CARBON CAPTURE, SEQUESTRATION, AND STORAGE IN WASHINGTON STATE PARKS: A REVIEW OF RELEVANT POLICY AND PROJECT FEASIBILITY

Submitted by

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Abstract

Successful examples of carbon capture and sequestration/storage (CCS) projects within voluntary carbon markets exist throughout the country. This paper examines policies related to the Washington State Parks and Recreation Commission (PARKS), state agency funding, greenhouse gas emissions, cap-and-trade markets, and carbon offset registries to determine the feasibility of providing compensation to PARKS for the ecosystem service of carbon sequestration that occurs on lands the agency manages. It compiles supporting evidence for the utilization of Washington's state parks as carbon storage banks to help achieve greenhouse gas emission targets, generate agency funding, or operate as a buffer pool for unforeseen carbon storage losses in other CCS programs. It identifies guidelines and establishes a framework for carbon offset project planning applicable to agency policy and operations; addresses the gap in research between CCS project design and PARKS emission goals; planning procedures, and budget policies, and identifies challenges in implementing CCS projects in state parks. To be successful, CCS offset projects within state parks must address concerns of certification, additionality, disruptions, and permanence of carbon stocks. PARKS' demonstrated ability to operationalize core stewardship values and conservation policy that supports stable carbon pools in forests across the diverse landscape of Washington make them an ideal CCS project manager.

Introduction

The Kyoto Protocol's Clean Development Mechanism (CDM) and Land Use, Land-Use Change and Forestry (LULUCF) framework identifies carbon sequestration as a means to reducing greenhouse gases (GHG) that contribute to global warming. The ability of forests to perform the ecosystem service of carbon capture and sequestration/storage (CCS) is well documented in academic literature. Supporting land management that promotes CCS in growing

forests can contribute to local, state, and national GHG reduction strategies. Research and application procedures addressing CCS project capabilities in Washington state parks has not been explicitly addressed in academic literature. This paper provides an overview of cap-and-trade markets, carbon offset registries, independent certification organizations, and consulting organizations to provide a CCS project model that can be utilized in research and development of a pilot project. It reviews relevant policy, financing procedures, and organizational priorities of the Washington State Parks and Recreation Commission (PARKS). It also reviews the benefits of the ecosystem service of GHG sequestration, applicable regulatory policy, agency conservation planning and management policy, examples of good practices in both project design and credit certification protocols, and CCS project challenges to demonstrate the feasibility of a PARKS CCS offset project. PARKS is required to make the necessary administrative decisions to comply with state and federal conservation management regulations and GHG emission targets. However, the agency is not compensated for the value of the ecosystem service of sequestering carbon in a stable, long-term carbon reserve that occurs as a result of management practices. Organizing a funding mechanism that compensates PARKS for carbon sequestration occurring in state park forests supports agency priorities, eases the tax burden for budget allotments, contributes to satisfying state and agency climate goals, and combats negative externalities of climate change.

PARKS is tasked with the scientific management, conservation, and preservation of diverse natural resources, fragile ecosystems, and unique landscapes throughout Washington. The updated 2014-2019 State Park Strategic Plan lists a core value PARKS is committed to as "stewardship that preserves the state's natural and cultural heritage in perpetuity." The plan affirms that "Commission-managed lands represent the greatest concentration of species of

conservation concern... held by any public or private entity in Washington (3).” It describes establishing preservation and restoration priorities as a central challenge to maximizing positive impacts of parks on people, and minimizing negative impacts of people on parks and resources (6). The agency includes over 120,00 acres in 125 parks across the diverse landscape of Washington. It is responsible for managing “19,800 acres of wetlands, 2.1 million lineal feet of riparian habitat and 15,800 acres of significant habitat supporting rare plants, animals or both… 4,799 acres of Natural Area Preserves and 13,173 acres of Natural Forest Areas (3).”

In the Strategic Plan, PARKS Director Don Hoch states “a modest increase in public financing has helped us move toward health and stability (1)” for the 2015-2017 budget planning period. From 2009 to 2015, PARKS more than doubled their earned revenue, resulting in 80 percent sourced from fees, donations, leases, etc., and 20 percent from tax sources. He states that PARKS mission “includes caring for a diverse array of natural and cultural resources that are iconic and essential to the heritage of our state, yet do not generate revenue (1).” A 2015 study by Earth Economics estimates the agency generates a state economic contribution of approximately $1.4 billion, and state general fund tax receipts valued at $64 million. PARKS’ role as "learning laboratories for natural and cultural heritage (6),” their ability to prioritize and account for environmental considerations, and their expertise in facilitating park planning and resource management demonstrate the competence of the agency. Their core values, capabilities, and experience position them to be well suited as an administrator and partner for projects organized to generate revenue from ecosystem services that require long-term commitments and detailed design.

Establishing a detailed, CCS emissions reduction strategy should be a priority for PARKS policy development to assist in their goals of promoting natural resource stewardship and

generating sustainable funding. Gren and Aklilu (2016) discuss challenges associated with heterogeneity and standards of additionality for CCS projects. They identify that "the value of a unit uncertain carbon sink is lower than that of a unit certain emissions reduction when the policy maker is risk-averse (130)." CCS policy design must address the fact that "the impact of carbon sequestration is site-specific and depends on factors such as soil quality, tree species, and local climate (129)." It is likely that this requirement will complicate attempts to create a universal policy framework because it will fail to address variability across PARKS lands. However, landscape diversity may insure PARKS for unique challenges of CCS projects. CCS projects must identify and account for uncertain areas of carbon sequestration among other areas of fixed GHG reduction. Agreements for sequestration estimation can be determined within individual park contracts, as well as diffused across the state parks system in aggregated, joint contracts.

Methodology

I researched peer reviewed literature concerned with CCS and Payments for Ecosystem Services (PES) project design, publicly available PARKS and state policy documents and websites, and carbon market-related organization websites and publications to investigate PARKS CCS project viability, design guidelines, and conclusions. I conducted brief interviews and discussions with several PARKS employees in the PARKS Stewardship, Policy and Governmental Affairs, and GIS offices. Initial research reviewed literature and applicable data to determine the current state of PARKS policy as it pertains to generating offsets in existing carbon markets. Identifying gaps in policy planning and academic research directed the review of regulation, administrative code, state and agency emission policy, and CCS project requirements. Official policies and agency functions that promote or challenge the development of emission offset projects were identified. Funding requirements and limitations of PARKS operations

guided research towards programs and organizations capable of supporting PARKS CCS project development. Combining multiple offset project's structural requirements, good practices, and applicability to agency protocols assisted the development of a general policy model.

Presenting an alternative management plan that includes a CCS project required research of carbon sequestration quantification methods applicable to PARKS. Saint Edward State Park is a 326-acre park with second-growth forests surrounded by urban development. I reviewed the 2008 Saint Edward State Park Management Plan, the Saint Edward State Park ball field project SEPA checklist, the City of Kenmore's project application website, and field measurement guidelines from the National Forest Service and related academic literature. Project parameters applicable to Saint Edward State Park lands were established. I calculated the potential amount of annual sequestration of carbon and associated values within those parameters to demonstrate a rudimentary example of a CCS project. Suggestions for PARKS actions and additional research were included as final conclusions.

Literature Review

There is a large body of research pertaining to assessment, funding mechanisms, and policy implications related to CCS. Research examining ecosystem services has produced a large body of literature and useful accounting models. The application of carbon storage projects in state parks, particularly in Washington, has not been explicitly addressed in academic literature and agency policy. The article "Policy design for forest carbon sequestration: A review of the literature" by Gren and Aklilu discusses literature and policy design for CCS project opportunities. It outlines the significance of carbon sequestration by forests through addressing current literature, policy design models, critiques, and the benefits of the various ways of addressing increasing GHG in the atmosphere. The article discusses successes and challenges

within policy frameworks, accounting models, and standards of additionality, and addresses contract design models to provide a foundation for the current state of academic literature and opinions about CCS projects. They review a study by Kim, et al 2008 that identifies a “time perspective.” to reduce uncertainty in sequestration. Determining a “perfect offset” over a contract length and including potential uncertainties in the market price of carbon offsets can be designed into offset project policy and contracts. This article compiles a large amount of evidence to suggest that carbon offset projects are viable and cost effective for reducing carbon emissions and subsequent externalities of increasing GHG levels.

Aldy and Stavins’ "The promise and problems of pricing carbon: Theory and experience” reviews research and pricing mechanisms to make policy suggestions for impactful carbon pricing that support a market approach to carbon reduction. The article examines carbon taxes, cap-and-trade markets, emission reduction credits, clean energy standards, and fossil fuel subsidy elimination projects as possible GHG emission reduction policy instruments. The authors identify that effective climate change policy can be accomplished if policy can “(a) mandate businesses and individuals to change their behavior regarding technology choice and emissions; (b) subsidize businesses and individuals to invest in and use lower emitting goods and services; or (c) price the greenhouse gas externality, so that decisions take account of this external cost (153).” Pricing carbon emissions will support lowest cost emission reduction solutions by internalizing costs of emission externalities. WA State policy is continually progressing closer to imposing a state-wide price on carbon and emission cap compliance regulation. PARKS is well-suited to benefit from market incentives established by pricing GHG emissions.

Law et al.’s "Land use strategies to mitigate climate change in carbon dense temperate forests” attempts to define the best mitigation strategies for meeting GHG emission goals of the

Paris Agreement. The article accounts for broad interacting factors to determine various ways to mitigate carbon emissions. The authors compiled evidence of successful strategies in forest management models and developed and quantified a sequestration framework with multiple reduction strategies that could optimize sequestration potential in the Pacific Northwest. Results indicate that "the spatial variation in the potential for each mitigation option to improve carbon stocks and fluxes shows that the reforestation potential is highest in the Cascade Mountains…(4)." The authors conclude that "alterations in forest management can contribute to increasing the land sink and decreasing emissions by keeping carbon in high biomass forests, extending harvest cycles, reforestation, and afforestation (5)."

The diverse nature of Washington's state parks create potential for multiple forms of CCS projects as sources of carbon offsets, or insurance against unforeseen disasters, such as flood or fire, that reduce the carbon stock in other CCS projects. In *"Forests, Carbon and Climate Change: A Synthesis of Science Findings,"* Von Hagen and Burnett focus on the structure of incentivization policies within a market-based, greenhouse gas regulatory system. Chapter eight, entitled "Emerging Markets for Carbon Stored by Northwest Forests," outlines four mechanisms for compliance with regulation to include: (1) internal emissions reductions, (2) purchase of allowances in an auction, (3) trading of allowances, and (4) purchase of project-based emissions reductions, also known as "carbon offsets" or "carbon credits." The authors provide evidence that emissions trading is well established as a viable option for reducing greenhouse gas buildup in the atmosphere. Carbon sequestration in forests address concerns of affordable, feasible offset projects by creating the least costs for offsetting GHG emissions. Utilizing the ecosystem service of carbon storage provided by forests protected under PARKS policy, for example, is cost effective because it organizes accounting for an existing offset mechanism and management

strategy. Von Hagen and Burnett indicate that “by directing funding from emitters to those who are most able to deliver mitigation cost-effectively, offsets are critical to maximizing the non-climate goods and services that we all really want (140).”

Thamo et al.’s "Dynamics and the economics of carbon sequestration: common oversights and their implications” reviews methods to estimate for carbon sequestration projects and challenges associated with their dynamic nature. The authors identify major elements in CCS planning and state “the cost of sequestration cannot be estimated without making (implicitly or explicitly) assumptions about the fate over time of three key factors: (i) the price of carbon; (ii) the opportunity cost of diverting land from its current use to one with higher carbon sequestration; and (iii) the rate of sequestration on land that has been converted (1096).” PARKS must consider the variability of these factors and prepare for dynamic carbon prices to influence project functionality. Section 2.2, “Process for determining the economics of sequestration” outlines their four step procedure for determining a break even carbon price. This process calculates the price of carbon by multiplying price by mass of stored carbon, converts the result into an annual payment amount over a specified period, and places this amount equal to opportunity costs to determine break even carbon prices. The authors examine a case study to determine variability in expected carbon prices to determine that “the use of dynamic rather than constant sequestration rates in a policy or scheme will, ceteris paribus, lead to the wider uptake of sequestration at a lower carbon price (1106).” They conclude that estimates of mitigation costs are sensitive to the dynamics of carbon price, opportunity costs of CCS projects, and the dynamics of sequestration. PARKS would have to account for new project transaction and consultation costs, but can mitigate some uncertainties because of existing practices in policy and park planning procedures. Having a variety of operating revenue sources and diverse land

holdings that are not part of CCS project lands are highly favorable attributes for reducing discounting and price dynamism in CCS projects and can reduce risks by acting as insurance for investors.

Law and Waring provide an overview of research observations in Pacific Northwest regional forests in "Carbon implications of current and future effects of drought, fire and management on Pacific Northwest forests." The article provides information about regional carbon storage potential and implications of policy attempting to account and plan for future regional carbon stocks. The article provides evidence of positive CCS policy benefits, regional research observations, and rotational management data that demonstrate the scalability of policy and methodology of offset projects. The article indicates that “carbon stocks are higher in older forests, while younger forests take up carbon at a faster rate per unit of ground area (6),” but more increasing evidence supports the potential for carbon to accumulate in biomass for hundreds of years, citing an old growth Washington Douglas fir forest that continues to sequester carbon annually. The authors determine that “cool, temperate, moist forests can attain higher biomass carbon than tropical and boreal forests (6).” They conclude that “there is considerable potential for increasing carbon sequestration in PNW forests by using longer rotations, particularly in those forests dominated by Douglas fir in climatically buffered areas, because they can continue, if undisturbed, to accumulate carbon for centuries (12).”

Gray and Whittier’s "Carbon stocks and changes on Pacific Northwest national forests and the role of disturbance, management, and growth” reviews the benefits of carbon stocks within national forests in the Pacific Northwest, making their conclusions regionally relevant. The article analyzes data to determine changes in regional carbon stocks and present the challenges of quantifying estimates to argue for the necessity of improved measurements and quantification

models for carbon pool accounting that complement Thamo et al's suggestion for dynamic price accounting. The study estimated regional woody carbon content to determine that "C density across all pools increased by 1.2 ± 0.05 Mg/ha/yr in undisturbed forests.." and "in forestlands experiencing cutting, C density across all pools declined by 1.3 ± 0.2 Mg/ha/yr (171)." Their results reveal the influence of regional drivers and indicated "C density was substantially greater on westside than on eastside NFS forests (171)," but high levels of variation occurred due to various local factors (172). The article complements Law and Waring's conclusions, and provides empirical support for the feasibility of PARKS CCS projects in smaller, undisturbed plots in western Washington.

Viable and sustainable PARKS CCS projects require dedicated, complete, and accurate accounting. Lopes' article, "Is REDD Accounting Myopic:Why Reducing Emissions from Deforestation and Forest Degradation Programs Should Recognize and Include Other Ecosystems and Services beyond CO2 Sequestration," discusses policy frameworks that address undervaluation of carbon pricing and deficiencies in Reducing Emissions from Deforestation and Forest Degradation (REDD) accounting. The article addresses challenges of additionality, permanence, and undervaluation to determine policy recommendations for GHG reduction projects in forests. Lopes defines additionality as the "difference between the reference level and the emission reductions achieved (26)." He suggests utilizing an accounting method that considers more sources of emissions from lands not considered forests per the Kyoto Protocol definition. This approach is called Reducing Emission from All Land Uses (REALU) with Agriculture, Forestry and Other Land Use (AFOLU) Expanding PARKS CCS projects to other landscapes requires evolving accounting frameworks, but could help address major CCS challenges through more expansive projects on other types of PARKS lands. Lopes recommends

pursuing accounting that results in "Full PES" by including other ecosystem services along with carbon sequestration (29). The ecosystem services provided by PARKS land holdings enhance the agency's ability to have a project that performs as a diversified investment, capable of producing substantial value if appropriate accounting can be achieved for market entry.

Ecosystem Services Provided by State Parks

Earth Economics 2016 report entitled *A Model for Measuring the Benefits of State Parks* includes an analysis of ecosystem services. The section entitled Measuring Environmental Services identifies water quality, aesthetics, and habitat as "most prominent (13)." The report provides an inventory of values per land cover type per acre, to account for the ecosystem services present within Washington's state parks. The provided range for values of ecosystem services is incomplete in that it does not account for carbon sequestration. The report lists stormwater, flood, or fire protection, climate regulation, carbon sequestration, and educational opportunities (7)" as additional ecosystem service provisions made accessible by Washington's state parks, but there is no accounting for these services in their estimates. In discussing future climate change impacts and land management planning, Law and Waring state that "potential impacts on ecosystem services including biodiversity, soil fertility, and stable water supply (Haberl et al., 2013)... are rarely part of the decision-making process in simulating land management change scenarios, but they need to be (11)." Understanding the value of ecosystem services provided by PARKS is an initial step towards ensuring they are fully compensated for their management and preservation of them.

Official recognition for the full value of the resources PARKS are tasked to manage ensures accurate prioritization in state budget accounting. Quantification methodologies that include biodiversity, recreation, mental and physical health factors derived from natural aesthetics, and

other ecosystem service benefits are continually being assessed and evaluated in contemporary, academic literature. However, researchers, land managers, and other stakeholders have failed to generate standardized formulas that determine values for ecosystem services capable of competing with traditional forest products or development. Appraisals of forest resources in state parks often take into account the economic benefits of recreation, biodiversity, and aesthetic value. Often, these ecosystem services are not valued high enough to outcompete market values of timber resources or development of other forest land. Specialized and highly technical management processes combined with easier access capabilities for timber harvesting promotes the perception of an efficient, sustainable commodity. High values of land from urban sprawl increase incentives for land development.

Von Hagen and Burnett identify co-benefits resulting from forest emission offset projects. They state "many carbon transactions in the voluntary market involve forestry and agricultural offset projects that generate considerable public benefit beyond the sequestration of greenhouse gases (145)." This supports the inclusion of CCS offset capabilities in ecosystem service appraisals that attempt to determine market values. In *The Future of the World's Forests: Ideas vs Ideologies*, Douglas and Simula identify that sequestered carbon is unique among what are known as forest public goods. They state "while retention of carbon in forest biomass has the public good characteristic of being of benefit to everyone, regardless of who covers the cost of providing this benefit, it is also a product which can be sold to the private sector without compromising its public good benefit (172)." PARKS can justify the inclusion of CCS values in asset accounting or park planning because both international and national, regulatory and voluntary carbon markets are currently operational. Advancing support for land use planning that promotes conservation or preservation of productive land requires innovative policy design that

formalizes detailed accounting procedures that harness market incentivization, and modernization and coordination of regulation that addresses stakeholder interests.

Traditional, economic accounting for resource use and production may determine that state park CCS projects have a high opportunity cost. Various models for natural capital accounting have been developed to take the value of ecosystem services into consideration and demonstrate greater values that can be attributed to conservation management plans. The SocialCarbon Standard was developed by the Ecológica Institute in 1998 and is often used in conjunction with CCS offset projects verified by other registry protocols. SocialCarbon's website states that "six aspects of project sustainability are individually measured using the SocialCarbon hexagon: carbon and biodiversity as well as social, financial, human and natural components." Natural capital accounting frameworks can assist to justify and quantify the value of various ecosystem services provided by PARKS. The Natural Capital Project's Natural Capital Protocol includes tools that can assist with determining valuation, as well as generate potential investment from partner organizations. According to the Natural Capital Coalition's *This is Natural Capital 2017* pamphlet "there are two main approaches to applying natural capital thinking; Assessments and Accounting (5)." The assessment framework focuses on identifying, measuring, and creating values, while the accounting framework addresses financing of natural capital. Natural Capital frameworks are available for organizational planning and direction for how to frame projects, focus scope, measure and value impacts and dependencies, and demonstrate how to apply findings. Ecosystem service audits could be conducted for PARKS to include within biennial budget requests, biennial agency emission reporting, and inventory assessments. PARKS policies, state park landscape diversity, and the lack of accounting for CCS on state park lands provide

ideal conditions for piloting new incentivization programs that generate revenue from developers and organizations trading offsets and supporting PES.

Carbon Markets and Indicators for CCS Viability

Carbon markets evolved out of the 1992 UN Framework Convention on Climate Change and the subsequent adoption of the Kyoto Protocol in 1997. The Marrakesh Accords, which outlined the rules for the Kyoto Protocol were adopted in 2001 and formalized agreements for reporting and certifying emission reductions to meet targets for participating countries. The United States has not ratified the treaty. Participants agreed to report emissions to the UN and work towards reducing global warming to below 2 degrees above pre-industrial global temperatures. Emissions trading and sequestration protocols developed out of these requirements. The Paris Agreement, entering into force in 2016, will effectively replace the Kyoto Protocol in 2020. Von Hagen & Burnett document that "the Kyoto Protocol does recognize the role forests can play in removing and storing CO2 from the atmosphere and storing it in trees, and establishes two mechanisms for creating forest carbon sequestration credits (135)." Emission registries and carbon exchange protocols were developed to account for carbon offsets and GHG emission reductions. Carbon Fund's website defines a carbon offset represents "a very real reduction of carbon dioxide emissions, and results in the generation of a carbon credit, but from a project with clear boundaries, title, project documents and a verification plan (Kelly, 2016)." It defines a carbon credit as "an instrument that represents ownership of one metric tonne of carbon dioxide equivalent that can be traded, sold, retired, etc (Kelly, 2016)." Carbon credits are certified by independent third parties, registered on official carbon registries, and exchanged or auctioned to offset emission production. The EU Emissions Trading Scheme/System (ETS) is the world's first, and largest, emissions trading market, and emerged as a viable model to structure

other markets. Volunteer carbon markets were developed in response to supporters of emission reduction goals who were not required by law to register or reduce emissions.

PARKS can consider accessing both regulatory and voluntary carbon markets that exist in the US and throughout the world. The World Bank's Carbon Pricing Dashboard website provides a resource for accessing the annual State and Trends of Carbon Pricing reports and other data about carbon markets. CCS projects attempting to receive credits per ton of sequestered carbon from an official offset registry must be verified and validated by an independent certification organization, and must meet the requirements of additionality and permanence. The CCS capabilities available in state parks is stable and reliable, and can be formalized within offset accounting as long-term carbon banks. Aldy and Stavins list carbon-pricing policy regimes to include "the European Union's Emission Trading Scheme; New Zealand's cap-and-trade system; the Kyoto Protocol's Clean Development Mechanism; northern European carbon tax policies; British Columbia's carbon tax; and Alberta's tradable carbon performance standard (163)." According to the NW Natural smart energy website, "the Greenhouse Gas Protocol for Project Accounting, The World Bank's Prototype Carbon Fund, and the Kyoto Protocol's Clean Development Mechanism (CDM), establish the foundation of carbon offset quality in both regulated and voluntary markets (Frequently Asked, 2017)." The Regional Greenhouse Gas Initiative (RGGI) is another emissions trading market established in 2005 as a coordinated effort between nine states in the northeast US. Aldy and Stavins state that the RGGI "regulates CO2 emissions from electric power plants…" and "recognizes offsets from activities such as landfill methane capture and destruction, reductions in emissions of sulfur hexafluoride from the electric power sector, and afforestation. (159)." According to rggi.org, the initiative "is the first mandatory market-based program in the United States to reduce greenhouse gas emissions

(Welcome)," and consists of individual state regulations that require CO2 emissions allowances for applicable fossil fuel power generators.

Similar to the EU ETS and the RGGI, the California cap-and-trade market represents a promising example for the future of emissions trading markets. According to the American Carbon Registry (ACR) website, "California is the first U.S. state to approve an economy-wide cap-and-trade program, which has created the second largest carbon market in the world behind the European Union (California)." The CA EPA Air Resources Board document entitled *Overview: ARB Emission Trading Program* identifies Assembly Bill 32 as the legislative regulation implementing the CA cap-and-trade program. According to ARB's website, the law "will help put California on the path to meet its goal of reducing GHG emissions to 1990 levels by the year 2020, ...ultimately achieving an 80% reduction from 1990 levels by 2050 (Cap-and-Trade)." The program set a cap at about 2% below emissions levels in 2012 for 2013, declining about 2% in 2014 and about 3% annually to 2020. Trading, banking, and reserve of emission allowances were authorized, and offsets were allowed for up to 8% of a facility's compliance obligation. Emission reporting for covered entities became mandatory under the program. The first allowance auction occurred on November 14, 2012. Offsets were limited to projects in the US, restricted to specific fields, and require independent verification.

Washington Parks and Recreation Commission Policy and Procedures

A thorough understanding of WA state agency and GHG emissions regulations, the PARKS policy process, and the WA State Budget process is required for design and implementation of a CCS project effective at generating PES. State regulations and guidelines for meeting and reducing GHG emission targets, agency organizational structure and policy development procedures, existing relationships and joint goals established among departments and agencies to

meet targets, and current or potential funding mechanisms available for project support can help to organize policy development and assist in accommodating stakeholder considerations in project planning. Accessibility and transparency allotted through RCW 42.30.010 Legislative declaration holds Washington's state agencies accountable to public involvement within their planning process, strategic planning, and policy development. Succeeding chapters determine the legal requirements of State Agency meetings and rule-making procedures in what can legally be cited as the Open Public Meetings Act of 1971. The nature of state agency policy planning regulations supports and validates PARKS' participation in pilot projects that are in line with their function as stewards of public assets that attempt to reduce tax burdens on Washington residents.

RCW 79A.05 PARKS AND RECREATION COMMISSION, outlines the agencies roles and authority. PARKS has identified their Park Stewardship Core Values to support and develop publically-driven resource management policies. Policy changes in PARKS require planning and political support of multiple stakeholders. The commission strongly encourages public participation in planning. Policy changes in PARKS require coordination and political support of multiple stakeholders. According to the PARKS Planning and Public Input web page "the primary planning project for the agency is to create land-use plans for all state parks (Planning)," to guide future park development and use. Their adopted planning process, labeled Classification and Management Planning (CAMP), includes identifying issues and concerns of park stakeholders, exploring alternative approaches to address identified issues, preparing preliminary recommendations to address issues or suggest a realistic compromise, and proposing final recommendations for formal agency and commission adoption.

According to their website, PARKS recently updated their real estate policy. The site states "in response to the agency's need to generate revenue for operations, the Washington State Parks and Recreation Commission is updating its real estate policy to cover three primary areas: 1. Providing appropriate opportunities for privately financed development of recreational facilities in developed state parks; 2. Leasing undeveloped surplus lands for revenue-generating purposes; and 3. Transferring selected lands to other government or tribal jurisdictions. Per RCW 79A.05.285 Land evaluation, acquisition, "the commission is authorized to evaluate and acquire land under *RCW 79.01.612 in cooperation with the Department of Natural Resources." RCW 79A.05.290 determines that "the commission may select land held by the department of natural resources for acquisition under RCW 79A.50.010 et seq. The 2014-2021 approved draft of the Parks and Recreation Commission's Strategic Plan states "the Commission's Acquisition and Development Plan is focused both on local and statewide needs; to appropriately expand the boundaries of existing parks, to acquire lands that fill in gaps in the statewide inventory, and to meet future needs of the entire park system (16)." PARKS CCS projects would align with funding and land acquisition priorities within policy planning.

Legislation regulating Commission function and forest management considerations places PARKS in the unique position of steward for public forest assets already protected from timber harvest priorities. PARKS rule-making procedures are regulated per RCW 79A.05. RCW 79A.05.035 Additional powers and duties- establishes that the commission will manage its timber and lands, ecological resources, and designated natural forests and natural areas with modern conservation practices to maintain and enhance their aesthetic and recreational values. The RCW states that "trees may be removed from state parks: (a) When hazardous to persons, property, or facilities; (b) As part of a park maintenance or development project, or conservation

practice; (c) As part of a road or utility easement; or (d) When damaged by a catastrophic forest event." It also states "when feasible, felled timber shall be left on the ground for natural purposes or used for park purposes..." with first consideration given to leaving timber on the ground in natural areas. Per RCW 79A.05.305 Declaration of policy—Lands for public park purposes, the Legislature directs the PARKS to "Preserve and maintain mature and old-growth forests containing trees of over ninety years and other unusual ecosystems as natural forests or natural areas, which may also be used for interpretive purposes" and "preserve and maintain habitat which will protect and promote endangered, threatened, and sensitive plants, and endangered, threatened, and sensitive animal species" among other management regulations.

WAC 352-28 PROTECTION AND CONSERVATION OF STATE PARK NATURAL RESOURCES directs PARKS policy procedures. WAC 352-28-010 Cutting, collection and removal of natural resources- outlines the limitations and approval requirements for removing any trees from a natural area, natural forest area, or natural area preserve. Removal procedures require director approval after consultation with several other agencies, preparation of a resource conservation plan, and a public hearing on each such proposed cutting or removal. Public notice and recorded testimonies are required. It states "the cutting or removal of natural resources, other than trees or those specified… will only occur as a part of a resource conservation plan approved by the director or designee" and "when feasible, fallen trees shall be left on the ground when deemed environmentally beneficial or used for park purpose." These protections support maximum carbon sequestration in PARKS managed natural forest areas and preserves. WAC 352-28-020 Resource sales and leases- states "the sale of natural resources will be undertaken only where they advance a commission approved development, are part of a resource conservation plan or interagency agreement approved by the director or designee, or are deemed

by the director or designee to advance agency stewardship goals and are surplus to the parks needs." Carbon Sequestration is likely to be categorized as a resource conservation plan. Per WAC 352-28-050 Protecting and restoring degraded natural resources- "a conservation plan, ...has been developed to protect, restore, or rehabilitate the significant resources." CCS projects serve to protect, restore and rehabilitate natural forest resources.

State Policy and Regulations

Washington's State Environmental Policy Act (SEPA) was enacted in 1971 and modeled after the National Environmental Policy Act of 1969 to assess the likelihood of environmental impacts for public and private planning, programs, and projects. SEPA requires government organizations to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment (RCW 43.21C.030)." According to the DOE website, "Proposals unlikely to have a significant adverse environmental impact or when sufficient mitigation has been identified, the lead agency will issue a Determination of Nonsignificance (DNS)." An Environmental Impact Statement (EIS) is required for any projects without easily identifiable mitigation conditions before a Determination of Significance (DS) can be issued. Carbon Sequestration projects are likely to remain exempt from SEPA requirements as they will likely be deemed a Class I forest practice. Per RCW 43.21C.037 Application of RCW 43.21C.030(2)(c) to forest practices, "decisions pertaining to applications for Class I, II, and III forest practices ...are not subject to the requirements of RCW 43.21C.030(2)(c) as now or hereafter amended." Per RCW 76.09.050 (1) A Class I Forest Practice pertains to "minimal or specific forest practices that have no direct potential for

damaging a public resource and that may be conducted without submitting an application or a notification."

RCW 43.21J.005 Legislative findings, under RCW 43.21J Environmental and Forest Restoration Projects, determines that "the long-term health of the economy of Washington State depends on the sustainable management of its natural resources…" and "… an insufficiency in financial resources, especially in timber-dependent communities, has resulted in investments in clean water and habitat restoration too low to ensure the long-term economic and environmental health of Washington's forests, estuaries, waterways, and watersheds." These findings have led the legislature to declare a recommendation "that immediate investments in a variety of environmental restoration projects… are necessary to rehabilitate damaged watersheds and to assist dislocated workers and the unemployed gain job skills necessary for long-term employment." PARKS resources would allow them to pilot and manage restoration programs that perform the function of sequestering carbon to contribute to fulfilling the intention of this policy with adequate provisions of support.

RCW 79A.15 -Acquisition of Habitat Conservation and Outdoor Recreation Lands- addresses findings by the Legislature in support of state conservation regulation. RCW 79A.15.005 states "it is therefore the policy of the state to acquire as soon as possible the most significant lands for wildlife conservation and outdoor recreation purposes before they are converted to other uses, and to develop existing public recreational land and facilities to meet the needs of present and future generations." This RCW authorizes the matching of federal, local and other funds, and the acceptance of private donations into multiple accounts. RCW 79A.15.060 Habitat conservation account-Acquisition policies and priorities- establishes that distributions from the habitat conservation account to be "used by grant recipients for costs incidental to

acquisition, including, but not limited to, surveying expenses, fencing, noxious weed control, and signing." It establishes criteria for critical habitat and natural areas acquisition proposals. Per RCW 79A.15.065, grants through the habitat conservation account require applicants to incorporate the environmental benefits of the project into their applications as a habitat conservation plan.

State Greenhouse Gas Emission Regulation

RCW 70.235 establishes Washington State's GHG emission targets. The Legislature created the Climate Legislative and Executive Workgroup to develop state policy recommendations for meeting those targets. "The Report to the Legislature on the Work of the Climate Legislative and Executive Workgroup" reviews and proposes Governor Inslee, Senator Ranker, and Representative Fitzgibbon "recommend a state program of actions and policies to reduce greenhouse gas emissions, that if implemented would ensure achievement of the state's emissions targets in RCW 70.235.020 (4)." Workgroup findings state that Washington's "statutory carbon pollution limits will not be met without additional action…" and "…further actions will be required to achieve the limits in later years." The Workgroup determined that "action will be needed on multiple fronts, both to ensure that the limits are met and to fairly allocate the responsibility for action," and that "Washington must reduce carbon emissions in the most cost-effective way possible" because delaying carbon reductions to a safe level will become increasingly more expensive. Proposed actions did not include CCS projects. Actions already adopted by PARKS are in line with the proposals developed by this Workgroup. These primarily include emission reduction efforts targeting electricity and gasoline usage across the agency.

RCW 70.235.030 is entitled Development of a design for a regional multisector market-based system to limit and reduce emissions of greenhouse gas—Information required to be

submitted to the legislature. Section 1 (a) states "the director shall develop, in coordination with the Western Climate Initiative, a design for a regional multisector market-based system to limit and reduce emissions of greenhouse gas consistent with the emission reductions established in RCW 70.235.020(1)." Washington state formally dropped out of the Western Climate Initiative (WCI) on 18 Nov. 2011. The WCI continues to formalize market pricing of carbon, and may provide a standard price for a PARKS CCS project. Specific targets with timelines are established in RCW 70.235.050 and 060 as: (a) By July 1, 2020, reduce emissions by fifteen percent from 2005 emission levels; (b) By 2035, reduce emissions to thirty-six percent below 2005 levels; and (c) By 2050, reduce emissions to the greater reduction of fifty-seven and one-half percent below 2005 levels, or seventy percent below the expected state government emissions that year. RCW 70.235.070 establishes that "when distributing capital funds through competitive programs for infrastructure and economic development projects, all state agencies must consider whether the entity receiving the funds has adopted policies to reduce greenhouse gas emissions." The projects must also be consistent with state emission limits per RCW 70.235.020, and vehicle miles traveled reduction targets per RCW 47.01.440. To remain in line with these requirements, PARKS has established GHG reduction targets and have continually formalized and reported their emissions data to the Department of Ecology since 2003, according to their GHG Emissions 2016 Report Appendix. The agency reported that 2016 emissions were 59% below the 2020 Agency reduction target, expressing the viability of the agency to administer sustainable and GHG reduction-oriented operations.

Washington State Emission Regulations: Energy Production Facilities

Formal carbon mitigation programs to offset fossil-fueled, thermal-electric generation facility emissions are in effect within Washington State. RCW 80.70 Carbon Dioxide Mitigation

includes RCW 80.70.010 which defines carbon credit as "a verified reduction in carbon dioxide or carbon dioxide equivalents that is registered with a state, national, or international trading authority or exchange that has been recognized by the council." It defines mitigation plan as "a proposal that includes the process or means to achieve carbon dioxide mitigation through use of mitigation projects or carbon credits." Mitigation projects are defined as "projects or actions that are implemented by the certificate holder or order of approval holder, directly or through its agent, or by an independent qualified organization to mitigate the emission of carbon dioxide produced by the fossil-fueled thermal electric generation facility." Projects must include "verified carbon credits traded on a recognized trading authority or exchange…" and "enforceable and permanent reductions in carbon dioxide or carbon dioxide equivalents…" among other requirements. Per RCW 80.70.020, mitigation by a third party is required for verification of project validity.

Per RCW 80.70.030, "carbon dioxide mitigation plans relying on purchase of permanent carbon credits must meet the following criteria: (a) Credits must derive from real, verified, permanent, and enforceable carbon dioxide or carbon dioxide equivalents emission mitigation not otherwise required by statute, regulation, or other legal requirements; (b) The credits must be acquired after July 1, 2004; and (c) The credits may not have been used for other carbon dioxide mitigation projects." For new electric generation facilities producing defined outputs, regulation states that site certification agreements submitted under RCW 80.50.100 "shall include an approved carbon dioxide mitigation plan." This plan must include "(a) Payment to a third party to provide mitigation; (b) Direct purchase of permanent carbon credits; or (c) Investment in applicant-controlled carbon dioxide mitigation projects, including combined heat and power (cogeneration)" and require that "mitigation for twenty percent of the total carbon dioxide

emissions produced by the facility" is met. These definitions and program criteria are applicable and consistent with new CCS offset program verification requirements and procedures in all regulatory or voluntary markets.

WAC 173-407-060 Carbon dioxide mitigation plan requirements and options under Part I- establish "requirements of the payment to a third-party option," and set initial mitigation requirements. This rate will change when the Washington Energy Facility Site Evaluation Council (EFSEC) adjusts it through the process outlined in RCW 80.70.020 (5)(a) and (b). EFSEC is a board whose authority is granted through RCW 80.50, which regulates energy facilities. According to EFSEC's website "before certain energy facilities can be sited, constructed, or operated in Washington, application must be made to the Energy Facility Site Evaluation Council." If EFSEC standards are met, the project can move forward with a recommended Site Certification Agreement (SCA) sent to the Governor for approval. A Prevention of Significant Deterioration (PSD) permit requires evidence that emissions standards and regulations are met. The website states "the state legislature passed Chapter 80.70 RCW in 2004 with the intent to establish statewide mitigation of carbon dioxide from fossil-fueled thermal electrical generation facilities." Mitigation can be accomplished through a payment to a third party, direct purchase of permanent carbon credits, or through investment in an applicant-controlled carbon dioxide mitigation program. EFSEC's IQO website contains a list of independent, qualified, third party organizations for carbon mitigation programs. The list includes The Climate Trust, Black and Veatch, and 3Degrees Group Inc. at the time of this publication. These organizations are field experts that can be utilized by PARKS for CCS project consultation.

Carbon regulation in the energy sector is also becoming more prevalent downstream. According to Carbon Washington, private utility companies in Washington are regulated by the Utilities and Transportation Commission (UTC). UTC requires utility companies to undergo Integrated Resource Plans (IRPs). In May, 2018 UTC mandated that all future IRPs must include a price on carbon per ton. This supports the position that power plants must be expected to remain profitable with a price attached to carbon and suggests future regulatory compliance can be expected in Washington State.

Washington State Emission Regulations: State Agencies

In addition to regulating GHG emissions in the energy industry, Washington has formalized emissions regulation for state agencies. According to the office of the Governor's website, Gov. Inslee signed Executive Order 14-04 in April, 2014 to outline procedures to reduce carbon pollution in Washington state. The Executive Order builds upon earlier studies and workgroups to take action in 7 key areas to include carbon pollution limits. The EO established the Carbon Emissions Reduction Taskforce for agency guidance and recommendations of best practices, organized the development of carbon reduction goals by Gov. Inslee's Results Washington, and directed the Department of Ecology to review timelines and targets for emissions reductions and State Agency compliance procedures. Executive Order 18- 01: State Efficiency and Environmental Performance (SEEP), also addresses emissions reduction in state agencies. The WA State Department of Commerce is responsible for overseeing the EO's implementation. According to the department's website, "SEEP directs state agencies to identify and adopt cost-effective measures that reduce emissions, focusing on new facilities, existing facilities, ferries, electric vehicles, environmentally preferable purchasing, and finance." The EO instructs agency directors to conduct cost-benefit analyses that attempt to avoid or reduce GHG emissions.

Emissions reduction initiative suggestions include various procedures to support zero-emission activities and fiscal policy/budget considerations for emissions reduction and carbon sequestration. PARKS is not listed among initial agencies covered under the EO. For included agencies, the EO states "each year, each covered agency's reported GHG emissions shall be multiplied by an appropriate cost of carbon to calculate that agency's emissions-reduction and efficiency investment target (4)." The EO also authorizes the Governing Council to "develop all policies, procedures, and tools needed to quickly and effectively implement this order (such as adopting measures, scorecards, agency reporting standards, a price of carbon, and standards for return-on-investment, Renewable Energy Credits (RECs), carbon sequestration, and offsets) (4)." The EO supersedes and rescinds EO 14-04 as of January 16, 2018.

The Washington Department of Ecology (ECY) is listed as an agency subject to EO 18-01. ECY was established in 1970 "to protect, preserve and enhance Washington's environment and promote the wise management of air, land, and water for the benefit of current and future generations." According to the ECY website, "in 2009, the Legislature approved the State Agency Climate Leadership Act establishing greenhouse gas emission reduction limits for state government (Tracking & Reducing)." This directed State Agency GHG emissions tracking and reporting procedures, and identified areas for agencies to reduce their emission output. The website identifies climate change is a significant issue facing Washington, and a management priority for ECY, resulting in their recommendation to lower GHG limits for the state. The ECY adopted the Clean Air Rule in 2017 with the intention of utilizing their authority designated in WA State's Clean Air Act for carbon pollution reduction regulations. Implementing the Rule statewide was blocked by a lower court ruling. ECY has asked the State Supreme Court to review.

State Park Funding

The 2014-2021 WA State Parks and Recreation Strategic Plan states that "a meaningful and significant part of its mission- natural and cultural heritage protection- does not generate direct revenue" but is "essential for sustaining the state's environmental health, vibrant economy, quality of life and legacy for future generations (8)." The Commission has advocated for public financing in administering these valuable assets, but no model attempting to generate PES has been formally proposed. PARKS is required to manage natural resources while being capable of addressing challenges that include natural disasters, staffing and administrative issues, and funding uncertainties that "may limit Parks' authority and also may necessitate the re-direction of resources (8)." Implementing user fees to fund the majority of PARKS operations fails to properly address unexpected costs. In planning for the 2013 Transformation Strategy, public feedback opposed commercialization and advertising within state parks. Sequestration projects monetize park assets without the advertising and marketing component PARKS' patrons oppose.

In a section reviewing partnerships, the Strategic Plan states "the agency is cautiously and systematically exploring partnership options where mission-aligned investment and development may more feasibly be accomplished by other public or private entities... directed at mission-aligned recreational facilities and/or programs developed and managed by the private sector within state parks (11)." This intention is to enhance recreation concession areas and designated enterprise lands, but demonstrates the willingness of the agency to enter into relationships for innovative funding mechanisms. The plan states "years of restricted budgets have left the system in need," and continues to outline what a healthy and sustainable park system encompasses (14). Indicators of a healthy park system express long-term management planning with sustainable goals intending to facilitate conservation of natural resources. These agency goals align well with

CCS project rationale. CCS project development can occur on lands remaining in line with the Commission's five primary themes that guide their Land Acquisition and Development Strategy Policy.

Comparing state park funding mechanisms across the country can identify effective practices and policy. Margaret Walls is a Senior Fellow with a Ph.D. in economics at the nonprofit research institute Resources For the Future (RFF). The 2013 report she authored, entitled *Paying for State Parks: Evaluating Alternative Approaches for the 21st Century,* outlines several approaches and critiques various funding sources for state parks throughout the country. The general categories of funding reviewed in the report include user fees and park-generated revenues, contractual arrangements with private firms, dedicated public funds, philanthropy and partnership arrangements with park conservancies and other nonprofits, and other creative financing approaches. A single page reviewing alternative funding approaches discusses the possibility of PES as a funding mechanism for state parks. The section includes a brief definition of ecosystem services as "public benefits from nature (16)." The report identifies the possibility that state parks would receive support by local governments that receive ecosystem services, and that offset projects meeting demands of cap-and-trade programs "could lead to a demand for conservation of forested and other natural lands (16)." The review does not address the potential for land management changes such as reforestation or new acquisitions that would meet additionality requirements to earn revenue from private sources. Walls' findings demonstrate that "no one-size-fits-all approach will work for state park systems given the diversity in their lands and facilities and the ranges in acreage and number of parks (25)." She identifies that general fund allocations will need to be supplemented with additional revenue sources to meet state park needs in most states.

Peninsula Pulse, a Door County, Wisconsin local newspaper, featured an article that discusses various funding sources for Wisconsin State Parks. These suggestions were considered due to a funding shift towards self-support in a similar process experienced by PARKS. The WI DNR considered selling sponsorship and naming rights for trails, shelters and other amenities, demand-based pricing for access fees to the most popular parks, increasing admission fees by $2 – $4 at all parks, expanding the available number and amenities of campsites, and creating individual admission passes rather than vehicle stickers. Demand-based pricing was harshly critiqued in that "fee increases will inevitably squeeze low-income residents out of the parks (Dannhausen)." Another suggestion was to increase public-private partnerships. This measure was critiqued as privatization of public land where private entities were more likely concerned about profit than conservation or stewardship in recreation areas. According to Walls in *Private Funding of Public Parks: Assessing the Role of Philanthropy*, drawbacks from privatizing funding also include the free rider problem, occurring because people loose the incentive to support the parks system. Other drawbacks included funding uncertainties from inconsistent donations and impermanent private commitments, crowding out that reduces reliable government funding and diversity in funding sources, unforeseen fundraising costs, and unequal distribution of funds because of donor and private preferences (43-44). The article concludes that establishing a predictable, tax-based revenue would help optimize operations budget and planning, and the role of philanthropy needs to be from sustainable funding sources complementing state budget allocations. Other funding sources for state parks across the country include dedicated funds collected specifically for the park system, dedicated percentages of lottery revenue, and other dedicated percentages of sales tax or fees such as plastic bag fees in grocery stores.

The Headwaters Economics Report for the Outdoor Industry Association entitled *State Funding Mechanisms for Outdoor Recreation* outlines the benefits and challenges in utilizing, changing, or creating new revenue sources. Funding options that may be most appealing to legislatures require public support for successful implementation in public agencies. The report demonstrates how most state budget allocations are used for operations and maintenance, with few authorizing state park agencies to implement innovative projects. The report states that "no matter which mechanism or revenue source is selected, the most successful programs incorporate common themes in establishing, designing, and administering a funding program (10)." Many of the common themes reviewed in the report identify strategies already adopted by PARKS, and match values underlying CCS projects. The report's suggestions for potentially successful funding projects include income sources that are subject to market variability. Agency managed, long-term, aggregated CCS programs on diverse, productive landscapes present an opportunity for a sustainable income source capable of overcoming uncertainties and potential externalities of existing funding strategies.

Funding/Revenue for WA State Parks and Recreation Commission

To determine the feasibility of a PARKS CCS project it is important to understand agency funding policy to develop a project implementation strategy and identify potential sources of initial investment capital. According to the Washington State Treasury website "for the 2015-17 Capital Budget, approximately $2.244 billion of the total $3.925 billion was funded with bonds." The two types of bonds the State typically sells are Various Purpose General Obligation Bonds, and Motor Vehicle Fuel Tax General Obligation Bonds. The State Finance committee is authorized to issue and manage these bonds by the State Legislature. State grants are distributed to municipalities, agencies, and nonprofit organizations for budget approved allocations.

PARKS is a Commission Agency, not a Cabinet Agency, with budgets set every two years. These budgets are planned one year in advance and submitted as proposals. The Office of Financial Management (OFM) coordinates and analyzes requests, and assists the State Legislature and Governor through the approval process. The approval of the budget produces appropriations bills detailing conditional usage of allocated funds from the Operating Budget and Capital Budget through the General Fund and other accounts. According to the OFM's May 2018 Guide to the Washington State Budget Process "in working with the Governor to develop his 2017-19 biennial budget, OFM used Results Washington goals, outcome measures and action plans — along with agency strategic plans and performance measures — to prioritize spending within and across agency budgets (3)." One of the seven broad categories for State budget expenditures is "Natural resources include expenditures for environmental protection and recreation (5)." The 2017-19 Capital Budget allocated "$53 million for preservation and minor repair projects throughout the state" specifically for PARKS.

Recent challenges to PARKS financing occurred as a result of Legislative funding priority changes from 2009 through 2013. There was a major decline ($94.5 million to $8.7 million) in State General Fund revenue in 2007-09 compared to 2013-15 biennium budgets. The agency went from tax support accounting for 70 percent of operating revenue before 2009 to user fee and donation support accounting for 80 percent of operations. As the legislature continued to assess the feasibility of a fully self-funded agency, "the Commission asserted that this goal was neither sustainable nor feasible and that stable public funding was necessary to achieve the type of a parks system the public expects and demands (Whaley, 7). In 2011, the Legislature passed the Engrossed Second Substitute House Bill 2373 to create the Discover Pass as a funding source to account for General Fund budget cuts (Bloxom, 3). Fees and donations were highly supported

as effective funding mechanisms by policymakers. The Discover pass generated the "fourth-highest revenue of any state park day-use fee in the country and is second-highest per-capita in the country (Whaley, 7)," according to the National Association of State Parks Directors. In a response to questions from 29th District Senator Steve Conway attempting to determine the success of the Discover Pass' funding capabilities, Owen Rowe, PARKS Director of Government and Policy Affairs, reported forecasts of 37.7% of earned revenue from 2017-2019 will come from the Discover Pass. The 2014-2021 approved draft of the Parks and Recreation Commission's Strategic Plan states "as demands on the park system grow over time, revenue from fees will not be sufficient to adequately maintain the park system (8)."

There are several accounts that would likely be available for funds dedicated to initiating CCS projects. The State Parks Renewal and Stewardship account per RCW 79A.05.215 is established for state parks funds received "from user fees, concessions, leases, donations collected under RCW 46.16A.090(3), and other state park-based activities." The Renewal and Stewardship Account is authorized to be "used for operating state parks, developing and renovating park facilities, undertaking deferred maintenance, enhancing park stewardship, and other state park purposes" after the legislature approves appropriations. The State Parks Education and Enhancement Account is authorized by RCW 79A.05.059 to "be used to provide public educational opportunities and enhancement of Washington state parks" as authorized by the director or director's designee. The Parkland Acquisition Account is authorized by RCW 79A.05.170 "to be used solely for the purchase or acquisition of property for use as state park property by the commission, as directed by the legislature," subject to legislative appropriation.

In 2014 a report by the Governor's Blue Ribbon Parks and Outdoor Recreation Task Force determined that parks should seek additional revenue sources for funding park operations with

user frees addressing user-related costs. Options discussed included a “motor home and travel trailer excise tax; a sales tax on bottled water; and the watercraft excise tax (19),” but no inclusion of generating payments for the value of natural area conservation or ecosystem services the park is experienced in managing. The agency’s stated principles, oriented towards keeping user fees and taxes primarily supporting user activities with broader state and private funding supporting additional expenses, would benefit from a model designed to draw funding from public and private sources. CCS programs directly address PARKS Transformation Strategy priority 1: Demonstrate that all Washingtonians benefit from their state parks, 2: Adopt a business approach to park system administration, 5: Form strategic partnerships with other agencies, tribes and nonprofits, 6: Expand use of land holdings for compatible revenue generating purposes, and 7: Expand use of land holdings for compatible revenue generating purposes.

Grants Available for CCS Project Funding

Several federal and state grant programs are available for acquisition of land that may otherwise have been purchased or managed for harvest or development. Using newly acquired land for CCS projects as a revenue source is another challenge that will require formalized planning and coordination of various organizations and sequestration protocols and standards. Federal and state grants that have traditionally supported conservation and recreation land acquisitions and capital projects are not designed to support continual payments over time for the ecosystem service of carbon sequestration. Funding opportunities for conservation easements and land acquisition will need to be supplemented by long term, carbon sequestration funding contracts.

The Recreation and Conservation Office (RCO) was established per RCW 79A.25 to coordinate government and NGO interactions, as well as interagency interactions, manage grants and funding, and serve as an information repository for recreation and conservation purposes. RCW 79A.25.005 states "it is therefore the policy of the state and its agencies to preserve, conserve, and enhance recreational resources and open space" justifying the authority and priorities the RCO administers. The RCW cites "rapid population growth and increased urbanization" causing "a decline in suitable land for recreation and resulted in overcrowding and deterioration of existing facilities." The Headwaters Economics report *State Funding Mechanisms for Outdoor Recreation* states that "Washington has taken the unique approach of managing funding through a stand-alone, independent agency focused exclusively on supporting recreation and conservation through grants (46)" allowing for focused funding assistance and eliminating competition with other state agencies for funding and asset management. The RCO requires a Recreation and Conservation Plan to be submitted every 6 years for grant applicants. The WA State Parks Recreation and Conservation plan includes appendix 2, which is comprised of a comprehensive resource management policy and a thorough strategic plan to conserve state park natural resources.

According to the RCO's website "the Recreation and Conservation Funding Board helps finance recreation and conservation projects throughout the state." The board was created through initiative 215 in 1964, and was authorized to allocate boater gas taxes on boating facilities. More than $1.3 billion in grants for more than 5,850 projects across Washington have been funded, with more than $934 million matched by grant recipients. The Recreation and Conservation Funding Board Factsheet 2017 states that the board offers "one-stop shopping for State investments," and ensures that only the best projects receive funding. The board determines

criteria and administers state and federal grant programs "to build parks, trails, ball fields, firearm and archery ranges, and boating facilities; conserve and restore wildlife habitat; and preserve farmland." It is authorized to administer conservation and recreation grants from the habitat conservation, outdoor recreation, and farm and forest accounts per RCW 79A.15.030. According to RCO's *Manual 7, Long-Term obligations*, RCO funding policy requires that use of grants awarded through the WA Recreation and Conservation Funding Board or the Salmon Recovery Board "creates a condition under which funded property and structures become part of the public domain in perpetuity (5)." CCS programs create a revenue source that would benefit from such requirements. According to the report *State Funding Mechanisms for Outdoor Recreation*, outdoor recreation grant eligibility for state parks requires that "40-50 percent must be used for new acquisitions (47)" and no existing facility renovations are eligible.

State Funding Mechanisms for Outdoor Recreation outlines the benefits of outdoor recreation on the economy and public health made available through access to state parks. The report outlines funding programs for outdoor recreation in seven states and includes the Washington Wildlife and Recreation Program (WWRP). The WWRP was created for "acquiring important recreation and habitat lands before they are converted and developed, and improving recreation areas for Washington's expanding population (43)." The RCO manages WWRP funds and projects which have included new land and asset acquisition, as well as preserve and state park creation. The WA biennium budget appropriates funds for the program averaging $56.4 million each biennium since 1990, resulting in more than $360 million in grants for 810 state and local agency capital projects. The grant application and disbursement process resulted in $385 million in matched contributions to projects. The RCO grants website states the WWRP "was envisioned as a way for the state to accomplish two goals: acquire valuable recreation and habitat

lands before they were lost to other uses and develop recreation areas for a growing population (Washington WWRP).” Grants are evaluated in 12 categories, must meet planning requirements, and funds must be matched with at least 10 percent matched by non-state and federal government sources. Land acquisition and habitat enhancement are eligible for funding.

Utilizing WWRP funds to acquire new land that generates revenue through carbon credits to be utilized for state park operation and maintenance costs reduces reliance on state capital budget appropriations, unreliable tax reform, or philanthropy to fund PARKS. *State Funding Mechanisms for Outdoor Recreation* identifies that three accounts divide WWRP funding as 45% dedicated to outdoor recreation, 45% for habitat conservation, and 10% for farm and forest preservation. The Washington Wildlife and Recreation Coalition website states “the Coalition is the chief advocate for the WWRP and has successfully leveraged over $1.3 billion for more than 1,200 projects, creating not only parks and wildlife habitat, but also jobs, revenue, and increased quality of life throughout the state (Washington).” State parks have benefited from these grants in the past, and should consider utilizing WWRP grants for acquiring land threatened by developers or timber production after partnerships with conservation entities are developed, and a CCS offset program is authorized to be pursued by the Commission.

PARKS can apply for funding for land acquisition and recreation improvement plans from federal revenue generated partly from offshore oil and gas resource royalties through the Land and Water Conservation Fund (LWCF). The royalties are reinvested into a funding pool for grants that preserve natural areas and conserve land, water and recreation areas. This fund was established by Congress in 1965. Typical projects include protecting wildlife habitat, land acquisition, natural areas, open space, and wildlife management areas. The LWCF has match requirements of 50%. According to the Washington Wildlife and Recreation Coalition’s website

"LWCF has invested $637 million in protecting the places that matter most to Washingtonians (Land)." The website also states "the program has been chronically underfunded, leading to a number of missed opportunities for investing in important areas in Washington State (Land)." The current Federal LWCF expires in September 2018.

In addition to the LWCF, Congress established the LWCF Outdoor Legacy Partnership program in 2014. The National Park Service provides matching grants to states for the acquisition and development of lands and waters for outdoor recreation purposes through the LWCF State and Local Assistance Program. The program is designed to provide funding to acquire and develop public land that would benefit underprivileged individuals and populated areas. According to the RCO website, "all property acquired or developed with Land and Water Conservation Fund grants must be kept forever exclusively for public outdoor recreation use." The National Park Service Financial Assistance Notice of Opportunity document for the LWCF states "that the property must be preserved for outdoor recreation uses in perpetuity and cannot be converted to other than public outdoor recreation use without the written approval of the Secretary of the Interior (5)." Acquisition project funds require a plan that demonstrates how and when lands will be used open and used for public recreation purposes, and how they will benefit targeted populations. A PARKS managed CCS project is unprecedented, and management plans could include a portion of sequestration funds to be distributed to target population social programs. Recreation authorized and overseen by PARKS management policies could continue to occur on lands earning revenue by sequestering carbon.

Other potential federal grants for initial land acquisition include the Fish and Wildlife Service's National Coastal Wetlands Conservation Grant (NCWCG) Program and the Wildlife Restoration Grant Program. According to grants.gov, the NCWCG was established by the

Coastal Wetlands Planning, Protection, and Restoration Act. Grant funding is authorized "to acquire, restore, and enhance wetlands in coastal areas through competitive matching grants to eligible state agencies." Fishing related excise taxes contribute to the majority of the grant funds which are deposited into, and appropriated from the Sport Fish Restoration and Boating Trust Fund. The primary goal of the NCWCG Program is the long-term conservation of coastal wetland ecosystems. The Wildlife Restoration Grant Program was established through the The Federal Aid in Wildlife Restoration Act of 1937, now called the Pittman-Robertson Wildlife Restoration Act. The act was passed "to provide funding for the selection, restoration, rehabilitation, and improvement of wildlife habitat, wildlife management research, and the distribution of information produced by the projects."

More research is required to determine the feasibility of grant programs for CCS-dedicated land acquisitions. Partner NGOs that can assist PARKS with this type of program design may include organizations such as the Conservation Alliance, The Nature Conservancy, and the Trust for Public Land, among other land conservation oriented NGOs. According to their website, the Conservation Alliance is a group of outdoor industry companies that "seeks to protect threatened wild places throughout North America for their habitat and recreational values (Funding)." Their Public Lands Defense Fund criteria includes quantifiable, long-term, landscape-scale protection projects that "engage grassroots citizen action in support of the conservation effort (Public)" and help create recreational opportunities. Specifically, the fund "supports organizations working to preserve and defend the integrity of our public lands system." The Conservation Alliance conducts two funding cycles for partner nominated organizations annually. A list of Washington's Conservation Alliance partner organizations are listed on their website. According to the Nature Conservancy's website, the organization aims to "address threats to conservation

involving climate change, access to clean water, ocean health, and everything in between," and "pursue non-confrontational, pragmatic solutions to conservation challenges" through partnerships, support from more than 1 million members through conservation and restoration projects among other social and political activities. According to the Trust for Public Land's website, the NGO "helps state and local governments design, pass, and implement legislation and ballot measures that create new public funds for parks and land conservation (Fund)." PARKS may benefit from consultation with these NGOs to address future funding and partnership opportunities, and CCS project feasibility.

Program Design

Authority for procedures and duties of PARKS is appointed in RCW 79A.05. Per RCW 79A.05.030, the Commission is authorized to "Grant concessions or leases in state parks and parkways upon such rentals, fees, or percentage of income or profits and for such terms, in no event longer than fifty years, except for a lease associated with land or property described in RCW 79A.05.025(2)(b) which may not exceed sixty-two years." The extension to sixty two years pertains to Saint Edward State Park, specifically. The regulation authorizes the commission to "cooperate with the United States, or any county or city of this state, in any matter pertaining to the acquisition, development, redevelopment, renovation, care, control, or supervision of any park or parkway, and enter into contracts in writing to that end." It also directs the commission to "maintain policies that increase the number of people who have access to free or low-cost recreational opportunities for physical activity, including noncompetitive physical activity." Additional authority is granted per RCW 79A.05.345 for the commission to "consult and enter into agreements with and solicit assistance from other public agencies, the state parks foundation, private entities, employee business units, and tribes that are interested in stewarding and

interpreting state parks scenic, natural, cultural, and recreational resources." Legal authorization and jurisdiction, as well as the general role and adopted core values, allow the agency to manage and receive credits from a CCS project while performing functions already undertaken by the commission and agency personnel. Pursuing an offset project requires careful coordination of procedures and collaboration among public and private organizations to generate a practical, equitable, and profitable outcome.

PARKS is in a unique position among other state agencies to gain revenue from entering into carbon markets through collaborative and innovative policy development. Facilitating the involvement of a state agency in a market exhibiting high levels of uncertainty and developing dynamics will produce policy challenges. Kelly and Schmitz identify the process of transforming carbon into a commodity through the Improved Forest Management program under the California cap-and-trade market. "Forest offsets and the California compliance market: Bringing an abstract ecosystem good to market" identifies difficulties in legitimizing offsets as a market commodity. The article includes a Forest Carbon Commodity Chain model that can assist CCS project planning and development. The authors suggest a framework that begins with a feasibility analysis conducted by the project developers. Project design and inventory, verification, registration, and sale follow sequentially. Final framework requirements involve maintenance of the project through long-term policy development that includes insurance pool credits to reduce unexpected carbon stock losses.

A CCS offset pilot project on existing PARKS land would begin with PARKS selecting an independent certification organization for project consultation. New land acquisitions of DNR managed lands or other sources that would otherwise be utilized for timber harvesting or development are supported by the Legislature. CCS potential could be assessed prior to

acquisition and funding would originate from applicable grants or dedicated state accounts. Quantification may also include other valuation metrics to include ecosystem services, biodiversity, and global warming potential (GWP) depending on viability and contractor capabilities. The most appropriate, applicable certification protocols and registry would be selected, and the agency would develop a forest management plan with the program consultant that includes CCS capacity and requirements of compliance. Once the plan is complete, the commission can contract with the appropriate registry to gain carbon offset credits on the applicable voluntary or regulatory market.

Figure 1. Logic Model for CCS Project

Program:	**WA State Parks and Recreation Carbon Capture and Storage Pilot Project**				
Problem Statement:	Increasing greenhouse gases in the atmosphere is contributing to global climate change. The WA State Parks and Recreation Commission (PARKS) is required to comply with greenhouse gas emission reduction goals according to existing policy for state agencies. PARKS is not compensated for the value of the ecosystem service of sequestering carbon in a stable and long-term carbon sink. This logic model is generated from combining multiple frameworks from cited references.				
Goal:	Provide a generalized framework for PARKS to assist in implementation of a CCS pilot project.				
	→	→	→		
Inputs (resources)	Activities (actions needed to implement program/achieve outcomes)	Outputs (Shorter term results from inputs/direct products of program activities)	Outcomes (changes that occur for different stakeholders, goals/successes of program)		
			Short (learning)	Medium (behavior)	Long (condition)
Carbon Capture and Storage/Sequestration					
PARKS Commission	Willingness to enter the market, CCS feasibility testing	Public announcement and feedback	Feasibility assessment		
PARKS Commission, Park Management	Consultant selection and initial project design planning	Inventory (can include additional ecosystem service accounting), modeling, and initial cost/requirement determination	Forest Management Plan to include CCS	Offset Registry selection	
PARKS Commission, Park Management, Arborists, Consultants	Certification of Carbon stock estimates	CCS project enrollment, verification, and validation	Marketing and sale of offsets, receive revenue	Continued maintenance, inventories, verification, receive revenue (can consider utilizing revenue for new CCS project for compounding factor)	CCS maintained in perpetuity
Initial funding source for CCS land acquisition and associated costs	CCS project initiation	Revenue for offsets and payments for ecosystem services	Agency goals for funding and projects met	State and agency funding requirements are realized	Agency and State GHG emissions and climate change goals met
			External agency funding demand decreases		
Assumptions: conditions necessary for success			**External Factors:**		
PARKS Agency is comfortable with CCS outputs and potential externalities			Time constraints- pilot project subject to biennium budget requests, grant dispursal, and engagement after other prioritized projects		
Agency staff is capable of fulfilling assigned tasks of program requirements			Funding constraints- various sources for CCS pilot potentially exist, options must be navigated by Agency staff or outsourced		
Agency constituents are comfortable with, and included in CCS program design					

Offset Project Registries

California's Cap-and-Trade regulatory agency, the California Air Resources Board (CARB), has approved three offset project registries for certification for its program. The proximity to WA establishes CARB as a relevant organization for PARKS to reference for program design. The registries and protocols approved by CARB would provide validation, verification, and access to the CA carbon market for qualified PARKS CCS offset projects. According to CARB's website, approved offset project registries include the American Carbon Registry (ACR), the Climate Action Reserve, and Verra. PARKS should consider these standards before entering into other voluntary markets to ensure projects are adaptable and transferable for potential future compliance markets. Other offset registries exist and PARKS should consider expert consultation to identify ideal partner organizations. According to ACR's website, "California is the first U.S. state to approve an economy-wide cap-and-trade program, which has created the second largest carbon market in the world behind the European Union (California)." CARB is also coordinating efforts with multiple Canadian provinces through the WCI to broaden emission reduction market access and stability.

The American Carbon Registry is a nonprofit organization operated under Winrock International, headquartered in Arlington VA. It is a carbon offset project verification and registry agency. According to their website ACR was founded in 1996 as the "first private voluntary greenhouse gas registry in the world (Homepage)." The organization is active in both the regulated California and voluntary carbon markets. ACR's verified emissions reductions (VERs) are issued as Emission Reduction Tonnes (ERTs) and are equal to one metric ton of carbon dioxide removed or sequestered from the atmosphere. The ACR requires independent third-party validation and verification of offset projects to meet their Validation and Verification

Standard. According to their website, the ACR electronic registry system records "the issuance, transfer and retirement of serialized, project-based and independently verified offsets (What We Do)" for members. ACR's Improved Forest Management Methodology for Quantifying GHG Removals and Emission Reductions through Increased Forest Carbon Sequestration on Non-Federal U.S. Forestlands is designed to quantify emissions reductions that occur from sequestration of carbon on non-federal forestland otherwise subject to timber harvesting. The Methodology for Afforestation and Reforestation of Degraded Lands attempts to quantify restoration of carbon sequestering biomass on land otherwise not likely to be restored without a project. These methodologies can serve as quantification frameworks for WA State Parks CCS projects.

The Climate Action Reserve (CAR) is an approved offset project registry. It is a nonprofit organization established for the North American carbon market in support of California's Cap-and-Trade Program. According to their website, "the Reserve establishes high quality standards for carbon offset projects, oversees independent third-party verification bodies, issues carbon credits generated from such projects and tracks the transaction of credits over time in a transparent, publicly-accessible system (About)." The Reserve marketplace consists of account holders who trade or retire carbon offset credits or develop offset projects. CAR protocol offset credits are issued as Climate Reserve Tonnes (CRTs), representing one metric ton of carbon dioxide equivalent (CO2e) emissions. These credits must be converted into CARB offset credits for compliance and use in CA's cap-and-trade program. According to the website, CAR verified projects "ensure projects are real, additional, permanent, verifiable and enforceable (Verification)" among meeting other established market standards. CAR's Forest Project Protocol (FPP) may be applicable to PARKS CCS forest projects. Their protocols website offers

detailed documents for how to quantify and monitor projects to meet requirements for project verification. The protocols can be utilized to guide and inform CCS pilot projects. All of CAR approved protocols are also approved methodologies of Verra.

Verra is a nonprofit organization founded in 2005. It is a voluntary carbon market certification organization that was known as the Verified Carbon Standard (VCS) until its name changed in 2018. Verra's website states the name change suggests verification and terra, reflecting the fundamental nature of their work. The standard certification process remains consistent and unaffected by the rebranding. Verra establishes categories of standardization to include the VCS Program, the VCS California Offset Project Registry (OPR), the Climate, Community & Biodiversity (CCB) Standards, the Landscape Standard (LS), the VCS Jurisdictional and Nested REDD+ (JNR) Framework, and the Sustainable Development Verified Impact Standard (SD VISta). These standards were developed to increase the reliability of the voluntary carbon market and perpetuate sustainable development goals. All standards aim for reducing and removing GHG emissions. The verification and registration process for entering the VCS program is considered rigorous, but it is also considered to be the most widely used voluntary GHG program. VCS certified programs are issued Verified Carbon Units (VCUs) that represent a reduction or removal of one ton of CO2e and can be traded or retired on the market. Verra administers the VCS registry system.

In addition to CARB's verified standards, the Gold Standard is an emissions reductions project marketplace, registry, and climate and development certification organization established in 2003 by the World Wide Fund for Nature (WWF) with other NGOs. The organization was developed to establish a standard for reducing carbon emissions that was within the guidelines of the UN CDM. It has become a certification registry in the voluntary carbon market with the

Voluntary Gold Standard (GS VER) methodology. According to the organization's website "Gold Standard now has more than 80 NGO supporters and 1400+ projects in over 80 countries, creating billions of dollars of shared value from climate and development action (Our Purpose)." Gold Standard reductions represent one tonne of CO2 with additional available products for trade. These products include the Gold Standard VER for voluntary markets and CER for compliance with regulatory markets. Various methodologies and partnership fee levels exist to be certified Gold Standard. The Gold Standard has protocols for afforestation and reforestation projects that may be applicable to PARKS management capabilities. The website states that the Gold Standard features "the most rigorous environmental and social safeguards" among other characteristics that result in greater value for participants.

Consultation/Verification Organizations

According to CARB's Mandatory GHG Reporting-Verification website only CARB-accredited verification bodies and verifiers may provide verification services to reporting entities. EFSEC's website also lists three independent, qualified organizations capable of verification for carbon offset credits. Registry options, standards, and budget constraints determined prior to initiating a pilot project will influence which verification organization is most appropriate for PARKS. The Climate Trust is listed on EFSEC's IQO website and is a nonprofit organization founded in 1997 to administer the Oregon Carbon Dioxide Standard. It is based in Portland, Oregon and had its first carbon offset project contract in 2001. Climate Trust's emissions trading website suggests "decarbonizing the production of electricity; massive electrification and, where this is not possible, switching to cleaner fuels; improving energy and resource efficiency, and reducing waste in all sectors; and preserving existing and increasing the number of natural carbon sinks in forests and other vegetation and soils (Emissions)." The website provides an

overview of Climate Trust Capital, an independent, for-profit investment manager owned by The Climate Trust. It has an investment pilot fund for U.S.-based carbon offset projects in forestry, grassland conservation, and livestock. The Fund was launched in 2016. Carbon credits issued by The Climate Trust meet third party standards for certification. The Climate Trust's Environmental Price Assurance Facility (EPAF) is modeled off of the World Bank's Pilot Auction Facility and serves to mitigate the uncertainty of voluntary carbon markets and guarantee future minimum values for carbon credits. The program was supported by the USDA Conservation Innovation Grant and will direct private investment to long-term conservation. The Climate Trust's methodology utilizes their experience, partnerships, and official carbon certification standards to ensure long-term investments and offset projects are equitable and dependable.

3Degrees is listed on EFSEC's IQO website and is a certified B Corporation from San Francisco, CA that offers energy and climate consulting among other conservation and environmentally sustainable, climate change-oriented programs. 3Degrees can assist in project development services and financing. They provide access to official carbon offset registries including CAR, The Gold Standard, and Verra. They partner with businesses, non-profit organizations and government agencies to provide Renewable Energy Certificates (RECs), carbon offset credits, and renewable energy power purchasing agreements (PPAs).

SCS Global Services is a third party certification organization that partners with various organizations to meet goals towards sustainable development. SCS Global is an accredited verification body that validates and verifies offset projects that meet the CAR, ACR, Climate, Community & Biodiversity (CCB), CARB, and Verra standards. SCS can verify these standards across multiple sectors and land-uses which could make them an ideal partner for a state park

carbon sequestration projects on the diverse land holdings within the state park system. A standard carbon offset project methodology must be chosen prior to SCS validation and verification process. The verification process generally takes three to six months.

Ecotrust is a nonprofit organization working in various sectors to forward innovative environmentally-oriented practices. Their website states that their mission is to "to inspire fresh thinking that creates economic opportunity, social equity, and environmental well-being (Our Mission)." Their work in the forests sector utilizes programs that foster funding as a reward for conservation of ecosystem services. They have worked to quantify carbon sequestration capabilities in Pacific Northwest forests and have developed software to assist partners in quantifying sequestration capabilities and launched innovative carbon sequestration programs. Their Forest Planner software provides an online tool that can be used to map forest management scenarios for land planning. The program is designed to demonstrate timber harvest values, and other ecosystem service values including carbon sequestration. Ecotrust' s 2017 Annual Report identifies that they "provided expertise in climate-smart forestry and forest carbon trade-offs to climate policy advocates who are shaping Oregon and Washington's emerging climate policy proposals (29)." The report identifies Ecotrust Forest Management (EFM) as a for-profit affiliate that has made more than "$100 million in climate-smart investments in forestland on behalf of its investors (51)." According to EFM's website "EFM seeks to capture a wide array of funding sources — New Market Tax Credits, carbon credits, conservation easements, and restoration funding — to supplement private capital resources in the acquisition and management of forestland (A Broader View)." They manage two primary investment funds and organized the first registered carbon project in Or and WA in 2014 at Moss Creek, Or, verified under VCS.

Challenges and Mitigation

Several existing PARKS procedures directly address major concerns associated with funding CCS projects. A favorable feature of a PARKS CCS project is its capability to maintain and enhance recreational opportunities within natural settings. Techniques that store additional carbon can be prioritized in CCS project forest management plans. Maintaining recreational opportunities on project land must take precedence over other land uses to correspond with agency functions. Meeting the additionality standard for a PARKS CCS project is likely the greatest challenge to generating funding for the ecosystem service of carbon sequestration on state park lands. According to The Climate Trust, addressing additionality "requires the estimation of a baseline or counterfactual scenarios (Methodologies)." PARKS will be tasked with the challenge of proving additional carbon will be sequestered from what would otherwise have occurred without their management. Risk mitigation techniques must be included in project planning and may include buffer pools, carbon banking aggregation programs, temporary offset credits, structural complexity enhancement (SCE) management processes prioritizing CCS, and temporary offset credits. Diversifying a portfolio of carbon sinks across multiple locations, landscape types, and storage mechanisms (forest, grasslands, soil carbon reserves, coastal vegetation, basalt carbon pools), and maintaining or purchasing additional storage pools as "insurance" not only reduces detrimental effects of unforeseen storage capability loss, but results in greater potential for CCS capabilities overall. This process utilizes insurance as a positive feedback mechanism to increase CCS earned revenue potential.

Gren and Aklilu identify seven major approaches in response to mitigating additionality in project policy design. These include "additionality tests of offset credits, increased monitoring and verification, increasing the baseline scale of offset projects, lower emissions baselines for the offset sector, more stringent emissions targets for the capped sector, trading ratios between the

capped and non-capped emissions reductions, and a limit on the offset sector (131).” PARKS is capable of directing an inventory of ecosystem services in existing managed forests to address concerns for CCS additionality. Valuation of ecosystem services can foster monetary support from public or private sources because it could specifically fund new acquisitions and resulting mitigation processes out of dedicated conservation accounts. Receiving and allotting revenue generated specifically for new acquisitions of land that would otherwise have been developed or harvested can provide measures of additionality capable of generating more revenue for PARKS. This model provides PARKS with a systematic, compounding process that supports the agency and conservation of CCS dedicated lands in perpetuity. The natural capital framework may be considered for the initial accounting of ecosystem services that will initiate future acquisitions that meet additionality requirements for CCS offset credits.

The Climate Trust suggests “aggregating reductions across a broader set of actors in a jurisdiction” as one potential means to ensure additionality can be more easily verified. Establishing aggregation across multiple agencies may prove more difficult for project coordination. An aggregating framework that supports the design of an interagency CCS program would disperse offset credit revenue in a similar manner as the Discover Pass. Alternatively, aggregation can occur across a broader set of carbon stocks within a single agency endowed with diverse lands. The diversity of terrain managed by PARKS can assist a CCS offset pilot project and may establish a model applicable for future interagency aggregation programs. USDA’s website profile for Unlocking Carbon Markets for NIPF Landowners in the Pacific Northwest program identifies how the ACR utilizes aggregation techniques to pool resources to reduce transaction costs for carbon credit trading. Aggregation addresses the concerns of permanence, which includes mitigating the risk of potential reversibility of carbon pools.

The Verra Agriculture, Forestry and Other Land Use (AFOLU) Pooled Buffer Account may provide an aggregation model for addressing the challenge of permanence, and demonstrate a variation to the traditional CCS offset project. Von Hagen and Burnett state that risks threatening offset permanence "manifest themselves in two forms: end-of-contract effects and unplanned disturbances (142)." Having a well managed, diversified stock of carbon sinks establishes added value through insurance of carbon pools from being lost to unforeseen natural events and market opportunity costs of land. According to Verra's AFOLU factsheet, the non-permanence risk tool "requires project developers conduct an analysis of the internal, external and natural risks to the project (VCS)." Results are audited and determinations for a percentage of offsets are contributed into the pooled buffer account. The account acts as "a reserve of non - tradable credits that serves as a shared insurance pool for all VCS AFOLU projects (VCS)." This account ensures the stabilization of unforeseen circumstances to ensure the highest value for offsets can be traded. Buffer credits also drive optimal management practices through maintaining the ability for credits to be released onto the market once unforeseen risks are verified as mitigated. For PARKS lands that cannot address additionality due to the limitations of existing conservation easements, or inability to demonstrate additional CCS capabilities, the buffer account provides a model for insuring similar verified CCS project lands. Navigating the requirements for accounting of this type of buffer pool will likely require independent, third party consultation services.

Buffer pools exhibit risk and strategic planning difficulties. The ACR and the organization Finite Carbon addressed risks in buffer pool design by creating the risk mitigation product called the Carbon Reduction Guarantee. According to ACR's website "companies registering forest carbon projects on ACR now have the flexibility to use the risk-mitigation product to guarantee

their projects against unforeseeable environmental threats, or reversals, in lieu of making contributions to a buffer pool (American).” Finite Carbon’s subsidiary, Carbon Reduction Corporation, covers liability for intentional and unforeseen reversals of CCS projects and reduces risk for ACR approved projects. This tool is only available for ACR projects but may be valuable for PARKS to consider in project and policy planning.

Temporary offset credits provide another strategy for addressing CCS permanence and enhancing the diversification of PARKS CCS projects. Contractual commitments for CCS offsets can either have a specific end date or can continue into perpetuity. PARKS conservation values directly address concerns of permanence in offset projects. The PARKS 2015-2017 Strategic Marketing Plan lists PARKS first core value as a commitment to “stewardship that preserves the state’s natural and cultural heritage in perpetuity (5).” Conservation easements, contracted in perpetuity, can contribute to stronger investment potential due to the long-term nature of protection from development or resource harvesting on PARKS lands. Alternatively, temporary offset credits can provide purchase options and more flexibility in CCS contract design. According to Forest Trends, a conservation oriented non-profit organization, the Kyoto Protocol's Clean Development Mechanism (CDM) is the only emission trading program to utilize temporary offset credits. Offset credits from CDM verified projects have shorter terms that do not require verification of a permanence indicator. CCS projects that facilitate frameworks that can support these types of credits reduce some risk, but result in lower carbon prices, require more contract renegotiation, and create additional responsibilities for buyers. Temporary, or non-permanent credits may provide potential, short term investment opportunities for PARKS to market. Carbon prices for such processes needs to be addressed in additional policy research for case-by-case situations and contract planning.

Leakage refers to the potential of carbon stock losses by tree harvesting occurring somewhere else as a response to conservation occurring in a CCS project. Leakage functions to eliminate any benefits of additionality in mitigation planning. Leakage concerns are inherently addressed in PARKS management policy due to the lack of forestry and resource extraction on PARKS managed properties. According to Verra's website "VCS requires that all AFOLU projects define, mitigate, monitor and account for any displaced emissions, known as leakage, using approved tools." These tools consist of leakage and buffer accounting frameworks and for VCS include the JNR Non-Permanence Risk Tool and the JNR Leakage Tool, which outline assessment and mitigation techniques. PARKS can reference these models for contract design, particularly if CCS projects are aggregated with other agencies. New land acquisitions by PARKS, specifically for CCS projects, do not generate concerns for leakage within agency actions. Concerns for leakage that may result from other agencies from which PARKS acquires land will need to be reviewed and addressed as necessary for specific verification standards.

Larger, regional CCS measurements are more prone to concerns for heterogeneity than smaller project plots. Gren and Aklilu identify CCS project's potential inability to address "the fact that carbon sequestration of a certain area of land differs between regions because of differences in climate and geo-hydrological conditions, which means that carbon sequestration per unit land depends on the location of the project." The diversity and smaller size of forest plots on PARKS properties address heterogeneity concerns because multiple, smaller forest tracts are distributed across variable ecosystems and climate zones. Individual park project contracts can account for individual park-level CCS capabilities. Gren and Aklilu identify that the challenge of heterogeneity can be mitigated "if the policy maker and agents had information on carbon sequestration in each plot (129)." This information is easier to obtain within state park

boundaries than in larger working forests. Aggregation accounting across agency projects will be more specific than blanket, regional applications of default carbon prices. Heterogeneity arguments may actually generate greater support for PARKS CCS projects in that they will affect carbon pricing by ensuring projects are worth the full value of appraisal, and not an inconsistent average across broader regions.

Status quo politics and business as usual management and marketing priorities pose additional challenges to implementation of CCS projects in PARKS. CCS planning and ecosystem service accounting is innovative, and demands fostering support for unknown results. Choosing to regard existing policies and management planning as permanent is a political decision. The State Parks 2014-2019 Strategic Plan states that a future challenge includes "a lack of agreement between legislators, the Governor and park stakeholders on how to best finance the state parks system moving forward, including questions about the level of public funding; the flexibility, purpose and fiscal goals of agency fees; and the creation of one or more dedicated public fund sources (21)." Price setting for carbon per ton is subject to fluctuate as state policy develops and market dynamics evolve. Diversity exhibited in PARKS lands and management requirements will be a significant leverage point for CCS project implementation.

Alternative Management Scenario

The following alternative management scenario does not address all potential elements that must be considered in planning and administering a CCS project. The scenario does not account for official zoning designations that could prevent the implementation of a CCS project. The example provides a rudimentary snapshot of alternative land management procedures to demonstrate a general CCS project model. A more detailed example may account for zoning

constraints, varying plot sizes, multiple project timelines, different vegetation, and other project variables.

Saint Edward State Park in Kenmore, WA has been undergoing a plan to renovate an existing ball field that has been used for more than eighty years. Reviewing the park's management plan, project proposal to the city of Kenmore, and the field improvement SEPA checklist assisted in establishing an example of a CCS project as an alternative management scheme. The current project will develop an artificial turf ball field on approximately 3.5 acres of park land under the fiscal management of the city of Kenmore for 20 years. Rationale for ball field restoration on Kenmore's project proposal website states "renovation of the existing ballfields benefits the public by enhancing recreation opportunities within Saint Edward State Park" for various sports. Comparable recreational benefits and ecosystem service values provided by forest conservation as an alternative are well established in existing literature.

Many carbon measurement methodologies are proposed and reviewed in existing literature. Reviewing regionally applicable literature, proposed methodologies, and utilizing software for calculating carbon storage in living trees can assist to determine an estimate for CCS potential. Detailed calculations and sequestration estimates of a PARKS CCS project would be developed through planning and consultation at specific project sites. Live tree sequestration potential varies due to its dependence on the growth rate of specific tree species and other dynamic project elements. The following example provides a basic approach to determining a specific CCS project's functionality by utilizing dimensional analysis to calculate tree biomass and estimate carbon sequestration. A single method for CCS capability calculation does not exist, and absolute values for project planning will be approximate. Accounting estimates can be assumed where growth is generally consistent across landscapes. Results included in the given example

provide a rudimentary snapshot of an alternative management plan that includes CCS accounting. Estimates given can be used as a starting point for facilitating discussions about the feasibility of a PARKS CCS project.

Determining specific biomass for estimating carbon sequestration potential of replacement trees requires species-specific allometric calculations. This example utilizes the allometric equation found in Curtis (2008), Kaitaniemi (2008), and Pilli et al.(2006) where M= aD^b where M is the total aboveground dry tree biomass in kg, D is the sample diameter at breast height (DBH), and a and b are the scaling coefficient and scaling exponent, respectively. Calculations include the Ter-Mikaelian and Korzukhin (1997) scaling coefficient of 0.0808 and scaling exponent of 2.5282 for total aboveground biomass of Douglas fir. Douglas fir seedlings may take several years to reach a standard size that is appropriate for applying these allometric equations. Alternative carbon storage calculation methods exist for seedlings that can be utilized for specific projects. For the purpose of this example, a standard size of 5 cm dbh with a height of 3 m per tree is assumed for project year one. At the end of this year a single tree would have a biomass of approximately 4.73 kg after applying this equation.

To determine a trees carbon content in kg, biomass must be multiplied by its percentage of stored carbon. Birdsey, 1992 Table 1.2 lists carbon percentages for specific trees. Pacific coast Douglas firs are listed as having .512 percent of carbon stored. Project trees would have a carbon content of approximately 2.42kg. Multiplying a kg of carbon by 3.67 converts it to a kg of CO2. It is important to distinguish between carbon content and CO2 in measurements throughout CCS calculations and planning. Single project trees in their first year would absorb and sequester approximately 8.88kg of CO2.

Kenmore tree management and protection code 18.57.060 Tree Density requirement specifies that land development projects within the city must exhibit a minimum tree density of 30 tree units per acre, less 10% for grove planting with designated tracts. The regulation's 18.57.060B replacement tree table includes conversions from measurements of replacement trees to tree units. Coniferous trees measured at a height of 8-10 feet represent 1.0 tree units. The sum of combined units must be equal or greater to minimum density requirements. This example assumes a Saint Edward State Park CCS project would initially reforest the 3.5 acre area with tracts of Douglas fir as replacement trees because of their high growth rate and predominance within the greater Western Hemlock zone and Puget Sound vegetation zone. 1.0 tree unit replacement trees would result in 94 trees (30 tree units x 3.5 acres - 10%, and rounded) being planted to meet minimum tree density requirements established by city code. 94 trees with dbh of 5cm are capable of sequestering approximately 834.9 kg of CO2. Conversion of kg to metric tons is required to earn offset credits. Ninety four Douglas firs could sequester approximately .83 tonnes of CO2e in their first year.

Carbon sequestration rates over time can be determined by calculating the tree's carbon content change as the tree ages. Accurately projecting tree growth rates requires the use of allometric equations and specific site measurements. Documented growth trends based on empirical measurements are available in academic literature. It is well documented that younger trees accumulate more biomass over time compared to older trees, resulting in S curve growth models. The contract term between PARKS and the city of Kenmore for the management of the 3.5 acre ball field is 20 years. For the purpose of this example, calculations for CCS over time will utilize the survival and growth rates reported in the 1998 DOE report entitled *Method for Calculating Carbon Sequestration by Trees in Urban and Suburban Settings.* Table 1

demonstrates how utilizing this model results in a 20 year project accumulation estimation of between 28.16 and 51.5 tonnes of CO2e, or potential offset credits, dependent on tree mortality. The World Bank's report entitled *State and Trends of Carbon Pricing 2018* places the price of a ton of CO2e at $15 in the CA Cap and Trade program. Prices range from less than US $1/tCO2e to US $139/tCO2e. If the example project's carbon price was constant and set to a conservative US $15 for 20 years, it would have the capability of producing a sequestration value between approximately $422.40 and $772.50. This is a conservative assumption with calculation limitations that does not account for many additional factors included in a dedicated CCS project plot.

A. Species	B. Tree Age	C. Number of Age 0 Trees Planted	D. Survival Factor	E. Number of Surviving Trees (C x D)	F. Annual Sequestration Rate (lbs/ tree)	G. Carbon Sequestered (lbs.) (E x F)	H. Carbon Sequestered with 0 Tree Mortality
Douglas Fir	0	94	0.873	82.062	1.4	114.8868	131.6
	1	94	0.798	75.012	2.2	165.0264	206.8
	2	94	0.736	69.184	3.1	214.4704	291.4
	3	94	0.706	66.364	4.1	272.0924	385.4
	4	94	0.678	63.732	5.2	331.4064	488.8
	5	94	0.658	61.852	6.4	395.8528	601.6
	6	94	0.644	60.536	7.6	460.0736	714.4
	7	94	0.63	59.22	8.9	527.058	836.6
	8	94	0.616	57.904	10.2	590.6208	958.8
	9	94	0.602	56.588	11.7	662.0796	1099.8
	10	94	0.589	55.366	13.2	730.8312	1240.8
	11	94	0.576	54.144	14.7	795.9168	1381.8
	12	94	0.563	52.922	16.3	862.6286	1532.2
	13	94	0.551	51.794	17.9	927.1126	1682.6
	14	94	0.539	50.666	19.6	993.0536	1842.4
	15	94	0.527	49.538	21.4	1060.1132	2011.6
	16	94	0.516	48.504	23.2	1125.2928	2180.8
	17	94	0.505	47.47	25	1186.75	2350
	18	94	0.495	46.53	26.9	1251.657	2528.6
	19	94	0.484	45.496	28.8	1310.2848	2707.2
	20	94	0.474	44.556	30.8	1372.3248	2895.2
				Total LBS of C =		15349.5326	28068.4
				Total LBS of CO2 (C x 3.67) =		56332.78464	103011.028
				Total tonnes CO2 (CO2/2000) =		**28.16639232**	**51.505514**

Table 1. Sequestration Potential for Douglas Fir

Limitations

The alternative management scenario assumes a young, sparsely-populated, regenerating tree plot. Higher density forests and multiple carbon pool accounting methods would produce much greater values of sequestered carbon. Alternative scenario measurements do not account for carbon stored in soils and shrubs existing in more dense forest-vegetation associations, below ground carbon pools, or dead carbon pools such as downed woody debris. The example does not account for consultation and management costs. PARKS experience with forest and resource management will likely assist to reduce unforeseen, additional project costs. Methods and extent of carbon storage measurements will be determined by certification procedures established by an offset registry protocol or third party certification organization.

The previous calculation is not applicable to acquired lands that can be utilized for CCS projects. If PARKS were to acquire an already forested acre that meets offset protocol registry requirements, specific protocol quantification methods must be applied. Existing literature expresses the variable nature and assumptions inherent with assessing CCS potential in trees. Waring and Franklin identify that "the key to the larger biomass accumulations in the Pacific Northwest is clearly in the sustained height growth and longevity of the dominants, coupled with their ability to accumulate and maintain a large amount of foliage (1383)." This suggests that acquisitions of higher density middle-age forests, projected to be developed or harvested, will likely provide the greatest value from a CCS project. Additionally, Douglas fir forests exhibit the potential for thousands of trees to grow per acre according to growth characteristics described in McArdle, 1930, significantly expanding the potential of sequestration from 94 juvenile trees. Utilizing measurement schemes specific to selected CCS project protocols will assist to mitigate potential uncertainties and false assumptions in specific projects.

Conclusion and Additional Research Recommendations

My research suggests that organizing a project that compensates CCS occurring from the carbon reserves within Washington state park's forests is logical, feasible, and defensible.This paper attempts to expand the area of knowledge connecting the function of PARKS with policy design that recognizes and rewards the ecosystem service of carbon sequestration on the lands the agency administers. Included information can promote policy reform or development, and prepare the agency for compliance with a regulatory carbon market. CCS offset projects may assist in reducing PARKS expenditures and contribute to meeting agency and state GHG reduction and climate goals. A recurring finding within state park funding literature is that the value which state parks are currently, and potentially capable of producing is not fully reflected in their funding.

Additional research recommendations for this area of CCS program design include applicable and practical carbon value assessment models and measuring techniques. Many different models for sequestration project design exists. More research is needed for PARKS to determine which standards and registries are most appropriate to pursue for pilot and future CCS projects. A thorough assessment and inventory of updated, applicable design models would greatly assist public agencies consideration and adoption of CCS projects. Researchers and developers should focus on promoting general accessibility to specific markets and registries when conducting assessments of existing protocols. Establishing a database to categorize, organize, and compare approved frameworks across multiple markets and registries would likely promote greater CCS project creation by assisting to streamline research. The database could serve as a "marketplace" for sequestration protocols. A single, updated repository of existing

frameworks would assist PARKS and other agencies in pursuit of initiating a profitable CCS program.

More research is needed to develop policy that generates dedicated funds for CCS projects and allocates CCS project revenue. Policymakers and PARKS commissioners should research the development of state or agency policy that mirrors the Land and Water Conservation Fund's financing mechanism. Utilizing a percentage of mandatory power plant offset payments or a percentage of state timber sale revenue to fund PARKS CCS projects could assist to meet State climate and land conservation goals, as well as reduce PARKS budget requirements. Alternatively, developing a PARKS policy that distributes a portion of CCS generated funds to target population social programs may generate political and community support for CCS projects and PARKS. In addition to policy research, PARKS should expand land inventory assessments to include carbon values in highly vegetated parks in preparation for potential regulatory markets. PARKS can outsource labor costs and data processing for these assessments to supporting partner organizations, volunteers, or crowd-sourcing databases. PARKS should continually aim to ease access to GIS and survey data. The agency could also consider application or functional software development to assist in inventorying ecosystem services and natural capital.

The dynamic nature of carbon markets and unpredictability of carbon price estimates do not negate the suggestion for PARKS to attempt a CCS pilot project to generate revenue and increase land holdings. Research indicates that PARKS is an ideal agency to coordinate an innovative CCS pilot project. This review of relevant policy and literature reveals that PARKS is in a region and serves the function to manage forested land holdings that are best suited to sequester carbon over long periods of time. The lack of research for CCS projects in state parks

and the absence of accounting for the high value of this ecosystem service provision and potential for additional carbon sequestration should be addressed from interdisciplinary approaches.

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