations for Easement Payments

$$PM1: EPV = \$75,000 + (0.5 * (EV - \$100,000)) - AC - CC$$

$$PM2 \text{ and } PM3: EPV = P_i * EV - AC - CC$$

Where:

- EPV = Easement Payment Value
- EV= The calculated market value of the easement, which varies across scenarios as follows:
 - Status Quo: The value of the easement is the appraised value.
 - GARC: The Average Area Wide Market Analysis (AWMA) value, which is calculated using the 2014 WRP GARC, the most recent from Colorado as the program was halted in 2014.
 - AALV: The Average Adjusted Assessed Value, which we assume is equal to the appraisal value, or PM1 EV value, since we have no examples from which to draw and this is the theoretically expected value of the calculation.
- AC = Appraisal Cost, which is assumed to be \$20,000 for the Status Quo and \$0 for GARC and AALV which would not require an appraisal.
- CC = Conveyance costs are constant across scenarios. Conveyance costs are assumed to be \$63,000 and include: Title and closing costs, \$2,500; Tax credit certification fee, \$8,000; required due diligence reporting (baseline, minerals, phase 1, etc.), \$8,000; Legal expense fee, \$10,000; Stewardship endowment, \$22,500 and Project coordination fee, \$12,000. This may be an underestimate of the total fees associated with a GARC

scenario. Conducting an AWMA can be costly and it is likely that the land trust would pass some or all this cost to landowners as a fee. The amount of the fee would depend on the number of applicants in the area that the AWMA cost could be spread over.

- P_i is the payment proportion under each of the payment mechanisms and is 0.75 for PM2 and 0.90 for PM3.

Table 3 shows the AALV approach is strictly preferred across all hypothetical land types to the status quo because the AALV approach calculates the same value as the appraisal approach without the appraisal cost. This builds on two important assumptions: an AALV approach would be able to accurately approximate the real appraisal value of the property, which may not be a realistic assumption in areas where markets are thin and relatively few comparable sales are available; and state policy would allow for parcels valued through the AALV method to qualify for tax incentives.

The GARC approach yields the highest easement payment of the three mechanisms for highly valued parcels. For average parcels the estimated payment varies by only 2-3% across mechanisms, but 14% for low value parcels, and a substantial 62% for highly valued parcels. Our hypothetical parcel, at 1,000 acres, is near the average parcel size for land in conservation easement in Colorado of 1,100 to 1,200 acres. Landowners who have smaller parcels than the average would see an even greater benefit of the AALV approach as the appraisal cost is spread over fewer acres, so this method would likely be preferred by landowners to the status quo across Colorado's diverse agricultural operations.

Public Benefit Approach

Alternatively, a parcel could be evaluated based on the public environmental value the land provides; The public benefits generated by the working landscape drive the easement payment. Under a public benefits approach payment received by the landowner will vary by ecosystem composition and not by the real estate market. This is a simplifying assumption, as public benefits that are non-consumptive use values will increase with the income and affected population, which also drive land conversion and real estate market pressure. We describe three means to evaluate the public benefits from parcels: Scores based on a conservation index, benefit transfer and selected enhancement practices under CSP. We mention total economic valuation (TEV) as an alternative but will not estimate it. All are alternative valuation approaches as the status quo does not take public benefits into explicit account.

We assume that the cost of participating in the public benefit alternative valuation approaches are equivalent and equal to the conveyance fees outlined in the opportunity cost scenarios. A TEV approach would require more costly parcel level evaluation of ecosystem services that would depend on the variety of ecosystem services generated by the parcel to be evaluated. It would include an appraisal and then expand to other appropriate valuation techniques. The remaining approaches can be implemented using existing parcel data and the literature. We describe a 1000-acre parcel with low, average and high ecosystem service values based on Seidl et al. (2018) and simulate potential payment levels using the benefit valuation approaches.

We adapt the CRP EBI to the specific objectives of Colorado's conservation easement programs to create the Colorado Conservation Benefits Index (CCBI). Currently, CRP EBI payments are based on the overall score a parcel receives on a scale of 0 – 545 total points. A typical cutoff is 200 – 269 points for CRP program eligibility with payments increasing progressively when surpassing established points tiers (Dooley, 2018). By means of illustration, the CCBI modifies the CRP EBI for the valuation of Colorado easements based on the IRS conservation purposes test. The conservation purposes test commonly is used by the Colorado conservation community and aligns well with the goals of private working lands conservation. It defines conservation as: "...the term conservation purposes means-- (i) The preservation of land areas for outdoor recreation by, or the education of, the general public, within the meaning of paragraph (d)(2) of this section, (ii) The protection of a relatively natural habitat of fish, wildlife, or plants, or similar ecosystem, within the meaning of paragraph (d)(3) of this section, (iii) The preservation of certain open space (including farmland and forest land) within the meaning of paragraph (d)(4) of this section, or (iv) The preservation of a historically important land area or a

certified historic structure, within the meaning of paragraph (d)(5) of this section.” (Qualified Conservation Contributions).

We rate easements on seventeen factors identified in the IRS conservation purposes test (Table 4). Measures of each factor were determined to evaluate a diverse set of public benefits captured from conservation easements. The CCBI generates an individual parcel level score based on the presence of identified environmental benefits and proposes two distinct payment approaches. First, payment could be based on the score received in the same manner as the CRP EBI. We illustrate three ways in which this scorecard system could be used (Table 5). Second, payments could be tied to the estimated value of public benefits provided by each of the attributes in the index using a benefits transfer approach (Table 7).

Table 4: Conservation Benefits Index Scorecard – Yes/No Scale	
Category	Yes/ No
<i>Natural Habitat</i>	
<u>Connectivity</u>	<input type="checkbox"/>
Is the land located in a crucial wildlife habitat or corridor?	
<u>Target Species</u>	<input type="checkbox"/>
Does the land provide habitat for species listed in the Colorado Department of Wildlife’s threatened or endangered list?	
<u>Vegetative Type</u>	<input type="checkbox"/>
Does the land contain some forest and/or wetland areas?	
<u>Biodiversity Index</u>	<input type="checkbox"/>
Does the land contain species that are weakly or moderately conserved according to the Colorado Biodiversity scorecard?	
<u>Water Quality</u>	<input type="checkbox"/>
Does the property implement water quality practices?	
<i>Open Space</i>	
<u>Soil Type</u>	<input type="checkbox"/>
Is the property’s soil classified as a prime soil?	
<u>AUM Average</u>	<input type="checkbox"/>
Are best practices for stocking rates implemented?	
<u>Irrigation</u>	<input type="checkbox"/>
Are parcel based irrigation best practices implemented?	
<u>Proximity to Scenic Byways</u>	<input type="checkbox"/>
Is the land located within view of a scenic byway?	
<u>Proximity to State Highways</u>	<input type="checkbox"/>
Is the land located within view of a state highway?	
<u>Connectivity</u>	<input type="checkbox"/>
Is the land located near existing conservation private or public lands?	

<i>Historic Designation</i>	
Does the property have Centennial Farm or Ranch designation?	<input type="checkbox"/>
Does the property have a Local/State/National Historic designation?	<input type="checkbox"/>
Does the property have a Designated Natural Heritage Area designation?	<input type="checkbox"/>
<i>Access</i>	
<u>Participation in the Designated Access Program</u>	
Does the property participate in Ranching for Wildlife or other Colorado Parks and Wildlife access programs?	<input type="checkbox"/>
<u>Outdoor Recreation Access</u>	
Is public recreation access permitted on the land?	<input type="checkbox"/>
<i>Education</i>	
<u>Partnerships with schools/non-profits</u>	
Does the property have a partnership with schools or non-profit educational organizations?	<input type="checkbox"/>
TOTAL (X/17)	

A scoring system to create the index should consider the potential tradeoffs between simplicity and accuracy, replicability, and comparability. Here, we explore three means to illustrate the assignment of CCBI scores. First, the simplest and least precise is a yes-no, dichotomous choice, assignment. If the identified factor is present the parcel is assigned a ‘yes,’ scored “1,” and if not a no, scored “0,” and then summed out of a possible maximum of 17. The second approach recognizes that there are different levels of public benefit provision and if the factor is present allows for a high (scored “3”), medium (2) and low (1) or non-existent (0) determination for a possible maximum of 51 across the 17 criteria. Finally, we recognize that we may want to weight the responses based upon category, not the number of questions within each category. Here, we have identified five categories of public value (i.e., habitat, open space, historic designation, access, and education). If we would like to consider each of the five categories equally, we can weigh the percentage of total possible points within each category at 20% for a maximum possible score of 100%. Of course, other weighting schemes may be more appropriate, but this can serve as an illustration. Early discussions with stakeholders in the land trust community suggest greater weights should be placed on natural habitat, historic and open space categories, for example. All three scores can be normalized to a percentage of total points obtainable to facilitate cross-comparisons (Table 5).

Category Type	Rating Category	High Value = 3	Medium Value =2	Low Value =1	No Value = 0	Unweighted score	0-1 score	Weighted score
Natural Habitat	Connectivity	✓				3	1	
	Target Species			✓		1	0	
	Vegetative Type	✓				3	1	
	Biodiversity Index		✓			2	1	
	Water Quality	✓				3	1	
Calculation for category weight: (sum of natural habitat scores/15*100) *(0.20)								16
Open Space	Soil Type		✓			2	1	
	AUM Average		✓			2	1	
	Irrigated	✓				3	1	

	Proximity to Scenic Byway				✓	0	0	
	Proximity to State Highway	✓				3	1	
	Connectivity	✓				3	1	
Calculation for category weight: (open space scores/18*100) *(0.20)								14
Historic Designation								
	Centennial Farm or Ranch				✓	0	0	
	Local/State/National Historic Designation				✓	0	0	
	Designated Natural Heritage Area				✓	0	0	
Calculation for category weight: (sum of historic designation scores/9*100) *(0.20)								0
Access								
	Designated Program Access				✓	0	0	
	Allow Outdoor Recreation Access				✓	0	0	
Calculation for category weight: (sum of natural habitat scores/6*100) *(0.20)								0
Education								
	Partnership with schools/non-profits				✓	0	0	
Calculation for category weight: (education score/3*100) *(0.20)								0
Total						25/51	9/17	30/100

Table 5 illustrates the relative scores across three likely weighting schemes. It indicates this parcel scores best (9/17 =53% of total possible points) on the unweighted sum scheme, second best (25/51 = 49%) on the more precise 4-point scale, and least well (30/100 =30%) on the weighted categorical mean scheme. Adoption of one scheme over another therefore may have implications for cost and ease of assessment, but also for prioritization and amount of payment a parcel might receive.

We use current Colorado easement assessments conducted by the Colorado Cattlemen’s Agricultural Land Trust to illustrate scores on actual easements under each of the three approaches. Summary information on the sample of easements used in this analysis is found in Table 6.

Table 6: Summary statistics of existing conservation easements in the sample	
Easements in sample	36
Ranch acres, mean	3,898
Easement acres, mean	590
Parcel appraised value, mean	\$ 1,613,992
Average Federal Payment per Acre, mean	\$ 1,201

A comparison of the average, minimum, and maximum scores assigned to our sample easements illustrates that the scoring systems and the weights assigned to different categories is important (Table 7). For a CCBI index to

be of value to the conservation community it will have to be adaptive to the goals and mission of Colorado Land Trusts, federal, state and local government program managers and agency personnel, and other conservation experts. Potentially, future adaptation, weighting, and payment levels could be an ongoing responsibility of the Conservation Easement Oversight Commission. Careful consideration of the scoring and weighting of different public benefit factors will need to be considered if a CCBI approach were to be implemented. If a CCBI were adopted, periodic revision and refinement would be required to meet Colorado’s evolving conservation objectives in view of emerging data collection capabilities.

	Minimum	Average	Maximum
Yes/No (N=17)	29% (5/17)	47% (8/17)	65% (11/17)
High/Medium/Low/No value (N=51)	14% (7/51)	33% (17/51)	53% (27/51)
Category weights	9%	21%	39%

Differential weighting of categories provides a means to score and rank public conservation priorities. Enrollment and/or payments could follow these scores, or weighted scores, directly or economic valuation values could be assigned to the categories or to the individual factors. In the former case, payments could be assigned per acre-point or per acre-tier. The latter case would further complicate matters by assigning dollars differently to a point earned in ‘habitat,’ say, than one earned in ‘education.’ Payments under this approach could be one time or periodic, and the easement term could be term or in perpetuity, parallel to the opportunity cost approaches.

Each year the CRP program establishes a minimum point threshold for enrollment. For the CRP EBI this threshold is determined by the Secretary of Agriculture. The Conservation Easement Oversight Commission logically could set the threshold value for the CCBI based on available budget and anticipated demand for participation. For this analysis we assign a one-time payment based on a tier level and do not assign a threshold for acceptance. We back calculate a per point value estimate under the three different weighting schemes using the actual federal funding received by each easement (Table 8). The derived per point scores and payments per acre would result in the same total expenditure for private lands as was invested in the sample. The sample easements are divided into three different tiers, based on one standard deviation from the mean score (low, average, and high). For each tier the average per acre payment is calculated based on dollars per point that easements in that tier would receive under each methodology (Table 8).

	Per point value	Low scoring acre	Average acre	High scoring acre
Yes/No (17 pt. scale)	158.54	1,017	1,334	1,612
High/Medium/Low (51 pt. scale)	81.11	746	1,382	1,974
Category Weights (100 pts)	64.14	770	1,352	1,882

Alternatively, the CCBI could use a benefit transfer methodology to provide an easement valuation based upon the public benefits the easement creates and nurtures. Each of the seventeen factors identified in the CCBI has an associated public benefit in dollars per acre or dollars per easement. This dollar benefit could be used to calculate a value based on identified conservation objectives (Table 9). Our sample easements are ranked in each of the seventeen categories based on how much or well they provided each of the identified ecosystem services using the four-level (high, medium, low, none) unweighted scale. By means of illustration, parcels in the higher category are assigned the benefit transfer value while parcels ranked in the medium and low categories are assigned a proportion of the benefit transfer value (60% and 30% respectively).

Appendix A provides more details into each of the categories of benefit transfer values, including the supporting

literature, and these assigned percentages can easily be adapted in a standard spreadsheet. With benefit transfer the value of the conservation easement is derived directly from the estimated ecosystem benefit the land provides, as opposed to a somewhat more arbitrary system based on payment per point, point tier or weighted percentage of desirable attributes. We can use a benefit transfer approach to approximate the public economic value generated from the conserved parcel (e.g., Seidl et al., 2018). In the future, a meta-analysis may provide additional statistical rigor and the potential for including other important dimensions of each individual parcel (e.g., community population and income) to the benefits transfer approach.

	Value			Unit
	Low	Medium	High	
Natural Resources				
Connectivity	131.40	262.80	438.00	Per Acre
Target Species	27.58	55.15	91.92	Per Acre
Vegetative Type	143.70	287.40	479.00	Per Acre
Biodiversity Index	33.68	67.36	112.26	Per Acre
Water Quality	120.55	241.10	401.83	Per Acre
Open Space				
Soil Type	74.10	148.20	247.00	Per Acre
AUM Average	6.89	13.77	22.95	Per Acre
Irrigated	60.44	120.88	201.47	Per Acre
Wildlife Watching				
Proximity to Scenic Byways	146.37	293.02	488.37	Per Acre
Proximity to State Highways	146.37	293.02	488.37	Per Acre
Connectivity	146.37	293.02	488.37	Per Acre
Historic Designation				
Centennial Farm or Ranch			21,997.60	Per Easement
Local/State/National Historic Designation			21,997.60	Per Easement
Designated Natural Heritage Area			21,997.60	Per Easement
Access				
Designated Access Program Participation	24.76	49.51	82.52	Per Acre
Allow Outdoor Recreation Access	292.43	584.86	974.76	Per Acre
Education				
Partnerships with schools/non-profits	9024.00	18048.00	30,080.00	Per Easement

Parallel to the CCBI scenarios, the benefit transfer scenarios are broken into three tiers for the easements in our sample with the tiers determined by one standard deviation from the mean payment. Average benefit transfer payments for the sample easements within each category can be found in Table 10.

Tier	Average Value/acre
Low	\$ 856.30
Average	\$ 1658.23
High	\$ 2649.51

We undertake a parallel analysis to our opportunity cost-based scenario to illustrate our benefits-based scenarios on a hypothetical 1000-acre parcel as follows:

Equation 2: Calculation for payments under public benefits approaches

$$EPV = PB_i - CC$$

Where:

- EPV = Easement Payment Value
- PB_i = Public benefit generated from the land under easement. The public benefits per acre for the Yes/No, High/Medium/Low and Category Weights methods are found in Table 8. The public benefit per acre for the benefit transfer methodology are found in Table 10.
- CC = Conveyance costs, which are identical to the conveyance costs in the market cost scenarios. For this analysis potential costs involved with implementing practices which provide ecosystem services are not considered.

Table 11: Hypothetical 1000-acre parcel: Payment by valuation method and score category of easement, USD2020

	Low	Average	High
Yes/No (17-point scale)	954,000	1,271,000	1,549,000
High/Medium/Low (51-point scale)	683,000	1,319,000	1,911,000
Category Weights (100-point scale)	707,000	1,289,000	1,819,000
Benefit Transfer	793,305	1,596,858	2,589,513

The benefit transfer methodology yields the highest payments for all but the low category parcel where the Yes/No methodology yields the highest payment (Table 11). Comparing Table 11 to Table 3 demonstrates Colorado taxpayers currently are receiving a positive return on their investment since benefit transfer tiered estimated payments are higher than those based on opportunity cost and on the three other benefits-based approaches.

Payment values vary by the weighting schemes across all categories. If a CCBI index is to be implemented care will need to be taken to evaluate which ecosystem services are most valued and to align the scoring system and weights to these values. In addition, landowners may incur costs associated with the provision of ecosystem services that are not internalized in this analysis. Future considerations should investigate the costs to landowners associated with the CCBI benefits index.

Landowners in locations with low land use conversion pressure will benefit from an approach that values the public benefits provided relative to an opportunity cost approach. Valuing public environmental benefits could entice landowners who have high environmental amenities but low land use conversion pressure to engage in conservation easement programs. Landowners in locations with high conversion pressure or who are interested in taking advantage of tax incentives would be better suited using the more traditional opportunity cost approach for the valuation of their easement. A TEV approach would benefit lands with high environmental amenities but would be a more costly method to capture the public environmental benefits provided by the land. Despite the likely expense, it should be included in future discussions of alternative methods for substantiating payments for conservation easements especially for particularly unique or otherwise highly valued properties.

Unbridled program expense is one of the principal concerns with benefits-based approaches. With these calculations we have shown that benefits-based calculations are broadly in line with opportunity cost-based calculations with high public benefits and high conversion pressure having a similar estimated effect on hypothetical parcel payments. Importantly, however, benefits-based approaches protect directly the ecosystem services valued by the public while opportunity cost approaches may not. Ironically, opportunity cost-based

approaches may be better for guiding growth, establishing habitat bridges, community separators, and broader scale ecological benefits and less well-suited conservation at the site level.

Mixed Method Approach

Perhaps the simplest means to combine private opportunity cost and public benefit approaches would be to create a conservation easement market or exchange wherein organizations representing the public interest (e.g., a land trust, GOCO, an open lands department of a city or county) negotiate directly with the landowner for the value of the easement. The minimum a landowner might be expected to accept would be the opportunity cost of the restrictions placed on land management and the maximum the public should be willing to pay is the market value as established by an appraisal of the unencumbered property. Given the relatively small number of annual transactions, ideally, a regular (say, quarterly?) auction hosted by the Department of Conservation bringing together (perhaps virtually) willing buyers and sellers would increase the efficiency of these transactions and reduce the likelihood of collusion, information imbalance or other market-distorting concerns. The CRP bidding/proposal process is a bit like this, with the important distinction that there is only one buyer. The Department of Conservation might put an arbitrary cap of 70-80% of market value in the interests of fiscal responsibility in order to cover the costs of oversights and approval of the transactions. The most important difference between an open real estate market and the conservation easement exchange is that the buyers are acting in the public’s interest, using public funds, and not in the private interest of an individual person or company.

A combined private cost- and public benefit-based method (or perhaps public benefit augmented opportunity cost based approach) can be constructed by assuming our parcels from the opportunity cost estimates have one or more configurations of ecosystem services. The public benefits from land conservation must be greater than the opportunity cost of conveying the easement on the property (the payment to the landowner) or the transaction would not be fiscally responsible. We conceive of an alternative approach that compensates landowners for the opportunity cost of the market potential plus a payment for stewardship of public ecosystem service benefits. In the mixed approach, it is likely the public ecosystem service benefit payments would be predicated on first conveying an easement against the property. This alternative payment method would be defensible on public finance criteria so long as the total payment is less than the total public benefits created. The mixed method would incorporate some proportion of the opportunity cost of development plus some proportion of the environmental benefits from the easement. Conceptually, something akin to a propensity score valuation (PSV) approach could be used in such cases.

Since an example of a PSV is not yet available, we combine the GARC approach (PM2) with the CCBI approach (Yes/No Methodology) for an estimate of the public environmental benefits from privately conserved land. For illustrative purposes Table 12 represents possible payments if easements are valued with equal weight placed on the opportunity cost of development and the public environmental value or CCBI score (50% payment from the GARC value and 50% payment based on CCBI score). The equal proportion assumption would require discussion and calibration to needs if implemented.

Table 12: Hypothetical values from a mixed method approach (GARC and CCBI)			
	<i>Environmental Value</i>		
<i>Market Pressure</i>	Low	Average	High
Low	\$ 710,250	\$ 868,750	\$ 1,007,750
Average	\$ 876,750	\$ 1,035,250	\$ 1,174,250
High	\$ 1,323,000	\$ 1,481,500	\$ 1,620,500

Valuation under this mixed method approach could be set up such that overall valuations and payments are not out of line with the status quo. Importantly, like the benefits driven approaches above, a mixed method approach could produce the added benefit of rewarding the conservation of land that provides greater public ecosystem services benefits. Landowners with high market pressure but lower environmental benefits provision would prefer the status quo approach, but other landowners could benefit from this alternative valuation method. This approach could prove effective at attracting lands which provide environmental benefits, but do not have high appraised value due to low developmental pressure.

Pay for performance

The Conservation Stewardship Program (CSP) could serve as a model for an alternative option that supports the environmental value of the land through the implementation of best management practices. Here we represent CSP payments as in addition to a CCBI or benefit transfer payment that come for a specified time after enrollment, typically a five-year period. CSP payments are based on the implementation of land management practices and payments increase with the perceived degree of conservation resulting from the management practices and/or the adoption of a package or bundle of preferred practices.

For comparison with our market-based evaluation scenarios we again look at a hypothetical 1000-acre parcel, under three different public benefit provisions and assume for simplicity all acres under the easement would receive the same payment:

- Low – Scores in the low tier for each of the methodologies have implemented minimal best practices. This property is in the lowest CSP tier with the minimum payment of \$1,500 per year per operation. Note that this is not acre based but a minimum per operation. On our hypothetical operation this would translate to \$1.50 per acre-yr.
- Average - Scores in the middle tier for each of the methodologies. Adoption of several best management practices to receive the average CSP conservation practice payment of \$18,000 per operation-yr, or \$18 per acre-yr
- High – Scores in the high tier for each of the methodologies. Adoption of a forest-related best management practices bundle including forest stand improvements to benefit wildlife habitat and soil quality, structures to enhance wildlife habitat and creating pollinator habitat to receive the maximum payment of \$40,000 per operation-yr, or \$40 per acre-yr on our hypothetical operation.

Conclusions and Future Steps

Conservation easements are an important tool to help guide Colorado's evolving land use mosaic benefiting landowners and the taxpaying public alike. The current method for valuation of conservation easements is limited to the opportunity cost of lost development potential through an appraisal. Appraisals can be costly and do not consider the public ecosystem benefits that private working lands and other landscapes provide. An alternative method for valuation may complement the current appraisal approach and increase both participation in Colorado conservation easement programs and the benefits Colorado residents receive from land conservation. A review of the literature and current conservation landscape in the United States led to the development of scenarios intended to increase access and opportunity to rural landowners while enhancing the returns to public investment in private lands conservation.

Scenarios are split into two approaches: the opportunity cost approach and the public benefits approach. Alternative opportunity cost approaches provide options within the current market pressure framework to landowners with which appraisal costs prevent participation in conservation easement programs. The public benefits approach allows for the expansion of valuation beyond the market value of the land, to look at a larger picture of the amenities that the land provides.

Under the status quo landowners in locations without current market pressure have little incentive to participate

when participation could provide large returns to the public in the form of ecosystem services protection. An alternative approach is needed to provide access to these landowners. However, under no conditions should the state pay more than the value of the parcel in the open real estate market as proxied by the total appraised value, regardless of the public values generated. If public values exceed the market price, in the interests of fiscal responsibility the state or its proxy should purchase the property and potentially lease it back as a private or public conservation property and/or work with the landowner to capture some of the public value through recreational or cultural enterprises. This could provide a fly-in-the-ointment for participation of low market pressure-high public value parcels.

The payoff matrix facing each landowner depends on the characteristics of current land conservation programs, including pre-participation tools, changes in differential taxation rates, and in the income tax credit rate. While not included in our scenarios, pre-participation tools, like the financial and technical assistance programs to support planning and implementation of best practices used EQIP and CSP, provide additional incentive for landowners to convey a conservation easement by lowering the barriers to program participation, particularly for small operation landowners. Further research into alternative methods for substantiating payments for conservation easements could explore how the inclusion of pre-participation tools may increase enrollment in the program and/or reduce the costs of engagement.

To create realistic scenarios, we consider a wide range of potential options from the status quo to zoning. While zoning would reduce the public costs of land conservation it was removed as a tool for an alternative valuation approach as it would reduce the private benefits to landowners and probably face legal challenges as a 'taking.' We excluded annual payments except for the pay-for-performance scenarios and term easements or contracts from the feasible alternatives to reflect the current needs and priorities of Colorado stakeholders. We describe specific scenarios that could be chosen to provide conservation benefits to Colorado's landscape. Further research could include Total Economic Valuation based upon willingness to pay of taxpayers in Colorado and deeper geographic analysis of land needs across Colorado's varied landscapes. We do not propose that these alternatives are the only options, but they potentially provide a suitable suite of conservation easement program incentives for the State of Colorado.

These scenarios consider alternative methods to estimate the opportunity cost of lost market potential as well as methods for estimating the public environmental value of the conservation easement. These alternative valuation approaches, in addition to the current approach, could improve Colorado conservation easement programs by providing additional options for landowners who may have had inadequate incentive to participate previously. Landowners in locations with little market pressure but high public environmental benefits provision would certainly support an alternative that values public benefits. Landowners in locations with high market conversion pressure would receive greater payments under the status quo and likely would not benefit from an alternative approach. Adoption of an alternative method for substantiating payments for conservation easements would incentivize a more geographically and environmentally diverse portfolio of conserved land in the state and potentially improve the efficiency of the program, providing benefits to landowners and taxpayers. Colorado taxpayers and landowners would benefit from an alternative approach to conservation easements that valued both the opportunity costs of development as well as the public benefits from land conservation. Implementation of an alternative approach could allow Colorado to continue to conserve our valuable private working land assets while maintaining fiscal control over the size of the conservation easement program.

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References

- 26 U.S. Code 170 – Charitable, etc., contributions and gifts. (I.R.C.) § 170(b)(1)(E). (U.S.A) Legal Information Institute. Accessed 2.11.2020.
- Agricultural Act of 2014 H.R. 2642 (2)(D) (2014). U.S.A. <https://www.congress.gov/bill/113th-congress/house-bill/2642>
- Akerlof, G.A. (1970). *The Market for 'Lemons': Quality Uncertainty and the Market Mechanism*. Quarterly Journal of Economics. The MIT Press. 84 (3): 488–500. doi:10.2307/1879431.
- Air Resources Board (2019). *ARB Emissions Trading Program. California Environmental Protection Agency Air Resources Board Cap-and-Trade Program*. Retrieved from https://ww3.arb.ca.gov/cc/capandtrade/guidance/cap_trade_overview.pdf.
- Audubon Conservation Ranching (2017). *Program Protocols*. Audubon. Retrieved from https://www.audubon.org/sites/default/files/conservation_ranching_protocols_sep2017.pdf.
- Bergstrom, J., Dillman, B., & Stoll, J. (1985). *Public Environmental Amenity Benefits of Private Land: The Case of Prime Agricultural Land*. Journal of Agricultural and Applied Economics, 17(1), 139-149. doi:10.1017/S0081305200017155.
- Boulder County (2019). *Transferable Development Rights (TDR) FAQs*. Boulder County. Retrieved from <https://www.bouldercounty.org/propertyandland/landuse/planning/transferable-development-rights-tdr/>.
- California Air Resources Board (2012). *Cap-and-Trade Regulation Instructional Guidance*. Retrieved from <https://ww3.arb.ca.gov/cc/capandtrade/guidance/chapter1.pdf>.
- California Air Resources Board (2019). *Cap-and-Trade Program Summary of California-Quebec Joint Auction Settlement Prices and Results*. Retrieved from https://ww3.arb.ca.gov/cc/capandtrade/auction/results_summary.pdf.
- Cheever, Frederico, & Nancy A. McLaughlin (2015). An Introduction to Conservation Easements in the United States: A Simple Concept and a Complicated Mosaic of Law. Journal of Law, Property, and Society, (107) 108-186. https://digitalcommons.du.edu/cgi/viewcontent.cgi?article=1033&context=law_facpub
- Clarion Associates (2005). *The Economic Benefits of Historic Preservation in Colorado 2005 Update*. The Colorado Historical Foundation. Retrieved from <https://www.preservationbenefitscolorado.com/sites/preservationbenefitscolorado.com/files/document/pdf/Economic%20Benefits%202005.pdf>.
- Colorado Cattlemen's Agricultural Land Trust (2019). *The Costs and Benefits of Conservation Easements*. Retrieved from https://ccalt.org/assets/files/Costs_Benefits_of_Conservation_2019_Final.pdf.
- Colorado Coalition of Land Trusts (2010). *A Conservation Easement Appraisal Guide*. Retrieved from <https://www.uwyo.edu/law/centers/rural-law-center/conservation-easement-conference/weston%20ccalt%20appraisal%20guide%206-01-04%20updated%2020101.pdf>.
- Colorado Department of Regulatory Agencies (2019). *Division of Conservation: About Tax Credit Certificates*. Retrieved from <https://www.colorado.gov/pacific/dora/division-conservation-about-tax-credit-certificates>.
- Colorado Parks and Wildlife. (2020). *Hunting*. Colorado Parks and Wildlife. Retrieved from <https://cpw.state.co.us/placestogo/Pages/Hunting.aspx>
- Credit Against Tax – Conservation Easements 2000-2019* (C.R.S.) § 39-22-522 (U.S.A.).
- ELD Initiative (2015). The value of land: Prosperous lands and positive rewards through sustainable land management. https://www.eld-initiative.org/fileadmin/pdf/ELD-main-report_05_web_72dpi.pdf
- Environmental Protection Agency (2010). *Guidelines for preparing economic analyses (Chapter 6)*. Retrieved from <https://www.epa.gov/sites/production/files/2017-09/documents/ee-0568-06.pdf>.
- Great Outdoors Colorado (2017). *What is a Conservation Easement?* Retrieved from <http://www.goco.org/blog/what-conservation-easement>.
- Great Outdoors Colorado (2018). *Annual Report 2018*. Retrieved from http://www.goco.org/sites/default/files/GOCO_AR2018_F1_web.pdf.
- Heimlich, Ralph. (2003). Water Quality Impacts of Agriculture. *Agricultural Resources and Environmental Indicators, 2003*. Retrieved from <https://www.ers.usda.gov/publications/pub-details/?pubid=41965>.

- Great Outdoors Colorado (2019). *Grants*. Retrieved from <http://www.goco.org/grants>.
- Hellerstein, Daniel M. (2015). The US Conservation Reserve Program: The Evolution of an Enrollment Mechanism. *Journal of Land Use Policy*, (63), 601-610. <https://doi.org/10.1016/j.landusepol.2015.07.017>.
- Johnson, J. and Clark, R. (2000). The Conservation Reserve Program. Farm Foundation. Oak Brook Illinois <https://www.afpc.tamu.edu/research/publications/259/jbjohnson.pdf>.
- Lachman, B., Resetar, S., Kalra, N., Schaefer, A., & Curtright, A. (2016). Water Market Mechanisms. In *Water Management, Partnerships, Rights, and Market Trends: An Overview for Army Installation Managers* (pp.127-188). RAND Corporation. Retrieved May 22, 2020, from www.jstor.org/stable/10.7249/j.ctt1btc12f.13.
- Magnan, Nicholas, Andrew F. Seidl & Loomis, John B. (2012). *Is Resident Valuation of Ranch Open Space Robust in a Growing Rural Community? Evidence from the Rocky Mountains*, *Society & Natural Resources*, 25:9, 852-867, DOI: 10.1080/08941920.2011.642459.
- Martín-López, Berta, Montes, C., & Benayas, J. (2008). *Economic Valuation of Biodiversity Conservation: The Meaning of Numbers*. *Conservation Biology*, 22(3), 624-635.
- Mellinger, A., Rashford, B., Smutko, L., Lieske, S., & Sawyer, H. (2012). *Economic and ecological tradeoffs of targeting conservation easements for habitat protection: A case study of Sublette County, Wyoming*. ProQuest Dissertations Publishing. Retrieved from <http://search.proquest.com/docview/1112252719/>.
- Natural Resources Conservation Service (2019). *Wetlands Reserve Program: Financial Information, Conservation Agreements, Conservation Practice Implementation Reports*. Retrieved from https://www.nrcs.usda.gov/Internet/NRCS_RCA/reports/fb08_cp_wrp.html.
- National Sustainable Agriculture Coalition (2019). *Conservation Stewardship Program*. Retrieved from <https://sustainableagriculture.net/publications/grassrootsguide/conservation-environment/conservation-stewardship-program/>.
- National Sustainable Agriculture Coalition (2019). *Regional Conservation Partnership Program*. Retrieved from <https://sustainableagriculture.net/publications/grassrootsguide/conservation/environment/cooperative-conservation-partnership-initiative/Nebraska>.
- Natural Resources Conservation Service (2011). *Wetlands Reserve Program*. United States Department of Agriculture NRCS. Retrieved from http://www.nwd-mr.usace.army.mil/rcc/MRFTF/docs/WRP_factsheet_2011press.pdf.
- Pearce, D. W., & Moran, D. (1994). *The Economic Value of Biodiversity*. Earthscan. Retrieved from <https://www.cbd.int/financial/values/g-economicvalue-iucn.pdf>.
- Pimentel, D., Harvey, C., Resosudarmo, P., Sinclair, K., Kurz, D., McNair, M., ... & Blair, R. (1995). Environmental and Economic Costs of Soil Erosion and Conservation benefits. *Science*, 267(5201), 1117-1123.
- Qualified Conservation Contributions*. (I.R.C.) § 170A-14(d)(1). (U.S.A).
- Rondeau, R., K. Decker, J. Handwerk, J. Siemers, L. Grunau, and C. Pague. (2011). *The State of Colorado's Biodiversity*. Prepared for The Nature Conservancy by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado. Retrieved from http://www.cnhp.colostate.edu/download/documents/2011/Scorecard_march1_2012_final.pdf.
- Seidl, A., Anderson, D., Bennett, D., Greenwell, A. and M. Menefee. (2017). *Colorado's return on investments in conservation easements: Conservation Easement Tax Credit Program and Great Outdoors Colorado*. Colorado State University, Fort Collins, Colorado. Retrieved from https://warnercnr.colostate.edu/wp-content/uploads/sites/2/2017/07/ColoradoStateU_CE-ROI-study_web.pdf.
- Seidl, A., Schwartzenhuber, R., and Hill, R. (2018). *Public Benefits of Private Lands Conservation: A Summary of Alternative Compensation Estimates*. Colorado State University, Fort Collins, Colorado. Retrieved from <https://hdl.handle.net/10217/192782>.
- Southwick Associates. (2017). *The 2017 Economic Contributions of Outdoor Recreation in Colorado: A Regional and County-Level Analysis*. Colorado Parks and Wildlife. Retrieved from https://cpw.state.co.us/Documents/Trails/SCORP/2017EconomicContributions_SCORP.pdf.
- Sueltenfuss, J., Cooper, D., Knighe, R. and Waskom R. (2013) *The Creation and Maintenance of Wetland Ecosystems from Irrigation Canal and reservoir Seepage in a Semi-Arid Landscape*. *Wetlands* 33, 799-

- The City of Fort Collins Colorado Natural Areas (2019). *Fort Collins Natural Areas Department Annual Reports*. Retrieved from <https://www.fcgov.com/naturalareas/naars.php>.
- The City of Fort Collins Colorado Natural Areas (2018). *Fort Collins Natural Areas Department Annual Reports*. Retrieved from <https://www.fcgov.com/naturalareas/naars.php>.
- The City of Fort Collins Colorado Natural Areas (2017). *Fort Collins Natural Areas Department Annual Reports*. Retrieved from <https://www.fcgov.com/naturalareas/naars.php>.
- The Katoomba Group, Forest Trends, and UNEP (2008). *Payments for Ecosystem Services Getting Started: A Primer*. Forest Trends and the Katoomba Group. Retrieved from https://www.forest-trends.org/wp-content/uploads/imported/getting-started_english-pdf.
- United States Department of Agriculture, Farm Service Agency. (2018). *CRP Enrollment and Rental Payments by State 1986-2018* [Database]. Retrieved from <https://www.fsa.usda.gov/programs-and-services/conservation-programs/reports-and-statistics/conservation-reserve-program-statistics/index>.
- United States Department of Agriculture, Natural Resources Conservation Service. (2019). *Conservation Stewardship Program*. United States Department of Agriculture, Farm Service Agency Natural Resources Conservation Service. Retrieved from <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/>.
- United States Department of Agriculture, Natural Resources Conservation Service. (2019). Environmental Quality Improvement Program. United States Department of Agriculture, Farm Service Agency Natural Resources Conservation Service. Retrieved from <https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/financial/?cid=nrcseprd1328426>.
- United States Department of Agriculture, Farm Service Agency. (2019). *Conservation Reserve Program*. United States Department of Agriculture Farm Service Agency. Retrieved from <https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index>.
- United States Fish and Wildlife Service (2016). *2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*. https://www.fws.gov/wsfrprograms/subpages/nationalsurvey/nat_survey2016.pdf
- United States Fish and Wildlife Service. (2008). 341 FW 6: Minimally Restrictive Conservation Easement Acquisition. United States Fish and Wildlife Service. Retrieved from <https://www.fws.gov/policy/341fw6.html>.
- United States Forest Service Pacific Northwest Region (1990). *Final Environmental Impact Statement: Land and Resource Management Plan: Winema National Forest (Vol. 2)*. US Department of Agriculture, Forest Service, Pacific Northwest Region.
- United States Geological Survey (2019). *Benefit Transfer Toolkit*. USGS Benefit Transfer Toolkit. Retrieved from <https://sciencebase.usgs.gov/benefit-transfer/>.
- Watkins, K. (2017). Memorandum: Colorado Conservation Easement Tax Credit Program. Retrieved from https://leg.colorado.gov/sites/default/files/images/lcs/conservation_easement_program_ip_memo_6052017.pdf.
- Wunder, S. (2005). *What are "Payments for Environmental Services?"*. Center for International Forestry Research: Payments for Ecosystem Services (PES). Retrieved from <https://www.cifor.org/pes/ref/about/index.htm>.

Appendix A: Benefit transfer values and definitions

The benefit transfer values adopted here were adapted from the existing literature for the purposes of this analysis and adjusted to 2020 dollars. All benefit transfer values are estimates that increase in accuracy with the similarity of the transfer site to the source study site. A 5% discount rate was imposed when a present value or annualized value was required. If Colorado were to implement a benefit transfer-based approach a comprehensive and detailed initial analysis and stakeholder process to establish the accepted values and regular periodic updates are strongly recommended. Here we adopt the following benefit category definitions and transfer values:

1. Connectivity is seasonal or bridging habitat for game and migratory species. This benefit translates into hunting values in the state of Colorado. The United States Geological Survey's Benefit Transfer Toolkit provides economic value estimates on hunting in the state of Colorado (United States Geological Survey, 2019). The average number of days of hunting and the average WTP for hunting from the Benefit Transfer Toolkit are used to estimate a value of \$438.00 per acre of connectivity. United States Geological Survey (2019). Benefit Transfer Toolkit. USGS Benefit Transfer Toolkit. <https://sciencebase.usgs.gov/benefit-transfer/>.

2. Vegetative Type of a land parcel can provide several valuable ecosystem services. The value of vegetative type is adopted from annual ecosystem service per acre values calculated *Public Benefits of Private Land Conservation: A Summary of Alternative Compensation Estimates* (Seidl, Schwartzenruber, and Hill, 2018). Here, this value was calculated using a combination of forested land and wetland values to arrive at \$479 per acre. For this analysis the CCBI High/Medium/Low categories are used. More options could be considered where the landowner instead values their parcels' unique vegetative profile.

3, 4. Target Species and Biodiversity are species of ecological importance to Colorado and its surrounding areas, according to the 2011 biodiversity scorecard in *The State of Colorado's Biodiversity* (Rondeau et al., 2011). To value these species, we evaluated the willingness to pay values observed in *The Economic Valuation of Biodiversity Conservation: The Meaning of Numbers* (Martín-López, Montes, and Benayas, 2008). The value of \$112.26 per acre (adjusted to 2020 dollars) is calculated using the average per person willingness to pay from Berta et al., extrapolated to the Colorado population and conserved acres.

5. Water Quality value was addressed through an avoided cost approach. Agricultural practices can have important effects on water quality and these water quality effects are costly to society. We use damage estimates from the Economic Research Services report *Water Quality Impact of Agriculture* to calculate the value of implementing water quality best practices in terms of avoided costs. Table 2.3.3 of the report highlights costs of water quality damages to society. The value of damage due to soil erosion, health costs and recreational damages are summed (adjusted to 2020 dollars) and divided by the total agricultural acreage in the U.S to come up with a per acre value of \$39.50.

6. Soil quality affects erosion control, the vitality of habitats, and other ecosystem services. This average cost of erosion from agriculture in the United States is used, calculated in *Environmental and Economic Costs of Soil Erosion and Conservation Benefits* (Pimentel et al). The per acre value is \$247.

7. AUM Average ecosystem services values were found in the United States Department of Agriculture's Forest Service's publication "Draft Environmental Impact Statement, proposed Land and Resource Management Plan, Fremont National Forest" volume three. In the publication they state: "Based on the information provided in the RPA 1985 Program analysis for the DEIS and a Regional Office Memo (2340, 9/30/83), the AUM value for the Fremont National Forest in 1982 dollars is \$8.44" (B-53). Using the United Bureau of Labor Statistics CPI Inflation Calculator this translates the \$8.44 to \$22.95 in 2020 dollars.

8. Irrigation return flows have been shown to help support wetlands. Sueltenfuss et al. (2013) mapped wetlands in Northern Colorado and found that agricultural were contributed to 89% of wetlands in the study area. Wetland

systems are complex and while 89% of wetlands in the study were supported by agricultural waters not all of the benefits of the wetland can be attributed to irrigation return flows. We assign 25% of the wetland ecosystem services value to irrigation return flows. The per acre wetland values found in Seidl et al., 2018 were used as the irrigation benefit transfer value of \$201.47 per acre.

9, 10, 11. Wildlife Watching was valued using the 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation data for Colorado to better understand the population's willingness to pay (WTP) for observing wildlife through the amount they spend per trip (United States Fish and Wildlife Service, 2016). An estimated value of \$488.37 is used for all three categories (i.e., proximity to scenic byways, proximity to state highways and connectivity) of wildlife watching in the CCBI.

12, 13, 14. Historic Designation was estimated from the amount of historical preservation spending and the number of historical landmarks in the U.S. They are used to calculate an average of 32 cents a person per year in the State of Colorado. The benefits of historic designation are calculated on per designation, as opposed to per acre. Using the spending values and the number of historical sites in Colorado this analysis uses a value of \$21,997.60 per designation in perpetuity (Clarion Associates, 2005). Due to the nature of Historic Designations an easement either has one or does not. Thus, the valuation for this category is Yes/No rather than High/Medium/Low.

15. Designation Access Program Participation is a program in Colorado that brings together landowners and recreators to provide improved hunting grounds in the state. Hunting revenue is estimated by Southwick Associates (2017, pg 8) for Colorado Parks and Wildlife. Evaluation in proportion to huntable acreage in Colorado yields an estimate of \$82.52 per acre in value to the State of Colorado in 2020 dollars.

16. Outdoor Recreation Access is evaluated using the Economic Value of Biodiversity study by Pearce et al. (1994) (pg. 63-64). This study estimated the net economic values per recreation day from travel cost and contingent valuation studies from 1968 to 1988. Values are corrected to 2020 dollars to find an estimated willingness to pay per acre for outdoor recreation. The value of \$947.76 per acre is used for the benefit transfer value.

17. Education for the environment is a longstanding Colorado tradition that today is largely supported by Great Outdoors Colorado (GOCO). GOCO's Inspire Initiative's funding for outdoor education in proportion to the population of actively engage youth in Colorado reveals an annual payment of \$30,038 in perpetuity. Great Outdoors Colorado (2019). *Generation Wild*. <https://www.goco.org/grants/apply/generation-wild>. In the analysis this payment is made to the property owner on a per easement basis rather than a per acre basis.

